THE COMPLEAT TALKING MACHINE

Second Edition

A COLLECTOR'S GUIDE TO ANTIQUE PHONOGRAPHS

REPAIR • RESTORATION • IDENTIFICATION • PRICE GUIDE

By

ERIC L. REISS

"It is hard to imagine how any phonograph collector, seasoned or novice, could manage without *The Compleat Talking Machine* on the bookshelf or workbench."—*Christopher Proudfoot, Christie's, London*

"Mr. Reiss leaves no stone unturned...a tour-de-force indispensable to most anyone who owns a wind up phonograph or is thinking of buying one."—*Cadence, The American Review of Jazz & Blues*

Photo: Kenn Kold

About the author

Eric Reiss acquired his first talking machine, a Brunswick console model, at the age of four and has been actively searching for old machines since his early 'teens.

Mr. Reiss was born in San Antonio, Texas in 1954. After graduating from Washington University in St. Louis with degrees in performing arts and political science, he moved to Copenhagen, Denmark to become a stage director at the Danish Royal Theater. Although he maintains his connections to the theater world, Mr. Reiss now works in advertising—an equally nefarious occupation.

About the machine

The "Melba" gramophone was produced by the Gramophone & Typewriter Co. in England around 1904. Named for the famous opera singer, Nellie Melba, with its 12" turntable, triple-spring motor, and elaborate "art nouveau" cabinet, the Melba was G&T's top-of-the-line model. Quite rare today, surviving Melbas are usually found with brass horns rather than the wood horn shown here. This horn is of later vintage, about 1912, and is probably of German origin. Both the machine and the horn were rescued from a damp cellar in East Berlin many years ago.

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The Author's grandmother on Christmas Day, 1912 admiring the family's first phonograph, a Victor Victrola VI, one of the earliest hornless models. Over eighty years later, the machine is still entertaining members of the family.

Victrola VI- 1911-1926. The machine pictured here is a favorite of mine as it has been in my family since 1912. The VI is a slightly larger machine than Victor's other lidless machine, the Victrola IV, of the same year. The VI has a 10" turntable, but models made after 1913 have 12" turntables. The initial cost was $25.00. (Author's collection)

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with photographs by the Author

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To my mother, Louise—who likes to play the jukebox

CONTENTS

ACKNOWLEDGEMENTS

There are so many people who have had a hand in making this book as complete and accurate as possible that I really don't know where to begin. Collectors from all over the United States and Europe have gone out of their way to help me, often letting me strip down their most prized possessions in order to photograph some detail or examine an unusual part. I think Miami collector Bill Robbins perhaps put it best of all. Bill said, "This hobby has given me a lot of pleasure. I'm glad that I have the chance to give something in return!"

I want to thank Mike Field, technical expert of the City of London Phonograph and Gramophone Society, and Dennis and Patti Valente, from the Antique Phonograph Shop in Davenport, N.Y., for sharing their expert technical knowledge with me and contributing valuable information to the repair sections. Reid Welch and Ernie Bennett of Miami have also taken considerable time out from their busy schedules to gather information for me since the very outset of the project. I am particularly indebted to Reid who first introduced me to the intricacies of the Higham reproducer and home electroplating.

Walter Bellm and the wonderful staff of Cars and Music of Yesterday, in Sarasota, Peter Dilg, Claes Friberg, Allen Koenigsberg, Bob and Susan Lloyd, Mike Patella, Bill and Peggy Robbins, and Emil and Kirsten Sørensen spent a great deal of time helping me photograph machines in their collections. During the photo sessions, talk naturally centered on phonographs and collecting, and much valuable information was contributed by all of these fine people. Allen Koeningsberg, editor of the *Antique Phonograph Monthly*, also allowed me to examine rare original catalogs, and provided extremely useful data regarding the early history of the industry.

It is distressing to realize how little one knows about a subject when the time comes to write about it. Howard Hazelcorn, one of the foremost authorities on Columbia machines in the U.S. has helped make the Columbia section accurate and comprehensive. Charles Mandrake has done a tremendous amout of research on Zon-O-Phone machines and supplied copies of rare catalogs, pictures from his files, and a host of other material. This comprises the basis for the Zon-O-Phone descriptions contained in this volume. Tim Fabrizio has supplied much useful information about the Chicago group of Columbia look-alikes, Standard, Aretino, etc., an elusive subject rarely mentioned in the published literature. All of these people deserve a hearty thanks.

My special thanks to Christopher Proudfoot and Christie's South Kensington who supplied me with some excellent photographs of machines I had difficulty locating. Thanks also to the following friends and collectors who have helped in the preparation of this book: Johannes and Birte Anker, Ingrid Egerod, Thomas Friberg, Howard Hope, Søren Hovmann-Muus, Ebbe Høst, Jeppe Lenstrup, Rita Lenstrup, Al Rector, George Reiss, Carleton Smith, Gil Williams and, of course, Harvey and Marion Roehl for their faith, support, and friendship.

Eric Reiss
Copenhagen, May 1986

PREFACE

Preface to the Second Edition

Ten years have passed since the first copies of *The Compleat Talking Machine* came off the press. It's indeed gratifying to know that the book has maintained its steady popularity for so long. Now, thanks to Sonoran Publishing and my patient and far-sighted editor, George A. Fathauer, I've been given an opportunity to expand the book far beyond its original scope. As these remarkable machines become increasingly scarce, I hope that this new edition will help a new generation of enthusiasts as they tackle restoration projects that most of us "old timers" wouldn't have touched only a few years back.

Much of the material in the expanded identification section was, in fact, given to me during preparation of the original edition. Nevertheless, my sincerest thanks go out to Walter Bellm, Ernie Bennett, Peter Dilg, Tim Fabrizio, Claes Friberg, Howard Hazelcorn, Allen Koenigsberg, Bob and Susan Lloyd, Charles Mandrake, Mike Patella, Bill and Peggy Robbins, Dennis and Patti Valenti, and Reid Welch for their enormous contributions back in 1985.

Of course, there are many new names that deserve a grateful mention. Neil Maken, now an author in his own right, has steadily provided me with decals, parts catalogs, plus much useful input to the price guide; the late Tim Goon added page after page of useful tips on the art of machine repair in his articles in *In The Groove*; John Whitacre, editor of *In The Groove*, not only let me quote from Tim's work, but also placed valuable information from his own files at my disposal. I'd again like to thank Allen Koenigsberg—this time for reviewing the revised historical section and helping me get my facts straight.

Quite apart from the many photos they placed at my disposal, Christopher Proudfoot and George Glastris of Christie's South Kensington worked so hard on the price guide that they are practically co-authors. I hope collectors and dealers around the world will benefit from the time these two fine gentlemen have taken to make the guide both accurate and informative. Many, many thanks.

Preparing this new edition has also required help from many other talented people. First of all, I'd like to thank my good friend and colleague, Jeppe Grangaard, who created the cover illustration and designed the new layout. Many thanks, too, to Ken Butler, who, via fax and diskette, turned Jeppe's ideas into reality—half a world away in Arizona—and who provided quite a few design solutions of his own. I'd also like to thank Bent Høier, Kenn Kold, Fintan Damgaard, and Peter Stallknecht for their invaluable assistance with illustrations and photos. I'd also like to thank my supportive colleagues at Cross-Border Communications in Copenhagen for putting up with all this nonsense—often during work hours.

Finally, my very great thanks to George A. Fathauer for giving me a chance to revise the book, and to my wife, Dorthe, and the rest of my extended family—Andreas, Karen, Marianne, and Lars—for their love, affection and patience.

Eric Reiss
Copenhagen, January 1996

Introduction

When I first started collecting gramophones and phonographs during the late 1960's, there were few books and reprints available to guide the novice. Back then, the best source of information was other collectors who usually were nice enough to show me their machines and tell me something about the different makes and models.

As far as repairs were concerned, there was virtually no printed information of any kind at all. Once again, one had to rely on other collectors. However, I never seemed to actually "catch them in the act" of repairing machines, so my information was usually based on casual tips mentioned during the course of a friendly visit. Without the proper step-by-step guidance, I soon discovered that these tips were not always useful and could actually result in disastrous mistakes due to my ignorance.

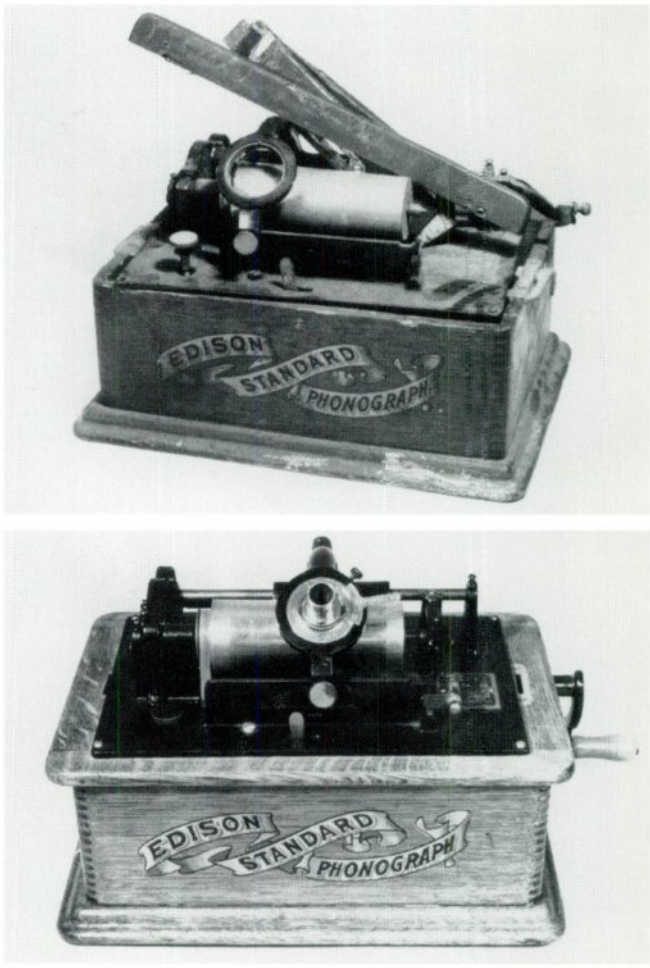
Over the years, early machines have become quite expensive, and the quality of the machines on the market has deteriorated. As a result, more and more collectors are forced to restore machines that they would have used for parts a few years back. As the quality of the machine goes down, the amount of effort required to restore it increases proportionally, and some collectors are now facing problems they have never encountered before.

The purpose of this book, therefore, is to provide the collector with a guide to repairing and restoring early talking machines so that he or she may overcome some of the problems I have encountered, and avoid some of the pitfalls. This book also provides enough historical information about the various makes and models so that it's possible to make an accurate appraisal of new acquisitions in terms of value and rarity.

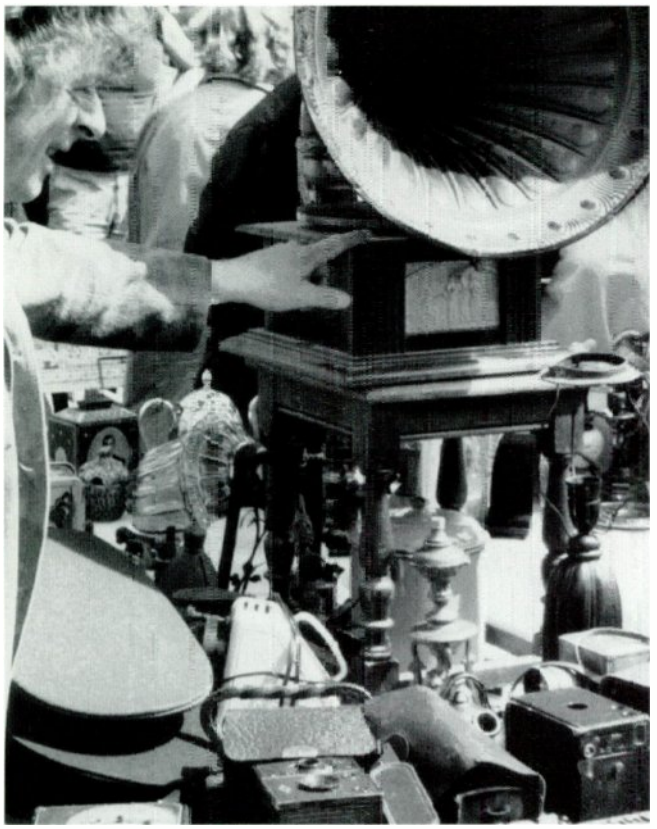
What's on the market?

In truth, old gramophones and phonographs are not nearly as scarce as many people believe—or dealers would have you believe. Although many of the really well-preserved machines are now in private collections and only turn up at auctions and such, a surprising number of machines still appear in antique shops and at flea markets.

Collectors usually have a pretty good notion of what their machines are worth, and those who have had a machine sitting in their den or family room often have an inflated sense of its value. As a result, when a really good machine does come out of hiding, it usually commands a premium price.



Even derelict machines such as this Edison Standard can be restored with a little time and effort.



Machines still turn up regularly at flea markets and antique shows.

For those of us who cannot—or will not—pay huge sums for well-preserved gramophones and phonographs, there is only one alternative: We must restore those machines that have been left to rot in damp basements and unheated barns. These are the sad remains that were passed over by collectors and pickers back when a clean Edison Standard cost less than a pair of Levi's. Back then, it wasn't worth the effort required to get these rusty relics to work. Now, all that has changed.

Happily, there seem to be a fair number of good machines that simply haven't been found yet, and scarce items such as cranes, reproducers, etc. are often not recognized for what they are. In short, your chances of finding interesting parts—and even complete machines—are as good as anyone else's if you make an effort. Even if you buy your machines from a dealer, the fact remains that derelict machines never cost as much as pristine examples. Moreover, there is a great deal of satisfaction in knowing that the machines in your collection work well and look good because *you* took the trouble to rescue something from the scrap pile. Pity the poor coin collector who is not allowed to even shine his tarnished prizes!

Many well-preserved machines are now in collections or used for interior decoration. They rarely come on the market again.

Where to look for machines

Phonographs and gramophones pop up in all kinds of unlikely places, but to increase your chances of finding something, you have to look in areas where these machines were once plentiful. You also have to look in places where machines were more likely to be stored, rather than thrown out. Areas close to large cities such as Chicago and New York are good hunting grounds. There were lots of potential talking machine owners back at the turn of the century, and houses had both attics and basements where machines could be deposited and forgotten. By contrast, a city like Miami, developed during the late 1920's, is made up of condominiums, and bungalows—both with limited storage space. Miami has another strike against it: any machine found there has undoubtedly passed through a number of hands before you got to it, and the price has increased with each change of ownership. The real key to buying a cheap machine is to be the *first* to discover it!

Farms often turn up interesting items, although this requires more traveling for the collector. People throw things out when they move, but sedentary people, such as the population of a country town, are more likely to accumulate things.

Keep in mind the economic and social conditions that prevailed in a particular area eighty or ninety years ago. Edison did a lot to promote his machines in rural America, while Victor appealed to the city slicker. Don't expect to find early electric machines or custom Chippendale cabinets in modest farm communities where electricity may not have arrived until the 'teens and fancy woodwork would have been out of place. Nevertheless, keep your eyes open—even in Miami!

Another good project is to find out who sold phonographs and gramophones in your area, and who

repaired them back in the early years. Some remarkable finds have been made in old warehouses and radio shops. A little detective work will increase your knowledge of the history of the talking machine in your community and can give good results. You have nothing to lose.

A word about prices

Antique talking machine prices are set by supply and demand, as are prices in any marketplace. The demand comes from two main sources—collectors and those people looking for unusual decorative objects.

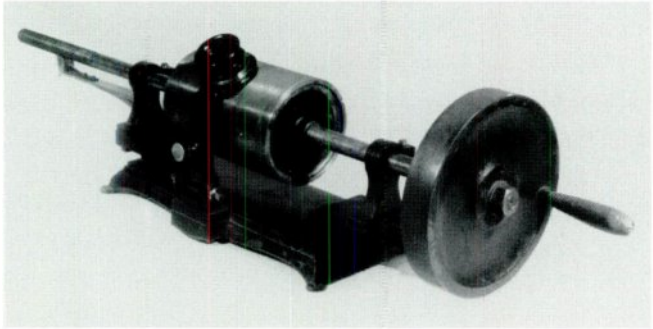
Oddly enough, collectors are often less fussy about the condition than decorators. I think the reason for this is probably that collectors are in a good position to judge the relative merits and defects of a machine. In most cases a collector would rather have a machine that didn't work than one that had been repaired improperly and perhaps irreversibly damaged.

Decorators, on the other hand, know that it's important to answer the question "Does it work?" in the positive in order to elicit the appropriate "Gee! Wow!"—despite the fact that the machine will probably never be used. Moreover, decorators are not interested in hunting for missing parts or wasting time fixing a machine. Either the thing works and looks reasonably good, or there's no sale.

I suspect that there are considerably more decorators running around than there are serious collectors. This, of course, puts the collector at a real advantage when it comes to buying junk machines to restore. After all, who but a collector (or lunatic) would buy a machine that might require thirty or forty hours of work before it can be displayed?

Even experienced collectors may occasionally pass up a "basket case." If the machine in question is fairly common, such as an Edison Standard or Home, the collector may already own a similar model and prefer to devote time to more unusual machines. As the demand for a particular talking machine decreases, so does the price—often dramatically. This gives the beginner a good chance to acquire new machines at a fraction of the going rate.

For those of you who are unclear as to what the "going rate" is, I have attempted to give some indication in the price guide at the end of the book.



The author's tinfoil machine, found at a Miami flea market. The machine was made by Max Kohl of Chemitz, Germany, around 1880.

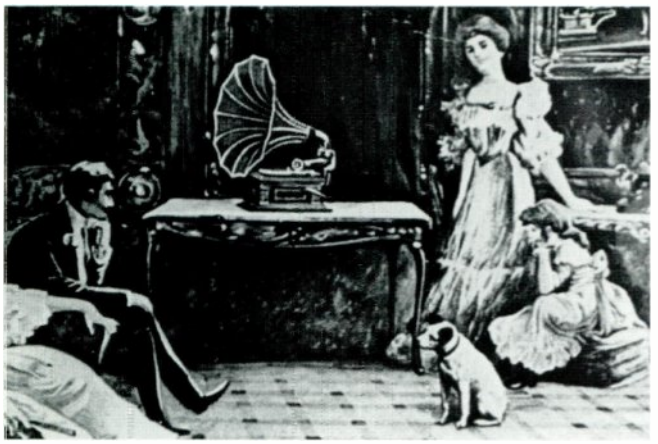
The subtle art of trading

Although the possession of three or four identical machines may increase the size of a collection, they seldom make it more interesting. Nonetheless, duplicate machines can be put to good use in a number of ways. Naturally, they can always be sold outright, hopefully at a profit, but perhaps their most valuable function is as items for trade. Often antique dealers would rather have two less expensive machines than one rarity. Rarities appeal to the collector, but less so to the decorator, who usually looks more closely at the price tag than at the mechanical subtleties.

I managed to get an original tinfoil phonograph some years ago in precisely this manner. The owner of the tinfoil machine had not made any real attempt to contact local collectors and the machine thus turned up at a South Florida flea market. The price was extremely reasonable, but as a struggling student, I just didn't have the cash. However, I did have two very pretty Edison machines that the dealer was delighted to take in trade. He now had two good, salable machines with nice morning-glory horns, and I came home with what looks more like a lathe than anything else. It would have been hard to sell to the uninitiated.

Duplicates can also be used to upgrade items in your "permanent collection." In this way, one can obtain replacements for noisy gears, mangled screws, and a host of other parts with minimal cash outlay.

During my first years as a collector, I met many wonderful people who helped me get started. However, I also had the misfortune to meet some real bandits—dealers and collectors alike. One of them talked me out of the complete works for an Edison Opera for a paltry $20. He sold it soon after for ten times the amount—and taught me a valuable lesson in the process: always know exactly what you are trading away and weigh this carefully against what you are getting. As far as I'm concerned, the whole idea of trading is to reach an agreement that benefits *both* parties. Unfortunately, not everyone shares this view.



Victor appealed to the city slicker. (from an early advertisement)

Many parts are not recognized for what they are.

On a final note, when trading with a dealer, remember to base your trade on uniform terms. If the dealer is talking retail prices, you should do the same. What you paid and what the dealer paid for his machine is usually irrelevant.

Reproduction parts

As good, complete machines become scarcer, it becomes more and more lucrative for people to reproduce parts that are in high demand. Some of these reproductions are skillfully made while others are very poor indeed. In all cases, a machine restored with reproduction parts will not (or should not) command a top price. At one point, a machine may indeed have so few original pieces that its value as a collector's item is questionable. Where you draw the line is your decision.

Obviously, some parts *must* be replaced if the machine is to function properly. By this I mean things like reproducer gaskets or, perhaps, a stripped gear. Replacement of these items should not detract from the value and will usually add to it. However, reproduction horns, reproducers, cranks, and the like, do not add any historical interest in themselves, and a machine equipped with reproductions of any or all of these parts is less desirable than one that is 100% original. This should naturally be reflected in the price you pay when buying a machine. I think that people should keep this in mind when selling their machines, too.

Recognizing reproduction or incorrect parts is largely a matter of practice. The seller may tell you if you ask directly, but will rarely volunteer this information of his or her own accord. Very recently, I saw a machine in a flea market in France with a reproduction horn. When questioned, the dealer countered, "Ah, yes, monsieur, but it is a very *old* reproduction!" Well, even if the horn was a copy, the sales argument was unquestionably original.

The reproduction parts most frequently encountered are horns, reproducers, and cranks. In short, the easier it is to remove a part, the greater the chance that it's a reproduction. In the case of disc machines, extra holes in the motor board or an extra crank hole usually indicate a swapped motor. Cylinder machines are less prone to this maneuver.

After looking at some original machines and learning what parts are available from various suppliers, you'll soon get a feel for things. The identification section in Part Four, should be of great deal help, too.

Edison did much to promote his machines in rural America. (from an early advertisement)

Home-made machines, forgeries, and other swindles

If the local community theater has just done a production of *My Fair Lady*, watch out! Some bizarre machines turn up from time to time made from odd bits of this and that. Usually a horn has been added to a hornless machine. Old cylinder dictation machines are frequently dressed up in this manner.

Flea markets, particularly in Europe, are overrun

Recognizing reproduction parts will help you determine a machine's value. The "witch's hat" on the left is original, while the one on the right is a recent reproduction. Note the different bell shapes.

with fairly good-looking fakes. These are almost always disc machines that use parts from portable phonographs mounted on new cases, plus reproduction horns and brackets. A good rule of thumb is this: If the back bracket is new, be wary. Back brackets usually survive on legitimate machines. Also, if the tone-arm goes into the cabinet rather than leading directly to the horn, the chances are the machine is a forgery. As far as I know, only HMV (English Victor) made any machines with this configuration—and they are fairly rare, even in Britain. Again, the only way to spot the fakes is to know what original machines look like.

Several years ago, a friend in London showed me an early Berliner "Trademark" machine in absolutely mint condition. Normally, this is an expensive machine, but the one I was looking at had cost but a fraction of the going rate. The owner explained that a whole series of Berliner forgeries had been produced in Taiwan and

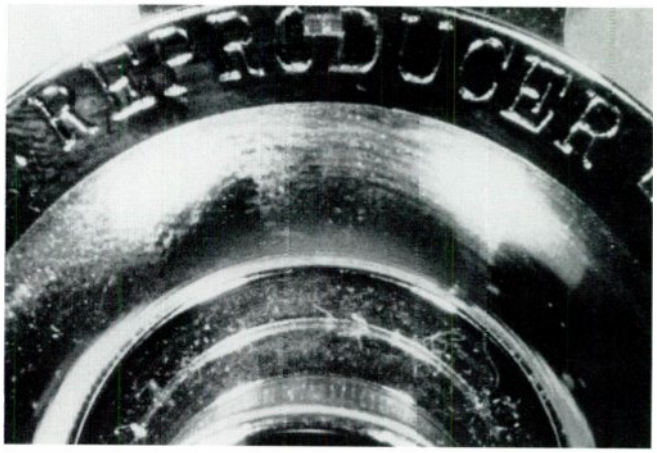
Original Edison reproducers have a serial number at the base of the neck.

had made their way to England. He got stuck with one. Except for the fact that the bolts had metric threads, the machines were perfect copies. Fortunately, these copies are few and far between, but you should be aware of their existence.

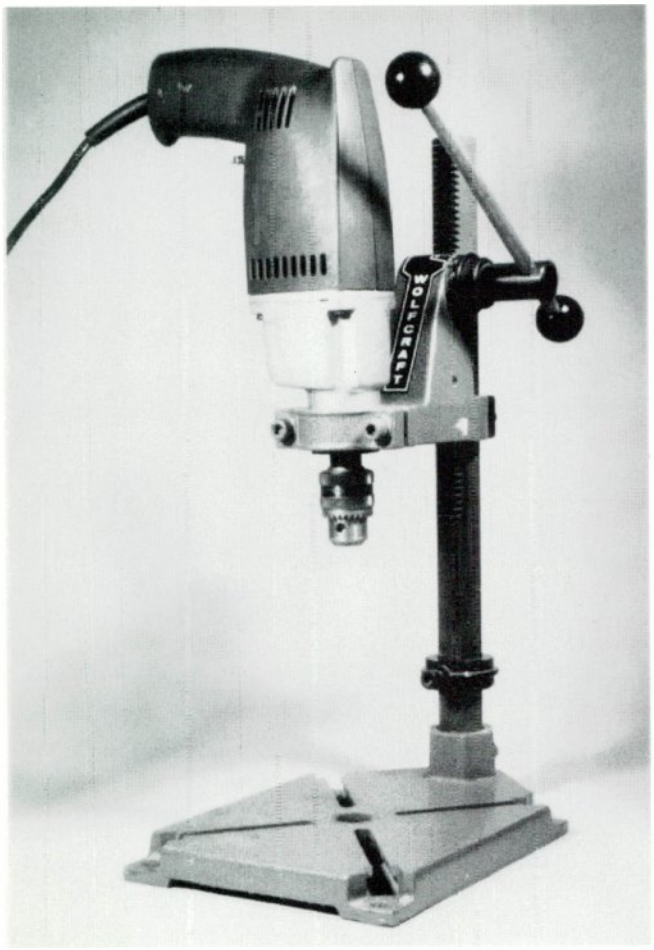
Tinfoil machines have also been copied from time to time. If you are considering buying one, you might consider asking for a written statement guaranteeing the machine's authenticity. If the seller is on the level, there should be no problem in obtaining this document.

Several years ago, an "original" Edison machine was offered through a well-known American mail-order catalog. Priced at more than three times the normal market price, careful examination of the accompanying photo showed that in addition to the cheap reproduction horn, the machine had been pieced together with a case from one model and the upper works from another. Quite apart from the outrageous price, the fact that the machine was so blatantly incorrect, though advertised as "original," placed this offering on the border of consumer fraud. I told them so in a letter but I never

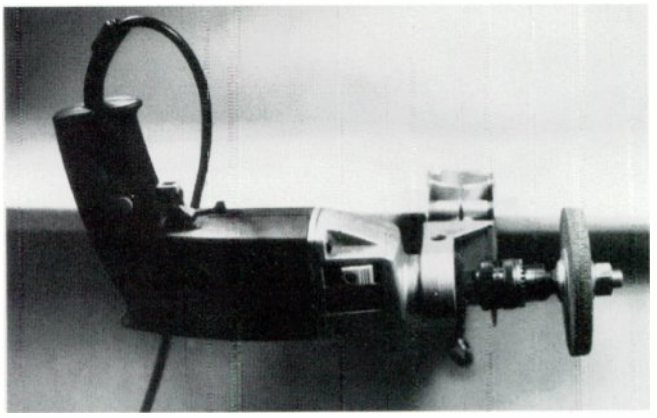
Many original horns have a stamped patent date.



Most reproduction Edison reproducers have no serial number.



An electric drill with a drill-press attachment.



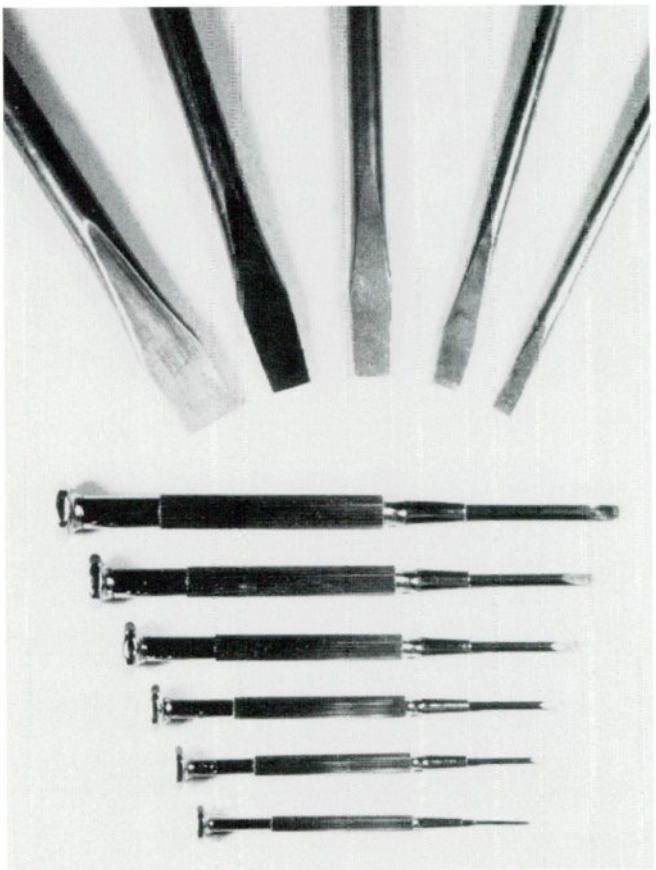
An electric drill used as a bench grinder.

received a reply—in fact, they dropped me from their mailing list. Oh well. As the ancient Romans said, "Caveat emptor"—"let the buyer beware." I'll add, "Caveat lector"—"let the reader beware!"

A few words about tools and skills

I have tried to limit the scope of this book to repairs that can be made in the average home shop. You don't have to know how to use a lathe or how to weld, but, if you can, you are already ahead of the game. As far as possible, I have made suggestions about where this work may be done locally at minimal cost. It is, however, a good idea to learn how to solder. For those of you who have never tried this before, I have briefly described some of the techniques in Appendix B. Soldering is not difficult to learn and is a very useful skill.

The only power tool required is an electric drill, preferably with variable speeds. Attachments for converting the drill to a bench grinder and a wide variety of grinding and polishing wheels are available at modest cost. Most other tools mentioned are inexpensive hand tools, available at any good hardware store—if you can find one. By this I mean *real* hardware stores and not the glorified hardware supermarkets that have popped up all over the place. Try to obtain the best quality tools you can afford, particularly with regard to screwdrivers, of which you should have a good assortment. Get into the habit of using the proper size. Using the wrong sized screwdriver will ruin the head of the screw, which is both irritating and unsightly.



The repairman should have a wide variety of screwdrivers in order to avoid ruining screws.

THE COMPLEAT TALKING MACHINE

Second Edition

MECHANICS

From the very first wind-up models made in the 1890's to the last portables made in the early 1960's, the general construction of a spring-wound machine has remained the same. The following are the basic elements of the spring motor: the winding shaft (also called an arbor), which connects to the center of a coiled spring; the spring itself; a mechanism to prevent the winding shaft and spring from slipping back to a neutral position; a series of gears to transmit the stored power of the wound spring to the turntable spindle or cylinder mandrel; and a centrifugal regulator (commonly called the governor), which works in conjunction with a speed regulator to provide uniform record speed.

On many cylinder phonographs (and some disc machines, notably Edison Diamond Disc) there is also a long, threaded rod called a "feedscrew." When the reproducer is lowered onto the record, this feedscrew is engaged by a small section of a nut, called a "half-nut." This is attached to the mechanism holding the reproducer and keeps the stylus and record groove in alignment while the record is playing.

Lubrication and upkeep

For the phonograph to function correctly, it is important that the motor and other mechanical parts are kept clean, lubricated, and well adjusted. Lubrication of bearings is best done with lightweight household oil. Although some repairmen grease the gears, this attracts dirt and dust, which will eventually cause the gears to wear, and is therefore not recommended. However, if the gears are already worn, a little Vaseline will decrease motor noise, particularly on the fast-spinning governor gear.

Feedscrews were originally lubricated with powdered graphite, but modern silicone spray works well, too. Greasing of the mainspring is discussed a little later in the section on mainsprings.

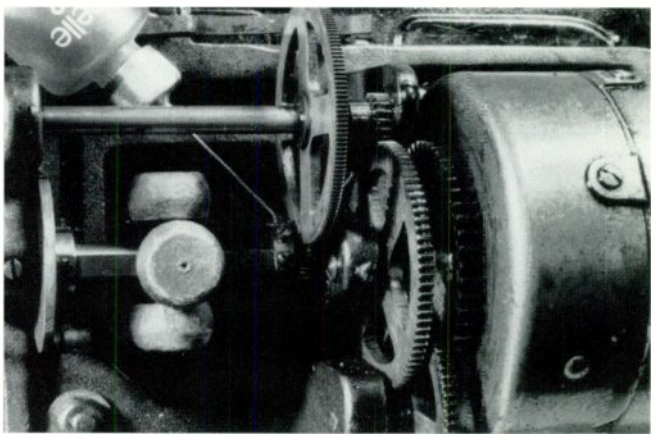
All rods and shafts that support the reproducer carriage on cylinder machines should be highly polished and *dry*. If you must lubricate them, use spray silicone. Oil will gum up feedscrews, particularly if a machine is out on display.

Never oil a machine to such an extent that oil drips into the case or onto exposed metal castings since oil can ruin the finish. To keep the machine running at its best, it ought to be played periodically to prevent the oil and grease from getting stiff. If the machine is only for display or will be stored, lubrication should be kept to a minimum—just enough to prevent any metal parts from rusting.

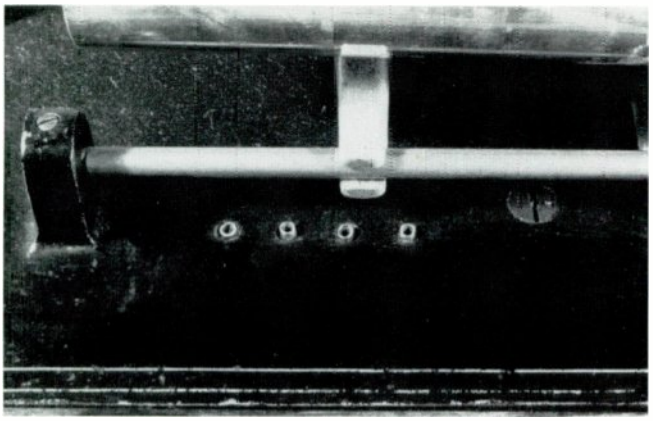
Some machines, including some Columbia cylinder models, have special lubrication tubes which make it possible to oil the machine without opening the case. On disc machines, these tubes can be accessed after the turntable has been removed. However, don't place too much trust in these devices—they are prone to clogging and should be carefully cleaned with a thin wire before using. Moreover, in my experience, anything heavier than sewing machine oil can cause them to block, so their usefulness is somewhat limited.

If, after cleaning, your machine doesn't run correctly, there is a short troubleshooting guide at the end of this section which may help you pinpoint the problem.

After playing a machine, many collectors let the



A needlenosed oil dispenser is good for getting at hard-to-reach gears and bearings.



The Columbia BK has a number of tubes which guide oil to the proper places. Make sure these tubes are not clogged before you start to lubricate.

spring wind down completely so that it will not weaken and possibly break. This also takes the strain off the governor. However, if you play a machine regularly, this is an unnecessary precaution and may actually cause other parts to wear out prematurely.

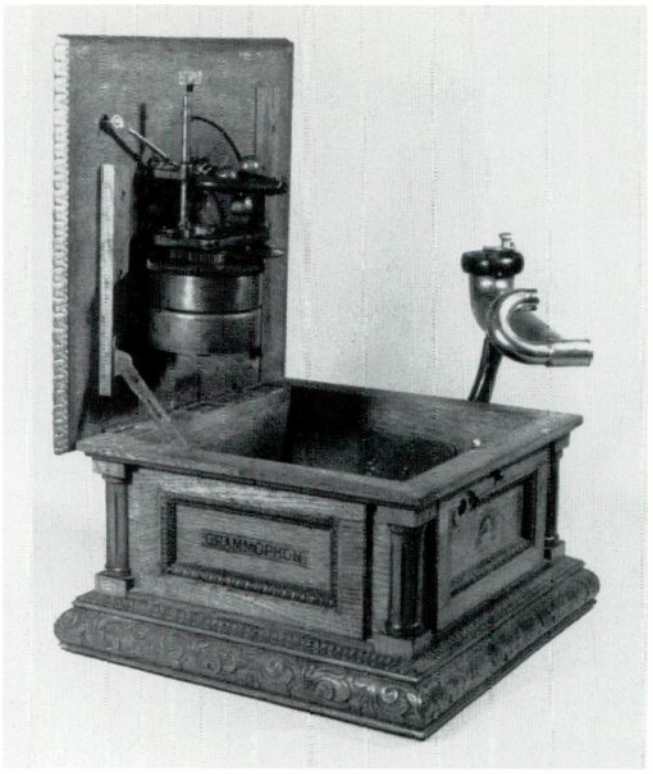
Repairing the spring motor

Removing the motor on disc machines

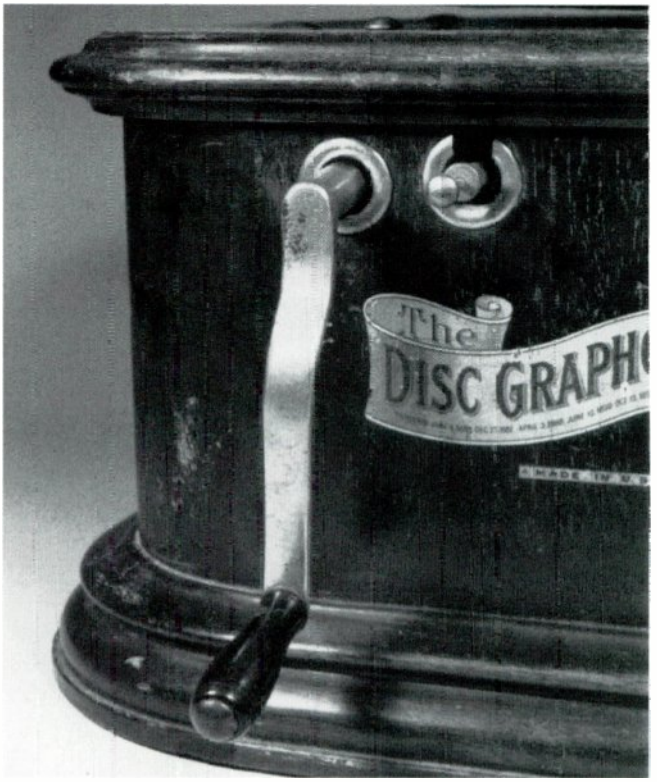
On disc machines, the motor is invariably attached to a board directly beneath the turntable, and in the case of machines with horns, the board is often hinged for easy access.

By removing the crank and any other attachments that may go through the sides of the case, such as a speed regulator, as is the case of early Columbia and Pathé machines, one can often lift the hinged lid for oiling and minor repairs. On some machines, there may be three or four wood screws around the perimeter of the motor board that must also be removed. This is also the case with many internal horn machines. On really cheap talking machines, generally those of German origin, one can only access the motor through the base.

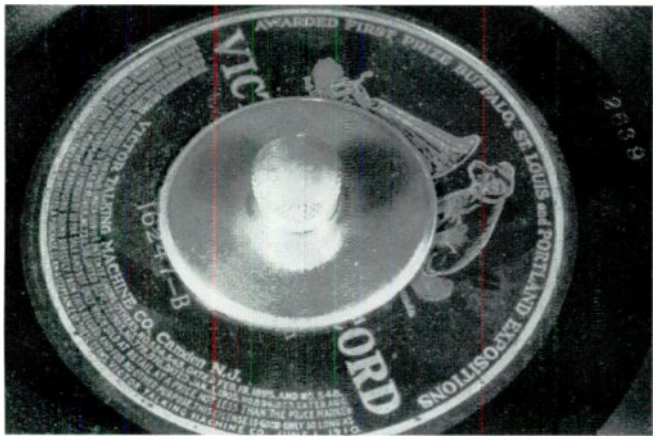
If you intend to remove the motor entirely, the next step is to remove the turntable. Turntables are attached in several different ways. A turntable can usually be lifted off, if it rests on a cone-shaped spindle. If the turntable does not come off easily, you might lift the whole machine slightly by holding the turntable and have a helper gently tap the spindle with a hammer. If the turntable is extremely stubborn, a few drops of WD-40 or similar lubricant around the spindle may help. However, before resorting to hammers and other aids, make sure that the turntable isn't held tight by some other device.



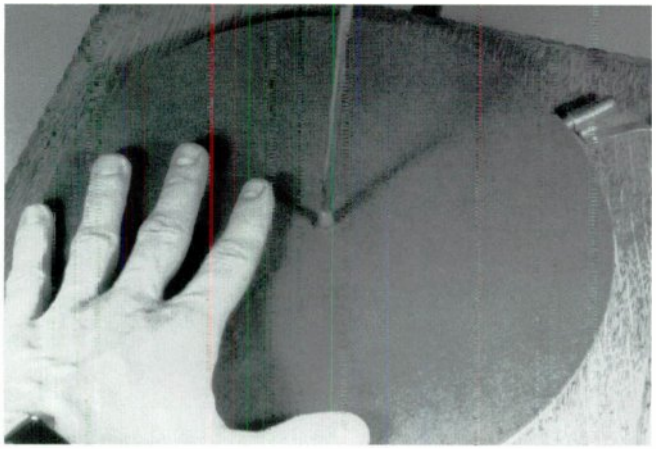
Many disc machines have a hinged lid which provides easy access to the motor.



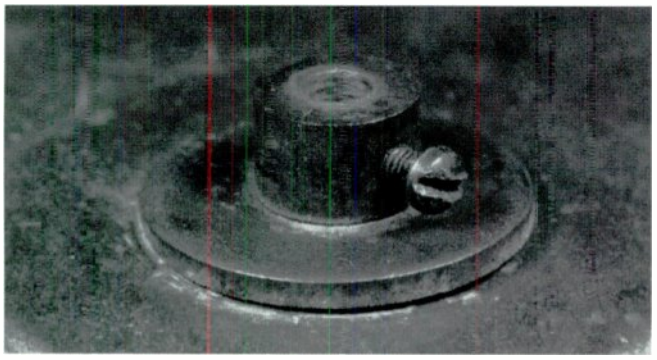
Cranks and speed regulators must usually be removed before the case can be opened. However, this Columbia BD disc machine has a slot so that the speed regulator can remain in place while the machine is being serviced.



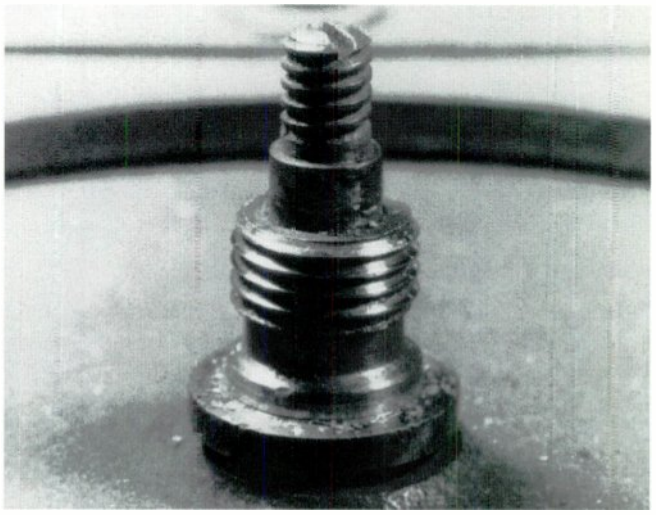
An early Victor record retaining plate.



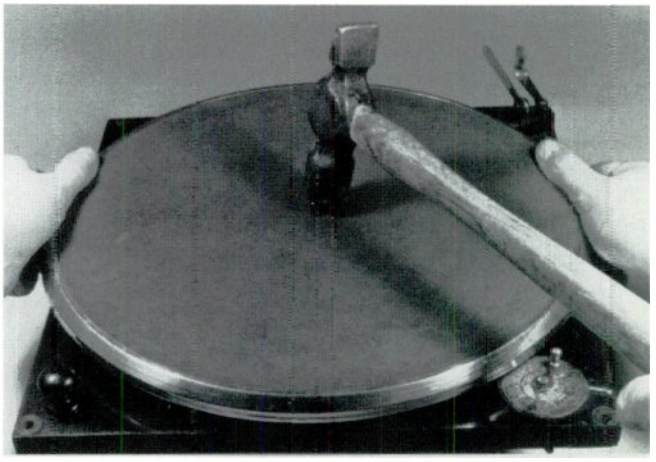
Removing a turntable from a threaded spindle. Threaded turntables almost always have a screwdriver slot in the spindle.



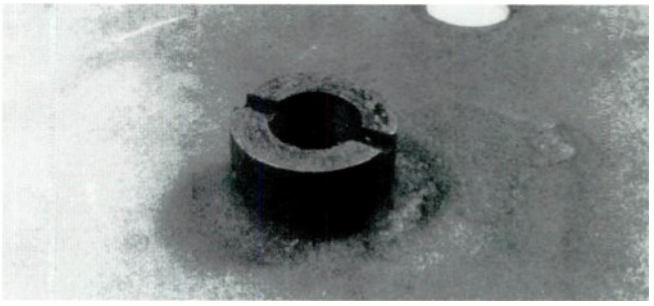
A turntable equipped with a set-screw.



Close-up of an early Victor spindle. The smaller thread is for the record retaining plate, the larger thread is for the turntable.



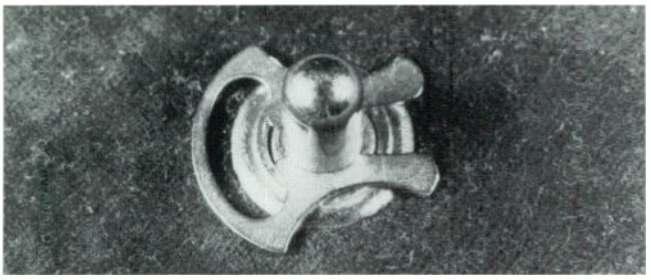
Removing a stubborn turntable requires a hammer and three hands.



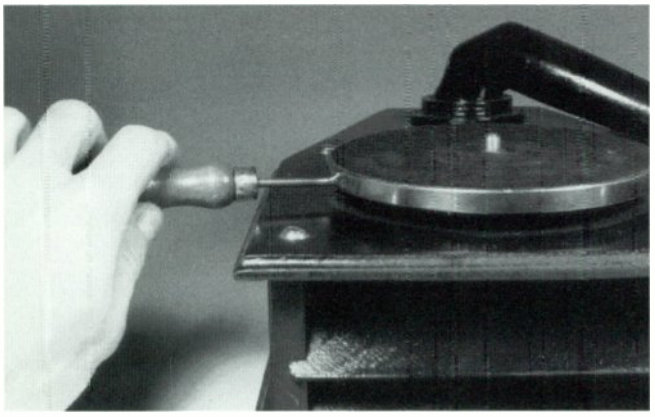
This turntable is designed to sit on a pin.

In some machines made by the Gramophone Co. in England, the turntable is held in place by a pin. In this case, an internal gear must be released from the turntable shaft, which is then removed along with the turntable.

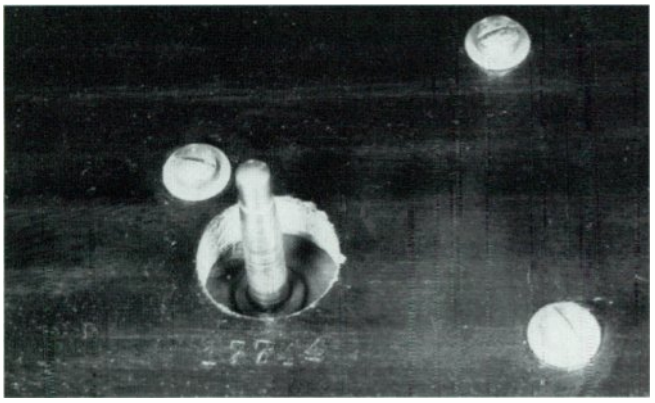
If the turntable is held in place by a retaining clip, as it often is on portable machines, this must be removed first. Any automatic brakes attached to the spindle should also be removed. Sometimes the turntable is held in place by a set-screw, which must be loosened with a long screwdriver. At other times, the spindle is threaded and the turntable must be removed by holding the spindle in a fixed position and turning the turntable in a clockwise direction. Early Victor-type machines made in England by the Gramophone and



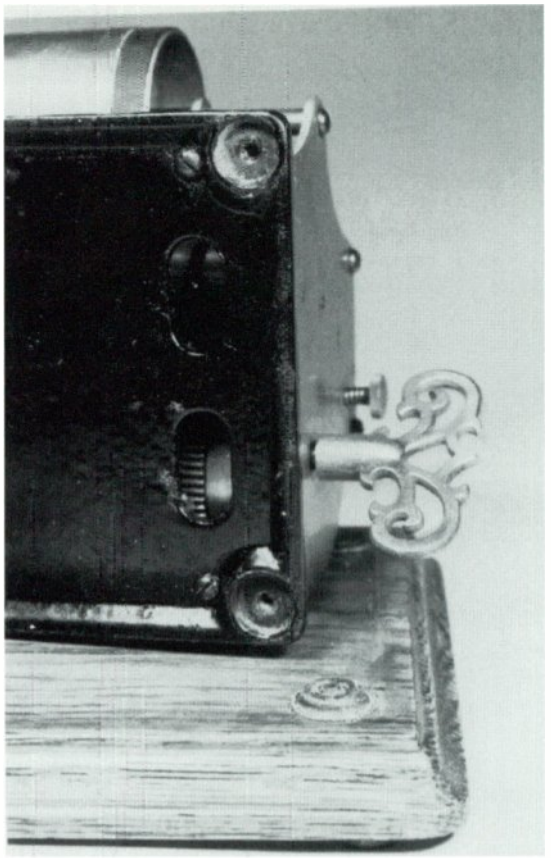
A turntable retaining clip, often seen on portables.



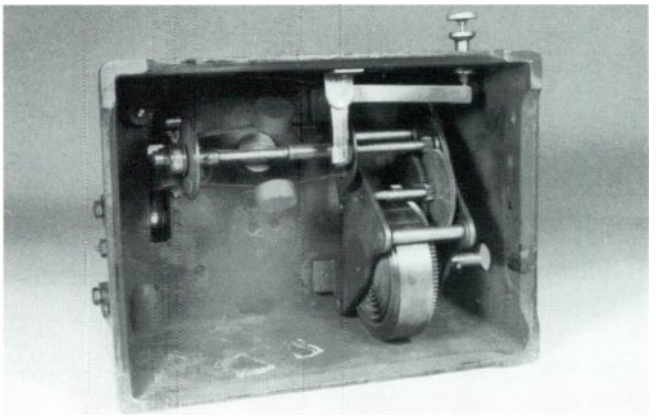
A long screwdriver is needed to loosen a turntable set-screw.



The motor is attached to the motor board with three or four bolts, hidden underneath the turntable.



Removal of the flat wooden base on this Columbia Q reveals two hidden bolts which fasten the motor to the bedplate.



On some cast iron machines such as this Edison Gem, the motor must be removed from the bottom of the machine.

Typewriter Co. use this system, which can be recognized by the convenient slot in the spindle. Using a screwdriver, the spindle can be kept stationary while the turntable is unscrewed.

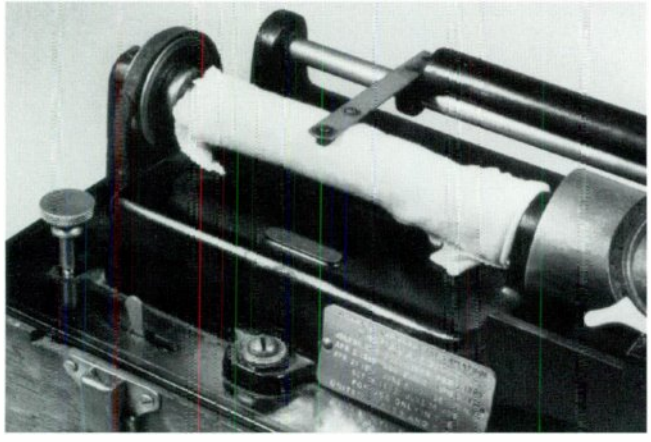
After the turntable has been taken off, removal of the motor is a simple affair. Generally, there are three or four bolts that hold the motor in position, or sometimes four bolts with attached nuts. By removing either the bolts or the nuts, the motor will come off.

Removing the motor on cylinder machines

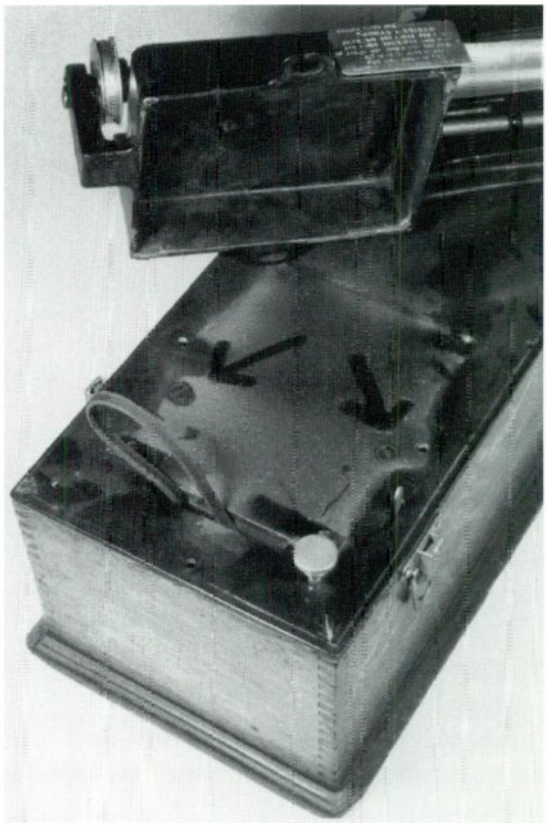
On cylinder machines, the motor is often bolted to a metal casting or steel plate called a "bedplate." The feed-screw, mandrel, and some of the gears are placed above the bedplate and are connected to the motor itself by means of a drive belt passing through it. The motor hangs underneath the bedplate, attached with bolts.

Many Edison machines, with the exception of very early models, have a hinged lid, which can be raised after removal of the crank. Some large Columbia machines have a hinged front panel. Otherwise, one must remove a number of screws which attach the bed-

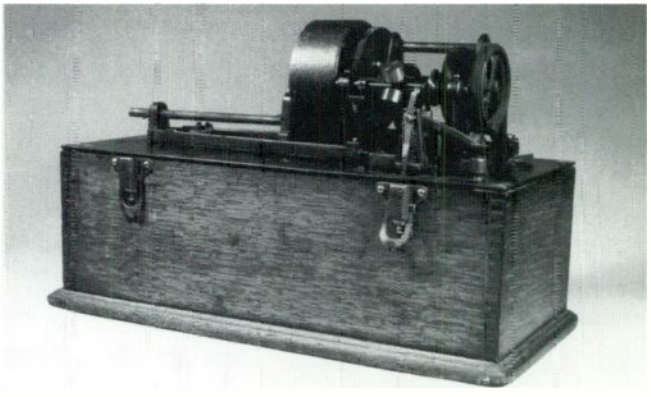
Fastening the carriage before turning over the bedplate prevents damage.



Old rags can be used to protect fragile feedscrews during motor repairs.



Removal of the upper casting on this early Edison Home reveals the motor retaining bolts.



Inverting the bedplate on the case provides a good support for the motor during repairs.

plate to the cabinet, after which the entire mechanism can be removed.

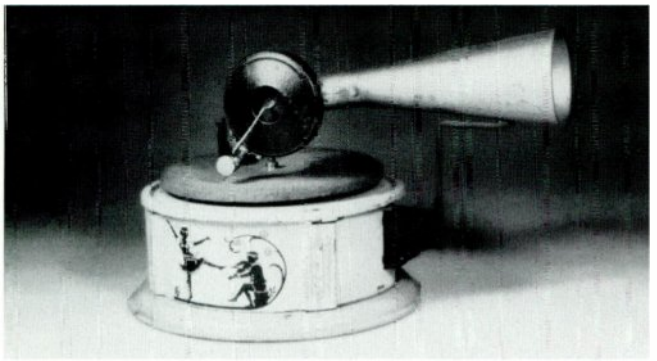
On open works machines, such as the Columbia Q, the various parts are bolted to the flat bedplate from both sides. Removal of the wooden base will reveal any hidden bolts. On Edison Gems and similar machines such as the Pathé Gaulois, the motor must be removed through the base of the casting.

It is generally a good idea to remove the reproducer and horn from the machine before you start tampering to avoid any possible damage. In the case of larger Edison machines, such as the Home and the Triumph, where the feedscrew is very, very fine and exposed to dropped screwdrivers and other hazards, it is a good idea to protect the threads by wrapping the feedscrew with rags before starting any major operation.

If you unscrew the bedplate from the lid, it is possible to turn over the entire mechanism and rest it on the empty cabinet. This is a good way to support it during repairs. Carriages on Edison machines should be fastened with some string so that they cannot flip backwards and cause damage.

A word regarding toy phonographs

Some toy phonographs from the 20's are sealed like a



A toy disc machine from the 1920's. (German, probably a Lemiphone)

tin can, which in fact they are. Many machines from the German toy-maker Bing have this design. I know of no suitable method for getting into them, short of using a can opener. If the machine works, then you would probably be well advised to leave the motor alone. If the motor is broken, then you have to decide whether or not to deface the cabinet. My opinion is that these machines really can't be considered serious instruments and probably should be left alone.

First steps

Before you tear into the motor, you must make sure that the spring is *completely wound down!* Should you neglect to do this, there is an excellent chance of damaging the machine and risk of personal injury. In fact, whenever working on machine motors, you should consider some kind of eye protection, such as goggles, if there is tension on the spring.

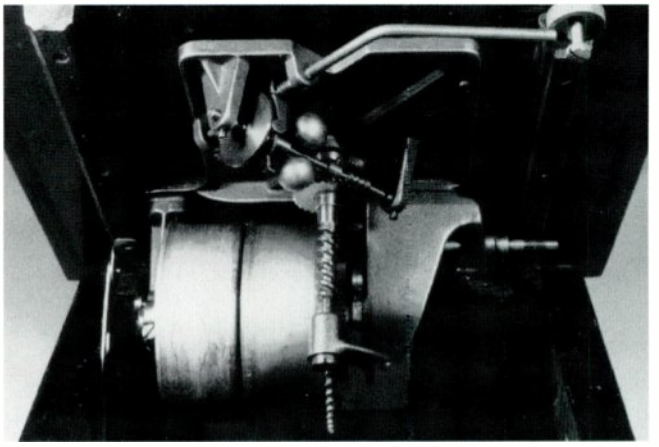
The spring ought to be wound down before the motor is removed from the case, and *must* be done if the spring and governor are not mounted on the same casting, as found in some Gems. If the spring is not enclosed in a metal case (spring barrel), you can see if the spring is wound down or not, although springs that touch the sides of the cabinet may not be as fully relaxed as you might think.

With an enclosed spring (or springs), the best course of action is to twist the spring barrel(s) with the fingers to see if there is tension. If you cannot *easily* twist the barrel a fraction of an inch, then there is a chance that the spring is still partly wound. In the case of disc machines, one can often reduce tension by turning the turntable with a finger in a clockwise direction to overcome any friction in the motor caused by dirt, lack of oil, or bad bearings. However, if you turn the turntable too much, you may open up the center coils of the spring, so don't overdo it.

If some part of the motor is simply jammed and will not permit the spring to wind down, you can also try to release any attachments of the winding shaft, such as a ratchet pawl. This device prevents the crank from slipping back during winding. Keep a good grip on the crank when attempting to unwind a spring in this manner and unwind slowly by hand. Failure to hold onto the crank when releasing the pawl is *very, very dangerous!*

Motor types

Most motors are built as units consisting of either a casting, which holds all the various parts, often at odd angles, or "pillar and plate" motors where the parts are held between two plates, with pillars in the corners that hold the plates at a fixed distance and also hold the mechanism together.



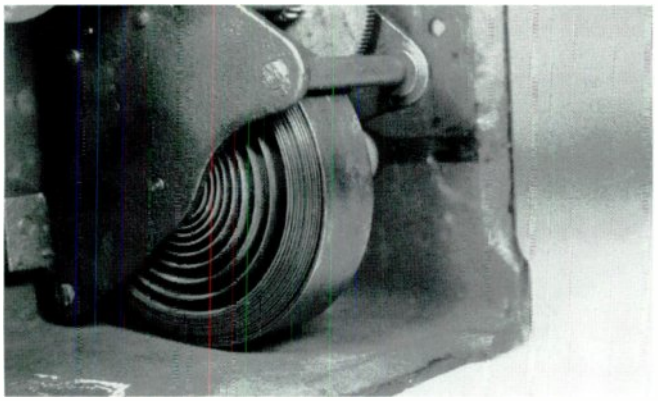
A typical cast motor. (Victor, 1907)

Disassembly of the pillar and plate motor

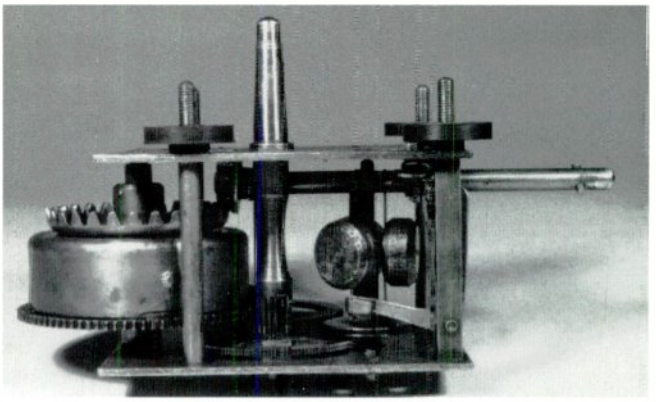
The pillar and plate motor is without a doubt the easiest type of motor to work on. It is generally seen on inexpensive disc machines and on most open works cylinder types. Each pillar usually ends in a long bolt with which the motor is attached to the motor board. Removal of the motor will usually reveal another set of nuts on the pillars.

By removing these nuts, the top plate can be lifted off and the various motor parts freed for cleaning and adjustment. Be sure to pull the plates off squarely to avoid bending the shaft ends.

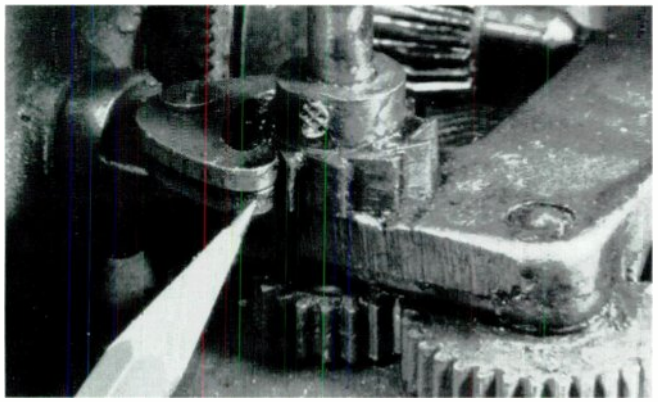
On some motors of this type, the bottom plate is attached with small removable bolts. At any rate, one must remove either the top or the bottom plate and a brief inspection of the motor will show how to take it apart. It is not necessary to remove every last piece of



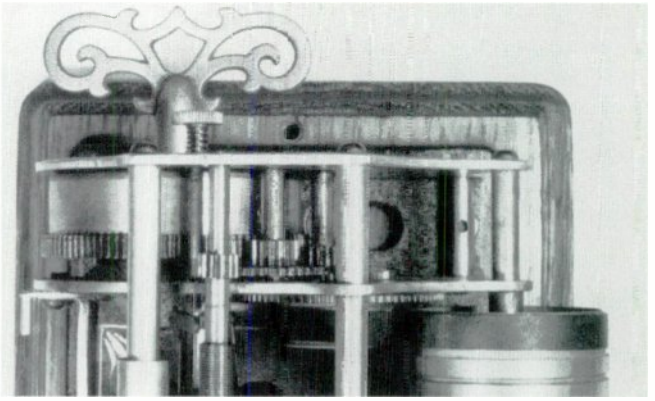
The Edison Gem has no spring barrel. Because the spring touches the side of the case, it may not be able to unwind completely. The motor must therefore be removed with some caution.



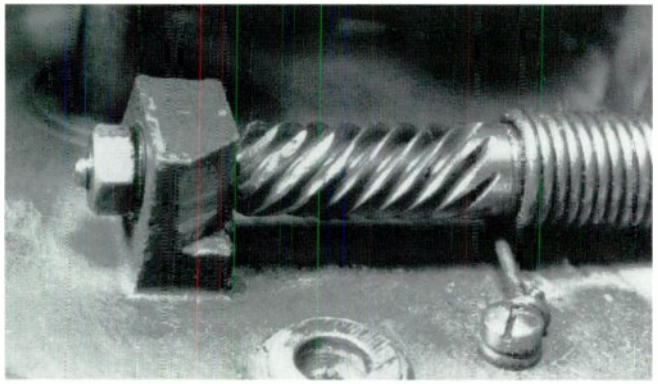
A typical pillar and plate motor. (German, Industria, 1922)



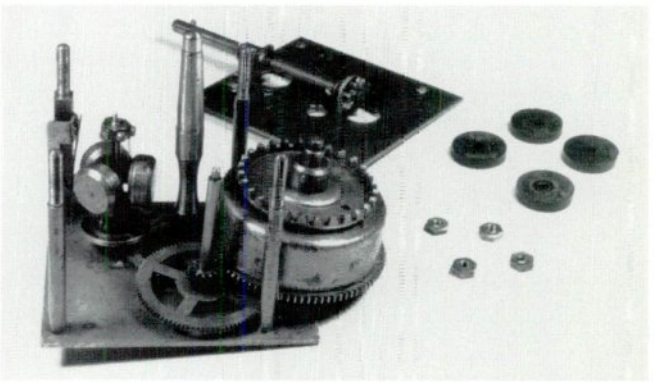
Releasing this ratchet while holding the crank firmly allows the spring to be unwound.



Most open works motors on cylinder machines are of pillar and plate construction. The machine here is a Columbia Q.



The damage to this worm gear occurred during disassembly of a wound motor. In this case, both the machine and repairman were lucky. The risk of personal injury is high if a wound motor flings parts around the room.



Removal of the top plate allows all the main parts to be lifted out without further disassembly.

hardware from the frame, such as speed regulating arms, etc. These usually require little in terms of cleaning and adjustment.

If you have never torn down a motor of this kind before, you might want to make a quick sketch showing the correct positions of the parts to aid reassembly. Just don't wait six months to put the thing together again or you may have problems, even with your sketch! However, the motor is *very* simple and a little experimentation will allow you to assemble it again. Make sure to keep track of all screws and, in particular, washers. These are often hidden under layers of old grease and can easily be overlooked and lost. Any rubber washers used as noise insulators between the motor and

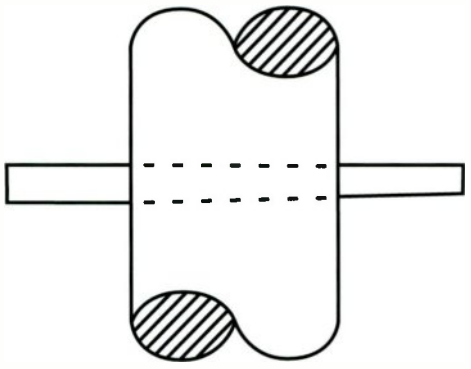
the board should be replaced with fresh ones. This applies to rubber washers in other motor types as well.

Disassembly of the cast motor

The cast motor frame allows individual parts to be removed whereas the pillar and plate motor falls apart all at once. Governors are almost always held in place by small cylindrical bearings which are in turn fastened with small set-screws. Larger parts, such as the spring barrel, are often held in place by smaller castings bolted to the main frame. By removing these smaller castings, most other parts will come off.

Some general comments on disassembly

In addition to set-screws, bearings, and bolts, you may come across pins that must be punched out. These are often tapered and can only be removed in one direction. I hope you will try to take all this in stride, without undue hysteria. Despite the fact that many of these motors look complicated, you have to remember that

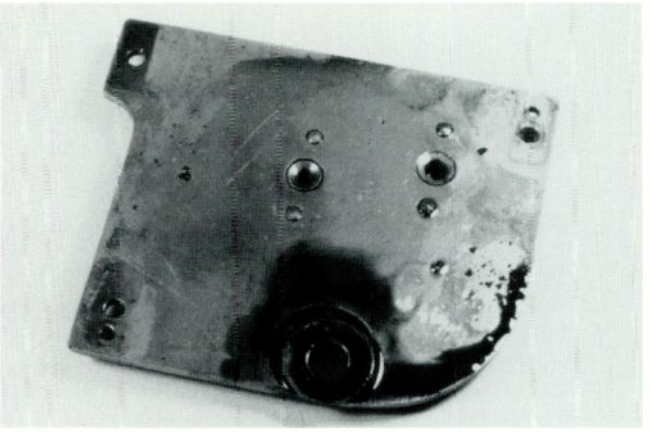


Conical pins can be punched out in one direction only.

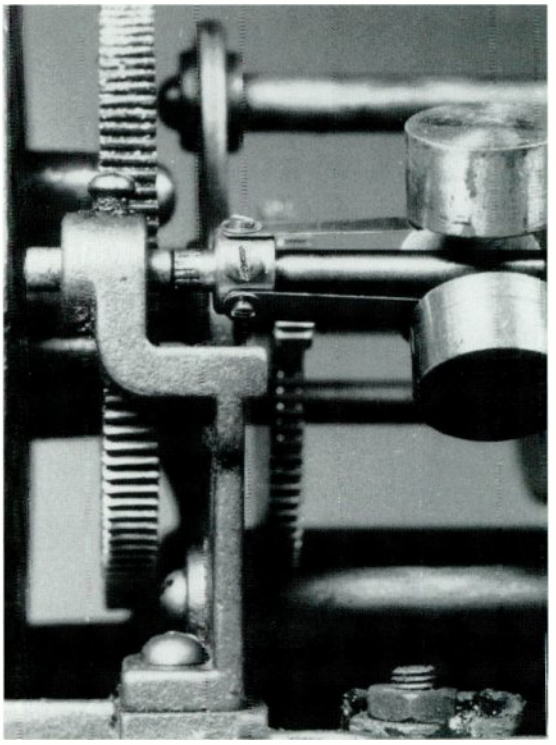
they were assembled by hand and not by black magic. The thing to do is to figure out in which order things were installed and then remove them in the reverse order. Only rarely were parts riveted or soldered *after* the motor was assembled—and even if they were, these are not usually the parts in need of service.

Often castings have become very rusty after years of storage. As a result, small set-screws and bearings can become almost impossible to remove. In these cases, it is best to soak the problem parts in oil overnight and then try again the next day. WD-40 is also very helpful in this regard. Rust remover or glass bead blasting can also help solve the problem if all else fails.

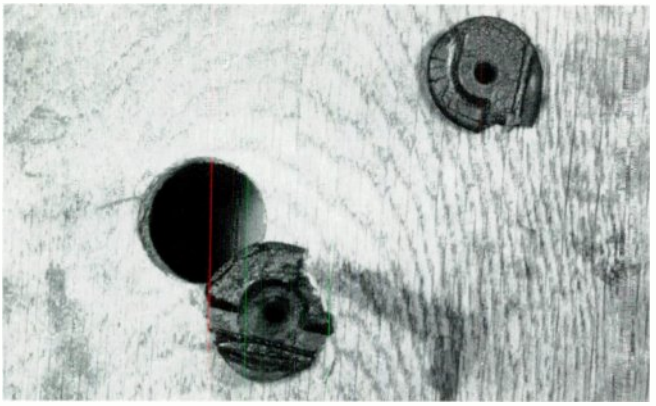
If there is still a head on the set-screw in question, it sometimes helps to insert a screwdriver and give it a sharp rap with a hammer to loosen it. You must be careful, though, not to break the rather brittle cast iron; welding this type of metal is not a job for beginners. If the head of the set-screw or bolt is broken, then you must either attack it with pliers (if there is any head left), extract it with one of the special extracting tools available at better hardware stores, or drill out the hole and cut a new thread. Stubborn bearings can then be punched out of the casting with any blunt instrument. For example, galvanized nails can be used after the point is ground flat. Since the galvanized metal is softer than the steel bearing, the risk of marring is reduced. Old brass hinge pins are great for this job.



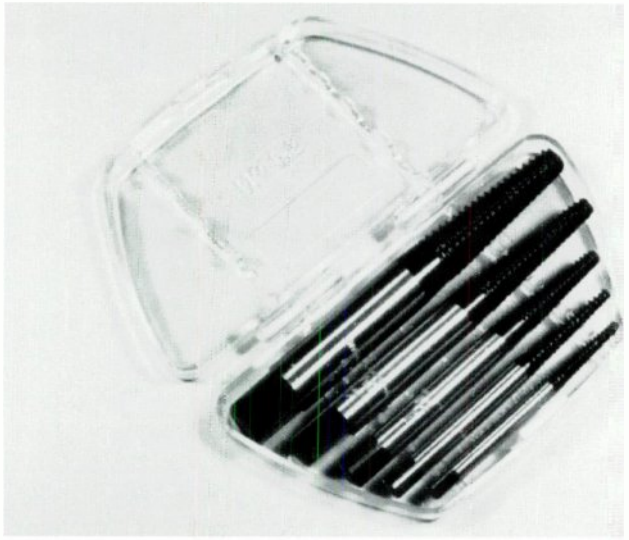
Washers are often hidden under layers of old grease and oil.



A detail of an Edison governor assembly mounted on a removable casting.

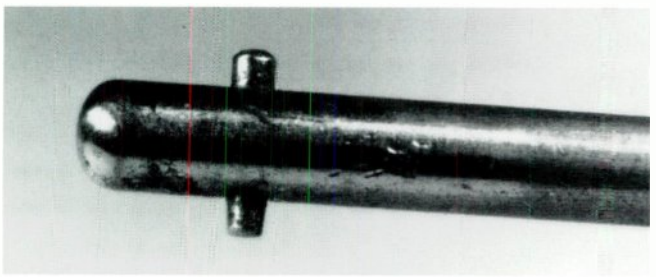


Rubber noise-insulating washers like these must be replaced.

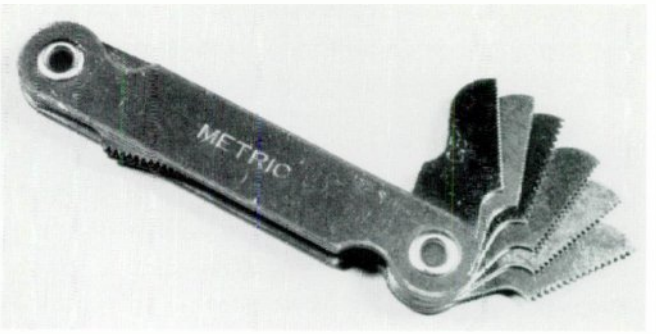


A set of screw extracting tools.

Should the worst happen and the casting break, you have three options: you can weld the part or have it welded; you can bolt on two metal splints; or if there is no great stress on the part, you can use epoxy to glue the joint. If you lack the experience to weld the piece, a good welder can often be found at a small body and fender shop. If you approach the welder early in the morning or just before quitting time with a few dollars in one hand and the broken part in the other, a suitable arrangement can usually be made. Just don't bother the man in the middle of a busy workday!



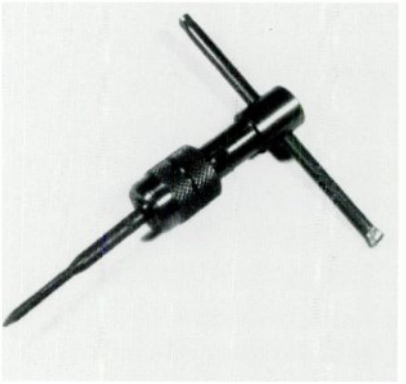
A pin such as this can be punched out in one direction only.



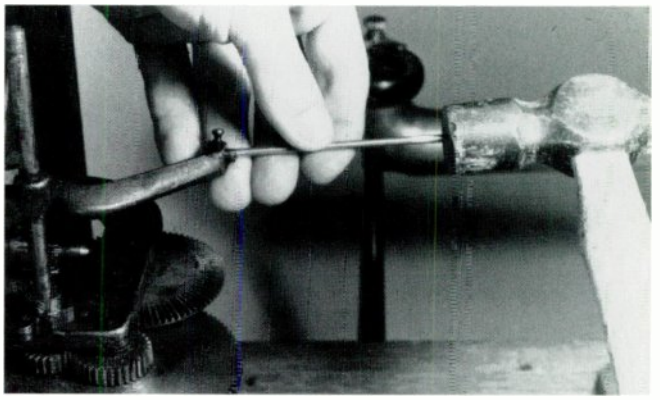
An inexpensive thread gauge.

Sometimes holes in metal castings have become so worn that the parts no longer fit properly. This is often seen in the bearings supporting the spring arbor (the rod passing through the center of the spring barrel). In such cases, the misshapen hole must be drilled out, filled with a short piece of solid metal rod, and pressed into place with a C-clamp. A new hole can then be drilled in the fresh metal. Before drilling a hole in any type of metal, make an indentation with a center punch (simply a pointed piece of hardened steel) in order to get the drill bit started in exactly the right place.

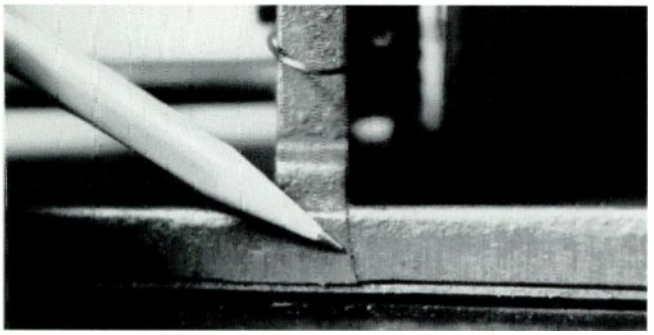
Well stocked hobby and art supply stores as well as good hardware stores often have solid brass rods in a



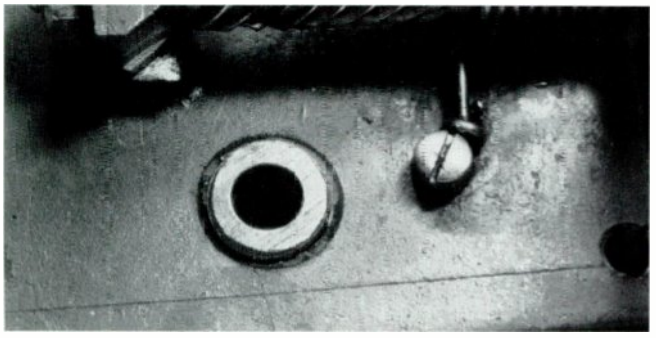
A tap for cutting new threads.



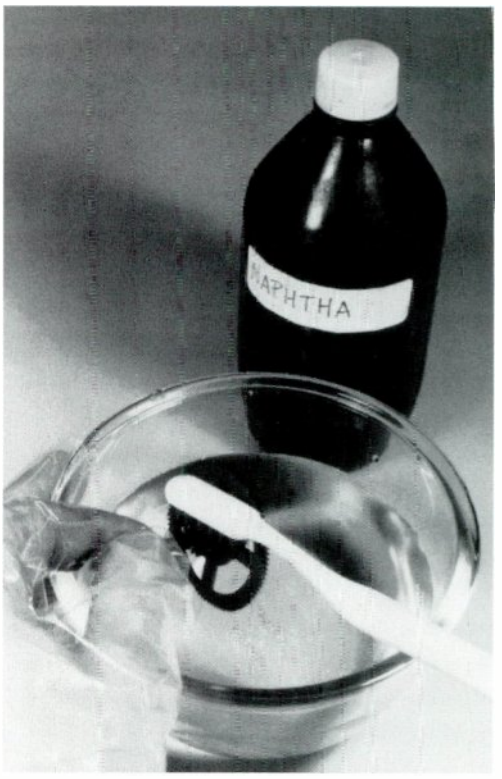
Punching out a stubborn bearing with a brass hinge pin.



A hairline crack in a motor casting.



A new bearing has been installed in a worn casting.

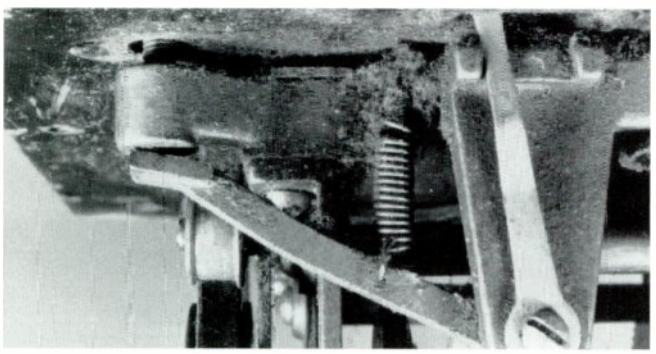


Dirty parts are easily cleaned with naphtha or lacquer thinner and an old toothbrush. Protective gloves and good ventilation are a must.

variety of sizes. Brass is easier to work with than steel or iron since it is softer and can be pressed into a tight hole without resorting to violence. Special brass tubes for repairing clock bearings are available from jewelry supply houses and are equally useful for small precision bearings, a subject discussed a little later. The problem of enlarged holes is not as great in cast iron as it is in pot metal, which is sometimes used for plates in pillar and plate motors.

Cleaning the motor

Over the years, an incredible amount of dirt collects in phonograph motors, largely due to the sticky consistency of old grease and oil, which attracts dirt like a magnet. Some collectors simply throw the entire assembled motor in a bucket of gasoline in order to loosen dirt and grime, but this is not recommended. First of all, gasoline leaves a sticky, white film on the metal and rarely gets at the gunk that collects in the bearings. Secondly, unless you intend to clean and regrease the spring (old grease is often surprisingly well preserved), dumping the assembled barrel into any degreaser usually thins the grease to such an extent that it drips dirty diluted gunk for a long time afterwards. This messes up the inside of the cabinet and may cause other mischief. Thinned grease can no longer do its job properly and the result is a weaker, noisier spring.



Motors collect an amazing amount of dirt!

The best method for cleaning motors is to soak the individual components in naphtha and to scrub them individually with an old toothbrush. If you've gone to all the trouble of taking the motor apart, this procedure is well worthwhile. It takes very little time and can dramatically improve the power of the motor. Be careful to inspect all parts for washers that may be glued on with old grease and note their positions. Also, it is a good idea to strain, or at least inspect, the dirty naphtha carefully to make sure that no small parts (usually washers) remain in the bath.

Rubber gloves and good ventilation are *an absolute must* when working with any organic solvent such as naphtha. Not only are the fumes dangerous to inhale,

but the chemical can also be absorbed through the skin. These solvents are also highly flammable. In some countries, naphtha is no longer sold for these very reasons—in which case lacquer thinner can be substituted, although the same health/fire precautions must be taken.

Any shafts used to guide the carriage in cylinder machines should be buffed and polished so that the carriage moves easily.

If old castings cannot be cleaned in any other way, I recommend glass bead blasting. This is just like sandblasting but uses small beads of glass rather than sand and is therefore not as hard on the metal. Again, if there is no sandblaster in your area, auto body shops and places that produce "etched" glass usually have the equipment for this task. For the home shop, small bead-blasting rigs can be purchased for a few hundred dollars. Bead blasting is also a good way to remove old nickel plating and prepare cylinder phonograph bedplates for refinishing. These topics are covered in more detail in the chapter on cosmetics.

The spring

A friendly warning

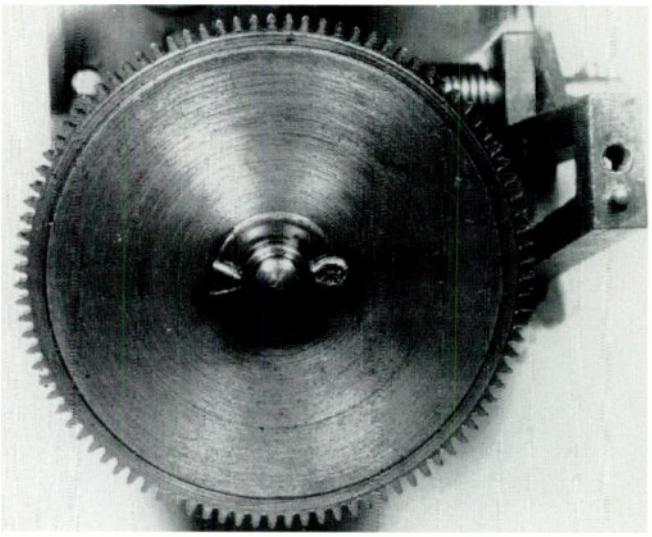
Even though your spring may be completely wound down, it is important to remember that the spring is still under quite a bit of tension even when resting in the barrel. Therefore, I suggest that you to put on protective eye covering and wear a long-sleeved shirt to guard against cuts.

Of course, springs are not mad beasts that jump out at you without provocation, but they must be handled with care. If you are nervous about working with springs, or lack the physical strength to keep them under control, I would strongly urge you to refer the work to a professional. The names of several reliable repair shops are listed at the back of the book.

Opening the spring barrel

Unless the spring is broken or "thumps and bumps" during use, it is not absolutely necessary to clean and regrease the spring and barrel, though this will improve performance. However, if the spring *is* noisy, there is a good chance that the old grease has solidified and *must* be replaced. Otherwise, the power and life expectancy of the spring is greatly reduced.

Some restorers insist that old grease becomes gritty with age, even if it appears to be alright. A good rule of thumb is, if the spring shows signs of rust, replace the grease. If you want to test the old grease, smear a dab on a piece of soft cotton, for example an old T-shirt, and polish the blade of a stainless steel dinner knife. If scratches appear, replace the grease.



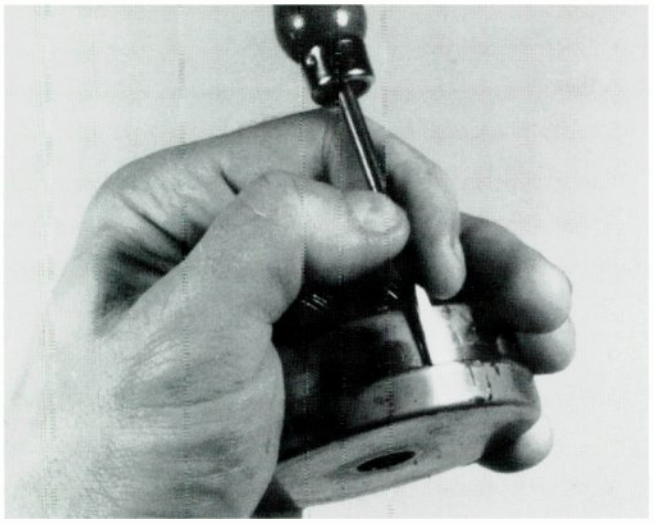
The lid of this spring barrel is held in place by a cotter pin.

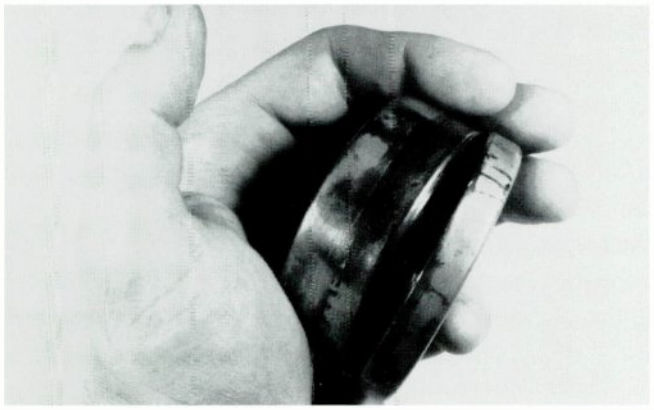
If the spring is not enclosed in a barrel, then the method of removal becomes obvious. A C-ring (a semi-circular steel rod) is good to have in order to form a kind of temporary spring barrel. This makes the exposed spring more manageable. In the case of the enclosed spring, the first step is to remove the "lid" of the barrel.

Although the barrel may appear to be hermetically sealed, there is always some method of entry. There are usually two gears attached to the barrel: a gear permanently fastened to the barrel, which is often the same diameter of the barrel itself, and a smaller gear attached to the center shaft. The smaller gear is part of the winding mechanism while the larger gear transfers the stored energy of the spring to the rest of the motor. The reverse setup can also be found but is less common. In some motors, the smaller gear does not exist, and the crank or key fits directly onto the shaft.

The barrel lid is often on the same side of the barrel as the large gear. This can take the form of a flat plate that forms the center of the large gear, or the entire gear can form the lid. Other times, the lid resembles the top of a cookie tin. In most cases, the lid is simply pressed into place, but occasionally it is screwed on, like the lid of a twist-off jar.

If it is possible to remove the center shaft, now is the time to do so. By twisting the shaft to further unwind the spring, the hook on the shaft will release the spring and allow the shaft to be withdrawn. This is sometimes





Opening a spring barrel of the "cookie tin" variety.

a little tricky and requires patience. On some motors, the shaft is too large to pass through the hole in the plate or lid that seals the spring. By tapping one end of the shaft, one can often push off the lid with the shaft itself. The spring is flexible enough to allow this. Always scratch a mark in the barrel lid and on the barrel itself so that you can align the two pieces during reassembly.

In cases where the lid fits over the edges of the barrel like a cookie tin, the lid can be removed by using a screwdriver and hammer, and gently tapping around the edges. If the lid fits into the barrel as part of the large gear, one can either use the method of tapping the shaft or, if the shaft can be removed, by inserting a screwdriver through the top hole and tapping against the bottom plate. This plate usually pops off easily.

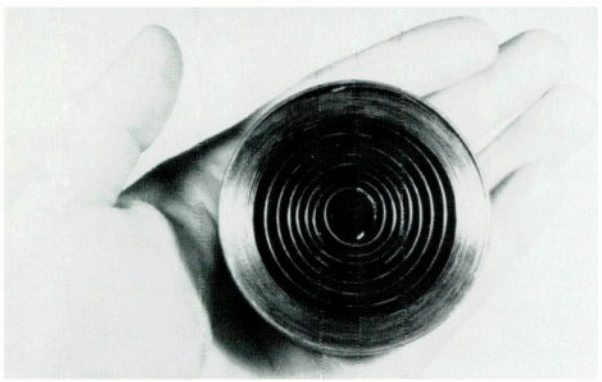
On some models, the center shaft and lid are held in place by cotter pins or circular clips which must be removed. Some double-spring motors are screwed together with the two springs facing each other. Generally speaking, removal of any screws on the spring barrel will give you clues as to its assembly and, when removed, will allow you to open the barrel. Look out for any washers or spacers between the two halves of the barrel so that you can note their positions.

Removing the spring

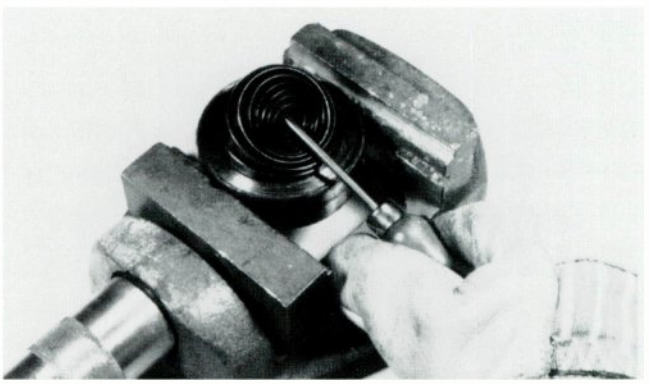
This next step is more dirty than dangerous when approached in a careful manner. Nevertheless, I would strongly recommend the use of safety goggles and gloves just to be on the safe side. A long-sleeved work-shirt is not a bad idea either as flying springs can make nasty cuts. Also, make a quick sketch showing the direction of the spring in the barrel. A surprising number of people put the spring in backwards during reassembly and have a terrible time trying to figure out why the motor won't run!

Next, secure the barrel to your work surface, for example by clamping it in a vise. Care must be taken not to deform the shape of the barrel by clamping it too tightly. Christopher Proudfoot, in his excellent book *Collecting Phonographs and Gramophones*, suggests the construction of two V-shaped wooden jigs in order to grip the barrel at four points rather than two. As you gain more experience, you may find that it is just as easy to wind the spring out of the barrel with the hands alone, particularly when working with small, light-weight springs.

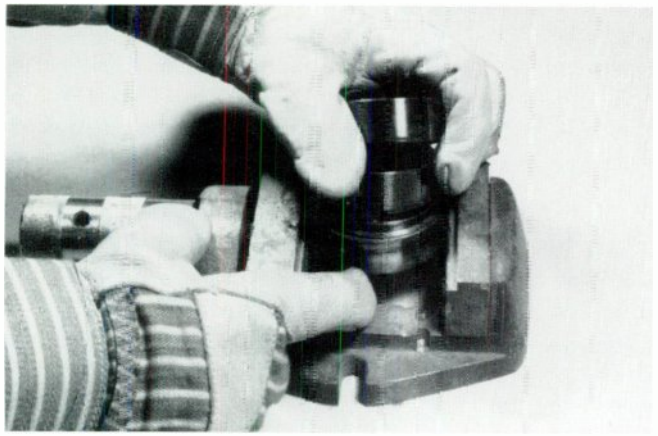
Before you go any further, take a careful look at the



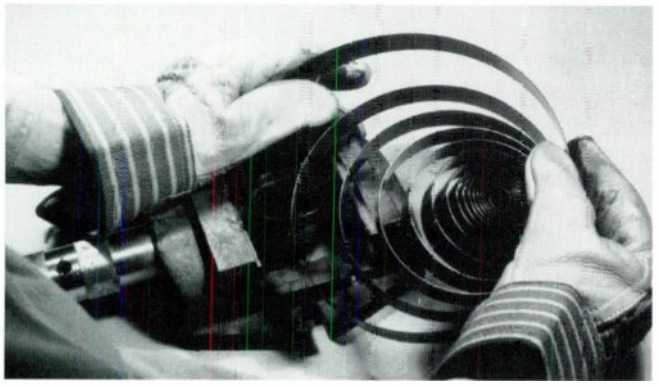
The exposed spring.



The center coils can be pried up with a screwdriver...



...and pulled out of the barrel.



By carefully feeding the spring from hand to hand, the rest of the spring can be removed. Be sure to keep a good grip on the spring at all times so that it doesn't fly out and hurt you.

spring and make sure you know where any breaks are situated. Otherwise a jagged piece of spring may hop out of the barrel and catch you by surprise.

When the barrel is secure, grasp the center of the spring and pull it out of the barrel. At one point, the spring will start to unwind itself and it is here that one must be careful not to lose control. I usually feed the spring from hand to hand, making sure that one hand always has a good grip, until the spring is all the way out.

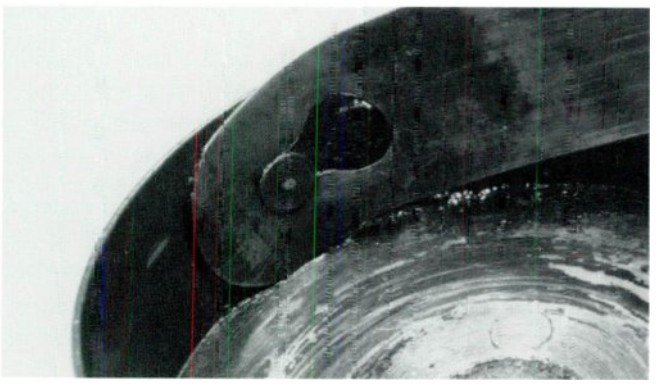
There is, however, an easier way to get the spring out. By placing the barrel in a heavy canvas bag (an old mail bag from the post office is ideal), one can grasp the barrel through the cloth and shake the spring out. The risk here is more to the spring than to the repairman. Small nicks in the spring can cause breaks at a later date. There is also a risk of breaking the hook on the inside of the barrel. I don't really care for this method, but I feel I should mention it anyway.

Cleaning, regreasing and replacing the spring

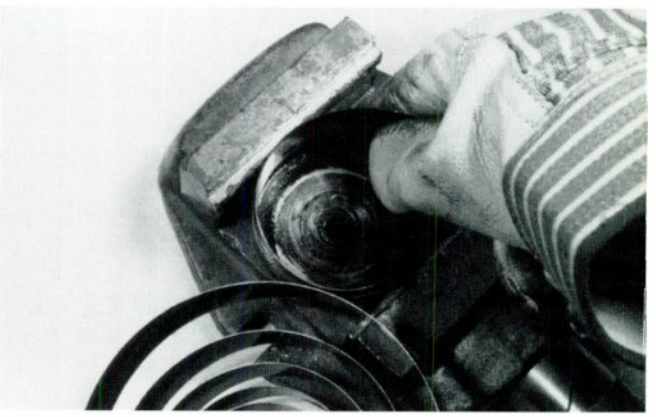
The old grease used to lubricate the spring must be cleaned off before replacement. Naphtha or lacquer thinner and a plastic scouring pad work well. Remember to use gloves and provide adequate ventilation. The inside of the spring barrel, lid, and shaft should also be cleaned off.

The basic procedure for replacing the spring is the reverse of the procedure for removing it—unless, of course, you shook the spring out. First, check the fit of the center shaft and the spring. The hook should engage almost automatically. If it doesn't, anneal, bend, or file the center coils so that the shaft engages properly and without difficulty. This reduces the risk of having to tear down the motor again should someone spin the turntable around by hand and disengage the spring. If you wait until after the spring is installed to adjust the center coils, the job is much more difficult. New springs in particular usually need a little filing and bending in order to fit properly.

Next, put a few spoonfuls of grease in the bottom of the barrel. Hook the end of the spring to the barrel and wind in at least one full circle of spring. This will prevent the end of the spring from coming loose. With larger springs, such as those found in the Edison Triumph and other big machines, this can be quite

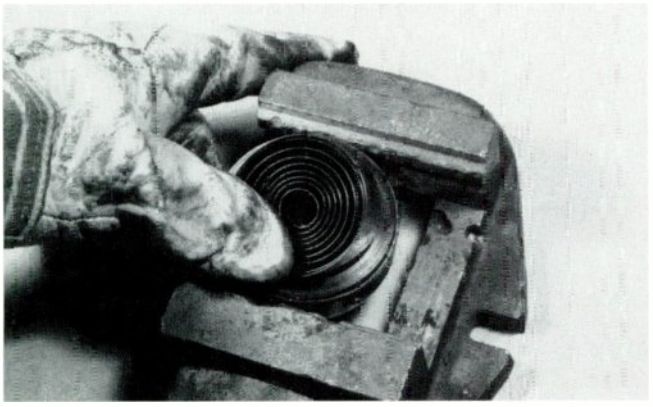


Although this spring is riveted to the barrel, the oblong hole allows the spring to be removed without tampering with the rivet.

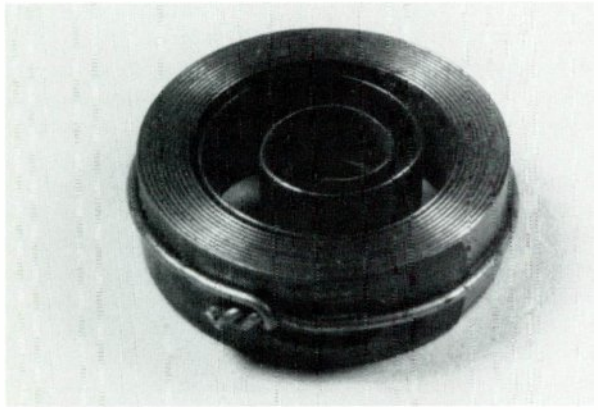


Replacing the spring is just like taking it out, only in reverse.

Wind the spring into the barrel...



...until the center coils drop in place.



A new spring.

tricky. In the case of new springs, it may be necessary to grind the end of the spring so that it is round (or rounder) so that it can be hooked from a more convenient angle. Also, the contour of the spring end must conform to that of the spring barrel. If it doesn't, you will have to bend it so that it does.

Continue winding in the spring. Although the first coils are difficult, the center coils drop in easily. To finish the job, put some more grease on top of the spring and press it into the coils.

If you have never worked on a spring before, it might be a good idea to practice on a small, lightweight spring to get the feel of things before plunging into something with big, strong springs.

It is a good idea to replace the center shaft before replacing the lid, if possible. If the hook won't grab the spring, it is helpful to be able to see what is going on inside so that you can help things along with a screwdriver or needlenose pliers.

In some cheap motors, the outer end of the spring is riveted to the barrel. If the spring only requires cleaning and lubrication, there is no reason to file off the rivet. However, if the spring must come out entirely, you'll have to replace the rivet or countersink a small flathead bolt, with the nut *outside the barrel.* Remember to note the direction of the spring since removal of the rivets will also remove clues as to the proper winding. If you are in doubt, examine the hook on the shaft.

A word about grease

Graphite grease is still available, if nowhere else, then from the various suppliers listed in the back of the book. Modern substitutes containing molybdenum, lithium and Teflon as well as ordinary car grease work well, too. Some collectors also thin their grease with engine additives to the consistency of thick cream, claiming that this provides better lubrication. Personally, I haven't found this method to provide any significant improvement over ordinary grease, but people I have great respect for swear by this method, so I'm passing it on.

If you're a purist, Edison's own recipe for mainspring lubricant was 10 parts Vaseline and 1 part Dixon's No. 2 flake graphite, by measure. I got this formula many years ago from a man in Chicago who had actually worked for an Edison dealership around 1910. I assume it's correct, though one may question why he would choose to remember such an obscure detail from his youth.

Replacement springs

A new spring should have the same width, thickness and length as the old spring, and should have rounded edges—not square and sharp. If the old spring is missing entirely, a good rule of thumb is that the wound replacement spring should represent about 30-40% of the radius of the spring barrel. On double-spring Victors, the length of the spring (6', 12', or 17') may be stamped on the plate separating the springs.

Replacement springs arrive from the dealer wound up tightly and secured with a wire. Getting this wire off

can sometimes be problematic. In many cases, the spring can be popped directly in the barrel and the wire pried off.

The only problem with "popping" the spring in the barrel, easy as it sounds, is that it can be very difficult to engage the outer hook. On machines where this hook *looks* like a hook, often pressed directly out of the barrel case, the spring will easily engage. In the case of hooks formed from round-headed rivets, this is much more difficult. Additionally, the force of the rapidly unwinding spring can damage or break the hook.

Perhaps the best method is simply to clamp the wound up spring in the V-shaped jig mentioned earlier and unwind it as if you were taking it out of a barrel.

Repairing the spring

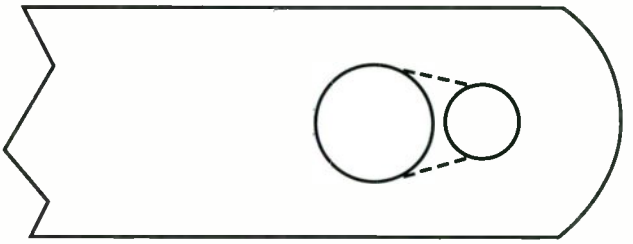
Types of breaks

Springs can break in several different ways. By overwinding the machine, the spring may break at the outermost end. In this case, the machine can be partly wound and may even play an entire record. Further winding, though, will eventually overcome the friction between the outermost coils and you will hear the spring slip and notice a decrease in tension on the crank. The second common type of break occurs at the center shaft. In this case there will be no noticeable tension at any time during winding. In either event, the spring may simply have become unhooked, which produces the same symptoms.

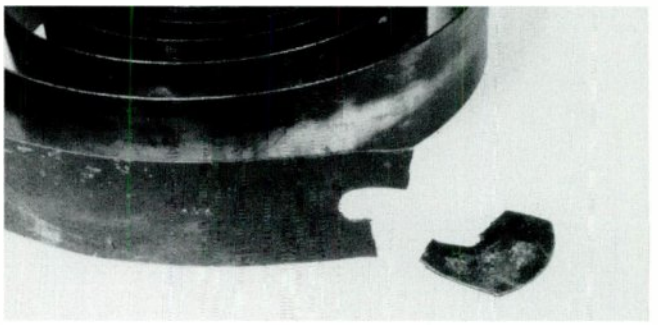
There is also a third type of break, which occurs in the middle of the spring and may allow the crank to be wound a few times before the spring slips. The fourth type of break is when the spring simply shatters into many short pieces. I have no idea what causes this last type of break, but it exists, and the only cure is a new spring. Extreme care must be taken when removing the short, sharp shards.

Breaks near the ends

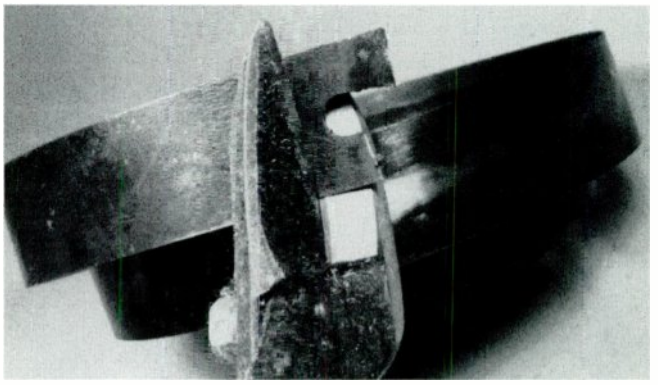
If the break is near the tail end of the spring, the old end can be cut off and a new hole can be drilled. The metal must first be annealed by heating the area around the new hole with a propane torch until it is red hot. Otherwise, it is impossible to drill in the metal. If the break was near the old hole, there may be some untempered metal left. However, the spring must still be annealed for three or four inches past the new hole to prevent the spring from breaking again when it is tightly wound.



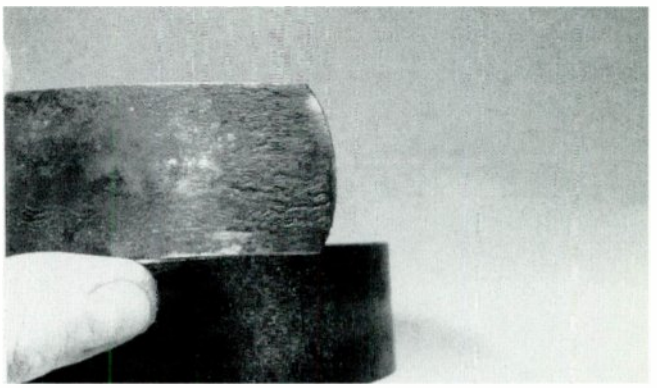
Preparing a new hole in a spring. Two holes are drilled and filed to shape.



A broken outer end—one of the easiest breaks to repair.



The broken end is cut off with tin shears...



...and the end is rounded with a file or on a grinder.

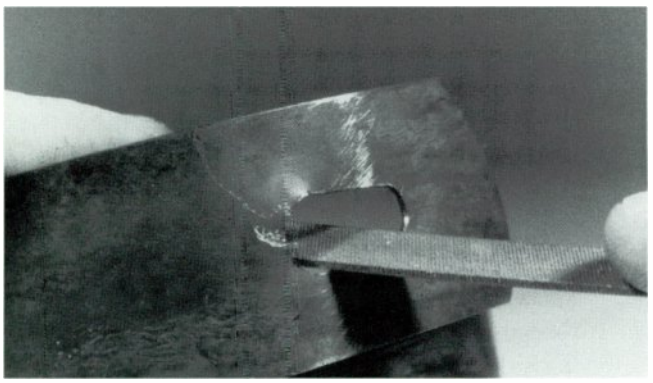
Shortening the spring results in a loss of power. If the machine could barely make it through a record when the spring was still intact, you should consider getting a new spring. Even when properly repaired, the old

spring will probably lack the necessary power.

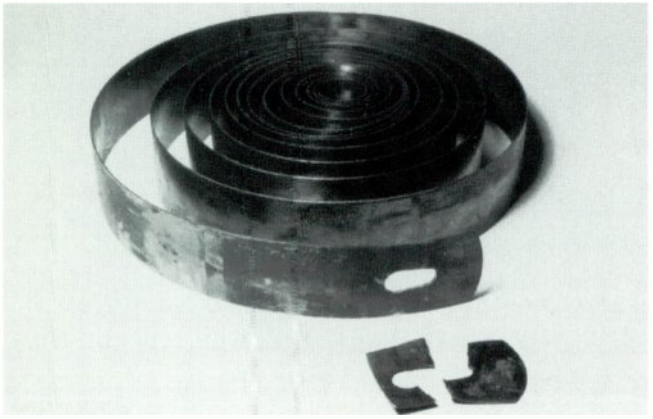
I have seen two examples of springs that have been spot welded through the barrel. This is *not* recommended as future repairs are next to impossible! In fact, I put this in the category of *major damage*—which should be reflected in the price you pay for any machine that has been repaired in this idiotic manner.

If the break is near the center shaft, the same method of annealing and redrilling is used. However, annealing of the center coils should be kept to a minimum since shortening the spring in the center results in an even more dramatic loss of power. Repairs of this type are only recommended when the break is located at the hole itself. If the spring is not too wide—an inch or less—it's possible to shim up the center coils with a screwdriver in order to make the area to be repaired more accessible.

Two or three inches of spring are annealed by heating the end with a propane torch.



Two new holes are drilled, one slightly larger than the other. They are then filed to shape.



The finished repair.

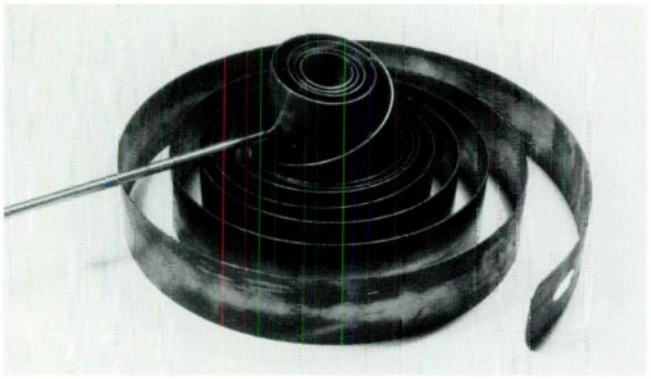
Breaks in the middle

If you really insist on fixing this type of break—which I really can't recommend—this is how you do it. First anneal about an inch of metal on either side of the break. The broken ends are then ground smooth on a bench grinder and tapered like the ends of a chisel. After this, the ends are carefully aligned (easier said than done) and overlapped about an inch. Drill two holes, countersink, and rivet the spring together.

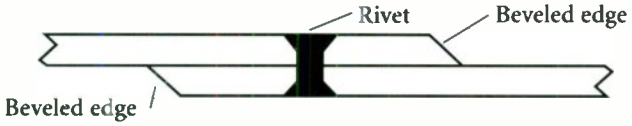
Aligning the spring for drilling must be done carefully so that the repaired spring doesn't rub on the barrel. Nailing two strips of wood onto a short board will help keep the spring halves in line. This can be clamped to a corner of a workbench, along with the outermost half of the spring. It's then possible to maneuver the center portion of the spring in place with one hand and drill with the other.

Any kind of flat-headed rivet will do as long as it is not of the "pop-rivet" variety, which cannot be ground flat. The rivets should be finished with a hand file so that

An inexpensive propane torch—ideal for annealing springs, soldering, etc.



The center coils of the spring can be lifted up and shimmed with a screwdriver or a piece of wood while fixing a break near the center shaft.



A cross-section of a spring splice.

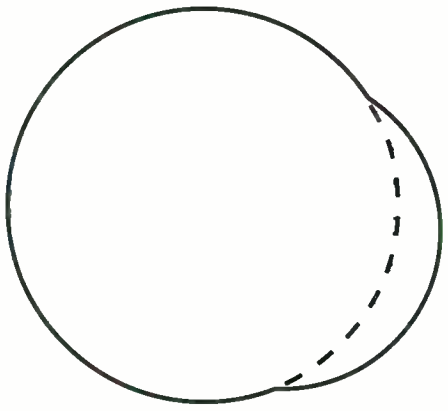
the total thickness of the joint is not much more than that of the two thicknesses of the springs.

Generally speaking, with the exception of breaks near the outer hole, which are easy to repair and usually effective, you ought to obtain a replacement spring if possible.

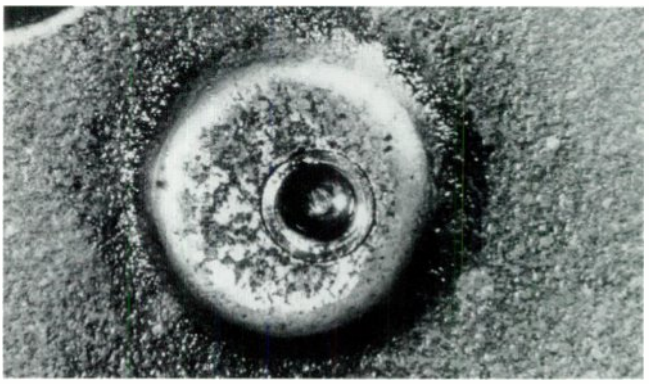
Bearings

Worn bearings are probably the greatest single cause of motor noise. Worn gears are usually a sign of worn bearings, though this is not always the case. Greasing the gears will reduce motor noise, but worn gears will continue to get worse as time passes.

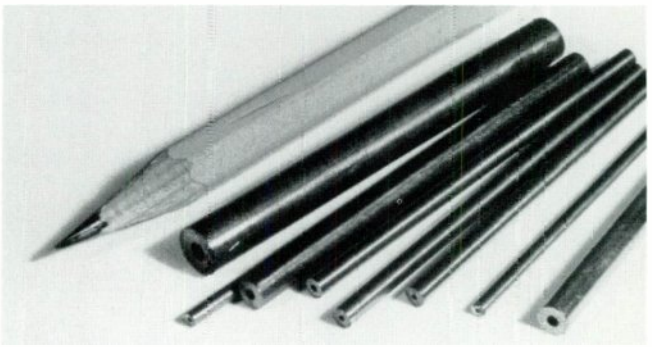
New bearings are installed by carefully enlarging the old bearing with a reamer and inserting a new brass bushing, available from jewelry supply houses and clock makers. New bearings are best pressed into the old metal with an arbor press, but a C-clamp will also



Worn bearings are frequently egg-shaped.



A new 1/32" bearing installed in an Edison Standard.



New brass bearing rods can be purchased from clock repairmen.

do the job. Hammering the new bearing will deform it and the repair will be useless. The tricky part is to accurately ream the hole so that the new bearing sits in exactly the right position. Tolerances are measured in thousandths of an inch. The original bearing can also be enlarged by drilling out the hole on a drill press, but this requires a very accurate drill setup.

Replacing bearings is not difficult, it just takes time and must be done carefully, with the proper tools and materials. Most collectors ignore bearings and learn to live with the noisy motor.

Sometimes it is difficult to identify the bearings that have worn out. Generally speaking, the faster a gear turns, the more likely that the bearing is worn. This means that governor bearings are usually the first to go.

Gears

Noisy gears

As mentioned above, noise is mainly due to bad bearings. However, worn or damaged gears are also noisy, as well as those that are badly adjusted. While lubrication of gears is not generally recommended, heavy "gear oil," sold in hardware stores or vaseline will reduce unwanted sounds until other repairs can be carried out. Lubrication attracts dirt and grit, and this works like sandpaper to wear down the mating teeth. Oddly

enough, if a steel gear mates with a brass one, the steel will usually wear down before the brass. And brass often wears out before fiber. This is because grit actually gets pressed into the softer material and makes it abrasive. If a gear is badly worn, the only good solution is to replace it. However, there are other ways to tackle the problem if a replacement is not available.

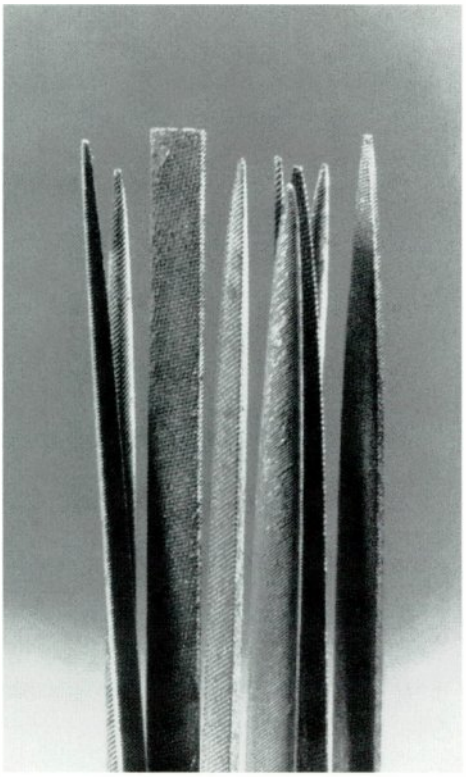
Repairing metal gears

Occasionally one finds a gear that is thicker than the one with which it meshes. This thicker gear is often visibly worn at one level, but serviceable at others. By taking a fine jeweler's file, you can smooth out any burrs in the metal where the worn section meets the untouched area. This helps reduce unwanted noise. If there is room, it may be possible to move one of the gears on its axle so that a usable section can mesh. Sometimes the entire axle can be moved through the use of washers. If the gear and shaft are mounted on adjustable bearings, the job is much easier.

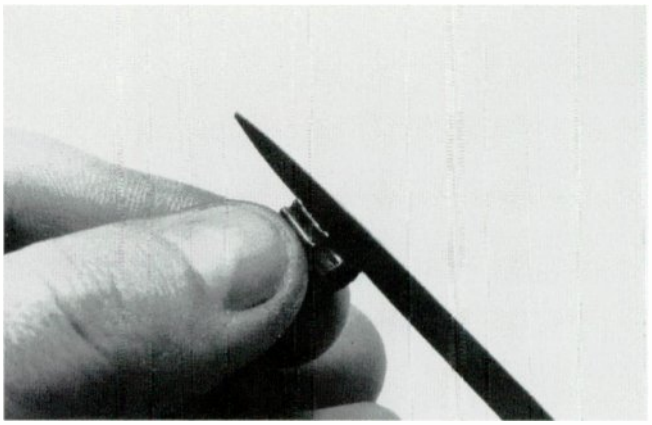
Gears are sometimes soldered onto their axles. A small propane torch will melt the solder and allow the gear to be moved or exchanged. In some situations, the gear is heated until it expands to such an extent that it may be fitted onto the cool axle.

When the gear cools, it shrinks and grips the axle tightly. In these cases, one must try to heat the gear alone so that the axle doesn't expand, too. If the gear is brass and the axle is steel, the brass, being softer, expands more rapidly than the steel and removal is not difficult.

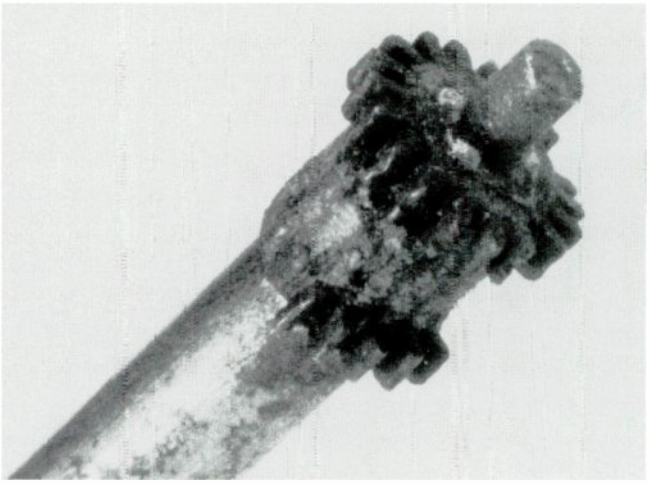
If gear teeth are mashed down but are otherwise intact, you can often heat the metal and carefully bend the teeth back into position with a screwdriver.



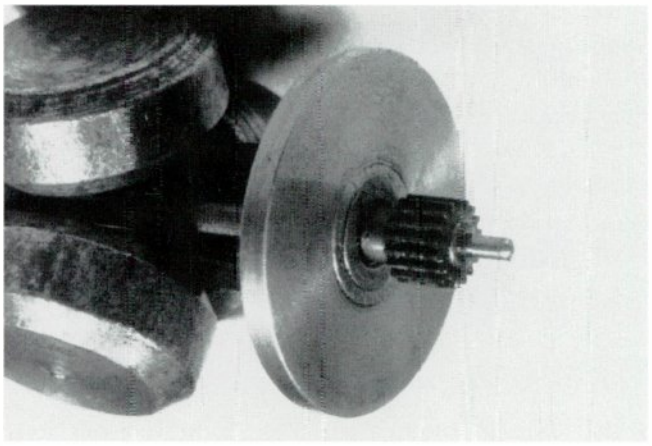
A good set of jeweler's files are an absolute necessity when repairing gears.



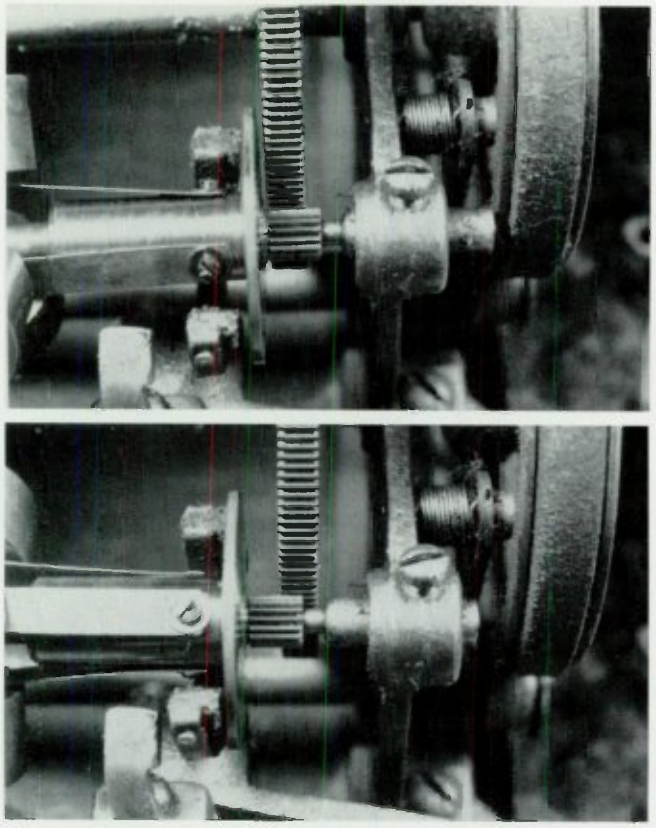
Smoothing out the burrs on a worn gear.



A badly worn governor gear.



This small, fast-spinning gear is often the cause of motor noise.



Cylindrical bearings generally allow for a great degree of adjustment leeway.

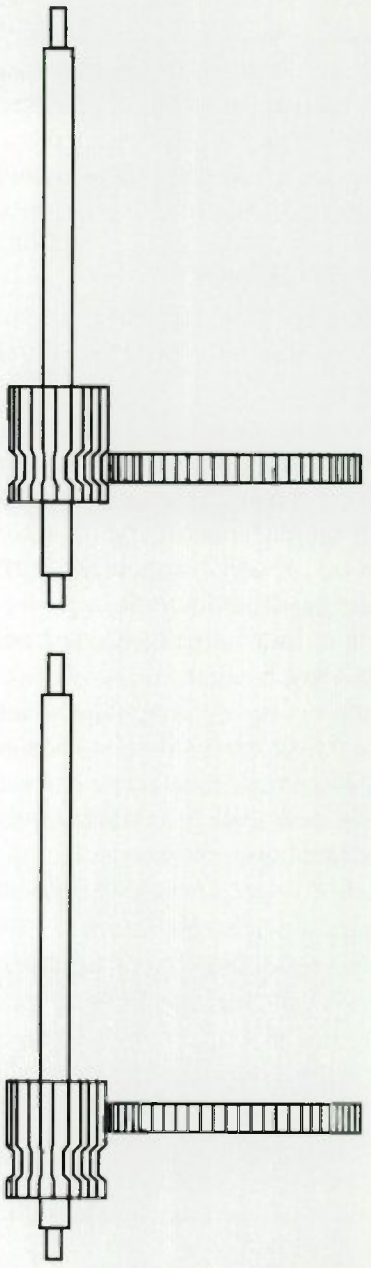
Afterwards, slight irregularities can be corrected by careful filing.

When dealing with broken teeth, there are two possibilities. If there are only a few missing teeth and the gear is lightly loaded, it is possible to build up the damaged area with silver solder and file new teeth. When repairing larger areas, the pattern from a good section of the gear can be scratched onto a new piece of metal, filed, carefully fitted into the old gear and sweat soldered in place. This solution is extremely difficult, very time-consuming and almost always noisy—but it can be done.

A few words about fiber gears

Fiber gears are often mashed but rarely broken. It is necessary to degrease them thoroughly with naphtha or lacquer thinner after which they can be strengthened with shellac. As shellac hardens, the teeth can be straightened. When the shellac is almost dry, I sometimes reinstall the gear and run the machine very slowly. This allows the meshing gear to make an imprint in the softer fiber and ensures a reasonably good fit.

Because the original fiber material was a laminate made of cloth and glue, never oil a fiber gear or it will lose its strength. Although old-fashioned brown printed circuit board is made of essentially the same materials as old fiber gears, brass is usually used as a substitute in replacement parts.

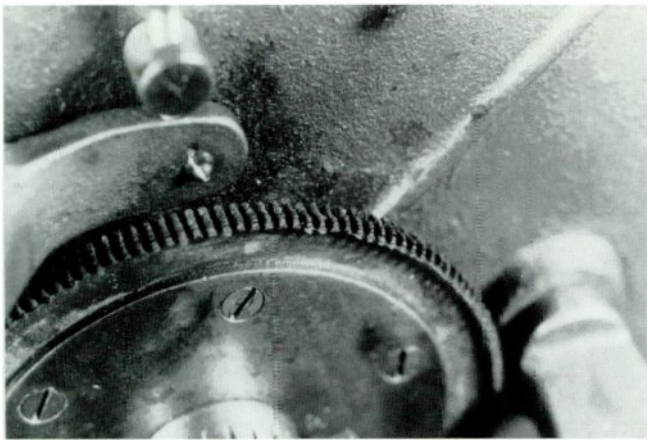


Wide gears can sometimes be repositioned so that an undamaged section comes into use.

Removing and replacing gears

Before removing a gear, scratch a thin ring on the axle to mark the position of the gear. Mark the side opposite the end of the axle from which you intend to remove the gear so that the mark is not obliterated later.

Removing gears is accomplished by applying heat,

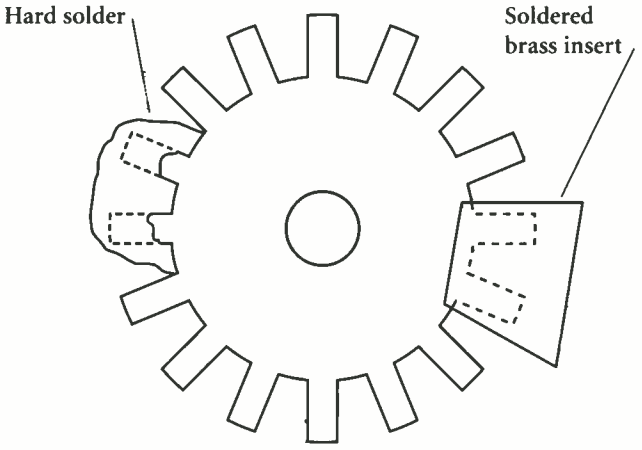


A worn, but serviceable fiber gear on an early Victor.

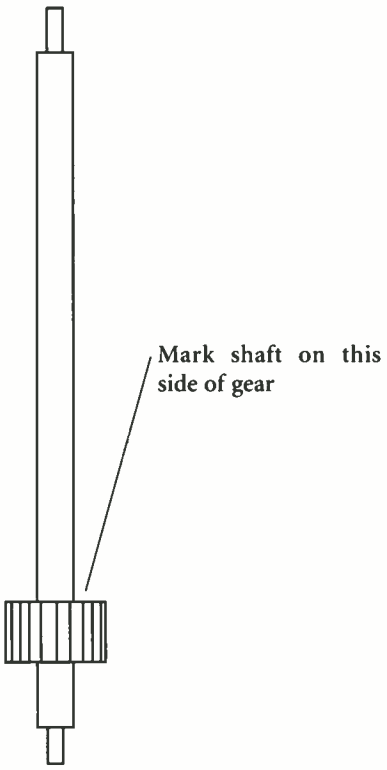
usually from a torch, in order to either expand the gear or melt the solder holding it in place. The hot gear can be twisted off with a pair of pliers. The next step is to clean off any remaining solder on the axle, burrs in the metal and any other blemishes. Wire brushing and careful filing are good ways to clean up the axle. Just remember not to clean off your scratch mark.

Test the fit of the replacement gear and check its position in relation to other parts by reinstalling the axle and loose gear. If the hole in the new gear is too large and the gear wobbles, it may help to tin the gear with solder to get a tighter fit. Soldering paste is a great help here. Just coat the inside of the hole in the gear with the paste and heat it until a bright solder ring appears. Then check the fit once again. If necessary, try coating the axle, too. When everything is positioned correctly, heat up the gear again and it will adhere to the axle.

If the gear in question is very large and thin, and still seems a bit loose, you might want to make some small wooden shims to hold it level so that it is perfectly



Two noisy, but workable solutions to the problem of broken teeth. After the addition of any new material, new teeth must be filed by hand.



Mark the position of an old gear before removal for accurate replacement.

aligned during soldering.

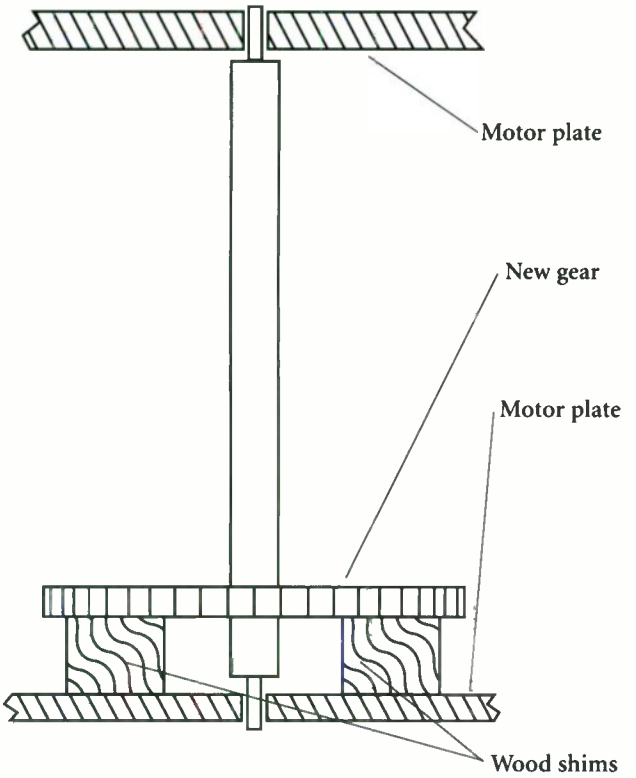
On the other hand, if the hole in the gear is too small, you will need to heat the gear in order to expand it enough for it to fit on the shaft. In this case, dry fitting is not possible nor necessary, provided the hole was properly drilled. If the heated gear will still not slip onto the axle, you may have to ream it. This should be done very carefully so that the hole does not get too loose. Avoid using files since these have a tendency to deform the hole.

Gears that are held in place by set-screws require only a screwdriver for removal and replacement.

Where to get replacement gears

In recent years, virtually all of the gears used on Edison phonographs have been duplicated for collectors. Many Columbia and Victor gears are also available. Replacing an unusual gear is often quite costly, so many collectors and suppliers have made small production runs in order to reduce the cost per unit. The extra gears are then sold to other collectors.

It's a good idea to get price lists from several different sources since parts (and prices) vary from dealer to dealer. Collectors and dealers usually have a limited supply of original parts, too. A letter of inquiry or an



Wooden shims are a great help when soldering a large, thin gear if it is a little loose.

ad in one of the collector publications will often put you in touch with people who have the gears you need. This, of course, applies to other types of parts as well.

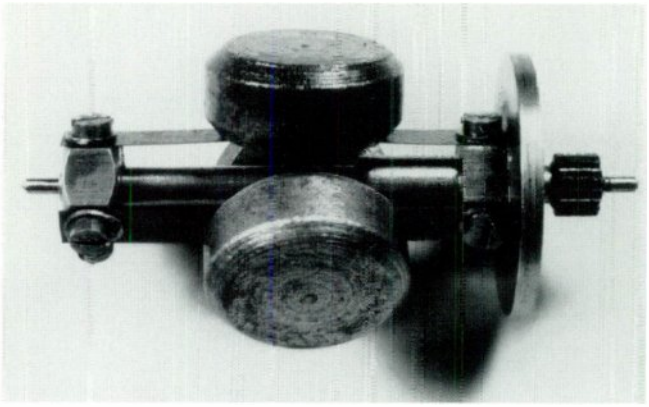
If you need a gear but cannot obtain one and don't have the facilities to make one yourself, some suppliers are willing to make parts to order. Otherwise, any antique store specializing in old clocks will undoubtedly know of someone in your area who can do the job. You might want to find out how much it will cost to make five or ten identical gears since the set-up time for the cutting lathe is usually much more expensive than the cutting itself. Extra gears can then be saved for future repairs, sold, or traded.

The governor

How it works

Perhaps the most delicate part of the entire motor is the governor. Apart from the spring, it is also the part that most frequently creates headaches for the repairman.

The governor consists of a set of small weights mounted on flat springs. These in turn are attached to a small ring at one end and a flange at the other. An axle equipped with a small gear (the noisy one) passes through the center of the ring and the flange. The ring



A typical three-weight governor.

is equipped with a set-screw to hold the assembly on the axle, whereas the flange is free to slide up and down.

When the motor is started—often by releasing the governor—the mechanism spins and the small weights pull away from the axle due to centrifugal force. As the weights pull away, the springs are bent, causing the flange to slide up the axle. At some point on its way up, the flange meets an arm or yoke equipped with small felt pads, preventing the flange from traveling further. Thus, the governor continues to spin at a steady rate until either the spring winds down and the governor relaxes, or the pads are moved away from the flange, allowing the weights to spin out even more, increasing the speed.

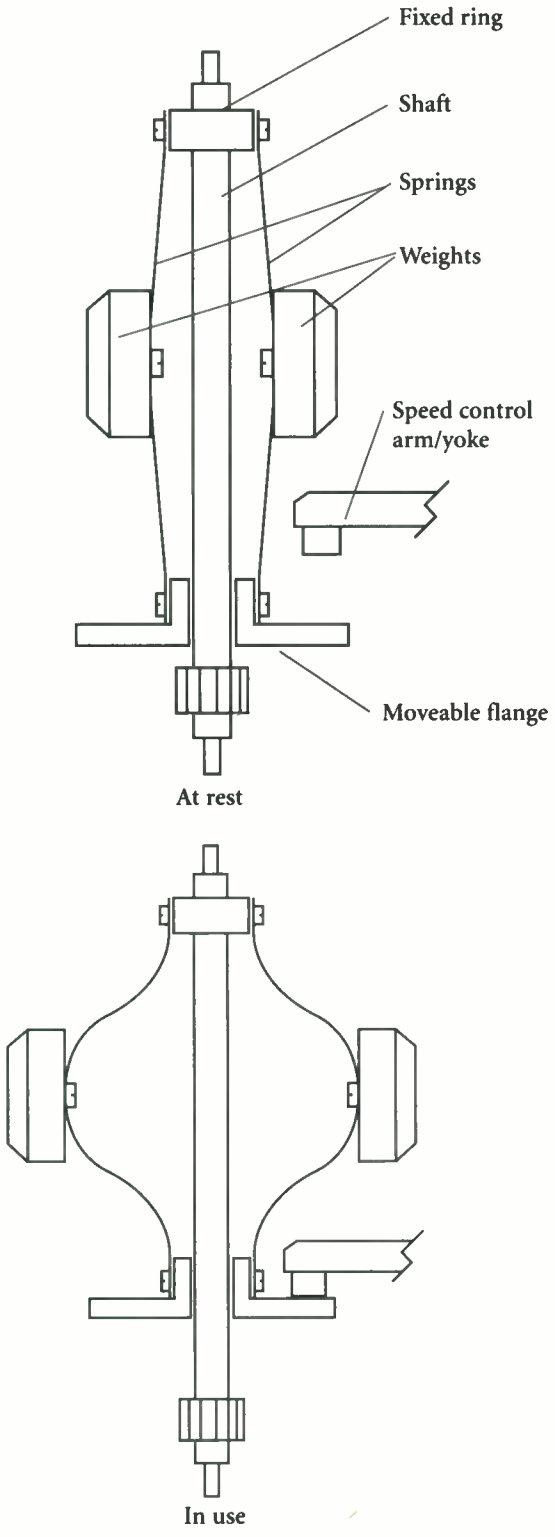
The small gear on the axle either drives a pulley wheel (as is the case in most cylinder machines) or is directly connected to the turntable spindle on disc models. In either case, the speed of the mandrel or turntable is directly related to the speed of the governor.

Before you start to tinker...

Once again, before you loosen any screws on or around the governor, make sure that the spring is *completely wound down*. If it isn't, there is an excellent chance that you will strip the governor gear. You may also put out an eye—so for goodness sake take care!

Governor springs

Having seen more than a few botched governor repairs, it strikes me that many people have not quite grasped the concept behind this ingenious little device. Many would-be restorers have ingenious ideas of their own, but when it comes to governors, they rarely work. For the governor to function properly, it is imperative that the weights have a certain freedom of movement so that centrifugal force can play its part. The weights must be



The governor.

heavy enough to bend the springs and the springs must be strong enough to return the weights and flange to the starting position as the motor slows.

Broken springs are probably the most common problem and replacements must have the correct properties. If the spring is too stiff, the weights cannot help move the flange and the motor runs faster and faster. On the other hand, weak springs or weights that are too heavy may cause the motor to run too slow.

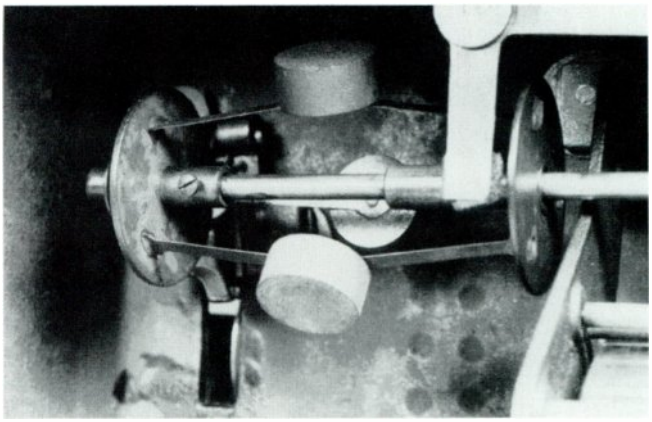
If replacement springs are flexible, but lack the necessary "spring," such as strips cut from a tin can, the weights will quickly bend the strips into a shape which they will retain. All kinds of strange things happen to the speed in this situation. Sometimes the speed is OK for awhile, but soon starts to race or becomes uneven due to the fixed position of the weights. Nothing must hinder the in and out movement of the weights if you want proper results.

There is no really good substitute for genuine governor springs. As their cost is minimal, I would suggest the purchase of a new set from one of the many suppliers. However, in a pinch, reasonable springs can be fashioned out of feeler gauge stock. Many different thicknesses are available in .001" gradations. Alternatively, metal strips cut from a thin measuring tape can be used in an emergency. Drilling holes in either of these materials is a little difficult so for best results, holes should therefore be punched instead.

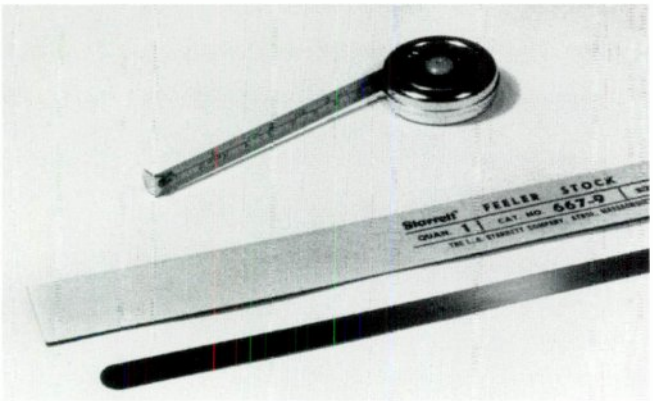
Small differences in length and flexibility between individual springs can create unwanted vibrations. Unless you have an *exact* duplicate of the broken spring, you would do well to replace the entire set.

In some cases, the weight is riveted to the spring rather than bolted on. If you don't happen to have a matching spring/weight combination left over from a previous repair, you might also want to invest in a new set of weights, too.

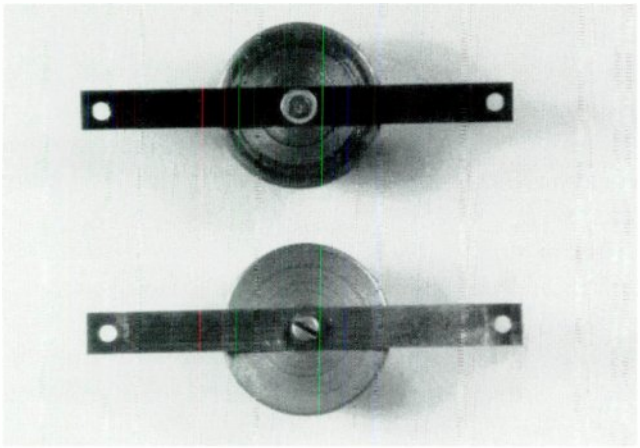
It almost goes without saying that any parts you replace should be saved for future repairs. In time, you will build up a good assortment of screws, washers, weights and springs. Screws, in particular, are worth



The springs on this governor from an early Edison Gem are soldered to the flanges, which makes repairs more difficult.



If necessary, new governor springs can be made out of feeler gauge stock, or even steel tape measures, if a correct replacement is not available.



Governor weights may be attached to the springs either with screws or rivets.

Tiny screws are worth their weight in gold.

their weight in gold.

I'd just like to mention that some governor springs have turned-up ends and are not completely flat. This is true of Victor governor springs, for example. Victor governor flanges are cylindrical and the bent tips cause the weights to flare out a bit when the governor is at rest. Edison flanges are usually tapered, so the flat springs bow out naturally.

Repairing the governor

There is nothing tricky about fixing the governor if you have the parts you need. If you have difficulties taking the governor apart, you might refer back to the section on disassembling the motor. You might also want to refer back to cleaning and gear repair, too.

The average governor consists of approximately 30 individual parts, including screws, washers and such. Many of these parts are very tiny, so you would be well advised *not* to work over a shag rug or out on the lawn should you drop something. A clean floor is a big help when it comes to finding lost parts and a small bowl or plate is a good place to keep them when making repairs on a crowded workbench. Perhaps the best solution is to work over a small tray that will catch any stray bits and pieces.

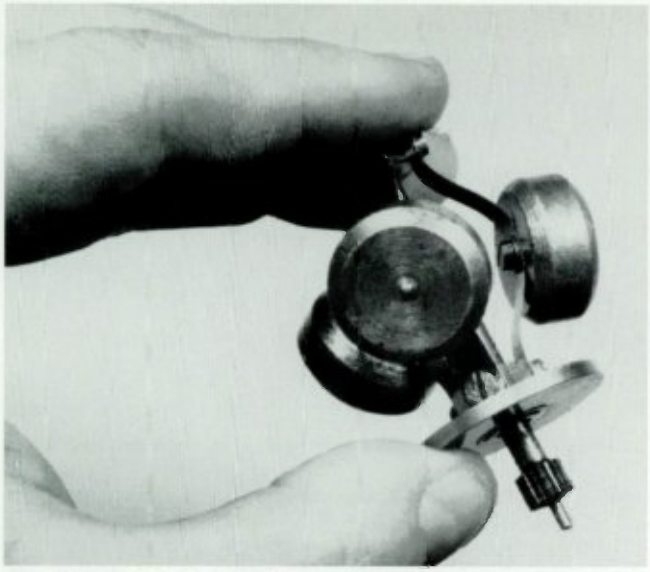
Apart from gears and springs, which have already been discussed, the only other real problem is stripped screw holes. It is sometimes possible to coat the inside of the battered hole with soft solder (the kind with lots of lead in it), and cut a new thread using the old screw. Soldering the screw itself or gluing it in place makes adjustment and future repairs difficult and irritating. If you insist on gluing a screw, do *not* use epoxy, but rather one of the various superglues. These can later be dissolved, if necessary, with acetone or some other solvent.

Assembling the governor

The first step in reassembly is to fasten the weights to the springs. The weights must be attached tightly so that they don't rattle. If the weights are riveted, these rivets must also be checked for tightness. Loose rivets can be tightened with blows from a hammer or pressed down with a screwdriver blade.

Next, attach the ring and the flange, making sure to replace all the washers. However, don't tighten the screws yet. If you have not inserted the axle, do so now and tighten the set-screw on the small ring. Align the flange so that the springs are parallel to the axle and tighten one of them. Recheck the alignment and if everything is OK, tighten up the rest of the springs. By waiting to tighten them until the axle is in place, you are assured that everything is positioned correctly.

Flex the assembly by pushing up on the flange. Sometimes, the small screws that hold the springs to the flange act as set screws and prevent the flange from



Flex the governor after assembly to make sure the large flange is not binding on the center axle.

moving up and down the axle. If the flange won't move, make sure you haven't forgotten any washers or used the wrong screws. Sometimes the screws in the small ring are slightly longer than those in the flange. Always make note of this when you take a governor apart for the first time.

Governor bearings

Before you install the governor, make sure that any pivot points in the bearings are clean and that the ends of the governor can revolve smoothly. If the bearing is a little tight due to rust damage, pitting or metal burrs, the end of the axle and the inside of the bearing must be polished.

To do this, insert either the axle (minus springs and weights) or, preferably, the bearing itself into the chuck of an electric drill, protecting the outside of the metal with a ring of tape. Place a tiny dab of rubbing compound in the hole in the bearing and start the drill. Push the pin on the end of the axle into the bearing and hold it there for second or two. Don't overdo it. Any deformities on the pin or in the bearing will be removed. Then, clean the parts and check the fit. If the bearing is still too tight, repeat the process.

If the bearing is too loose, this too will lead to problems, usually noise. When working with the cylindrical bearings found in most cast motors, it is sometimes possible to drill all the way through the bearing and then reverse it in its casting. Otherwise, it may be necessary to construct a new bearing or even a new governor shaft.

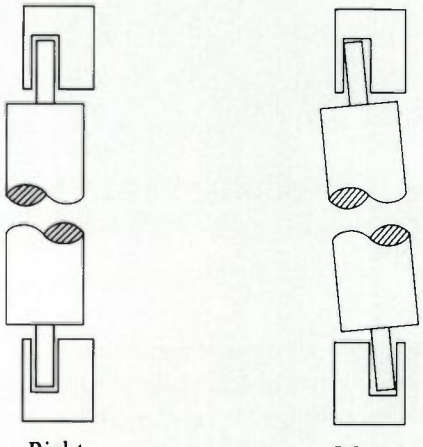
Dipping the pivot pins in molten solder, much as you would dip a candle, is not a long-lasting solution but can reduce the problem when other repairs are not practical.

Adjusting the governor

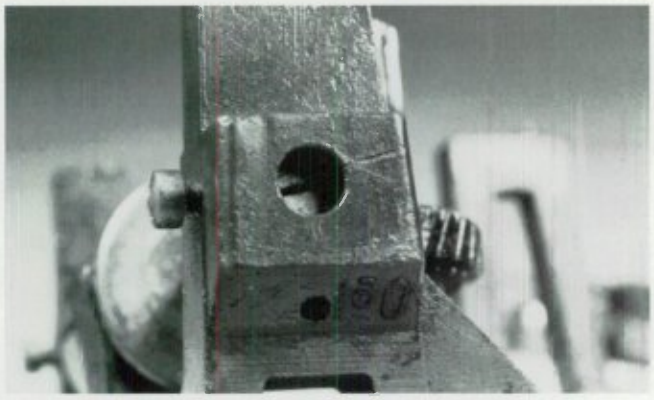
When installing the governor in the motor, check that the governor gear meshes properly with the driving gear. There is almost always some way to adjust this distance, either by moving the casting that holds the governor, or through the use of eccentric bearings. If the distance between the gears is too great, the gears will be noisy and will wear unevenly. If they are too close together, the gears may bind.

Great care must be taken with eccentric bearings since they are tricky to adjust. If they are not turned in exactly the same direction, the governor will stick. Many a repairman has cursed worn gears, weak springs and other innocent parts when, in reality, the problem was bad governor adjustment. Small cylindrical bearings (eccentric or otherwise) must be spaced so that there is just a tiny bit of end play in the governor. Even more end play may be needed if the governor has a worm gear.

Inexperienced repairmen often bend the pins on the ends of the governor shaft during removal. This occurs when one bearing is removed and the governor is allowed to fall and dangle from the remaining bearing. The easiest remedy is to remove the axle, determine the nature of the bend, and flex the pin back into shape using the old bearing as a kind of vise. This method works and is not difficult—just take it slow and easy. Otherwise, you may break off the pin and then you have a *real* problem!

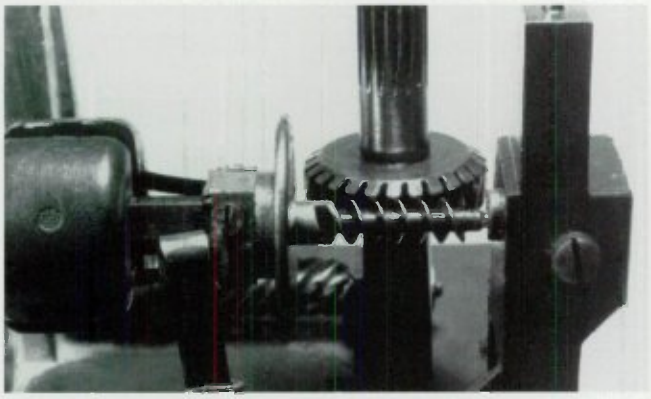


Eccentric bearings must be carefully adjusted or the governor may bind.

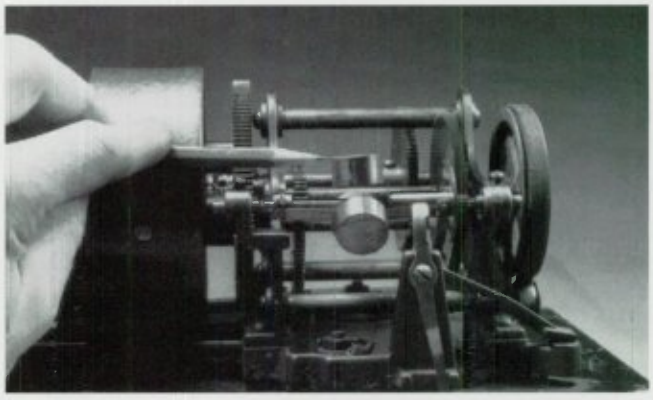


Eccentric bearings often have screwdriver slots for easy adjustment.

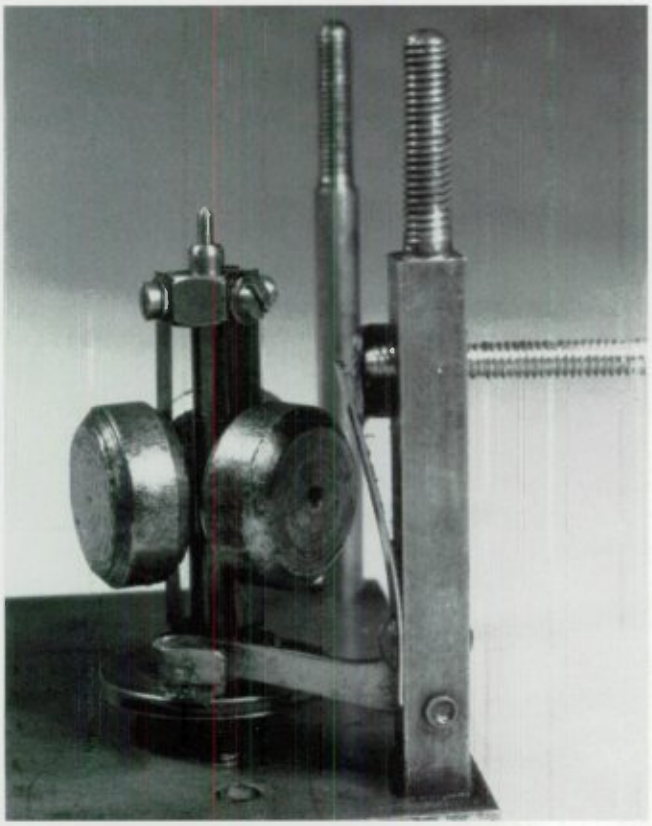
This speed regulator has a yoke equipped with two pads. This provides more stable speed.



A worm gear on a governor requires careful adjustment.



A pencil used as a point of reference when adjusting governor weights.

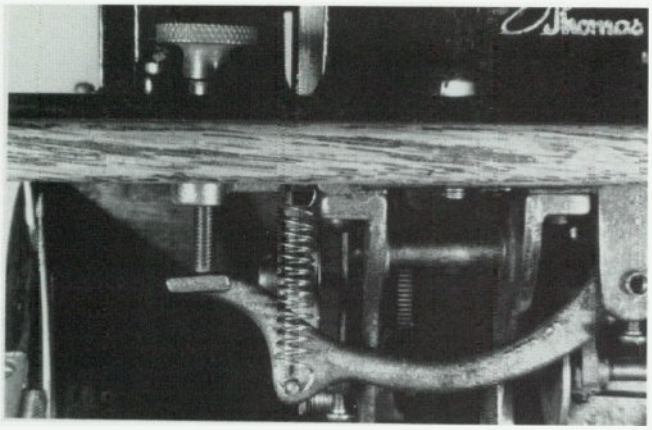


A simple speed regulator with a single pad.

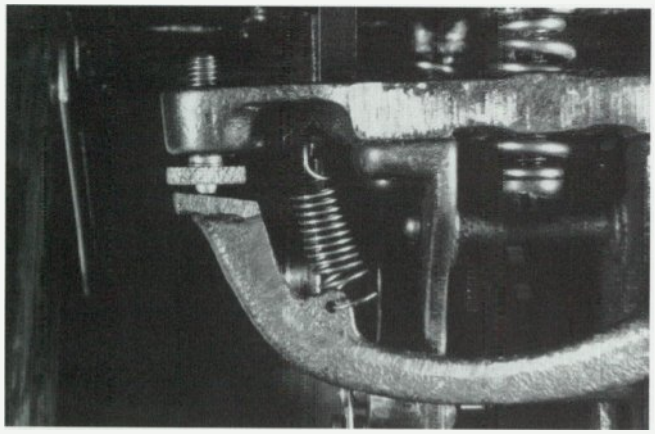
Lubricate the bearings and the shaft of the axle with lightweight oil. Also, oil the top of the flange where it meets the felt pads. These are *not* friction pads, despite the fact that they are often misnamed in parts catalogs. The pads must be reasonably soft for best results. Hard pads should be replaced with new leather or felt.

When everything is in its proper place, make sure adjustable bearings are held in place with their set-screws, wind the spring slightly and start the motor. Watch the governor carefully to make sure that the weights do not hit any other parts as they spin. If they do, stop the motor immediately, loosen the set-screw on the small ring and readjust the weight assembly. *Do not attempt to adjust the axle position while the motor is wound!*

The weight assembly must be perfectly balanced and positioned to avoid vibration and rumble. By using a screwdriver or pencil as a stationary point of reference, slow rotation of the governor will reveal any weights that are out of position. If you start the motor and allow the governor to revolve at normal speed, the visual "ring" you see made by the rotating weights should be perfectly true. This is easiest to see under AC artificial lights due to the slight stroboscopic effect.



The early-style Edison speed adjustment passes through the bedplate.

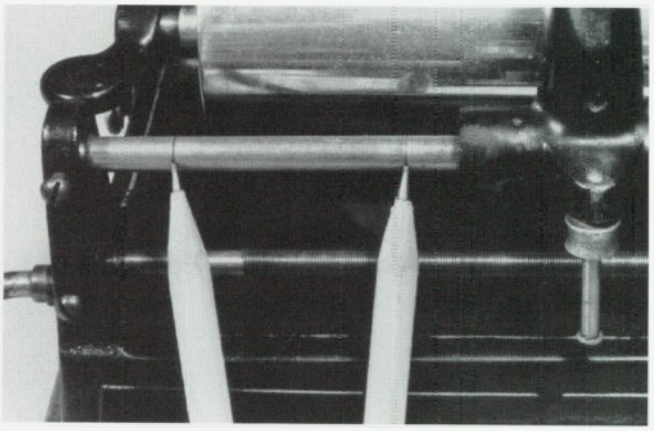


Most later Edisons have a knurled speed adjustment underneath the bedplate.

Adjusting the proper speed

Almost every governor will hit other parts of the machine if it is allowed to spin at top speed. You might want to listen to a recording in order to determine the maximum speed required.

Cylinders produced after 1901 are designed to play at 160 RPM. Those made before the era of molded cylinders played (officially at least) at either 100, 122 or 144 RPM. Many later Edison phonographs have two engraved rings on the carriage shaft. When playing a two-minute cylinder at 160 RPM, the carriage should take one minute to travel from ring to ring. Most disc machines are designed to run at 75-85 RPM (disc recording speeds vary greatly), and Pathé disc machines can require a top speed of 110 RPM, though 90 RPM is fairly standard. You might want to make a stroboscopic disc to check speeds. There are some examples you can photocopy in the back of the book, along with instructions on how to make your own.



Many Edison phonographs have two engraved rings on the back rod. It takes one minute for the carriage to travel from one to the other when the machine is running at 160 RPM.

Feedscrews and half-nuts

How they work

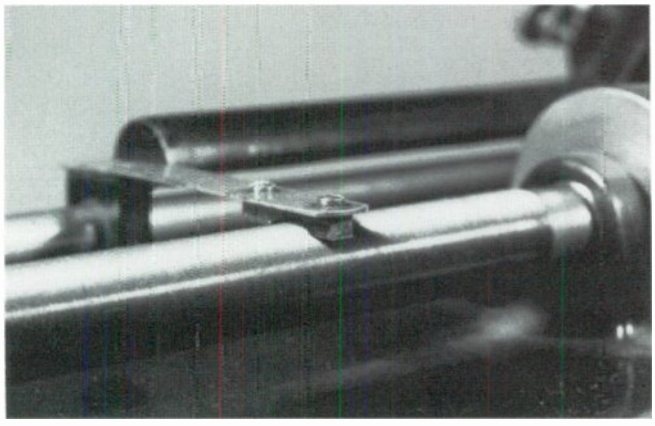
Feedscrews are found on most good-quality cylinder phonographs as well as on Edison Diamond Disc machines. Some Sonoras and Talk-O-Phones had feedscrews in order to circumvent patent restrictions but not out of need.

Feedscrews are essentially threaded rods whose grooves correspond mathematically to the grooves in the recording. When the record starts to revolve, so does the feedscrew. A section of a nut, called for fairly obvious reasons a "half-nut," engages the feedscrew when the reproducer is lowered onto the record. It moves or "feeds" the reproducer across the record surface as it plays, coordinating the stylus and the record grooves. The half-nut can also be constructed as a simple knife edge, as found on some English Edison-Bells. On Edison Operas and some Amberolas, the mandrel moves under the stationary reproducer. Keen-O-Phone, a maker of disc machines during the early 1920's, had a turntable that moved across the machine as the record played. All of these machines have feedscrews and half-nuts, too.

On most cylinder machines, the feedscrew is placed parallel to the mandrel, but in larger Edison machines such as the Home, Triumph and Idelia, it is an extension of the mandrel shaft itself. This last type of feedscrew has an extremely fine thread and exceptional care must be taken when working on or around it.

Usually, the feedscrew is located somewhere visible, at least on outside horn machines. Columbia is a notable exception, often hiding the feedscrew inside the shaft supporting the reproducer carriage.

A feedscrew and half-nut on an Edison Gem.



The feedscrew threads are much finer on Edison Homes, Triumphs, etc.

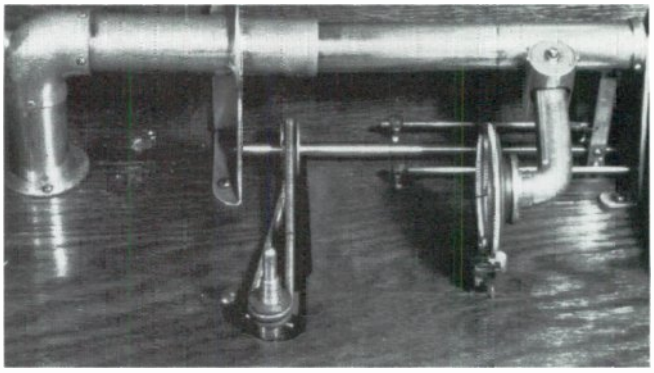
Most Columbia feedscrews are hidden in the carriage shaft.

Cleaning the feedscrew

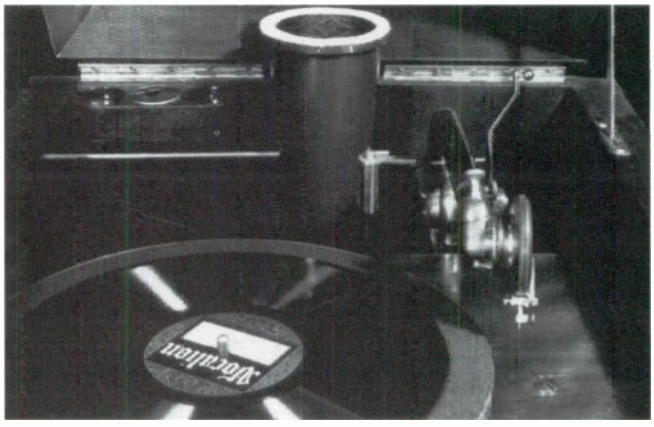
Surprisingly, most feedscrews manage to survive remarkably well. In most cases, cleaning in a solvent bath is all that's needed. In cases where the feedscrew is badly rusted, an overnight bath in rust remover or a good dousing with WD-40 will loosen most of the scale clogging the threads.

When the feedscrew is reinstalled, the machine itself can be used as a simple lathe and any remaining rust and gunk can be cleaned out with a sharpened brass awl

This interesting Sonora from 1911 also has a feedscrew. (Bill and Peggy Robbins collection)



A detail of the Sonora mechanical feed assembly.



The Keen-O-Phone is unusual in that the feedscrew moves the turntable underneath the reproducer, which is stationary. (Walter Bellm collection)

The Edison Diamond Disc phonograph also has a feedscrew. (Ernie Bennett collection)

while the feedscrew rotates. I would like to mention that this is really something of an emergency cleaning treatment meant only for hopelessly (almost) corroded feedscrews. If you do this to a reasonably good feedscrew, you will end up doing considerably more harm than good!

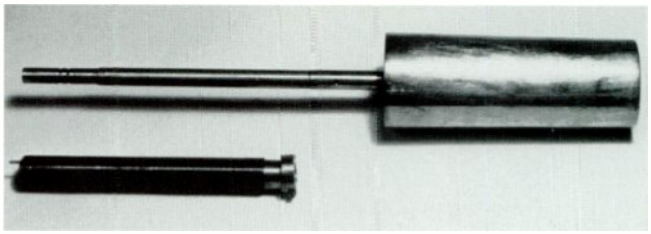
Under no circumstances should you attempt to wirebrush any feedscrew as even brass brushes can blunt the sharp edges of the threads. Don't use steel wool or other abrasives for this same reason. Avoid using the half-nut as a cleaning tool—tempting as this might be. It, too, will be damaged.

If you absolutely have to use a pointed tool to clean the threads, use something made of brass or plastic—materials that are softer than the steel feedscrew. If you use a steel knife of any kind, the feedscrew will look shiny and clean, but only because you have probably cut a new groove in one of the walls of the thread. Machine performance will deteriorate and your half-nut will eventually wear out.

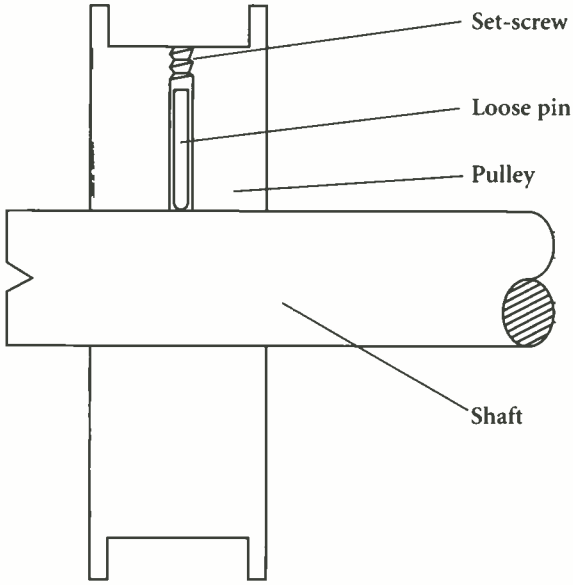
Repairing the feedscrew

On feedscrews with reasonably coarse threads, many of the techniques used for repairing gears will apply. In the case of bad dents, careful filing and addition of extra material in the form of solder can solve many problems. Also, the half-nut itself often covers four or five grooves, in which case minor "bald spots" may not cause problems.

Very fine feedscrews, such as on the Edison models mentioned earlier, can sometimes be rescued by painting over the bald section with shellac and recutting the grooves with the half-nut. Slight warming of the half-nut helps. This is not really a lasting repair and experienced restorers may laugh, but short of expensive machine-shop work or replacement, I know of no other reasonable method for the home workshop.



Two/four-minute Edison Homes and Triumphs have a feedscrew that rotates around the mandrel axle.

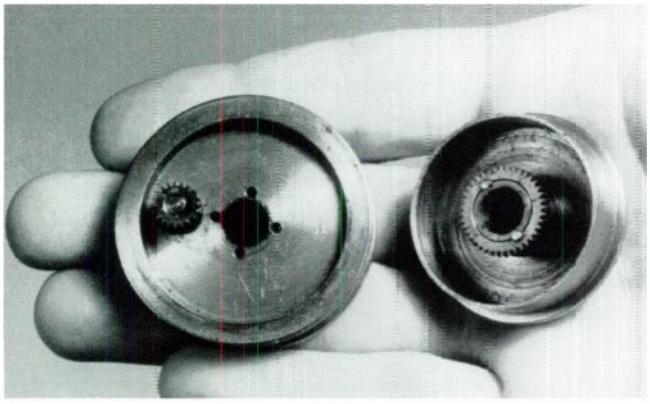


The small pin in the pulley on Edison Homes, Triumphs, etc. is easily overlooked and may get lost.

Often, exchanging the half-nut with a good, sharp replacement will overcome wear in the feedscrew and should be tried before resorting to other methods. Naturally, all rods and supports must be clean and polished for good performance. Use only a dry lubricant on the feedscrew, such as graphite, in order to avoid attracting dust and grit. Silicone spray works well, too.

On combination model (two- and four-minute) Edison Homes, Triumphs and Idelias, the feedscrew revolves around the mandrel shaft, which will require oiling on the *inside*. Don't overlook the small gears hidden inside the upper pulley wheel during cleaning and lubrication of these models. They're easy to miss.

One final note: the large pulley on combination model Homes, etc. is fastened with a set-screw. However, this set-screw is not very long and a short metal pin (about ½") is used to take up the rest of the distance from the set-screw to the shaft. If you don't know this pin is there, you will probably lose it, or you may find the pin lying on the bedplate and not know



Don't overlook the small gears in the pulley on two/four-minute Homes and Triumphs when cleaning and lubricating.

where it goes.

Adjusting the half-nut

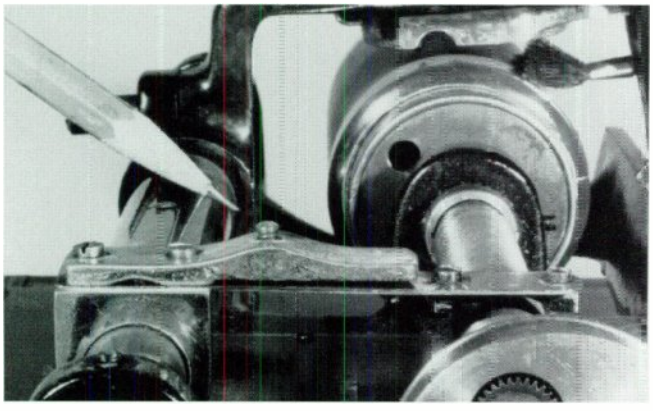
Edison phonographs allow for the adjustment of the half-nut. The best way I have found for positioning them is to loosen the screws on the nut itself and the lower the reproducer. By rocking the half-nut from side to side with a finger, you will feel it fall into place. Continue to press down on the half-nut bar to retain the position while you tighten the screws. It the case of a worn feedscrew or half-nut, it may help to move the half-nut backwards or forwards (across the feedscrew) a fraction of an inch.

The half-nut should bear down very slightly on the feedscrew when it is in the "engaged" position, but not so much as to increase the drag on the mechanism so that the machine slows noticeably when the reproducer is lowered. This adjustment is made by either bending the spring steel half-nut bar or by using the adjusting screw found on later model Homes and Triumphs. By placing a paperclip between the carriage and the knife edge on Edison machines, the carriage can be raised slightly. If the half-nut *just barely* engages when the carriage is supported in this manner, the drag should be correct when the clip is removed. It may be necessary to anneal the half-nut bar by heating it a bit so that the metal is a little more flexible, but still retains its spring.

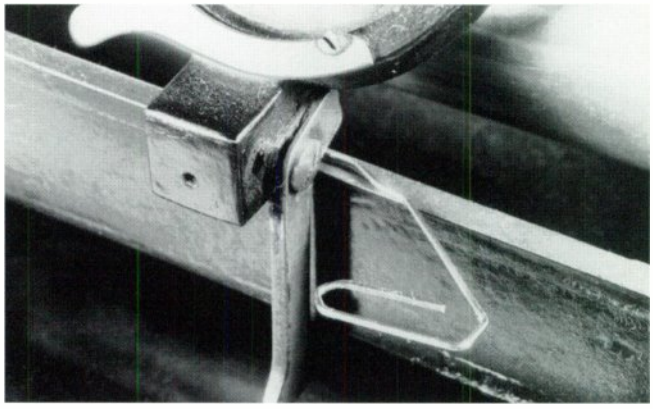
Edison Home and Triumph half-nuts have a front and a back. The long end is in the back. Feedscrews and half-nuts on smaller Edison machines can have either right- or left-handed threads. If there are an odd number of gears between the mandrel and the feedscrew, the thread is right-handed. An even number of gears indicates a left-handed thread. For example, the model B Standard has three gears whereas the model D has four. This is good to know if you plan on stealing parts from derelict machines.

On most Columbia machines, the half-nut is pressed up against the feedscrew with one or two tiny springs. Columbia feedscrews are of the "buttress" type, that is to say, the groove is shaped rather like a lopsided "V." Consequently Columbia half-nuts have a definite front and back. Sometimes a small letter is stamped on the front of the half-nut, but this is not always the case. Always check that the threads on the half-nut and those on the feedscrew correspond correctly. If the half-nut is not engaging properly but is installed correctly, check that the spring is still intact and that the half-nut is not binding on the yoke-shaped half-nut housing.

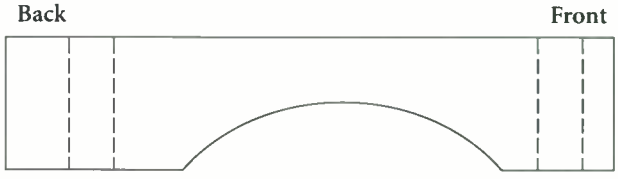
It is useful to play a record during feedscrew and half-nut adjustment in order to hear any skips or



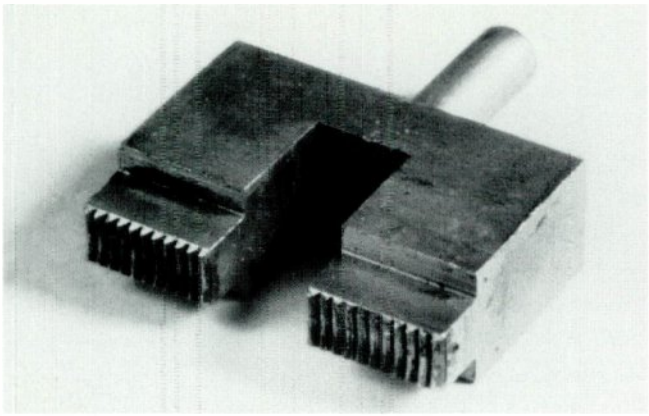
A half-nut adjusting screw on an Edison Triumph.



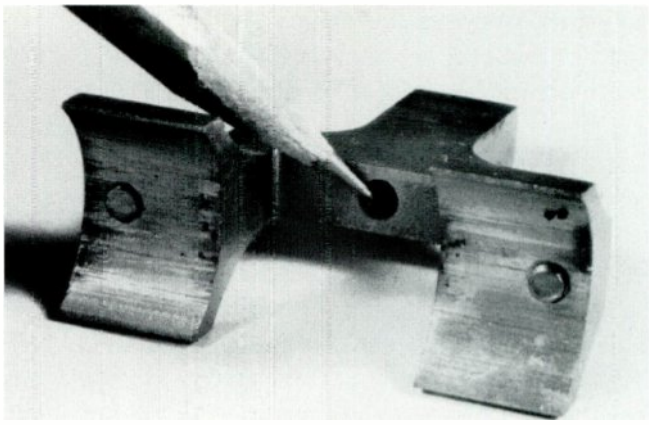
A paper clip can be used as a temporary spacer between the carriage and knife edge during Edison half-nut adjustment.



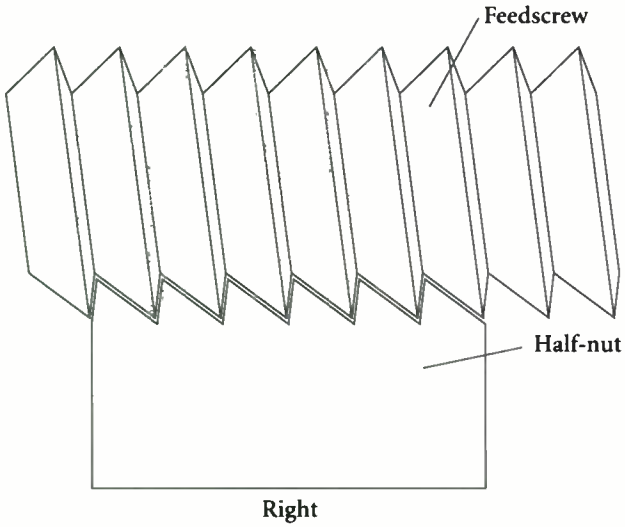
Edison Home, Triumph, etc. half-nuts have a definite front and back.



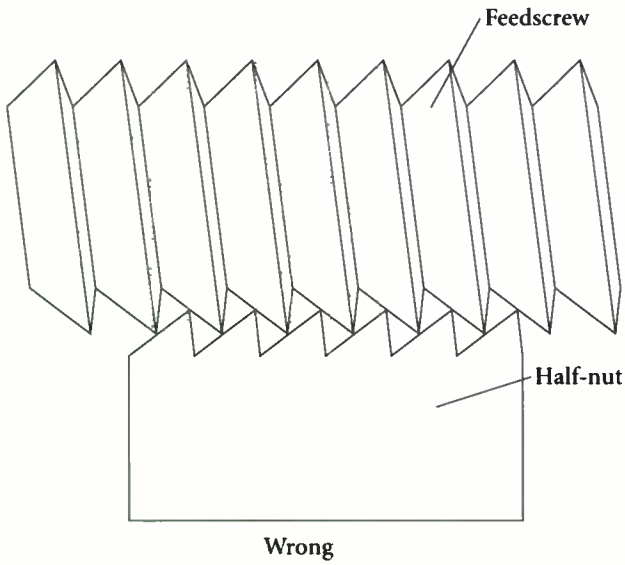
A typical Columbia half-nut from a model A.



This hole should be checked for swelling on Columbia machines so that the half-nut moves freely up and down.



A properly installed Columbia half-nut with a "buttress" thread.



An incorrectly installed Columbia half-nut.

repeats caused by poor alignment. Remember to use an "expendable" record, as skips and repeats may ruin it. For your own sanity's sake, you might want to remove the horn or stuff an old sock in it to reduce the volume during repeated testing.

Replacement half-nuts

If you need to purchase a replacement for a missing or worn half-nut, try to obtain a "new original stock" replacement, know as NOS in the repair trade. This means that it is a genuine old part, but one that was never installed in a machine and comes from a turn-of-the-century dealer's stock.

Inspect the quality of new half-nuts carefully. Many of these so-called "new" parts are really worn ones that have been nickel plated. The plain truth is, they don't usually work, particularly on Homes and Triumphs. Shop around and get a good one. Genuine parts, especially Edison parts, are not hard to find.

I came across a rather unusual half-nut replacement a while back. It was made of plastic and had apparently been shaped by pressing the plastic into the grooves of a heated feedscrew. Despite its unique construction, it worked surprisingly well. Like the shellac on the feedscrew, it's not "according to Hoyle," but I thought I'd pass it along anyway. Epoxy can also be used to mold a half-nut if you cannot get a proper replacement.

Winding mechanisms

There are two ways to prevent the crank from snapping back when the spring is wound. On almost all American-made machines, there is a gear and ratchet arrangement on the winding shaft. This rarely requires adjustment and a good cleaning is usually all that is needed. However, on many European machines, partic-

ularly those with pillar and plate motors, and the Edison Diamond Disc machines, the winding shaft is held in place by a tightly wound coil spring made of piano wire. If you have never encountered one of these before and it is defective, it can be difficult to see exactly how it works and how to fix it.

When removed from the shaft, this little spring has an internal diameter slightly smaller than that of the winding shaft. The spring therefore grips tightly when it is twisted onto the axle. A small "tail" with a loop on the end is fastened to some stationary portion of the motor chassis. When the winding shaft is turned in the direction opposite that of the coils, the spring releases its grip. When the crank is pulled back by the tension of the mainspring, these coils wind even tighter, preventing the winding shaft and crank from unwinding again. The construction is simple, cheap, and, if you don't oil it, very effective.

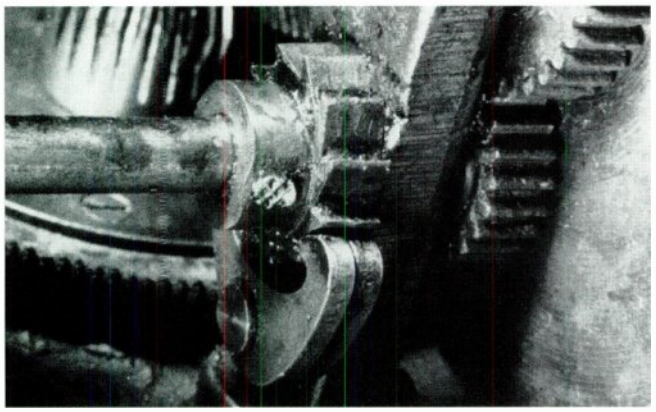
Often the loop that fastens the spring to the chassis breaks off and the spring turns with the shaft. In this case, it is often possible to unwind a coil or two and fashion a new tail. If the winding shaft is worn down, thus preventing the spring from getting a good grip, then the solution is either to move the spring to a new, unworn section of the shaft or to replace it with a spring with a smaller internal diameter. Roughing up the surface of the shaft results in wear on the small spring and the problem soon returns.

If the spring cannot be saved and no replacement is available, a new spring can be constructed by tightly winding piano wire around a drill bit. The diameter of the finished spring must be smaller than that of the winding shaft, and the drill bit must be smaller still to compensate for the natural "spring" of the piano wire. The new spring is then twisted onto the winding shaft and fastened to the chassis.

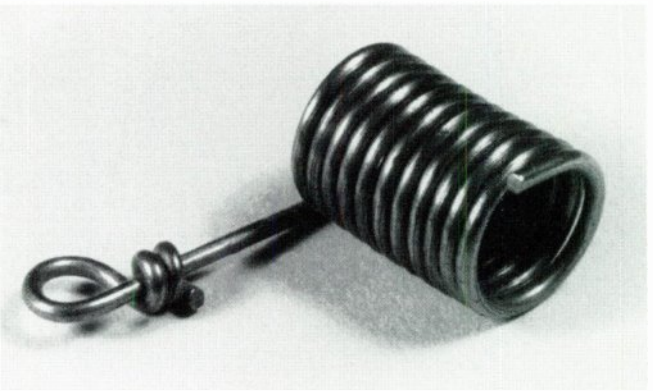
Drive belts

It is frequently necessary to make a new drive belt for a phonograph. Belting is available from all suppliers at reasonable cost, but thin leather from any source can be used equally well, as long as it is soft and cannot stretch too much.

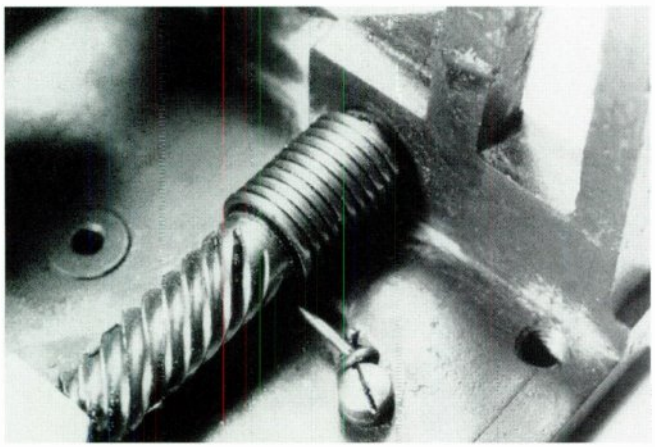
Cut a strip of leather with the correct width, or a length of ready-made belting, and loop it around the motor pulley. Draw the loose ends up through the machine, making sure to engage any belt tightening devices. Hold one of the free ends of the belt against the



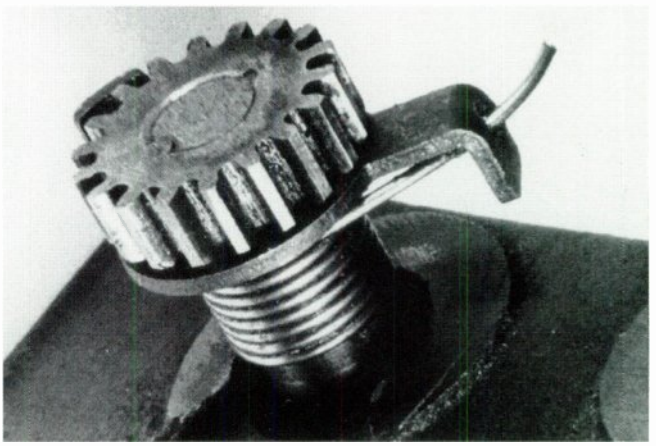
A ratchet-type attachment on the winding shaft.



A winding shaft spring.



A spring-type winding shaft attachment.



A winding shaft spring used on an Edison Diamond Disc machine.

mandrel pulley and pull the other end tightly over it. Use a screwdriver to mark the spot where they start to overlap and remove the belt. Cut the extra belting off, about ¼" to ½" past the indentation you made with the screwdriver.

Next, take a razor blade and taper the two ends in order to reduce the thickness of the joint. A carpenter would call this a scarf splice. An easier method is to feather the ends of the belt by dragging them across a piece of fine sandpaper while pressing down on the end with the index finger. The best glue for fastening the two ends together is contact glue. It is flexible, strong, and easy to work with. Smear a small amount on the two overlapping surfaces and *let it dry*. When the glue is no longer tacky, align the ends carefully and press them together. Needlenose pliers are good for squeezing the splice and rounding it a bit. For extra strength, some repairmen stitch across the joint with thread. A few stitches are all that is needed—any more and you make a lump in the belt.

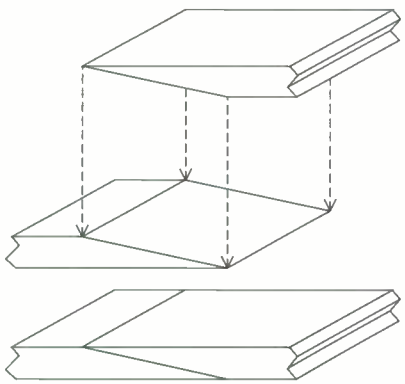
In machines without a belt tensioner, you have to make sure that the belt is pulled good and tight when you mark the length, otherwise it will slip. You may also come across machines where you must glue the belt *after* it is looped around various parts. Always check for this uncommon problem.

The length of the overlap and the thickness of the belt can vary from machine to machine. Generally speaking, the larger the diameter of the pulleys, the thicker the belt and longer the overlap. 1/16" is about the largest permissible thickness, and 1" is about the longest overlap.

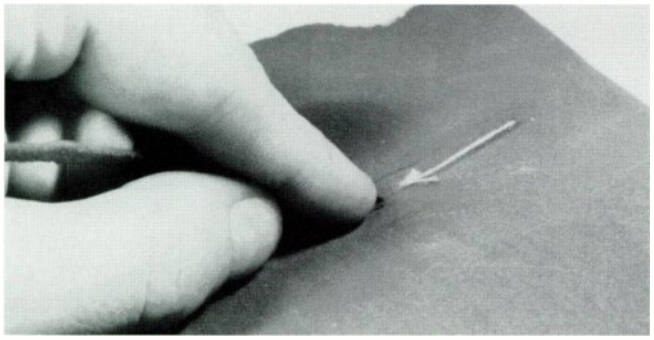
Some machines have perforated belts which run over sprocket wheels. If the sprockets aren't too long, it is possible to roll one of the wheels along the length of the belt in order to make indentations in the leather. These marks are then punched out. When making the splice, make sure that the holes remain properly spaced.

If the original belt is intact but slips, it is sometimes possible to shrink the belt a bit by degreasing it in naphtha. Let it dry out while it is installed in the machine. Don't use water as the belt will get stiff. Roughening the inside of the belt with medium grade sandpaper is also useful and should be tried before resorting to one of the commercial "belt dressings," which I think are of questionable value. Edison model 60 and 80 Diamond Disc machines are especially prone to slipping belts. I have found that coating the inside of the belt with a thin layer of rubber cement works wonders.

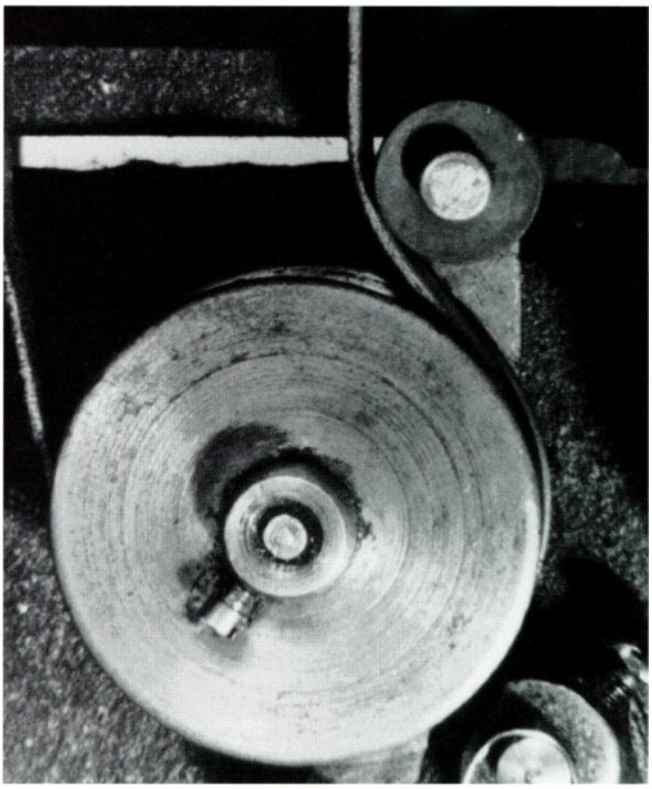
Normally, when a mandrel is turning at proper speed, the belt will run off about an inch if the mandrel



A scarf splice.



The end of a new belt can be feathered by dragging it across a piece of sandpaper in order to create half of a scarf splice.



An Edison belt tension device.

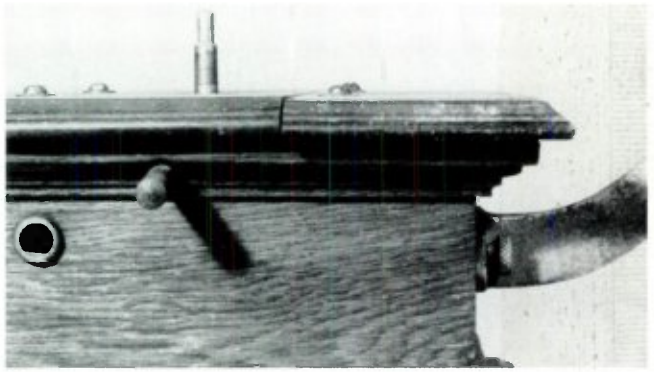
is suddenly stopped with the hand. Any more run-off may cause problems. Conversely, if the belt stops immediately, it may be too tight, but can be stretched by hooking a finger behind the belt and pulling it slightly. Don't overdo it or you may make the belt too loose.

Turntables

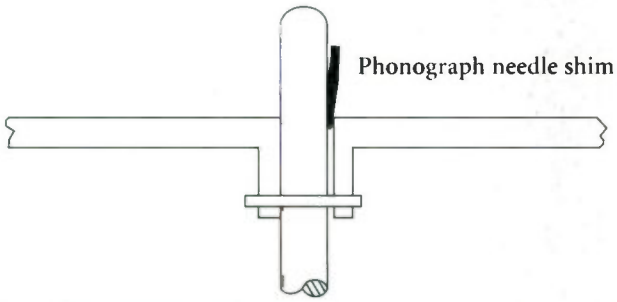
Most turntable problems are cosmetic rather than mechanical. These are discussed in Part Three. The mechanical problems that can be encountered include turntables that are not level, turntables that bob up and down during play, and turntables that wobble.

In the first instance, the cause is almost always improper installation of the motor. Check that all insulating rubber washers are in place and that the motor is level. If the motor is level, the turntable will also be level.

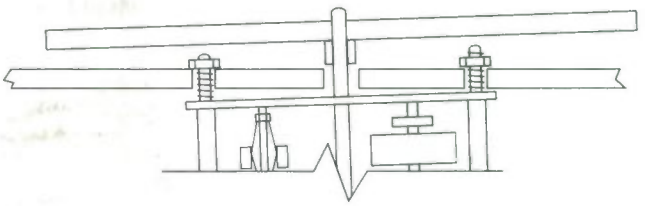
If the edge of the turntable bobs up and down but is otherwise properly installed on the spindle, the problem may stem from either a bent spindle or a badly drilled hole in the turntable, often from a previous repair. Bent spindles can sometimes be straightened by careful flexing of the turntable, or, in extreme cases, by removing the spindle and straightening it with a hammer and anvil. Heating the spindle helps. It is difficult



Cracks in the motor board can also cause turntable problems.



A wobbly turntable can be shimmed with a gramophone needle and packed with epoxy or superglue. Remember to grease the spindle first so that the glue adheres to the turntable alone.



If the motor is not installed properly, the turntable may tilt and hit other parts mounted on the motor board, such as the on/off lever.

to correct the problem 100%, but it is possible to reduce the bobbing.

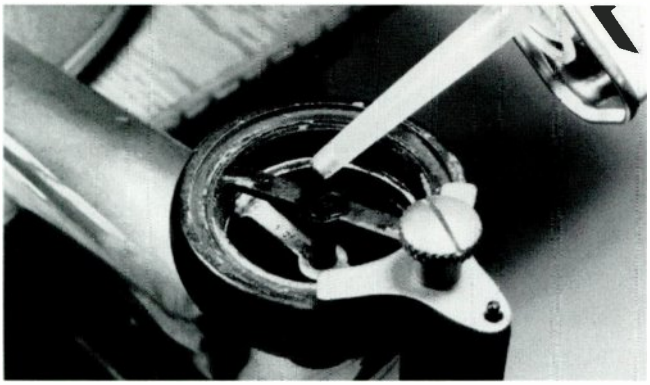
If the hole in the turntable is badly drilled or worn, the only solution is to ream out the hole and make a new center bearing. If you think this is beyond your capabilities, you might try the following method.

If the turntable wobbles, it is almost always the type of turntable that rests on a split through the spindle. Invariably, the center hole has become enlarged and will have to be rebushed. This requires a good drill press or a lathe for best results, but there is one other possibility. Grease the spindle with some vaseline and install the ungreased turntable. Using steel phonograph needles, shim the turntable and check the rotation. When you feel that the turntable is correctly positioned, drip some superglue around the hole. The grease prevents the glue from adhering to the spindle, and the glue forms a new bearing. The needles can be broken off when the glue is dry. If you oxidize the spindle by heating it with a torch instead of greasing it, it is possible to pack the joint with solder, as long as the solder has no flux core. For a really quick repair, try shimming the turntable with toothpicks.

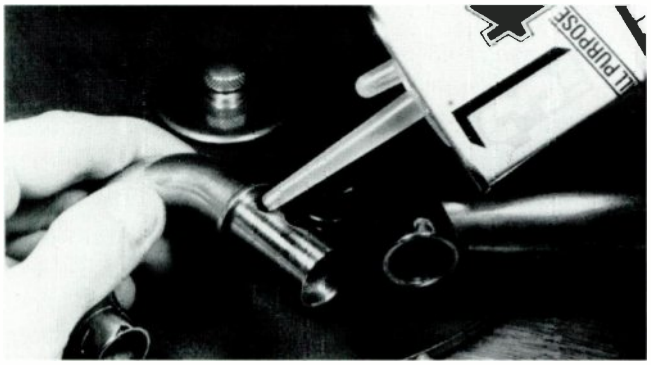
I have been told that one can dip the spindle in melted solder to increase its diameter, but I haven't tried this myself. Apart from the fact that the turntable and not the spindle is usually the culprit, increasing the diameter of the spindle may make it difficult for records to fit properly.

Tone-arms

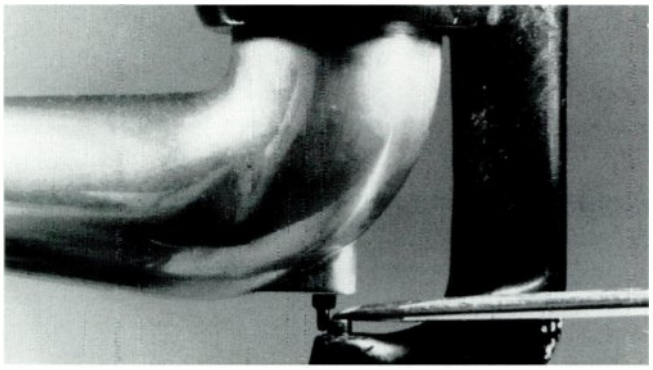
For the tone-arm to function properly, it must be able to swing freely across the record with as little drag as possible. In tone-arms with goose-necks, such as those used by Victor, the reproducer must also have freedom of movement up and down. Columbia tone-arms and others without a goose-neck must be able to pivot up and down at the supporting bracket. If these movements are stiff, the record will sound bad and will quickly wear out. There are so many different tone-arm constructions that it would be impossible (and very



Lubrication of the tone-arm bearings.



If the machine has a goose-neck, this, too, must be oiled.



This tone-arm pin is spring loaded. A screwdriver can be used to push down on the bearing and free the tone-arm. On most machines, however, the pin is held by a set-screw.

boring) to describe them all. Generally, machines with outside horns have tone-arms that fit into a ring in the back bracket, and are held in place with a small pivot pin at the base of the bend. When the pin is removed, after loosening the set-screw, the tone-arm can be taken off, cleaned, and lubricated.

Later model machines with internal horns often have a tone-arm supported by ball bearings. Unless it is absolutely necessary to take the assembly apart, *don't!* These arms can be murder to put together again, particularly late Columbia models.

It is not unusual to see a machine that has had the tone-arm replaced at one time or another, or is missing the tone-arm entirely. When searching for a suitable replacement, it is important that the length is correct. When the tone-arm is installed, the tip of the needle must be able to hit the turntable about ¼" past the spindle. This is a good way to spot homemade imitations, which are often way too short. However, this is merely a handy rule of thumb. The determination of the ideal length and position of a tone-arm is a complicated affair, and though phonograph design is beyond the scope of this book, I have included a brief discussion of tone-arm length and design in the section on acoustics.

Some steel tone-arms are found with a layer of rusty scale on the inside surface. Removal of this rust will sometimes improve the tone quality considerably.

Casting new parts

Although it is unlikely that you will ever need to cast things, I thought that you might like to know how to do it. It is more time consuming than difficult, and is more satisfying than buying castings from other sources.

Perhaps the easiest parts to cast are the pretty horn supports used on front-mount Columbia and Talk-O-Phone disc machines. These are frequently missing and must be replaced. Other ways in which you can use this casting technique for solid parts will undoubtedly suggest themselves.

The first thing you will need is a model of the part to be cast. This can be carved out of wood, modeled in clay, or, preferably, an original part borrowed from a trusting friend. Next, make a wooden box, large enough to hold the part and at least three to four times taller than the tallest portion of the part you wish to duplicate. If the part isn't very big, an old shoebox can be used, or even a disposable aluminum baking tray.

Grease the model with vaseline and fill any bolt holes and other indentations that may trap it in the mold with modeling clay. These holes will have to be drilled out in the reproduced part. You can cast pretty much any solid part as long as you take these precautions.

Prepare some plaster of Paris, grease the inside of the box, and fill it about half full with the wet plaster. When mixing the plaster, pour the plaster into the water and not the reverse. This creates a much stronger material.

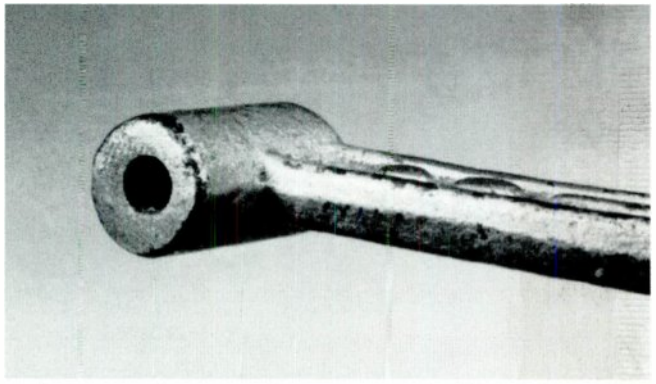
When the plaster is thick enough to prevent the model from sinking (after a bit of drying), carefully place your greased original in the plaster so that it is half imbedded in the wet plaster. Also push three or four marbles halfway down into the plaster. Now wait

for the first half of your mold to dry. The marbles will help you position the two halves of the mold when you cast the metal.

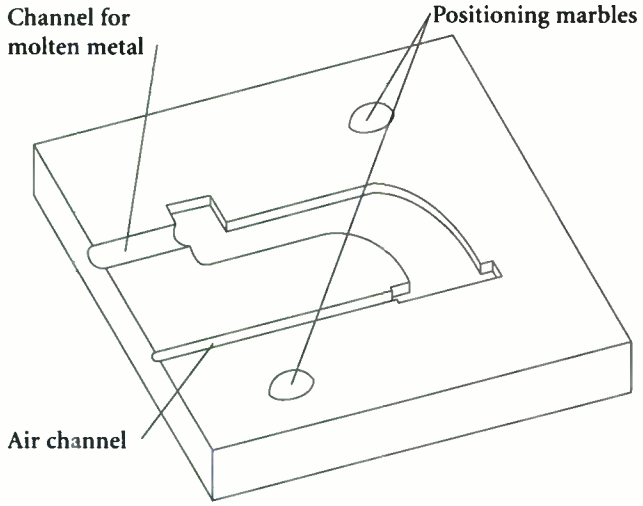
When the first half of the mold is thoroughly dry, grease the entire surface, including the marbles and model, and then pour in a new batch of plaster. Let this dry completely—usually overnight. Now you can remove the sides of your box and carefully separate the two halves of the mold. Remove your model, but leave the marbles in place to ensure correct alignment.

Carve a channel in the two halves of the mold so that you can pour in the molten metal. Also, carve one or two smaller channels to allow air to escape as you fill the mold. Since you probably will be standing your mold on end when you pour in the metal, make sure the air channels lead back to the same side as that of the main channel. Otherwise, the molten metal will run out the sides or somewhere else you don't want it.

Now dust the entire surface of the mold with graphite. This prevents the new casting from sticking in the mold. When this is done, place the two halves in a medium-hot oven for an hour or two. This removes the last traces of moisture and heats the mold to such an extent that the metal does not start to harden in the channel or other sections before the mold is entirely filled. It also reduces the risk of cracking the mold when you pour in the hot metal.



Holes in parts that you wish to recast must be filled with modeling clay before making the plaster mold. They are drilled out in the finished casting.



Half of a plaster mold. The marbles serve to align the two halves.

The metal used for casting can be purchased from art supply and handicraft stores. It is called, oddly enough, "casting metal." This is very similar to the metal used to make tin soldiers but is not quite as soft. It is heated in an old pot over a gas flame or torch and is easy to melt. The work area must be well ventilated.

When the mold is well-heated, bind the two halves with strong twine or wire and stand the assembly on end. Stand well back, should the mold break, and pour the molten metal into the channel. If all things go well, you should be able to remove a perfect casting when the mold is opened. If not, re-melt the metal and try again. You may need to carve additional air channels.

The final step is to cut off the metal branches, extending into the various channels, and file and polish the casting. And that's all there is to it!

Special problems with Edison phonographs

Pot metal mandrel bearings

Edison phonographs produced before 1908 have an endgate, which supports the end of the mandrel. Standards, Homes, Triumphs and Idelias made after this time have no endgates and the mandrel is supported by a pot metal bearing placed in the bedplate casting just to the left of the mandrel itself.

Pot metal is about 91% zinc, but the presence of tin, aluminum and other metals, especially lead, in the remaining 9% causes the metal to swell, distort and crack. This is called "intergranular corrosion." However, the metal was cheap and easy to cast, and very little thought was given to the long-term consequences. Collectors today curse otherwise fine companies for their lack of regard for the poor repairman 90 years hence.

Edison's bearings have often swollen to such an extent that the mandrel is frozen solid. They are practically impossible to remove and it is, of course, impossible to play a cylinder. To make matters worse, there is often a fragile feedscrew bouncing around on the other end as you twist and pull the mandrel in order to free it.

As mentioned earlier, protect an exposed feedscrew

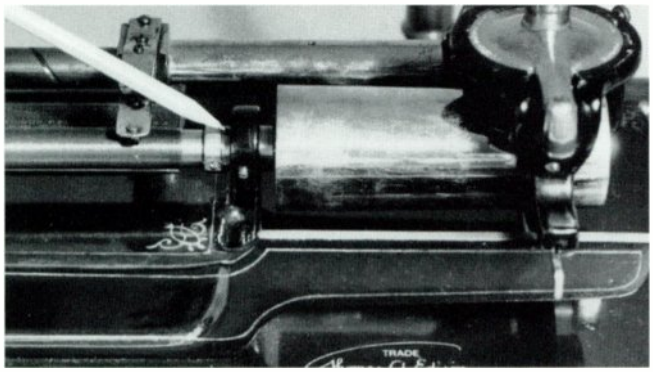
by wrapping it in a rag, and loosen all pulleys, set-screws and other paraphernalia, including the set-screw on the pot metal bearing itself. With patience, you will be able to work the mandrel loose by twisting it back and forth. Continued twisting and pulling should enable you to get the shaft out, removing loose hardware from the left side of the machine as space becomes available. At one point, either the bearing will come out of the casting, or the mandrel shaft will come out of the bearing. In either event, the next step is to break off the old bearing, clean the casting, and polish the shaft.

New bearings are available from most suppliers and are made of brass. Usually the new bearings fit like a glove, but if the glove is a little tight on the mandrel shaft, you will have to do a little more work to complete the repair.

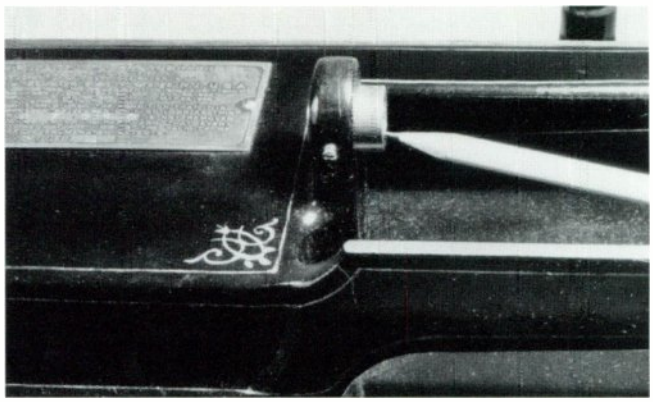
In the section on governors, I mentioned the use of rubbing compound and an electric drill—and these are what have to be used now. Place the bearing in a vise and smear some compound inside the bearing. Push the mandrel shaft through the bearing and attach it to the drill chuck, protecting the metal end with tape. Start the drill and work the shaft back and forth. The compound will grind the brass to a perfect fit. However, before you do this, make sure that the problem really is the new bearing and not burrs or other scars on the shaft caused by the old pot metal or your tools. When the shaft and bearing fit properly, insert the new bearing, tighten the set-screw, oil it, and the job is done.

Mandrel bearings that are exceptionally worn can also cause problems by producing drag in the mechanism. This may cause the machine to slow or stop before the cylinder is through playing. Replacement of the bearing is the only correct solution.

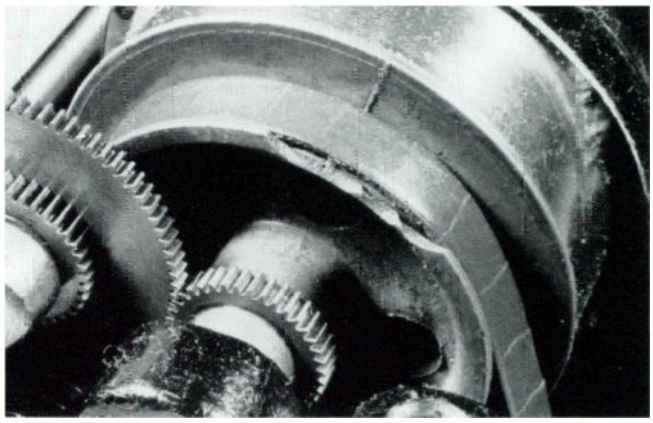
Many Gems have a pot metal pulley and gear attached directly to the mandrel. If this is broken or has deformed the shape of the mandrel, a replacement core must be purchased from a dealer.



This mandrel bearing on a late model Edison is made of pot metal and may swell up and freeze the mandrel.



Another view of the Edison mandrel bearing. If it has swollen, it must be chipped out and replaced with a new, brass bearing.



This pot metal pulley on an Edison Gem has started to crack. However, it is still serviceable. If the wheel has collapsed completely, it will require replacement.

Edison also used pot metal for some of his reproducers. This is discussed in the section on acoustics.

Special problems with Columbia phonographs

Pot metal carriages

Columbia pot metal reproducer carriages are notorious and many collectors avoid Columbia machines like the plague for this reason alone. Although they may not be as robust as Edison's machines, they *are* well made and are often a lot more decorative. The truth is, they *can* be restored with a little patience.

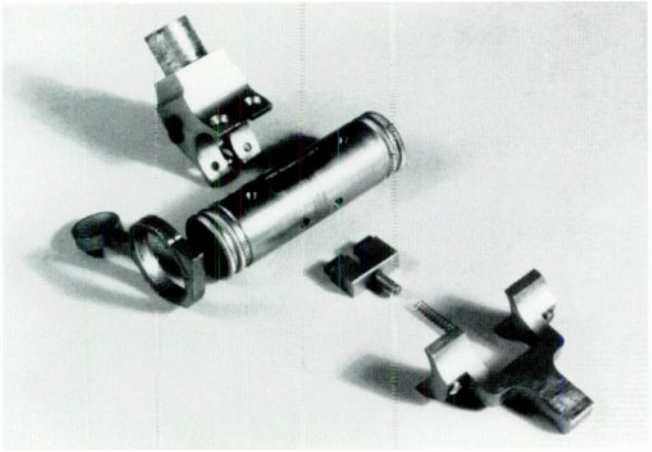
The most frequent problem is that of the cracked or frozen reproducer carriage. The base of this carriage is in the form of a tube which slides along a steel shaft. The shaft is hollow and contains the feedscrew. As the pot metal swells, it grips this shaft tighter and tighter. The reproducer bracket is screwed onto this tube with four countersunk bolts. Passing between the "feet" of

the bracket is the lever for engaging the feedscrew and lowering the reproducer. This lever is part of a ring passing around the tube. Even if it is not broken (and rarely is since it is usually made of brass), the lever is almost always stuck.

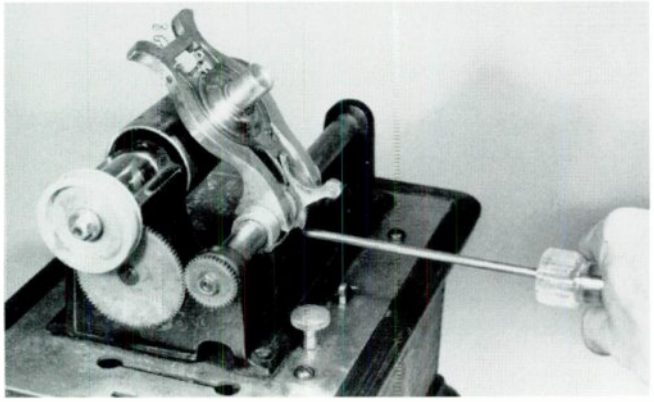
A second bracket is screwed underneath the tube. This bracket contains the spring-loaded half-nut and has a long tail, which travels along a guiding groove in the base of the bedplate. The groove and tail serve to hold the carriage assembly in position on the feedscrew shaft.

If you are lucky, the carriage is more of less undamaged, just a little stiff, and you can get by with minor filing to alleviate any binding. Disassembly is pretty straightforward. If you are less lucky, you will have to carefully work the tube off by force. The whole assembly is quite fragile and there is a good chance of shattering it.

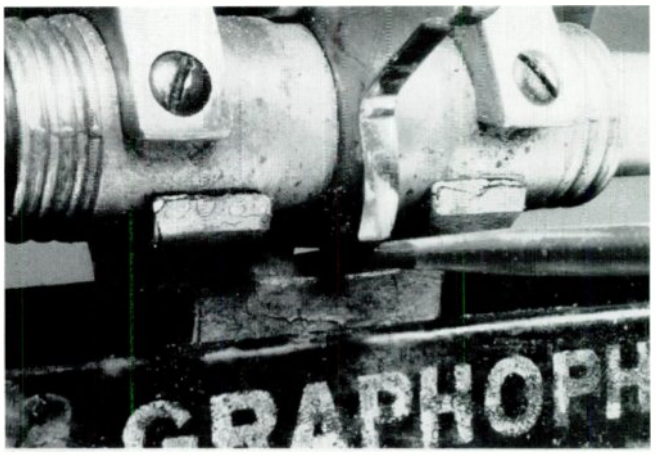
Start the repair by removing the reproducer bracket. This is done by unscrewing the four small bolts in the feet. In some cases you may need to punch out the small pin which holds the reproducer lift arm in order to free



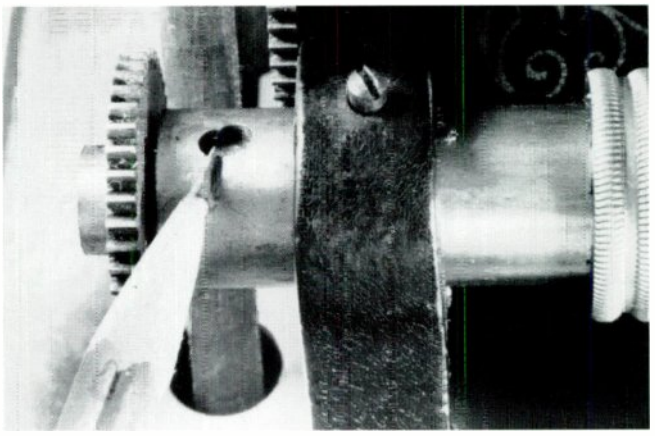
A fairly typical Columbia carriage showing all the component parts. This one is from a model A.



Releasing the half-nut on a Columbia AZ.



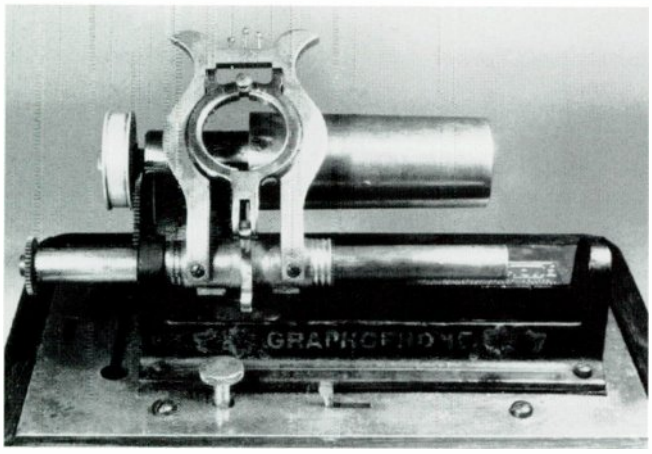
The screwdriver is inserted between the lift lever and the half-nut in order to push the half-nut down and out of the way.



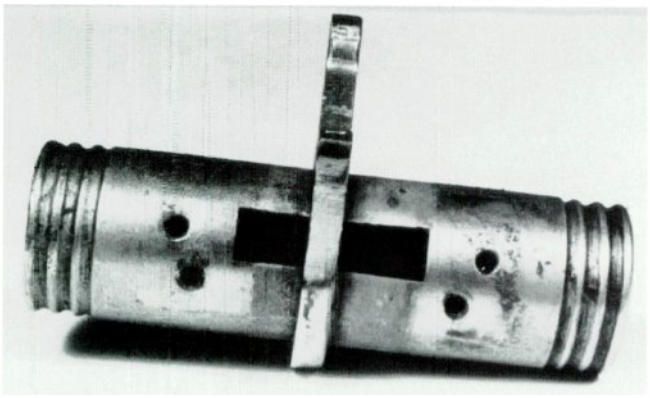
The carriage shaft set-screw ought to be removed completely so that it can't catch in the indentation.

the bracket. Next, check to see if the half-nut was engaged when the machine was abandoned. If it was, you will have to free it by pushing the half-nut downward with a screwdriver. Otherwise, it may be possible to remove the upper casting from the bedplate and unscrew the guide bracket by inserting a screwdriver through the groove in the base. After the half-nut is freed or removed, you must gently tap the carriage off the shaft. For this you need a lot of patience.

There are two things you must be aware of before you go any further. First, the set-screw that fastens the feedscrew shaft screws into an indentation in the shaft. This indentation assures that the opening along the bottom of the shaft for the half-nut is correctly positioned. Don't just loosen this screw, remove it completely. Otherwise it may not clear the shaft. Second, if you haven't been able to remove the half-nut bracket, you may find that the half-nut hits the right-hand feedscrew bearing when the shaft is tapped almost all the way out. If the half-nut and lever were still operating correctly and you simply disengaged the half-nut in the usual



The carriage and shaft have been moved as far to the left as possible.



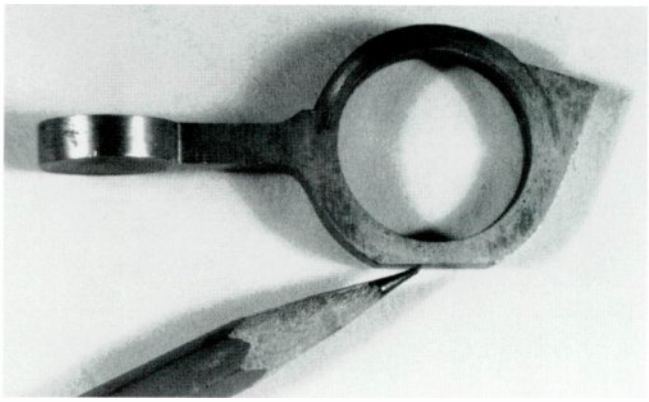
The half-nut hole should be checked for swelling. This one is slightly butterfly-shaped.

manner, the half-nut *will* hit this bearing every time.

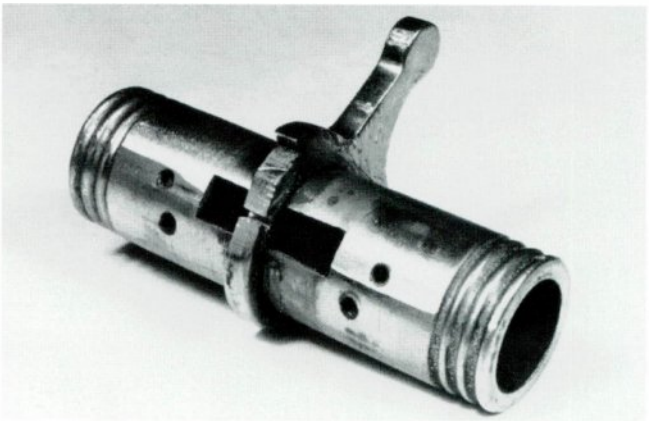
In order to avoid harming the half-nut, you will have to press it down even further in order for it to clear the bearing. You may want to make a small wooden shim to press the half-nut down as far as possible. This shim is inserted between the half-nut and the lever. Remember this problem when you reassemble the machine.

On some machines, such as the model AD and AF, the right-hand shaft support can be unscrewed from the bedplate. The shaft can now be removed with the carriage still attached to it. The carriage can be pushed off the shaft by drilling a hole in a board, just large enough to insert the shaft, and tapping the shaft out with a hammer and wooden dowel. The carriage cannot pass through the hole and is gradually pushed off. Unfortunately, the end support cannot be removed on most models and you will have to press the shaft out of the carriage tube while they are both still in the machine. In some cases, it is possible to use a C-clamp in order to press the carriage off against one of the end supports. You can also tap the shaft through the support with a hammer and wooden dowel as long as you support the end casting in order to keep it from breaking. Be careful not to twist the shaft or you will break off the half-nut bracket, which is still held in place by the groove in the casting. I might mention here that although the carriage may be swollen, the real culprit may in fact be the half-nut bracket. This, too, is frequently made of pot metal and swells in the groove so that it becomes good and stuck. This is another good reason for unscrewing it at an early point in the repair, if possible.

When the carriage assembly has been removed, you can start to check for other damage. If any moving parts on the carriage are frozen, you must work them free, attempt to disassemble them, and file them down. In some cases, it may be necessary to crack the part and reglue or resolder it in order to implement repairs. I would like to emphasize that I mean this as an *absolutely last resort* measure. Spend some time examining your specific problem—not just five minutes. Make sure you have exhausted all other options before you purposely inflict damage.



If you must cut the lift lever, cut on the flat side.



The lift lever has now been cut and rotates freely. The gap must be filled with a piece of brass or epoxy.

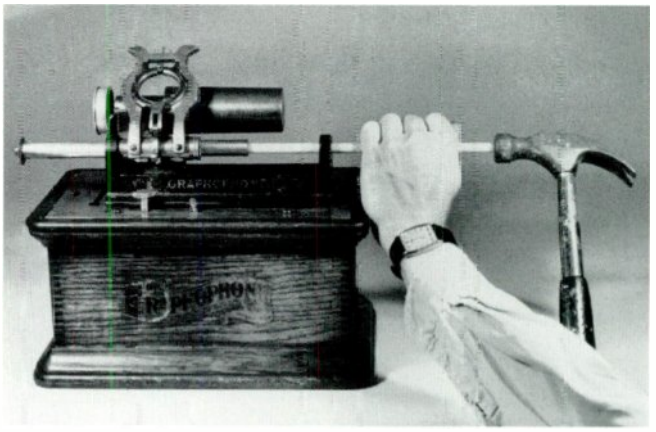
The half-nut bracket must slide freely in the guide groove.

One of the parts you may have to damage is the lift lever. By cutting the lift lever ring with a thin hacksaw, it is possible to ease the ring so that the lever comes loose. It may not be necessary to cut all the way through, so check the results at various stages. It is also possible to gently tap the lever/ring slightly to one side. This may also loosen it enough so that major surgery can be avoided, but be *very careful.* Please note: your goal is not to get the lever to move *smoothly* at this point—you just want it to *move.*

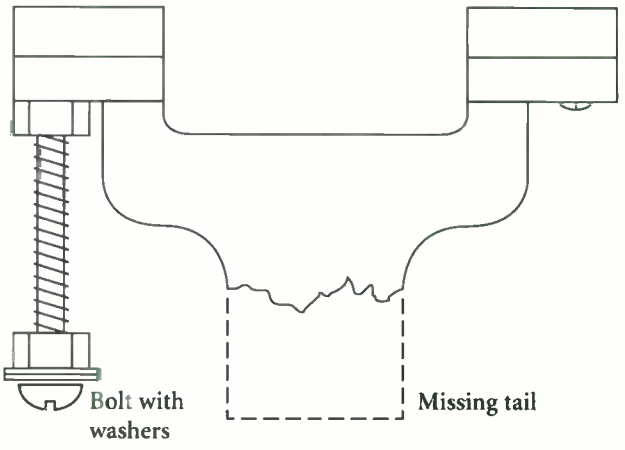
If you have to cut, cut across the flat side of the ring. It's difficult to cut the ring without marring the tube. In this manner, damage is confined to a portion of the tube that is not normally visible. Afterwards, the gap in the ring can be filled with epoxy, or a small piece of brass. Make sure that any repair does not catch on the half-nut or on the edges of the slot in the tube.

If the ring still isn't loose when you have completed the cut, you may have to ease it a bit with a screwdriver. Don't deform the ring, though. If it is too loose, the lever may not stay in the "disengaged" position when you try to move the carriage when the machine is reassembled.

Don't try to remove the ring from the swollen tube.



Driving out the shaft with a wooden dowel and a hammer.

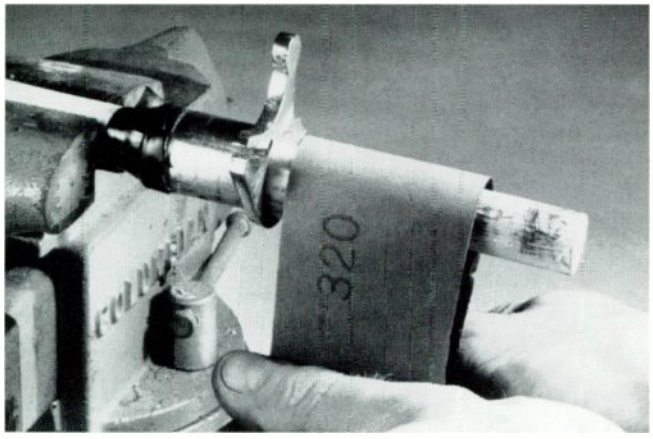


A simple method of repairing a Columbia guide bracket if a replacement is not available.

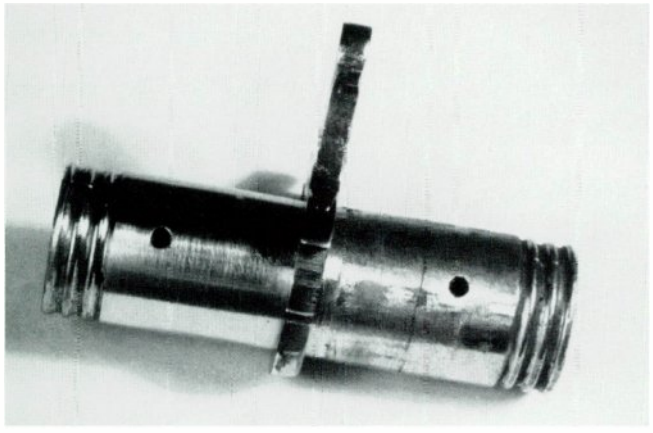
It isn't necessary and you may do more harm than good. If the lever is stiff, work it back and forth for awhile. If it is still stiff, try running some Brasso, or some other liquid abrasive polish under the ring and use it like rubbing compound. This will usually do the trick.

The tube itself ought to be reamed so that it slides easily on the feedscrew shaft. If you don't have a reamer, careful filing will usually suffice. Of course, if the tube is badly deformed, it may be wise to buy a new brass replacement or have one turned on a lathe. If there are only small surface cracks or small chips, these can be filled with epoxy or some similar plastic filler and sanded smooth. There are a number of epoxy fillers available in metallic colors, which are ideal for this type of reconstruction work. You can also run superglue into the cracks. Some patient people have managed to glue all the bits and pieces of a shattered tube together and baked the assembly in the oven!

If you insert a dowel in the tube, fasten it at one end



Polishing the trunnion.



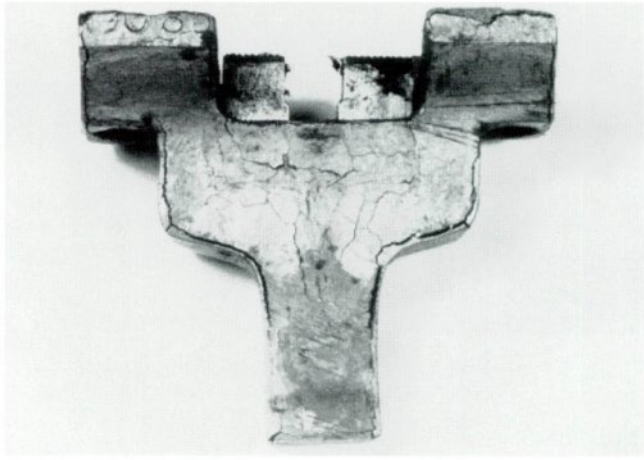
The left side of the trunnion has been polished and looks quite respectable.

with tape, and secure the dowel in a vise, the tube can be sanded and polished easily, much as you would shine shoes. The slot for the half-nut should also be checked for swelling. Often this has become almost butterfly-shaped because the ring has prevented the tube from swelling evenly. File the hole back to its proper shape if necessary.

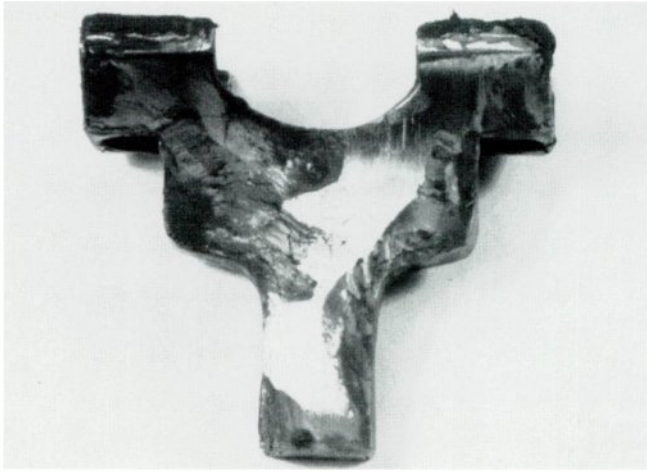
The half-nut guides in the bottom bracket should also be checked for swelling and filed if needed. The half-nut spring should also be examined to make sure it is strong enough to do its job. A new spring can be made by rewinding the wire from a ball-point pen spring onto a thinner axle of suitable size. The bracket itself may have begun to deteriorate, in which case it is possible to fill in cracks and chips in the same way the tube was repaired. Check the tail for swelling and make sure it fits correctly in the groove in the casting.

Occasionally, the tail has broken off and is missing, even though the upper portion is still intact. If you don't care to spend money on a replacement part, or are waiting for a part to arrive, here's an inexpensive solution to the problem. Instead of replacing both of the short bolts that fasten the bracket to the tube, exchange one of them with a long bolt extending down into the groove guide. This bolt will probably be too thin in itself to guide the carriage properly, so bolt on three or four washers of the proper diameter to increase the thickness. This is not a proper repair, but it works well and allows you to enjoy the machine until parts become available. I've found that although Columbia parts are frequently listed in dealers' catalogs, they are rarely in stock. Often made only on special order, this may mean a wait of several months before you get what you need.

When all the parts have been filed or reamed so that they fit properly, the carriage can be reassembled. Remember to check the direction of the half-nut. Refer to the section on feedscrews and half-nuts if you are in doubt as to what I mean. Care should be taken when tightening the bolts on the feet of the brackets, particularly the top ones for the reproducer bracket. If the



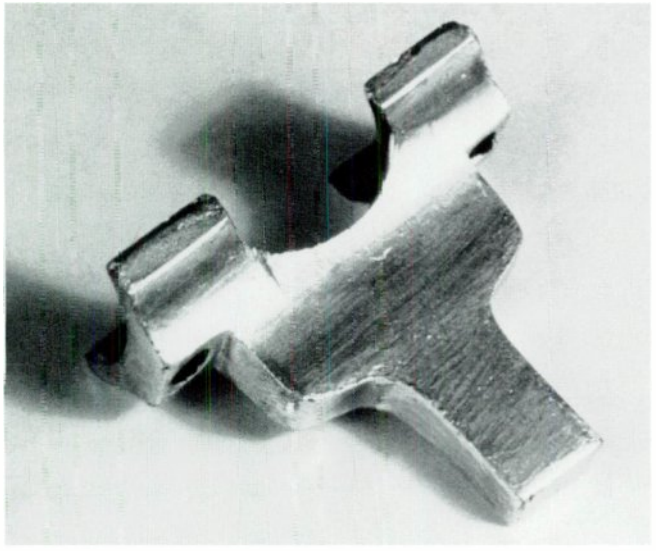
The pot metal half-nut bracket from this AZ is swollen and cracked.



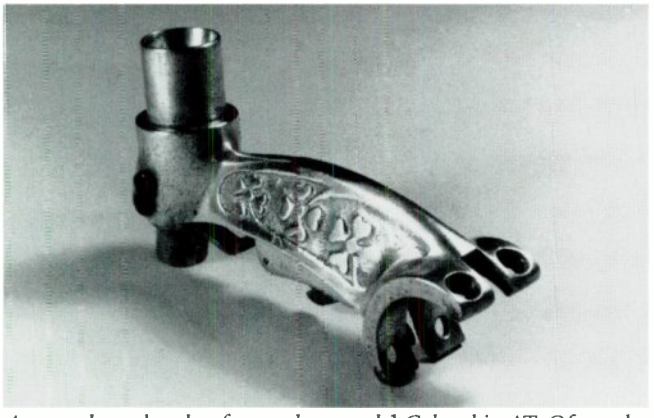
After some grinding and polishing, the cracks are repaired with epoxy filler.

bolts are tightened too much, the feet may break.

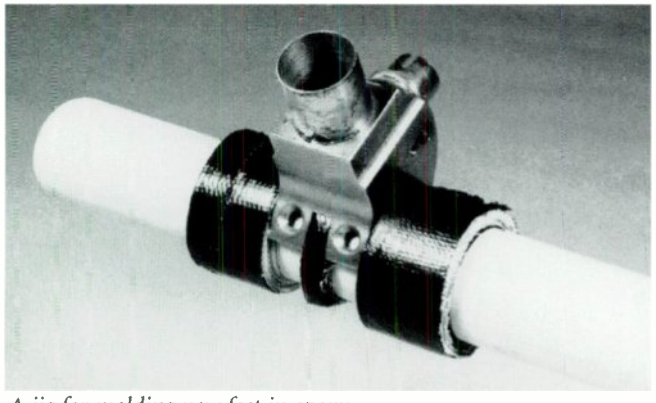
The small feet on the base of the reproducer support have often broken off at the screw holes. These, too, can be remodeled in epoxy. To do this, the part is screwed to



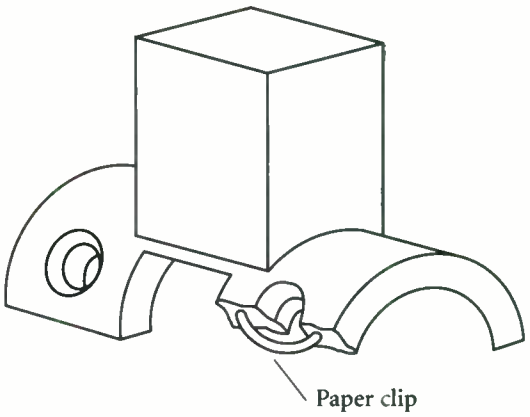
The finished repair may not look perfect, but still represents a major improvement in both appearance and performance.



A reproducer bracket from a late model Columbia AT. Often, the small "feet" at the base are cracked or missing and must be reconstructed.



A jig for molding new feet in epoxy.

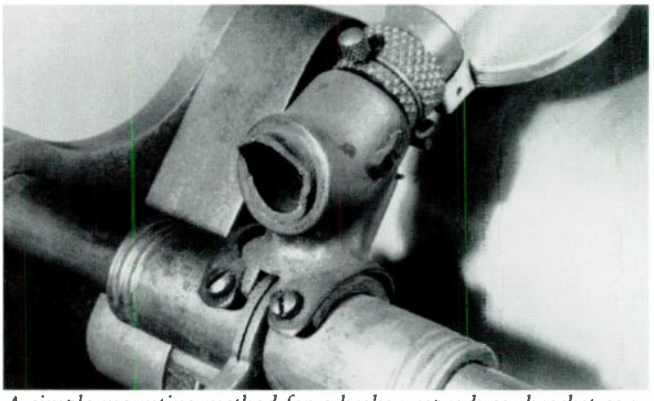


A paper clip can be used to strengthen repairs on Columbia "feet".

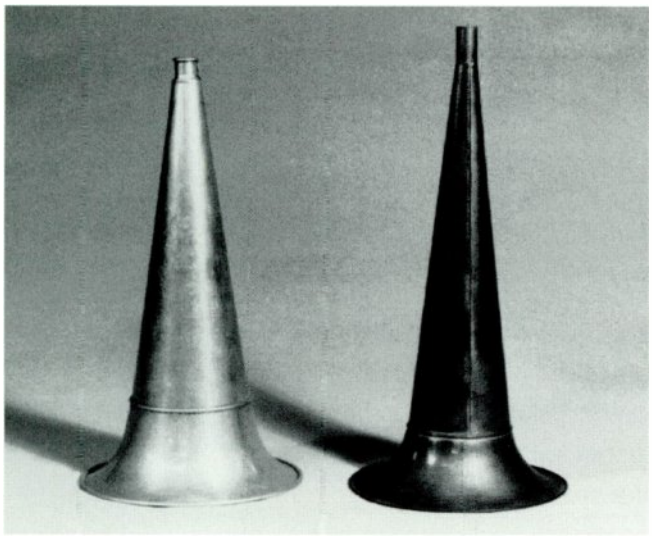
a dowel of the correct diameter and tape is wrapped around the dowel on both sides to form the sides of a mold. Mark the insides of the feet and remove the part. A third ring of tape is now wrapped between these marks to form the inner sides of the feet.

Grease the mold and screws with vaseline and fasten the bracket to the wood. Now, epoxy can be pressed into the grooves. When the new material is dry, the feet can be shaped with a file and *carefully* screwed to the tube. If too little remains of the original screw holes to allow the bracket to be attached to the mold, it can be taped in place with strong electrical tape.

A better way to support the reproducer bracket during gluing, which also helps to make a stronger repair, is to drill two holes in the cracked surface on either side of the screw hole. A small loop of wire can then be glued in place to form the missing half. This not only helps hold the part in place during rebuilding of the feet, but also gives the glue something to grip. The metal rings also relieve strain on the glue when the bracket is installed. It is not absolutely necessary to do



A simple mounting method for a broken reproducer bracket consists of two brass collars. The broken neck must be reamed out and replaced if the machine is to support a horn.



Left : A 14" aluminum "witch's hat" horn from Columbia, original equipment on most machines with pot metal carriages.
Right : An Edison-type brass "witch's hat" horn. This horn is more than twice as heavy as Columbia's version!

this to all four feet; two are sufficient provided they are in diagonally opposite corners. No matter how well you repair the feet, the repair will in all probability not be as strong as the original, undamaged part. Because of this, you should avoid using horns that ride the carriage without the benefit of a crane, particularly all-brass witch's hat horns, which are very heavy. Besides, all-brass witch's hat horns were rarely standard equipment on models with pot metal carriages. The distinctive aluminum 14" horn from Columbia was much more common and a whole lot lighter. As an alternative to molding new feet, the reproducer bracket can be secured with two small metal collars. This is quick and easy to do, and not too unsightly, although it can hardly be called "restoration."

Finally, the neck of the reproducer bracket may be broken to such an extent that it cannot support a horn. The only correct solution is to carefully ream out the old neck and insert a new brass tube. However, if you want to display the machine and wail until some future date to make major repairs, simply make a wooden plug for the neck to support the horn. The machine won't make much music, but at least it will look nice.

Although your particular machine may not conform exactly to the model described here, most carriage problems can be solved in a similar manner. The techniques are the same, regardless of the shape of the part.

Troubleshooting the spring motor

Effect	Cause
Motor sluggish, runs down too quickly	Weak spring, bad governor adjustment, improper lubrication. On cylinder phonographs: worn mandrel bearing, bad endgate adjustment (early Edisons), worn half-nut, drive belt too tight, horn too heavy.
Motor noisy	Worn gears, bad governor adjustment, lack of lubrication. Rubber motor washers hard or missing Worn bearings.
Motor (spring) "thumps and bumps"	Spring grease solidified. Tight spring barrel cover.
"Machine gun" noise from motor	Governor weights are hitting something. Stop motor immediately.
Motor jammed	Broken governor, locked gears.
Motor rumbles and vibrates	Check for badly balanced weights and mismatched governor springs
Uneven speed	Bad governor springs, no oil on pads. Slipping belt (cylinder machines)
Spring noisy	Improper lubrication.
Winding crank "snaps" back	Ratchet or winding shaft spring defective.
Spring winds partially, then slips	Spring unhooked from barrel, or broken somewhere past the middle.
Crank turns but won't wind spring	Spring unhooked from shaft, or broken close to center of coil. Springs broken in this manner can usually be heard turning around inside the barrel when winding.
Cylinder machine "repeats" a groove	Half-nut worn or not engaging. No lateral movement in reproducer (i.e. stiff hinge block). Bad carriage/feedscrew lubrication. "Tail" on carriage of Columbia cylinder machines swollen. Check for proper gearing (2- or 4-minute). Check for a bad record groove.
Cylinder machine "skips" a groove	Check for proper gearing. Check record for damage.
Disc machine "repeats" a groove	Check for stiff tone-arm movement or damaged record.

Acoustics

The reproducer is, in many ways, the real heart of any phonograph or gramophone. The machine's decorative value is easily understood, and other collectors will appreciate a quiet motor. However, if the machine cannot reproduce sound in the proper manner, it remains a museum piece and nothing more.

Much of the fun of owning an antique talking machine is being able to play records on it, and if the sound is awful, the enjoyment is minimal. It is well worth the effort to invest some time in the repair of your reproducer. The difference in sound quality can be quite amazing.

How reproducers work

All reproducers work in exactly the same way. The movement of the stylus in the record groove pulls and pushes the diaphragm in and out, moving the air trapped behind it, thus artificially recreating the recorded soundwaves. These soundwaves are then directed through the tone-arm and horn out into the room. It is well to note that these soundwaves are *not* amplified at any point in acoustic machines. Sounds are merely produced and given a direction, like talking through the garden hose.

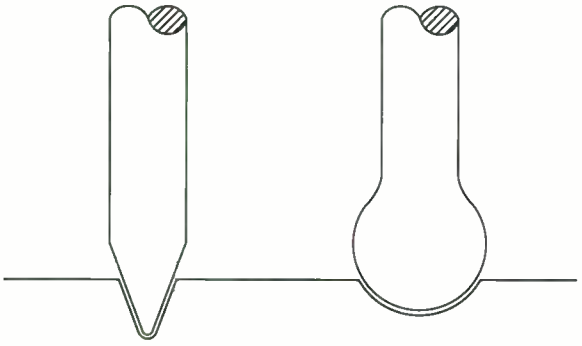
For the reproducer to function correctly, it must be air-tight. The soundwaves must not be allowed to escape other than down the tone-arm. Connections between the stylus and the diaphragm must not hinder the diaphragm's movement in and out, or fail to transmit the motion of the stylus accurately. Lastly, the stylus must fill the groove in the record.

The diaphragm itself must be held tightly in place around its perimeter and must not be broken or damaged.

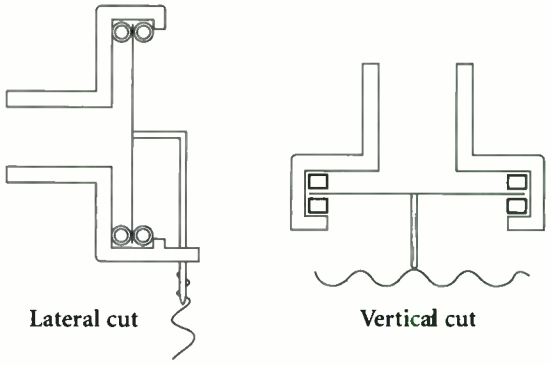
Recording methods

Sound was recorded on wax in two ways. All cylinders are recorded by the vertical-cut method, which was developed simultaneously by Edison and his competitors Alexander Graham Bell, Chichester Bell, and Charles Sumner Tainter. This caused enormous legal fights regarding patent ownership in the early 1890's. In the vertical-cut method, also known as "hill-and-dale," all the grooves have a constant width, but vary in depth. The stylus is rounded and rides up and down in the grove, pushing and pulling the diaphragm to create soundwaves. This method was also applied to Edison's Diamond Disc records, Keen-O-Phone records, as well as many discs produced by the French firm Pathé.

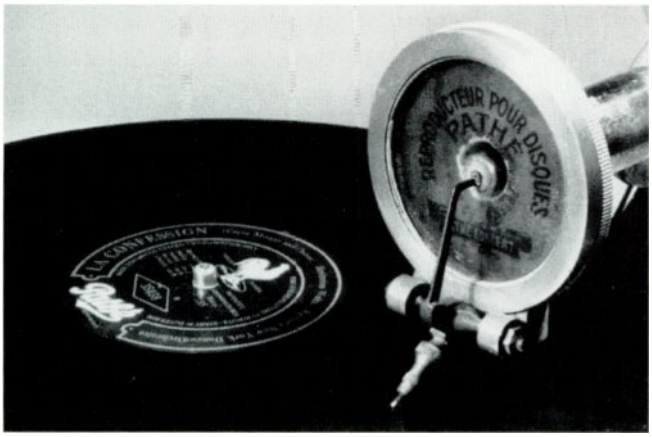
Almost all other disc recordings use the technique pioneered by Emile Berliner in 1887, the lateral-cut method. Here, the depth of the groove is constant, but its path swings from side to side. This is also known as the "needle-cut" method. The stylus is pointed and its



The stylus must fill the groove for best results.



Two recording methods. Lateral-cut is generally used for discs, while vertical-cut is used in all cylinder recordings.



Pathé reproducer for vertical-cut records.

movement back and forth causes a similar in-and-out movement of the diaphragm. In theory, the entire tone-arm ought to move, but owing to the weight of the reproducer and tone-arm assembly, the sideways movement of the stylus is only transmitted as far as the diaphragm. Only recently, with the advent of light-weight hi-fi tone-arms has this become a problem. It is interesting to note that the modern tangential arm turntable, which overcomes this defect, is actually a variation on the old "carriage and feedscrew" design introduced over 100 years ago. Edison was no fool.

Repairing the disc reproducer

Disassembly

The first step in any major reproducer overhaul is to take it apart and assess the damage. To do this, start by unfastening the stylus bar from the diaphragm. This bar is usually attached with a tiny bolt, which can be removed through the reproducer throat. Often it is covered with wax and must be dug out in order to insert the screwdriver. The wax was used to seal the joint and in some cases, it is the sole means by which the stylus bar is attached. The Clark-Johnson reproducer from the famous Victor model B "Trademark" machine is a case in point.

The Victor Orthophonic reproducer has a metal diaphragm equipped with a "spider" to distribute the impulses from the stylus bar. Here, the stylus bar is soldered to the spider and must be removed with a soldering iron.

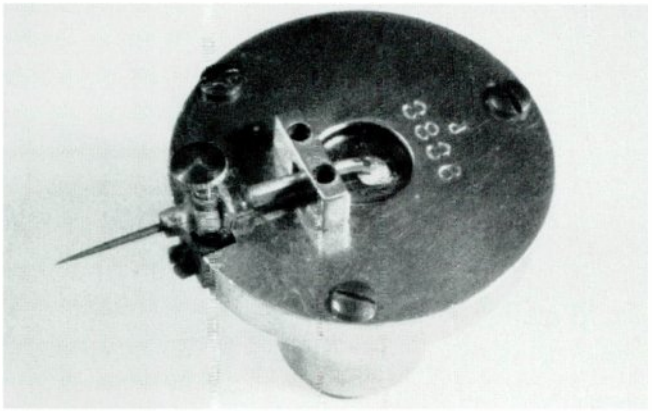
Sometimes, the stylus bar is riveted to the diaphragm, in which case the stylus bar and diaphragm can invariably be removed while they are still attached to each other. Some late model reproducers will have decorative covers that must be removed at some point in disassembly.

The Victor Concert reproducer presents some special problems and is discussed a little later.

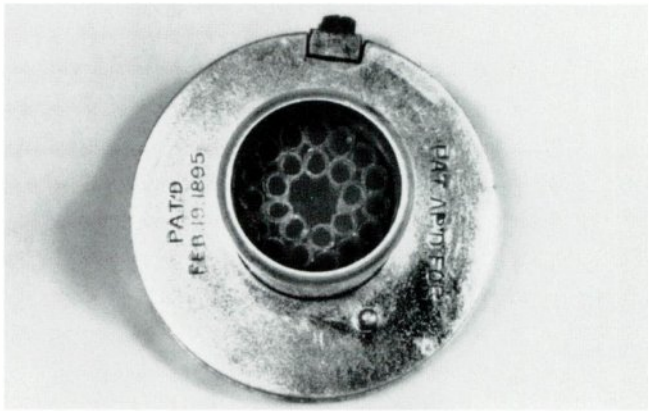
Make sure to rescue any small washers that may remain glued to the diaphragm. You should probably have a small bowl on hand in which to collect these tiny parts.

The next step is to remove the stylus bar from the reproducer case. The base of the stylus bar is always mounted on pivots of some kind and is usually held in place with a screw and spring arrangement. Taking out these screws will allow the entire stylus assembly to be removed. In some reproducers, often of later vintage, the stylus bar is held in place by two conical pivots, which "pinch" the base of the bar. Loosening these pivots will free the bar,

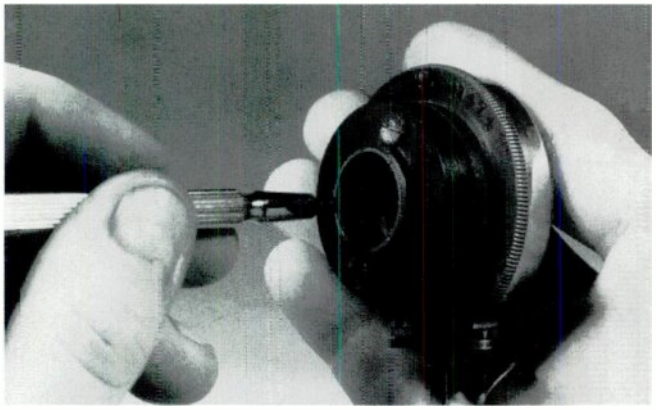
The final step in disassembly is removal of the diaphragm and rubber gaskets. If the reproducer has a one-piece housing, frequently found in cheap pot metal or zinc-alloy reproducers, removal of the outside gasket will allow the diaphragm to be withdrawn through the front. The gasket alone serves to hold the diaphragm in



The Clark-Johnson soundbox of 1896.



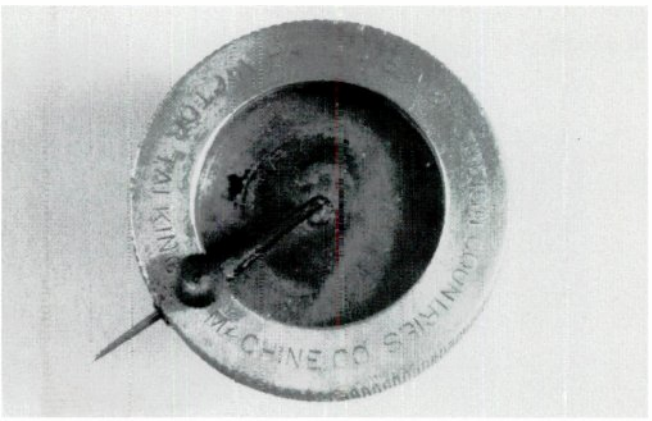
Some Clark-Johnson reproducers are equipped with a honeycomb of straws in the neck. The reason for this acoustical development has been lost to history.



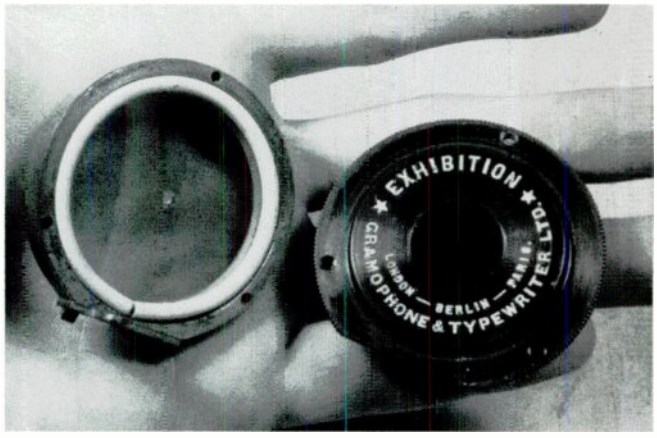
Removal of the stylus bar screw through the neck of the reproducer.

The Victor Orthophonic reproducer of 1925.

Removal of the stylus bar.



The Victor Concert reproducer.

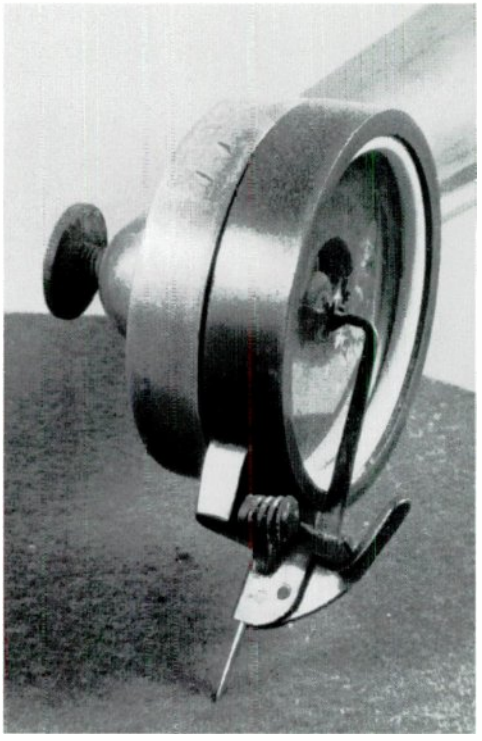


Removal of the bezel give access to the inner gasket.

place. Check to see if there are any cardboard rings wrapped around the inside of the housing. These prevent the gaskets from spreading out too far to the sides.

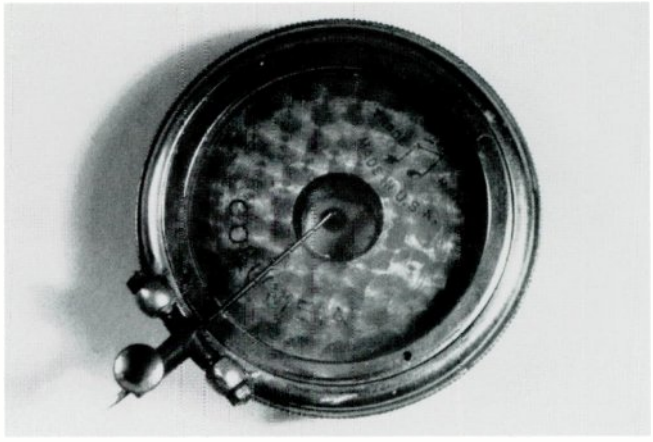
Removal of the inner gasket and the throat (if this is screwed on) completes the breakdown. If there is a paper disc glued inside the reproducer, this should be carefully removed and saved, particularly if it bears the maker's name or other interesting information.

In better quality reproducers, such as those made for

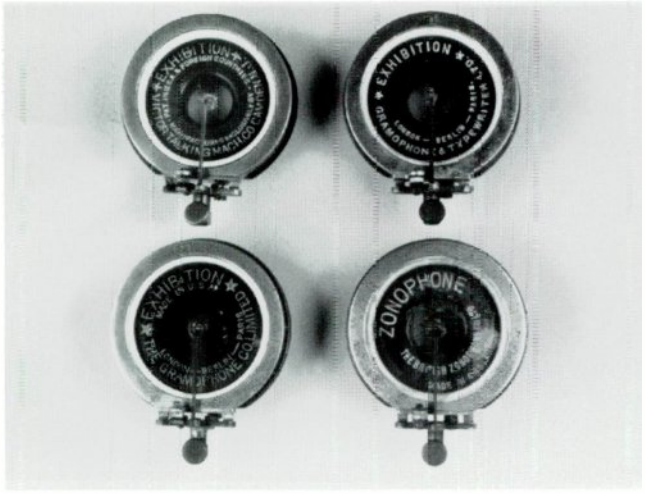


A close-up of an early Columbia "Analyzing" reproducer equipped with a spring-loaded needle holder and "Dolcher" muting device, c. 1906.

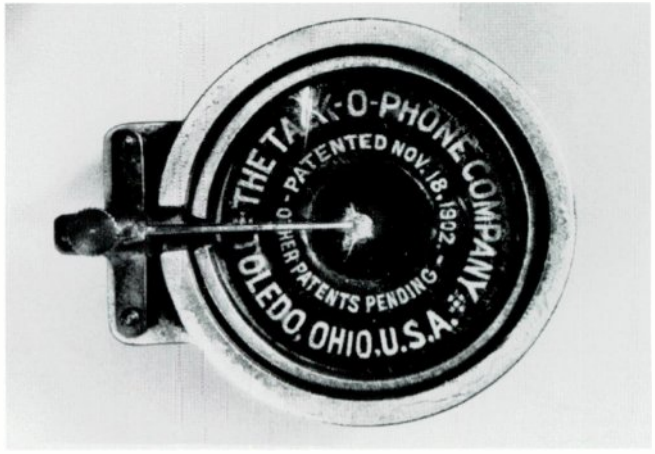
The Victrola No. 2 reproducer, a refinement of the Exhibition.



A later Columbia reproducer. Note the conical side pivots.



Four versions of the Exhibition reproducer: (clockwise from top left) Victor Exhibition of pre WWI vintage, early Gramophone and Typewriter Ltd. reproducer from 1903, British Zonophone, c. 1920, American-made Exhibition for English Gramophone Co. machines.

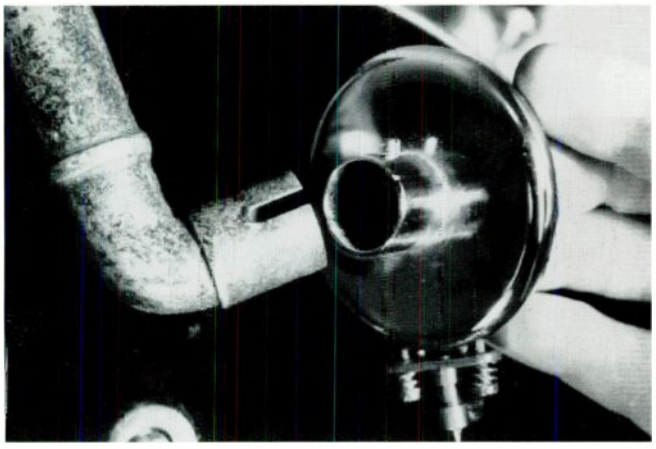


The Talk-O-Phone reproducer has flat gaskets, similar to an Edison O, held in place by a circular spring.

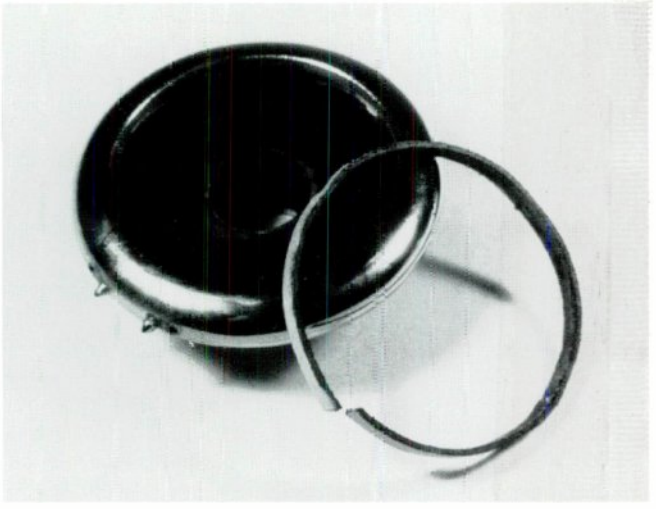
A Victor reproducer fitting.

A late version of the Victor Concert, c. 1910.

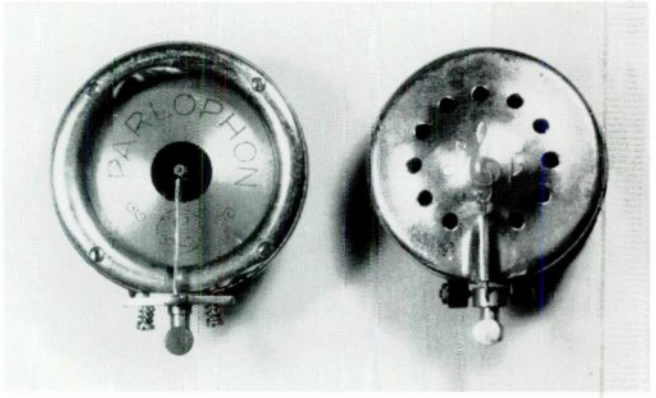
Victor and Columbia machines, the diaphragm is often too large to pass through the opening in the front. Here, the case is screwed together, and a bezel or cover can be removed in order to withdraw the diaphragm and replace the gaskets. The back of the Victor Orthophonic reproducer is equipped with a screwed-in bezel which holds the flange in place. Unscrewing the ring allows the flange and diaphragm to be removed. Unfortunately, the Orthophonic housing is usually made of pot metal and this ring is impossible to turn. Often, the outer rim of the reproducer has split and further tampering will cause the reproducer to crumble. In



A so-called "continental" fitting.



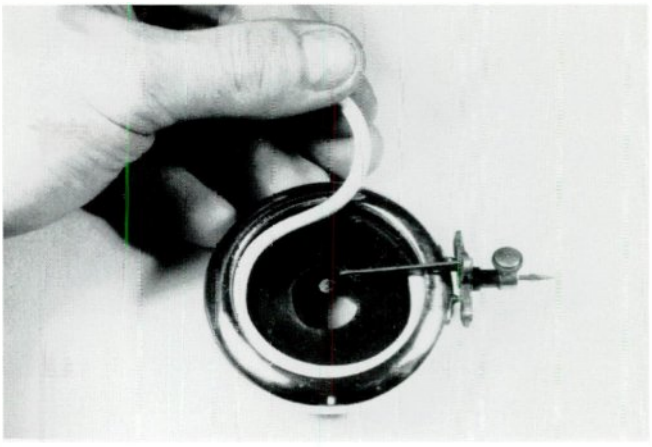
Cardboard rings are often used to pack the sides of a cast, one-piece reproducer.

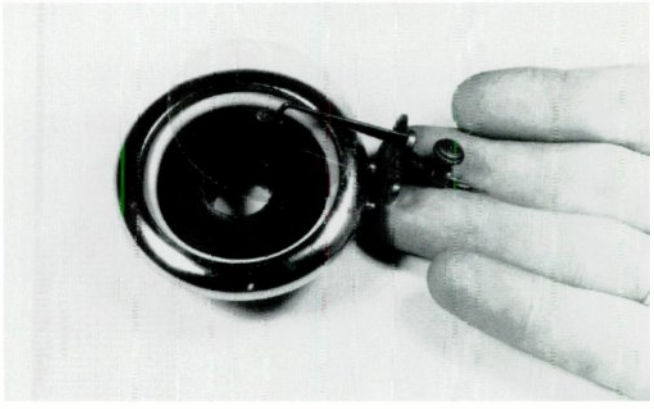


The reproducer on the left has a removable bezel which must be unscrewed. The reproducer on the right has a similar construction, plus a decorative cover.

situations like this, it is best to send the reproducer to a qualified expert for repair.

Other reproducers, such as those used by Pathé, or multi-purpose heads, such as the Sonora and Brunswick Ultona, have a slightly different construc-



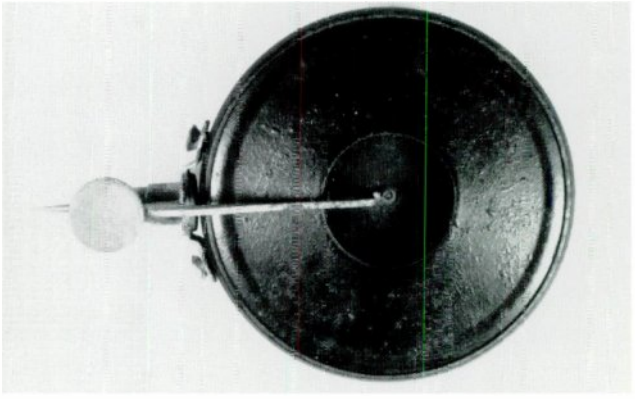


The stylus bar and diaphragm on a one-piece reproducer can be removed while still assembled by taking out the outer gasket and stylus bar screws.

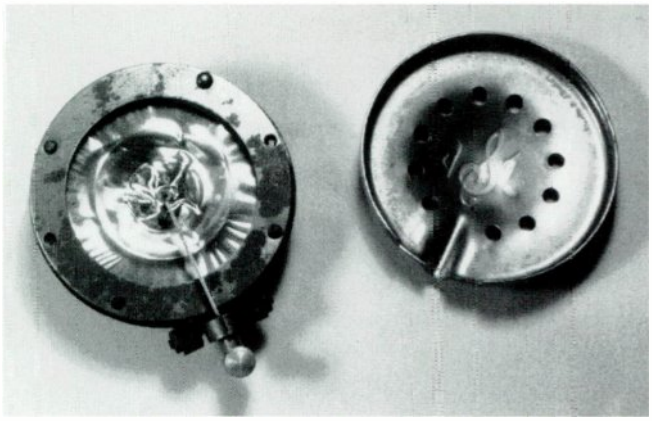
tion, sometimes with two separate diaphragms, but the basic principles remain the same.

Basic cleaning

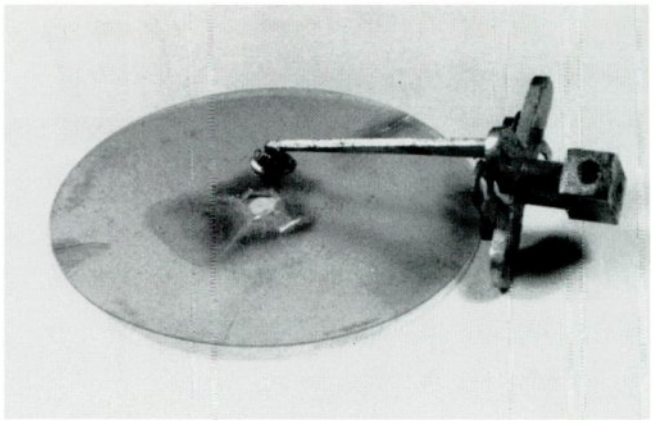
Usually, all that is necessary at this point is to wash and polish the various metal parts. Any rust, particularly on springs and screws, should be removed with a wire brush. A rotating brush on an electric drill is quick and



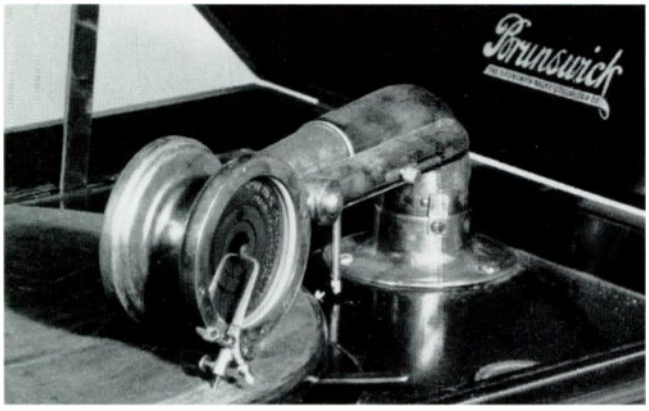
This reproducer from a toy talking machine has been sealed on a machine. A metal lip holds the front cover in place and prevents children from damaging the diaphragm. This also makes the reproducer next to impossible to repair.



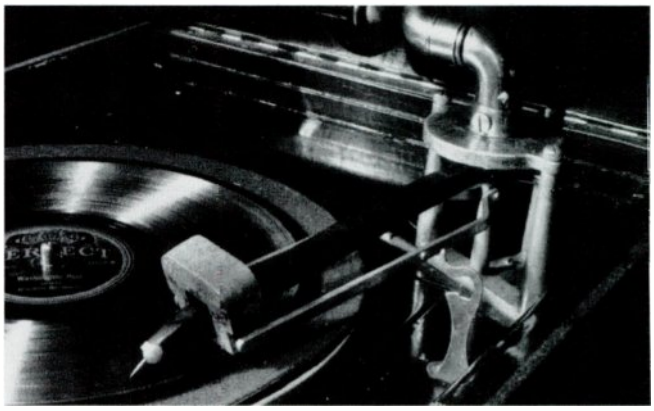
Removal of the front cover reveals a mashed aluminum diaphragm. Surprisingly, the diaphragm sounds quite good despite the damage!



A badly damaged diaphragm like this should normally be replaced, but emergency repairs can be made if a replacement is not available.



The Brunswick Ultona reproducer has two diaphragms and can play lateral- and vertical-cut records, plus Edison Diamond Discs.



The Vitaphone tone-arm/reproducer of 1920 can play both lateral and vertical-cut records through a simple change in the diaphragm link. (Walter Bellm collection)

effective. Small parts can be held with needlenose pliers. If the gaskets have become soft and sticky, the old residue can be removed by soaking the parts in gasoline, followed by a bath in naphtha.

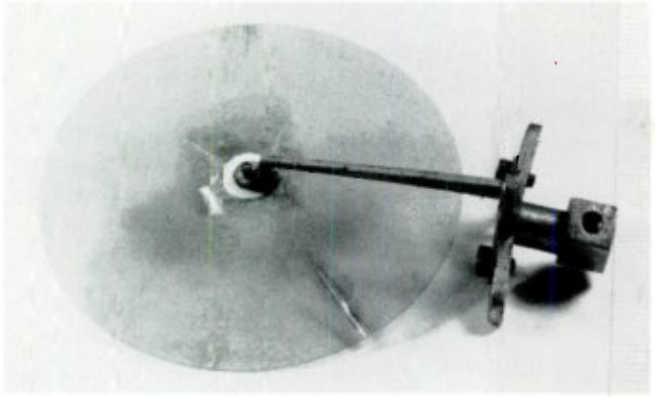
The diaphragm

Frequently, the center hole in the diaphragm is broken or enlarged to such an extent that the stylus bar cannot be firmly attached. Any damaged diaphragm really ought to be replaced, but in the case of a torn center hole, there is a way to repair it with reasonably good results.

The technique is to soak two paper punchings from a hole puncher in shellac and to use the sticky coating to glue them to either side of the hole. Excess shellac should be removed before gluing and I recommend that you wait until the shellac becomes tacky before covering the hole. When the punchings are dry, a new hole can be made with a needle. In order to hit the center, this hole is best punched after the stylus bar has been reinstalled, using the threaded hole in the bar as a guide.

Soaking the punchings in shellac stiffens the paper, which improves sound quality. Shellac is better than glue because it doesn't increase the total thickness as much and thus permits the tiny screw to reach the threads in the stylus bar. Excess shellac on the diaphragm is easily removed with denatured alcohol.

During the 1920's, mica was replaced by aluminum in the production of diaphragms. The thin aluminum is often embossed with a pattern of concentric mounds. These increase the radial stiffness without reducing the axial compliance. In simpler terms, the diaphragm can easily move in and out without distorting the edges. These mounds are frequently kinked and mashed, and if the reproducer plays at all, it can sound like something echoed in a tin can. Even visibly unharmed diaphragms of this type can become "tired" and sound tinny. A replacement is the only real cure—and these can be hard to find. Unless the diaphragm is torn or



Two thin paper washers provide a foundation to which the stylus bar can be attached.

The pot metal back of this Orthophonic reproducer has cracked due to intergrannular corrosion. There is no satisfactory way of repairing damage of this kind.

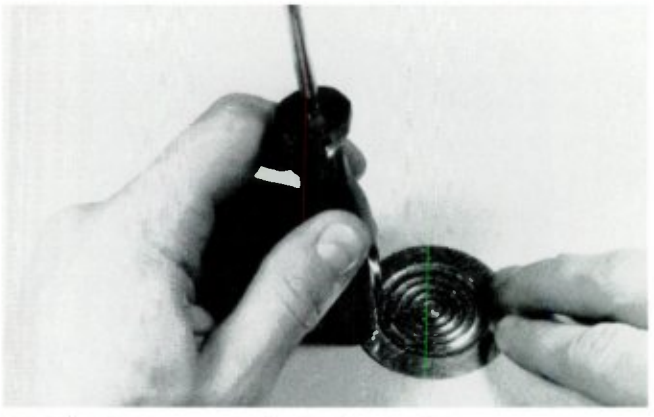
mashed beyond recognition, I would suggest you reinstall the old diaphragm and "play it by ear," so to speak. Due to the difference in height across the face of the diaphragm, it is rarely possible to substitute a flat mica diaphragm. If you have no alternative, it is possible to fill any gap between the stylus bar and the new, flat diaphragm by using a "spider," as described in the section on floating reproducers.

For good reproduction, small kinks around the perimeter of a metal diaphragm *must* be flattened out no matter what the rest of the diaphragm looks like. This is easily done by placing a ring of stiff cardboard over the metal edge and pressing with the butt of a screwdriver.

Should you decide to replace a mica diaphragm, it is important that the new one has the same approximate thickness and diameter as the old one. A thick diaphragm reduces the ability of the stylus bar to move as it should, which will result in low volume and chewed up records. A diaphragm that is too thin may result in "mushy" sound reproduction and it, too, can damage records. If you are fortunate enough to have

A selection of aluminum diaphragms. The two top diaphragms are equipped with spiders.

Creases on the edge of an aluminum diaphragm must be repaired for good results.



Straightening a crease on the diaphragm edge.

several diaphragms from which to choose, it is well worth the time to listen to all of them before making a decision. Actually, one of the best and easiest ways to find a good diaphragm is to drop it from a height of

one or two inches onto a hard surface. A good diaphragm will make a "pinging" sound. A tired diaphragm will simply "thud." Some collectors actually insist that the diaphragm "ping" at a definite pitch, such as F# over high C! I have no clue as to how they arrive at these notes.

Some repairmen have substituted thin plastic for mica, such as the lens from a flashlight. I personally don't think they sound very good, but if you have no other option, it's better than nothing. Plastic diaphragms can easily be identified if you scratch the surface with a fingernail. Plastic makes no sound, while scratching on real mica makes an audible noise. However, don't be fooled by glass diaphragms, found in early Edison and Columbia reproducers and recorders. These don't make noise either. They, too, make a "ping" when dropped, but they also have a tendency to break!

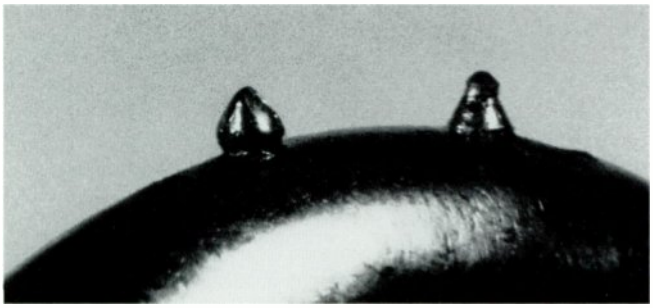
Stylus bars

The stylus bar should be cleaned of rust and old wax, and should be straightened if it is bent. Broken needle screws must be drilled out, rethreaded, and the screw must be replaced.

Pivot points

In order for the stylus bar to swing easily from side to side, it is mounted on two pivot points. These can be pointed and cone-shaped, or long and wedge-shaped. For the bar to pivot properly, these points or edges must be clean and sharp. The holes or grooves in which they sit must also be free from dirt, rust, and so forth.

During polishing and other cosmetic procedures, pivot points may become rounded or damaged in other ways. The points must be built up with hard solder, reground, and polished so that the stylus bar sits properly and the hole in the diaphragm corresponds with the hole in the stylus bar when the reproducer is reassembled. Ideally, new pivot points should be turned on a lathe, but this is not usually a home workshop option.



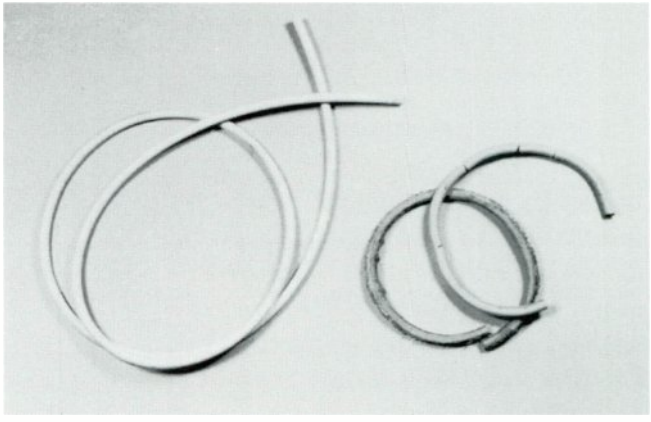
Conical pivot points on an inexpensive reproducer.

Gaskets

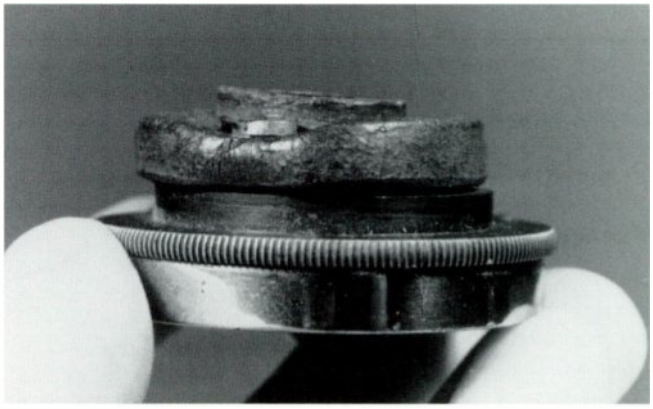
Old rubber gaskets are almost always too stiff to be reused, and new gasket tubing is available from all suppliers at very little cost. Gaskets are of the utmost importance, and if you do not replace them, you might as well not rebuild the reproducer at all. However, if you are very impatient and *must* hear the machine play *right now*, you can get reasonable results by using rubber insulation from electrical wiring. Make sure it really is rubber; plastic insulation lacks the necessary resilience. Another option is to contact a hospital supply company. Often, thin white silicone rubber tubing is used in laboratory equipment and can sometimes be purchased by the yard in a variety of diameters—internal and external.

Soft rubber tubing used in repairing bicycle tire valves is *not* recommended. It is too soft to do the job and deteriorates in a matter of months. I don't understand why it holds up so well in bicycles!

New gasket tubing has an outside diameter of about 1/8" and can be solid or hollow. The solid tubing is nat-



Replacement of old gaskets greatly improves the tone and reduces record wear.



The flange at the back of the reproducer must be airtight. This original Victor Exhibition flange will never give good results due to distortion and deterioration of the rubber.

urally a little harder. Choosing the correct tubing is really a matter of taste. Tubing that is too soft will absorb some of the vibrations of the diaphragm and hurt the sound quality. If the tubing is too hard, the diaphragm may not vibrate properly and the bass may be diminished.

Choice of gaskets is more important when dealing with mica diaphragms than with metal ones. If you have a choice of tubing, try experimenting with different types. I have the feeling that many collectors spend more time worrying about the color of the tubing than about the sound.

Reassembling the reproducer

This is just like taking it apart, only in the reverse order. When replacing the bezel, it is a good idea to insert all the screws and tighten them a little at a time, alternating opposite screws as if you were tightening the wheel lugs on a car. Otherwise, there is a risk of breaking a screw, stripping a hole, or even breaking the bezel.

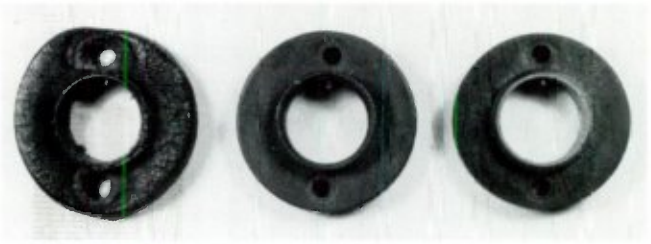
The gaskets must be cut long enough so that they meet at the ends. Any gaps will produce air leaks, which lower the volume. It is wise to install the top and bottom gaskets in such a way that the joints are *not* aligned. This also reduced the possibility of leaks. In addition, any flanges which attach the reproducer to the tonearm must be checked for tightness.

Victor Exhibition reproducers are especially prone to leaks at the flange. The solution is either to seal the joint with an extra gasket of some sort (Dow Chemical's Sil-Glide, a non-hardening silicone jelly, is ideal), or replacement. An easy way to check for air leaks is to blow tobacco smoke through the neck of the reproducer and see where it comes out. It helps to stand in front of a mirror.

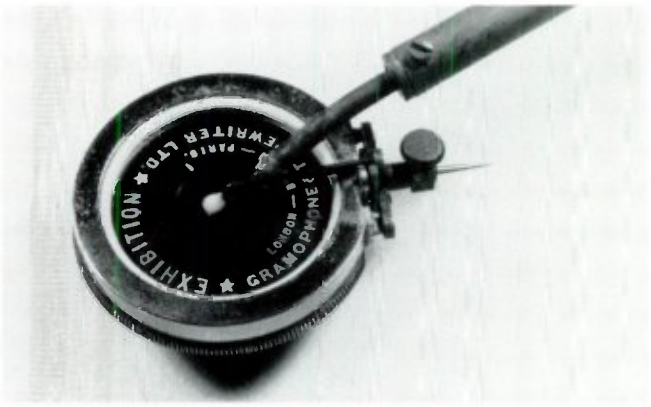
If the new gasket tubing doesn't hold the diaphragm firmly, flat paper rings can be inserted in back of the inner gasket to make a tighter fit.

The only difficult part in reassembly is attaching the stylus bar to the diaphragm. If the housing is of one-piece construction, the bar and diaphragm can be assembled before final installation. It the case of Victor Exhibition reproducers and others equipped with a removable bezel, you will have to screw the tiny screw in from the back. Often there is enough old wax seal remaining in the screw slot to hold the screw on the screwdriver while you install it.

The final step is to replace the wax at the diaphragm/stylus bar connection. To do this, make a small ball of hard wax (beeswax is good) and press it



Left: a badly misshapen Exhibition flange.
Middle: a usable original flange
Right: a modern replacement



Rewaxing the stylus bar.

Decorative paper discs inside the reproducer should be preserved at all costs. Replacements can be made on a graphic computer or with pressure-sensitive letters if needed.

over the end of the stylus bar. Now take a soldering iron and heat the bar until the wax melts, sealing the joint. Repeat the procedure on the other side of the diaphragm.

Although this is a cosmetic detail, I thought I'd mention it now. For regluing the paper disc that decorates the inner surface of many reproducers, I recommend a product called "Spray Mount," made by 3M. This can be sprayed on the back of the paper to produce a tacky surface similar to Scotch tape. The paper can always be removed again, just like tape, and excess Spray Mount can be removed with naphtha or benzene. It is available

from most art supply and stationery stores. A similar spray adhesive is marketed by Duro and can usually be found with the other glues at the hardware store. If you need to replace the paper, origami paper, used in Japanese paper folding, is good for this purpose. It is very thin, slick, and comes in a wide variety of colors. Most arts and crafts stores carry it. Maker's names can be recreated with pressure transfer letters, also available from art supply stores. Naturally, if you have access to a computer with a good scanner and printer, plus suitable graphic software, other reproduction methods will suggest themselves.

Tuning the reproducer

If the reproducer has been cleaned and assembled properly, there are really only two adjustments which need to be made. First, the springs that hold the stylus bar in place should be just tight enough to stop the bar from buzzing on the pivots—and no more. Any additional tension will hinder the "swing" of the bar. Second, the stylus bar should just touch the diaphragm. It mustn't push or pull the diaphragm or otherwise deform it. This is, of course, a good thing to check *before* the stylus bar screw is installed. On cheap reproducers there is not much you can do by way of adjusting the bar apart from filing the pivots or bending the bar.

On those stylus bars pinched by side pivots, this problem cannot occur. The only adjustment here is to make sure that the pivots are neither too loose, which causes buzzing, nor too tight, which restricts movement. These side pivots are subject to changes in temperature and may rattle in a cold room, or they may become too tight in a warm one. There isn't much you can do about this, apart from readjusting. Just keep it in mind.

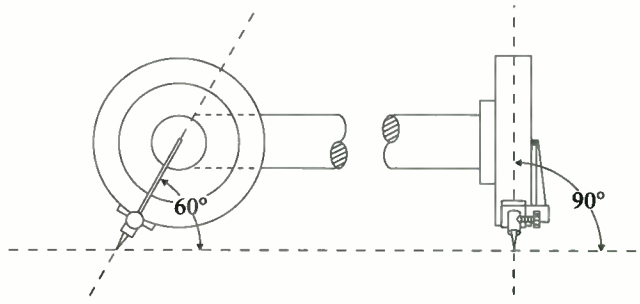
When attaching a metal diaphragm to a stylus bar, make sure that the bar sits flat on the face of the metal before you screw it on. It is easy to kink the center of the diaphragm if the two parts don't meet correctly.

The Victor Concert reproducer

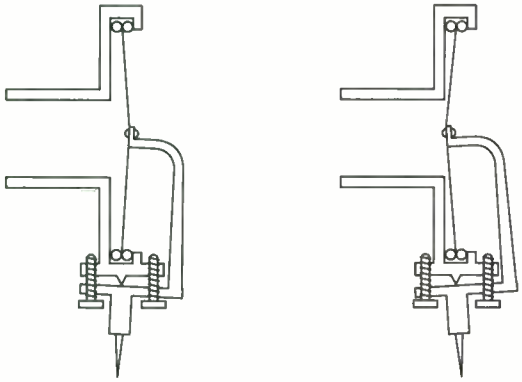
I'd just like to take a moment to explain the repair procedure for the Victor Concert reproducer since it is a little trickier than most. I'd also like to give proper credit to the late Tim Goon, who explained the secret to the Concert's disassembly in an article for *In The Groove*, the monthly newsletter for the Michigan Antique Phonograph Society.

First of all, let me mention that the Concert is not a particularly good reproducer, and Victor only produced it for a few years before it was superseded by the popular Exhibition. Therefore, even if you do a first-rate restoration job, its sound quality will invariably be disappointing.

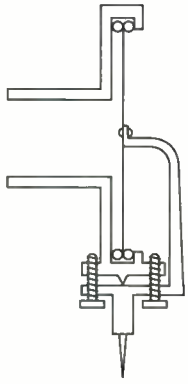
If you look closely at the Concert, you will see that the back flange is press-fitted into the front bezel. It is impossible to remove the stylus bar or make other repairs while these two parts are still joined. So, the first



The "proper" angles for a disc reproducer. Actually, the 60° angle is only a suggestion as early recordings were often cut at different angles.



Incorrect alignment in a disc reproducer. When the reproducer is "at rest" it mustn't push or pull the diaphragm.



Correct alignment of the stylus bar and diaphragm in a disc reproducer.

step is to carefully cut out the center of the diaphragm so that you can push the flange back out. Do not attempt to remove the stylus bar—cut the thin wire link attaching it to the diaphragm and save the tiny washers that should be present on either side of the mica. An Exacto knife is good for cutting through the diaphragm, but you must be careful not to scratch the inside of the flange with the sharp point.

Before you separate the two halves of the reproducer, you will need to make some kind of mark to indicate their relative positions when you reassemble the unit. Tape or magic marker can be used, but if you plan on polishing the housing, you may want to make a tiny scratch mark or even better, note the relative positions of the writing on the face of the reproducer and the serial number on the back. If you forget to do this, you might note that there is a small plug or pin at roughly the 10 o'clock position on the rear flange when viewed from the front.

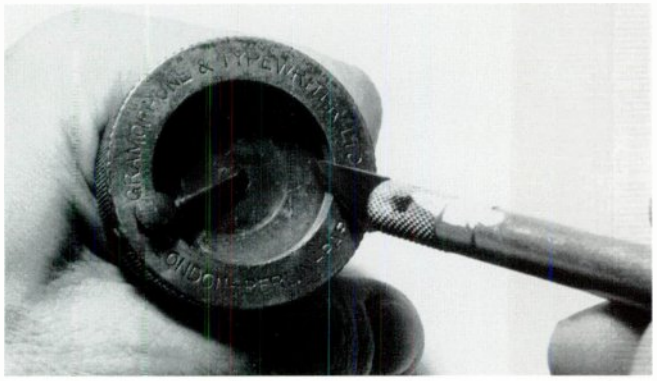
Next, find a piece of old car radiator hose, or some other thick tubing, and cut off a ring about 1" wide and slice it open. This is used to protect the sides of the outer bezel when you secure it in your vise. Don't try to clamp the reproducer in anything metal—or even two pieces of wood. You will invariably scratch or mar the metal.

When the reproducer is firmly clamped in the vise, face up and protected by the rubber ring, place a hardwood dowel on the inner flange and give it a good rap with a hammer. The entire reproducer will probably move. If so, reclamp the reproducer and give it another whack. Eventually, the flange will start to move. It will probably take five or ten minutes to remove the flange in this manner.

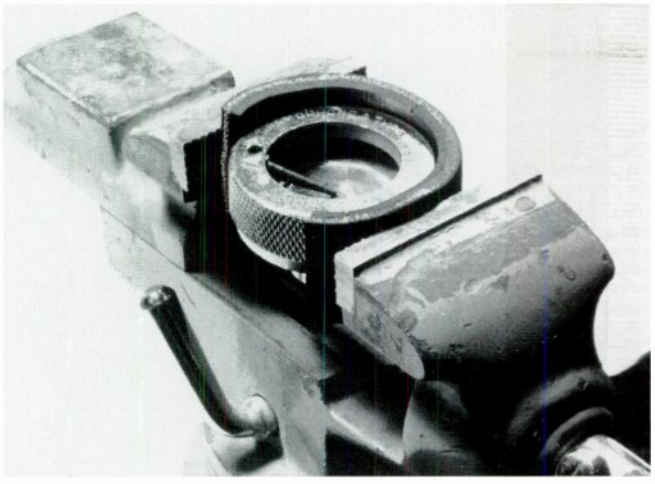
When the pieces are separated, carefully unscrew the stylus bar, assuming this is still intact. You may need to soak the screws in penetrating oil—they are very delicate. If the small wire loops on the sides of the stylus are broken, you will have to make new ones out of thin, stiff copper wire and solder the new part into the original groove in the bar. If you cannot locate suitable wire, you can twist together two thin strands of copper wire from ordinary electrical lamp cord. This will be about the right size.

From this point on, everything follows the procedure for repairing any other reproducer. Use the outer circle of the old diaphragm to determine the proper size for the new one. Also, remember that the Concert has *flat* gaskets, which will have to be recut from a thin sheet of rubber. Please note: even though Edison C/H/K gaskets can be adapted, they are only about half as thick as those used in the Concert.

Finally, you will have to replace the thin wire connecting the stylus bar to the diaphragm. If you bend suitable wire into a very tall "L" shape, this, plus the washers can be glued onto the diaphragm with superglue. After the reproducer has been reassembled, the stylus bar can be reattached, preferably with solder.



Cutting through the old diaphragm, the first step in disassembly.



A ring of radiator hose can be used to protect the fragile knurling when holding the reproducer in the vise.

The basic components of the Concert reproducer. The small wire loops on the stylus bar are missing from the part in this photo.

Troubleshooting the disc reproducer

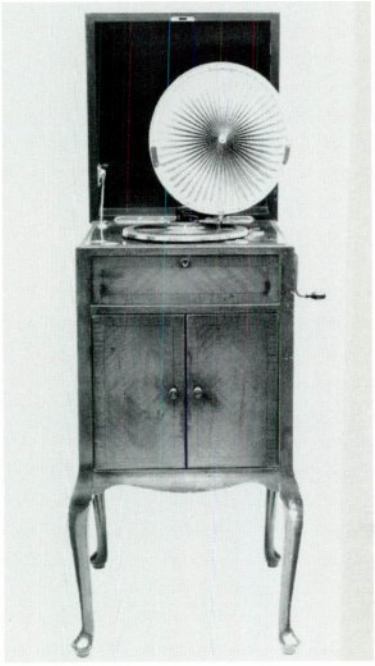
When checking a reproducer, always use a record that is in good condition, but not one that you cannot live without. There is always the chance of breaking, scratching, or wearing out the record while experimenting.

Troubleshooting table

Effect	Cause
Blasting	Harsh sounds during loud passages, or at certain frequencies are usually caused by bad gaskets.
Buzzing	This occurs whenever things are not tightened properly or if the diaphragm is damaged. Check the pivot points and stylus bar for tightness. You may also need to tighten the center screw and rewax. The problem also occurs in those rare instances where the diaphragm touches the reproducer housing. Loose gaskets should be replaced.
Muffled sound	This is a common problem when the stylus bar deforms the diaphragm due to bad adjustment. If the diaphragm is too thick, or is broken, the sound will be muffled and lower in volume. If there is good volume, check the needle. Some newly manufactured needles can't even play an entire record before they are worn out. Try some different brands. Take the sock out of the horn.
Tinny sound	Usually this is due to lack of bass caused by a diaphragm that is too thick, or gaskets that are too tight or stiff.
Low volume	This can be caused by the same things that muffle sound. Also, check for air leaks in the flange and tone-arm. In internal horn machines that have been stored in barns, you may find mice nests and other obstructions that need to be removed.
Distortion	In addition to bad needles and poor stylus bar adjustment, you have to make sure that the needle meets the groove at the correct angle. This also reduces record wear. The correct angle is about 60°, although small differences, 57-62°, will not make much difference. The angle across the groove *must* be 90°. The tone-arm must be able to swing freely, and the goose-neck must not be stiff. Lastly, make sure the record is in good condition.

The Lumière pleated diaphragm

The Lumière diaphragm made its brief appearance in England on HMV (His Master's Voice) machines in 1924-5. The diaphragm consists of a large 14" pleated paper disc and radiates sound directly into the room rather than through the tone-arm and horn. As the paper is quite sensitive to high humidity, sound quality can be improved by placing the diaphragm next to a light bulb to dry it out if the sound is muddy. Repairing this fragile reproducer requires about sixteen hands, all attached to origami experts. Small tears can be patched with rice paper. The trick to making the repair as invisible as possible is to refrain from gluing down the edges of the patch (wheat paste is best for this job). When the patch is dry, carefully tear off the excess paper. This leaves a ragged, but barely visible edge. By the way, this same technique is used to mend pages in old books.

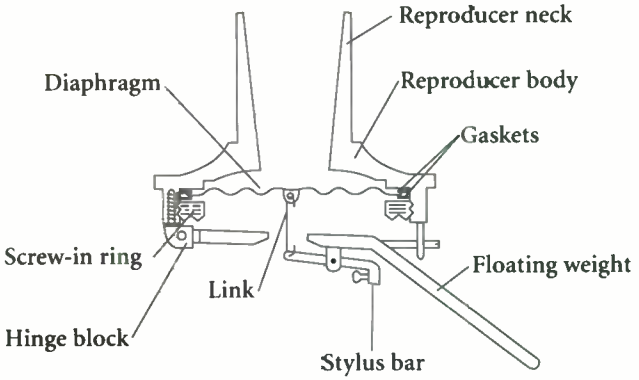


An English HMV (His Master's Voice) machine equipped with a Lumiére pleated diaphragm. c. 1924. (photograph courtesy of Christie's South Kensington)

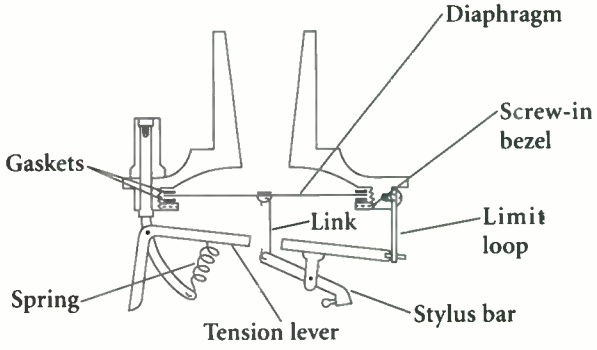
The cylinder reproducer

Main types

There are two main types of cylinder reproducer—Edison's and almost everybody else's. All Edison and a few later Columbia reproducers are mounted in a ring, which firmly supports them. These reproducers have a weight (or in Columbia's Lyric reproducer, a spring), which exerts the proper pressure on the stylus as it plays.



A cross-section of an Edison model C reproducer.

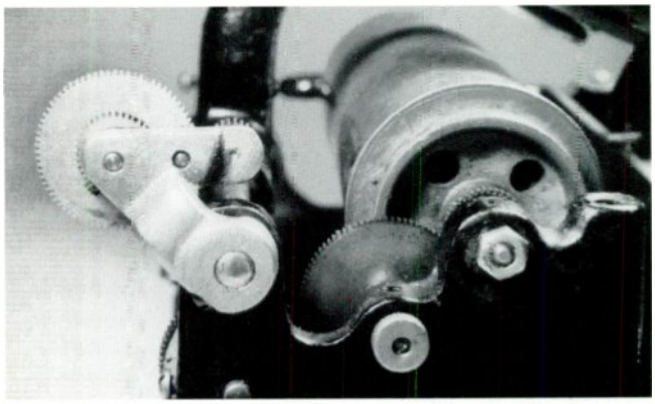


A cross-section of Columbia's spring-tension "Lyric" reproducer.

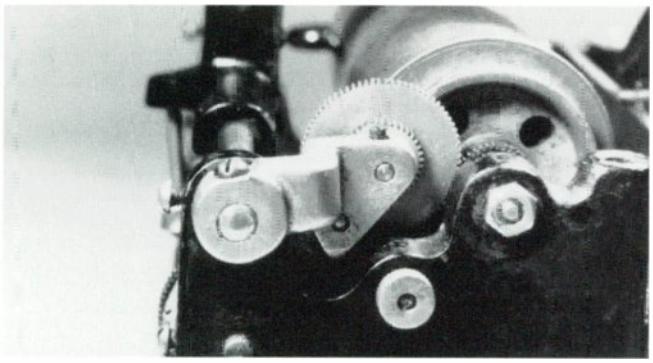
The second type is that of the "floating" reproducer, where the stylus is fastened directly to the diaphragm without levers, linkages, or weights. Here, the weight of the entire reproducer bears down on the cylinder.

Speeds and styli

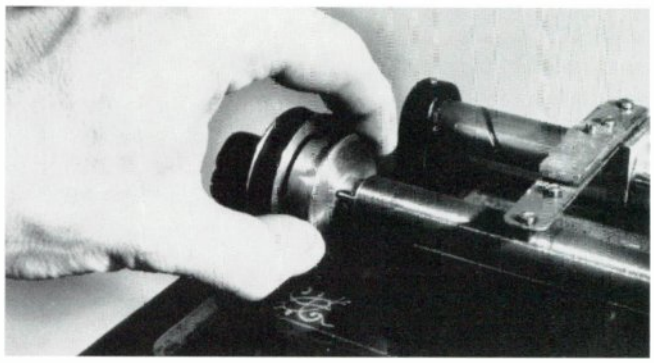
Basically, cylinder recordings can be broken down into two categories: two-minute and four-minute cylinders. Until Edison introduced his wax Amberol cylinders in



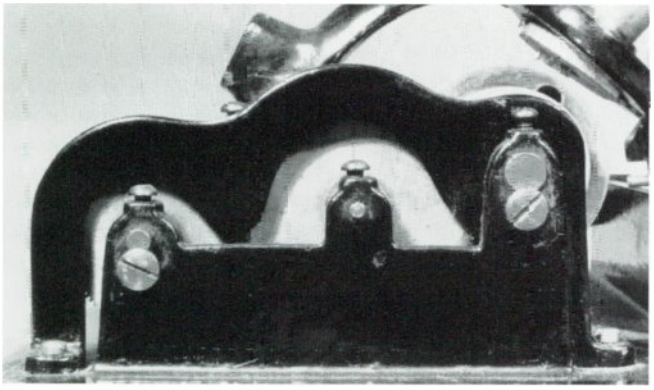
Two- and four-minute gearing on an Edison Gem, set for two-minute cylinders.



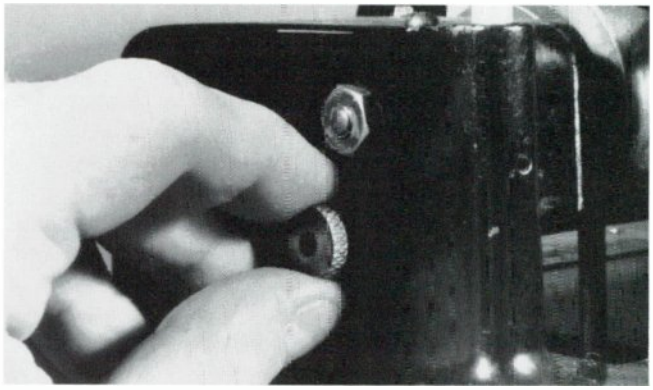
The same attachment set for four-minute recordings. Although this is a later addition, the gearing adds interest and value to the machine.



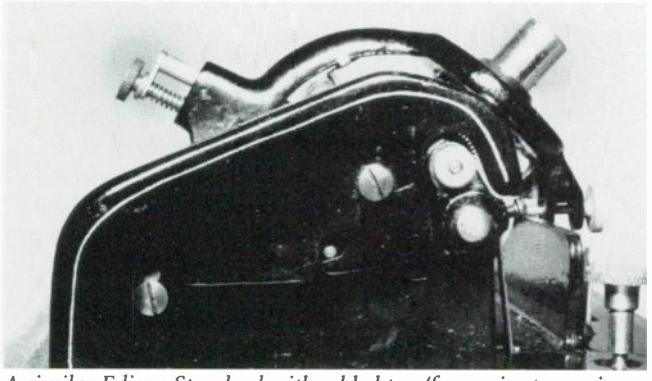
Changing the gears on a late style Triumph. The post-1908 Home is almost identical.



The Edison Standard gear train as it came from the factory.

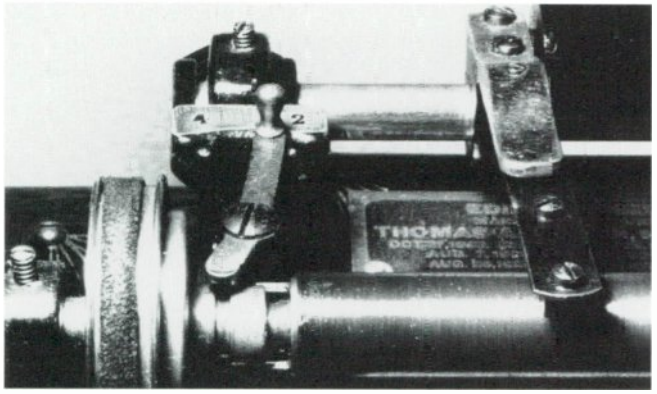


Speed changes on other post-1908 Edisons is accomplished by pulling or pushing this small knurled knob.



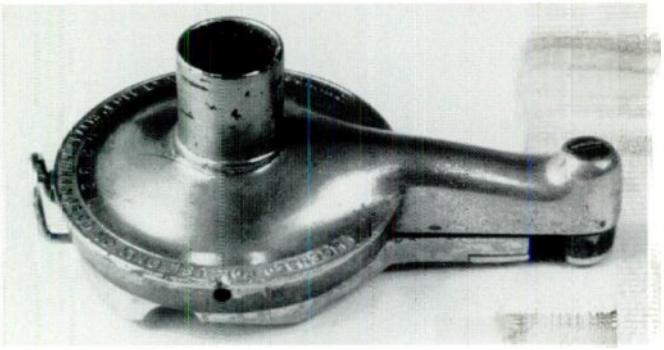
A similar Edison Standard with added two/four-minute gearing.

Cylinders come in a variety of sizes, speeds, and colors.

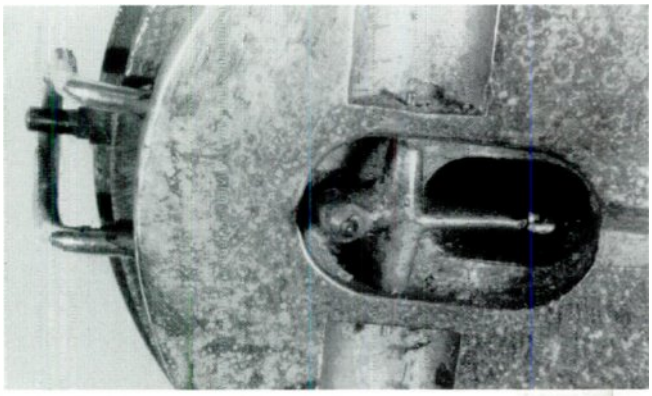


Additional gearing on an early Edison Home.

Some common cylinder types: (from left to right) Edison dictation cylinder; standard cylinder; Columbia "20th Century" cylinder; Pathé "Salon" cylinder; "Concert" or "Grand" cylinder



The Edison Diamond B reproducer.



A detail of the Diamond B stylus bar.

the fall of 1908, the industry standard was a wax cylinder that played for two minutes and was cut with 100 grooves per inch. Although some manufacturers produced cylinders with varying diameters, such as the 5" Concert and Grand, Pathé's "Salon" cylinders, and Busy Bee cylinders, which are slightly oversized and only fit Busy Bee machines, the grooves per inch were identical with those of standard cylinders.

In October 1908, in response to the challenge of the longer playing disc records, Edison changed the size of his cylinder groove to 200 grooves per inch, thus doubling the duration of the record. Special gearing, which halved the speed of the feedscrew, was added, and a new series of reproducers with very fine sapphire styli came on the market. In 1912, Edison discarded the brittle wax composition of his Amberol cylinders in favor of celluloid. He also produced a new reproducer to play these cylinders, the Diamond B, which had a diamond stylus. The new cylinders were called Blue Amberols because of the blue color of the celluloid.

Columbia and the other manufacturers did little to meet the challenge of the four-minute Amberol cylinders. Realizing that the days of the cylinder machine were numbered, they concentrated their efforts on disc machines, with the result that very few phonographs other than Edison's are equipped to play four-minute records. Columbia stopped making cylinder machines altogether in 1910. Some independent makers produced celluloid cylinders, notably U.S. Everlasting and The Indestructible Record Company, but these are not nearly as common as the Blue Amberol recordings, which Edison produced all the way up to 1929.

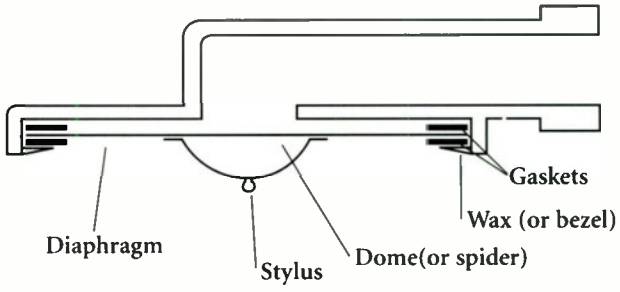
The earliest two-minute cylinders were made of a brown, lead-soap composition and have often become too moldy and pitted to play. This material was changed to a more robust, black wax-resin material when Edison produced his first "Gold Molded" cylinders in 1901. This remained the main substance used in the production of cylinders for the next decade.

Old hands at the collecting game will no doubt ask, "Why this long history lecture?" Well, the point is, that unless the reproducer matches the cylinder, you can do a lot of damage, and for the newcomer, this can prove to be a very costly lesson.

Floating reproducers, with *very* few exceptions, are designed for two-minute cylinders only. Edison Standard, Automatic, B, C, and D reproducers are also two-minute units. Edison K, M, O and S reproducers have two styli and can play both two- and four-minute cylinders. All other Edison reproducers are designed for four-minute cylinders only. The Diamond A, B, C and D reproducers, which are recognized by their oblong shape, can *only* play *blue* Amberols, that is to say, indestructible cylinders, not wax ones. The Diamond Disc reproducers are, of course, for Edison's thick hill-and-dale disc recordings. Using the wrong reproducer will ruin a record in nothing flat!

More about the floating reproducer

The stylus in the floating reproducer consists of a short rod with a ball on the end, usually a sapphire. In cheap machines, the stylus is often plain glass. This stylus is mounted in wax or resin, either in an arm, as is the case with most Columbia floating reproducers, or in a small dome or metal "spider." The arm, dome or spider was



A representative floating reproducer.

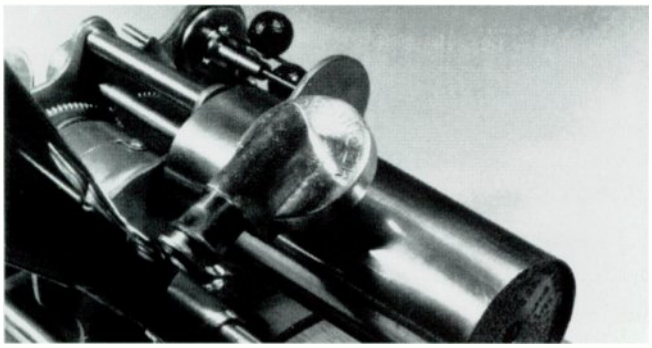
attached to the diaphragm with more wax or shellac.

The diaphragm is placed on a thin, flat rubber gasket and is held in place with either wax or a circular spring. This spring was often simply a piece of piano wire, run through a piece of rubber gasket tubing like that used in disc reproducers, and bent in a circle.

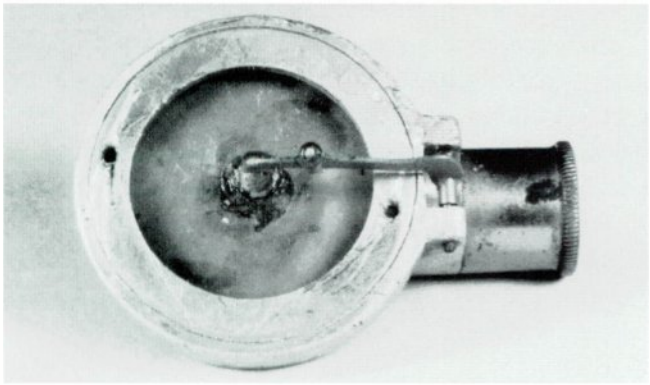
Occasionally, reproducers have a second gasket glued on with shellac rather than a ring of melted wax. In better quality reproducers, the flat gaskets and diaphragm are held in place with a bezel, which is either screwed onto or into the housing.

In order to save the cost of a feedscrew and reproducer carriage in inexpensive cylinder machines, the floating reproducer could be rigidly attached to the horn. Here, the walls of the grooves alone are used to guide the reproducer along, like the grooves guide the tone-arm on a disc machine. This is almost never seen in American-made machines, the exception being the Columbia AP. However, the system was quite popular in Europe and Pathé used the method in a number of models. The German-made "Puck," which is probably the cheapest phonograph ever produced, is a well-known example of this type of "ride-the-groove" machine.

Good quality floating reproducers are allowed some lateral movement to compensate for small irregularities in the cylinder. These reproducers have a pivot in the neck and are only used in machines which feature a carriage and feedscrew.



A Columbia floating reproducer mounted on a Columbia "Eagle."



Unfortunately the screw-in bezel on this Columbia floating reproducer has been defaced during amateurish repair attempts.

Repairing the floating reproducer

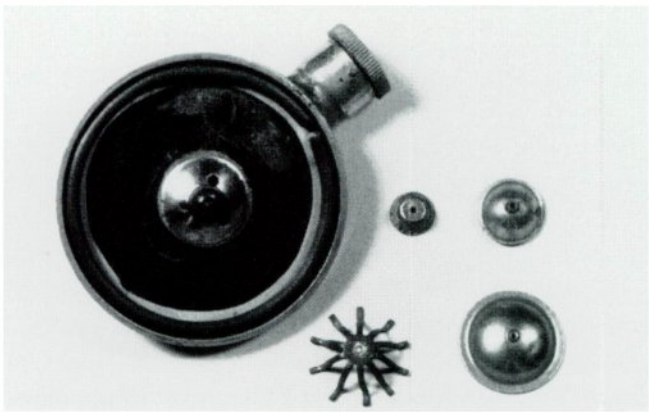
General inspection

For the reproducer to function correctly, the diaphragm must be held firmly in position, and any joints allowing vertical and lateral motion must move freely. Moreover, the diaphragm must not be broken or cracked, and the stylus must be perfectly intact and free from dirt. Floating reproducer diaphragms have no center hole. The stylus must be well-attached to the dome, arm, or spider, which, in turn, must be well-glued to the diaphragm. The rubber gasket under the diaphragm ought to be renewed, but if the diaphragm is waxed in place and the wax and gaskets are still intact, there's really no reason to disturb things.

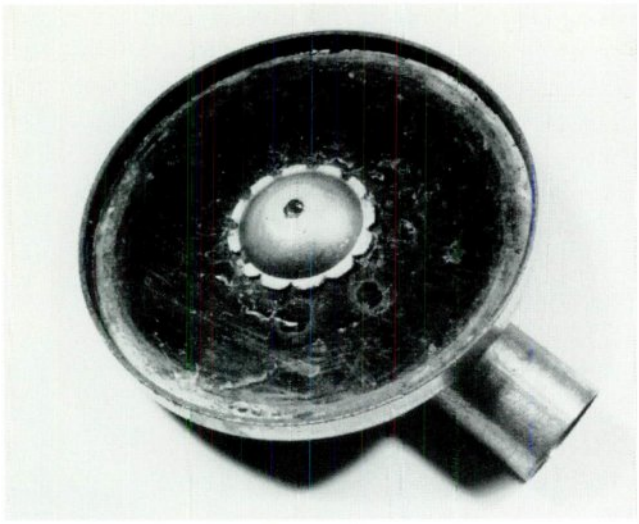
Rewaxing

If you need to rewax (sadly, many collectors take a short-cut and simply glue), you will need to obtain a hard beeswax candle. Cut a long sliver from the side

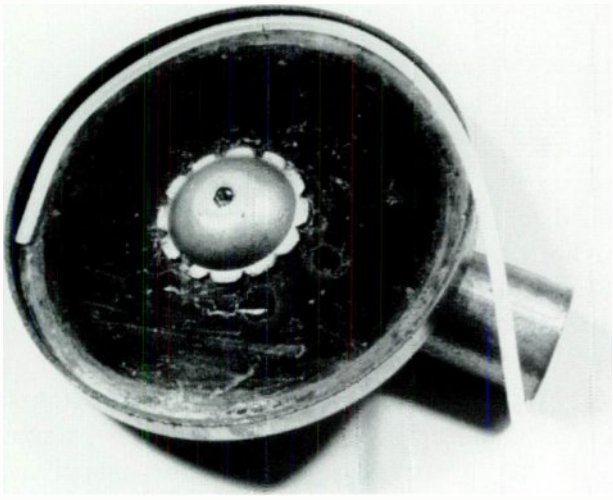
The German-made "Puck" has no feedscrew.



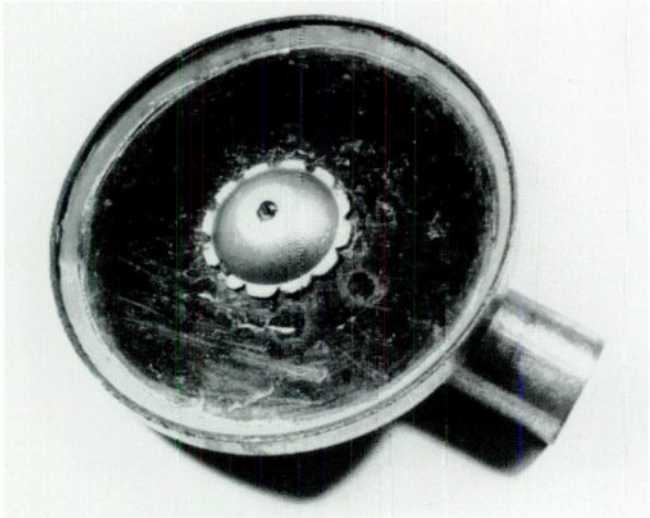
A floating reproducer shown with a variety of domes and a spider.



A reproducer, cleaned and prepared for rewaxing.



A ring of beeswax is placed around the edge of the diaphragm.



The wax is pressed into shape with a suitable tool (fingers are good) and "flashed" with a propane torch to smooth out irregularities and strengthen the seal.

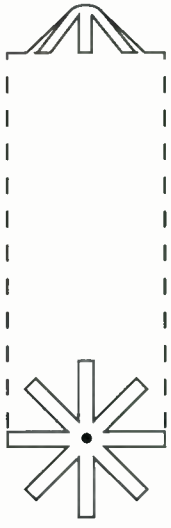
and bend this to fit around the perimeter of the reproducer. The wax is then melted and smoothed out with a soldering iron or hot screwdriver blade. You can also flash the reproducer with a propane torch and smooth the wax out with a finger. It is important to use real wax and not paraffin or other substitutes. These are simply not sticky enough when hot nor hard enough when cool. Beeswax candles can also be melted and poured onto a cookie sheet. The thin (⅛") "pancake" can then be cut into narrow strips with a knife. Special waxes containing resins, which are even harder, can be obtained from workshops specializing in accordion repair. This wax is used to hold the reeds in place.

Housings made of hard rubber or composition material, as found in some early Columbia and many Pathé reproducers, almost always have a glued (with shellac) rubber gasket in lieu of wax or a bezel. Heat would ruin the housing.

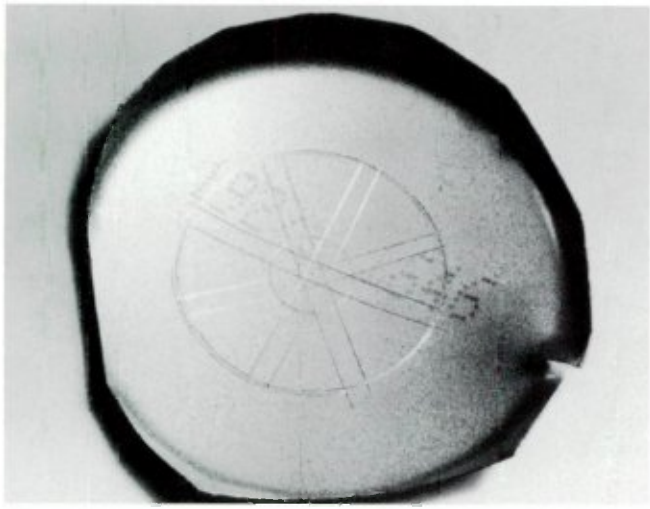
Spiders

If the dome or spider is missing, it is possible to make a spider out of an aluminum soda can. To do this, cut a portion out of the bottom of the can and transfer the design, shown in the pattern, and use tin snips to cut it out. Drill a shallow hole in the surface of a board with a ½" drill bit, just deep enough to make a good dent.

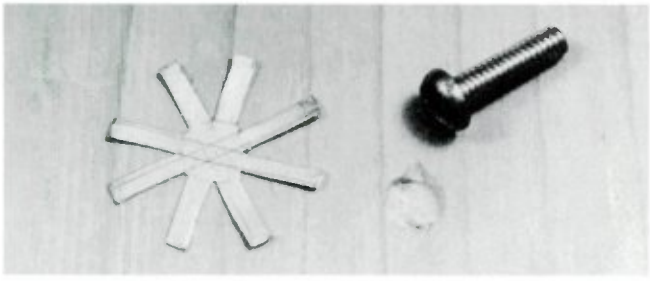
Place the spider over the hole and form the dome by placing the head of a round-headed bolt (or similar tool) on the spider, striking it with a hammer. The spider's "legs" can now be bent into shape with needlenose pliers and a hole drilled for the stylus, thus completing the operation. As an alternative to drilling such a tiny hole, simply punch a hole in the thin metal with a phonograph needle.



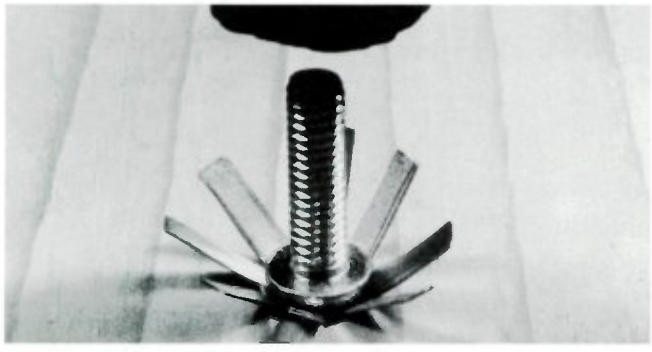
A simple spider (actual size).



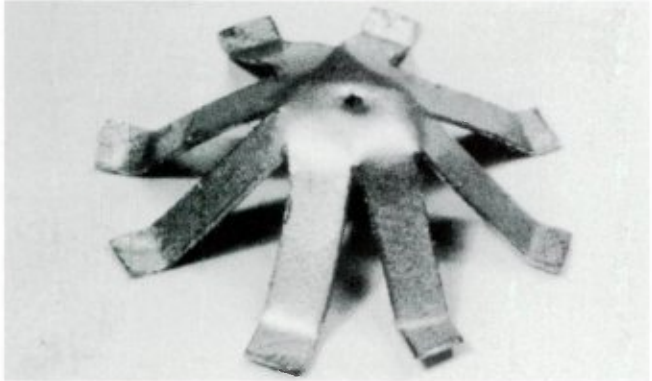
The bottom of an aluminum soda can has been marked with the spider pattern.



The spider has been cut out and is ready to be bent into shape.



The dome is formed by placing the spider over an indentation and striking the bolt with a hammer.

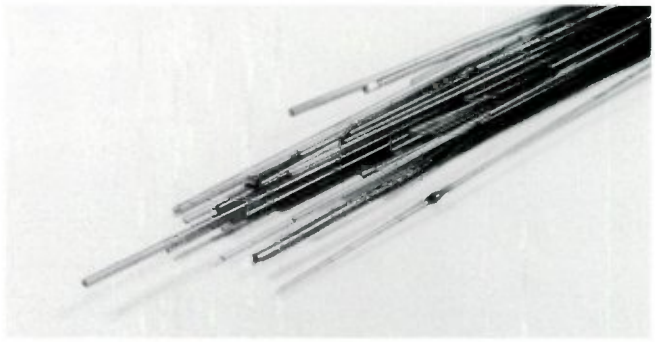


The finished spider. The legs have been bent into shape and a hole for the stylus has been punched with a phonograph needle.

Making styli for floating reproducers

Although Edison was very precise with regard to the size and shape of his styli, others were not. I don't think many collectors have gone through their horde of reproducers and measured the different stylus diameters with a micrometer. In fact, two-minute styli vary a great deal in size. Even the so-called "precision" reproductions differ tremendously from one source to another.

Replacements cost five to ten dollars apiece, but if you follow my instructions, you will make back the price of this book in no time flat by making your own.



A selection of thin glass rods used to make new styli.

Forming the two-minute stylus.

The procedure is so simple you won't believe it, and I guarantee you cannot hear or see the difference!

Most two-minute styli have a diameter between .027" and .038". Most makes average out at around .033". Pathé disc styli have a diameter of .034". Bearing this in mind, go down to the local arts and crafts store and buy a test-tube full of very thin glass rods. They are used in copper enameling and the test tube will probably contain many different colors and thicknesses. Look for a tube which contains rods about the size of the wire in a paper clip or thinner. When you find the right tube, buy it. If the entire test-tube costs more than a dollar or two, it's expensive.

Now, holding your prize tightly, run home and find a gas cigarette lighter. Take one of the thinnest rods, usually about .020" and dangle it vertically, directly over the flame. In a moment, the end of the glass will turn red and a small glass bead will form on the tip. Make about a dozen of these beads, breaking them off the rod about half an inch up. Just wait long enough for the bead to form, the remove it from the flame. If you wait too long, the bead may get too big.

Measure the batch of beads you have produced. Chances are, about half of them will hold the correct tolerance. Throw the others out. With practice, you can hit the right diameter about eight out of ten times. If you don't have a micrometer and don't feel like buying one, take the styli down to the local hardware store and measure them. Real old-time hardware stores often have employees who go out of their way to help. After all, if they're nice about little things, where are you going to go first when you want to buy an expensive bench grinder?

Examine the styli carefully with a jeweler's loupe, which can be purchased for a few dollars at a coin store. Make sure that there are no bubbles or other irregularities on the surface which might damage the record.

Admittedly, a glass stylus is more subject to wear than a sapphire stylus, but you ought to get a hundred playings out of a glass one before it starts to get flat—and the cost is minimal. If you are a serious record collector, the chances are you won't be using this type of reproducer anyway.

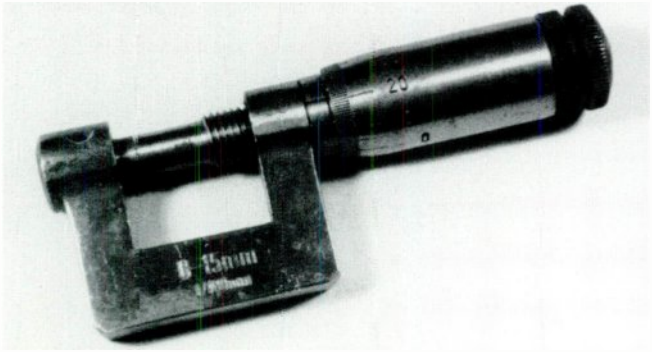
A worn stylus must be replaced immediately. One of the first signs of a worn stylus is an echo during play. Ball styli for disc records wear out much faster due to the heavy weight of the reproducer, and an investment in a good sapphire is recommended.

Although much less common, you may need to make a four-minute stylus for a non-Edison machine. The procedure is the same, but you will first have to draw out the glass rod horizontally over the flame in order to make it thin enough. When the glass starts to melt, pull it apart so fast that the glass breaks in the middle. The ends will now be very thin. When you make the bead, you have to be very quick about it. Otherwise the bead will get too big. .017" is about the right diameter for the four-minute bead.

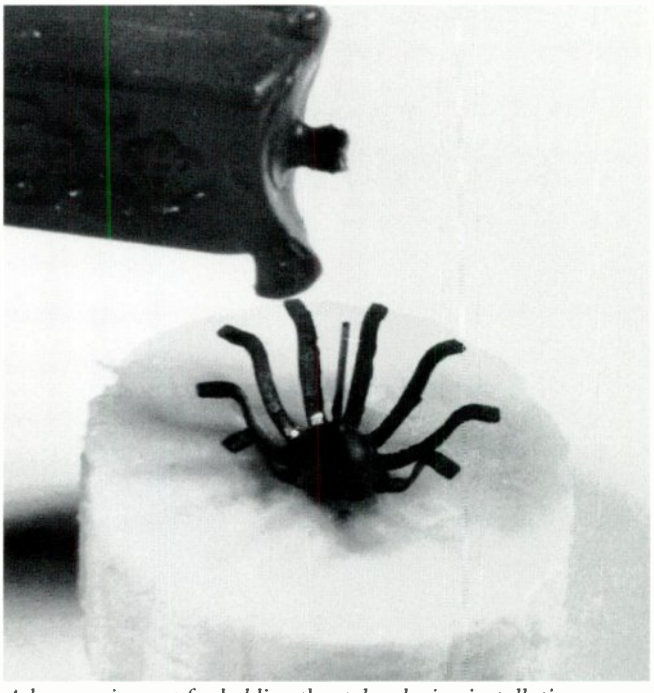
Mounting the stylus

Mounting the stylus in an arm, such as Columbia did, is not difficult. Melt the old wax or shellac with a soldering iron and insert the stylus. Excess rod must be cut off.

In the case of the dome or spider, it can be a little tricky to hold the stylus and drip the wax at the same time.The easiest way to accomplish this is to stick the stylus, head first, into something soft, such as modeling



A micrometer.



A banana is great for holding the stylus during installation.

clay, and rest the inverted dome on top. Now you have both hands free to drip the wax. Modeling clay can leave a residue on the stylus, which is difficult to clean off. Butter gets a little soft, but is usually in the house already. I like to use banana slices. These keep their shape, and the stylus is easy to rinse off.

Checking a new stylus

After installing a new stylus, it is best to make sure that it will not damage the record. For testing, take a wax cylinder that you think is about as entertaining as the neighbor kid practicing the piano. Try to endure the cylinder once more, all the way through, using the new stylus. When the cylinder is over, remove the reproducer and examine the stylus for traces of wax. If there is any evidence that the stylus is cutting into the wax, replace the stylus and test again.

A jeweler's loupe.

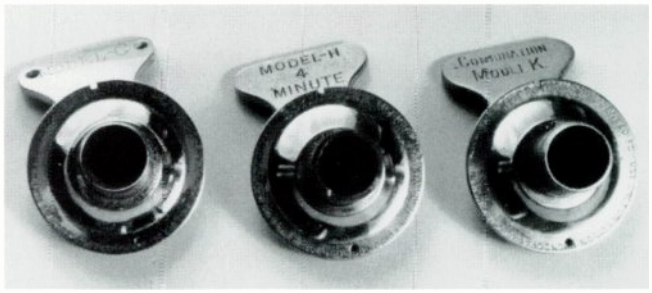
The floating weight reproducer

Some general comments

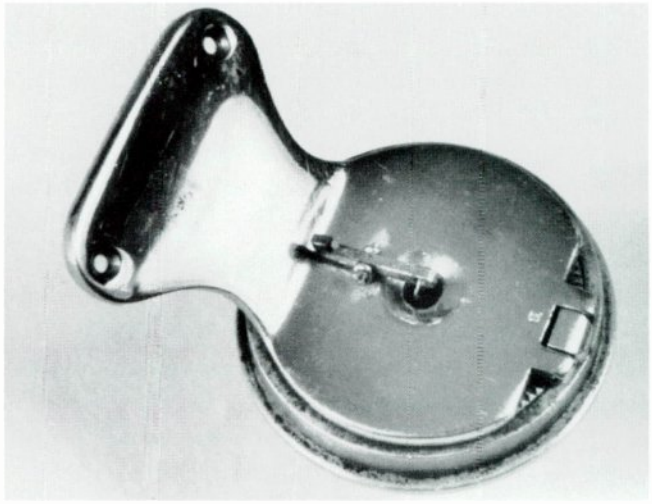
In floating weight reproducers, the reproducers body is mounted firmly on the carriage. The stylus is mounted on a "floating weight," which is allowed the freedom of movement that the reproducer body is denied. The stylus itself is mounted on a small lever, and the lever pivots on the weight. This arrangement effectively increases the stylus pressure on the record, without increasing the mass of the weight or restricting lateral movement. The lever also serves to change the relatively small fluctuations of the stylus into a correspondingly larger diaphragm movement. The extra weight and larger diaphragm movement produce a louder sound than the floating reproducer in which the stylus and the diaphragm move in a one-to-one ratio.

The lever and diaphragm are connected by a tiny wire linkage or, as seen in the later Diamond B reproducers, by a flexible cord.

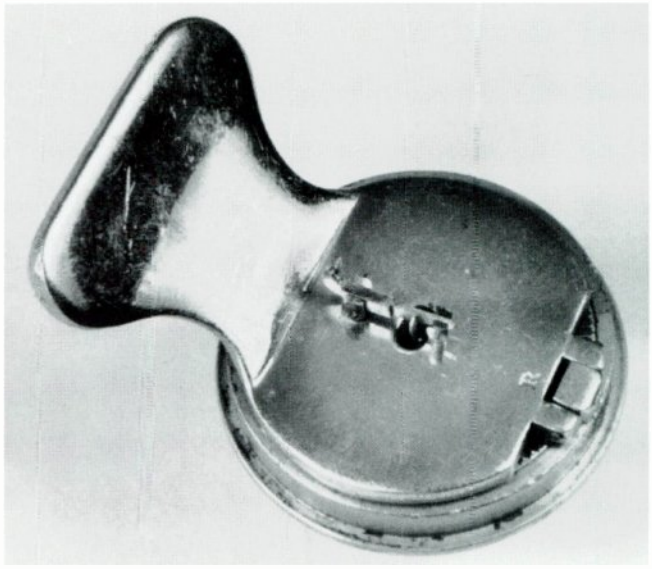
All Edison machines, both disc and cylinder, utilized the floating weight system exclusively. Columbia adopt-



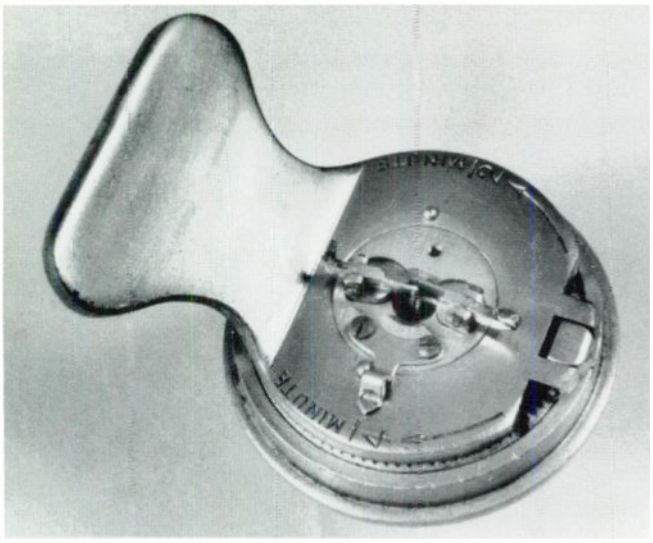
The three most common Edison reproducers (from left): model C; model H; model K.



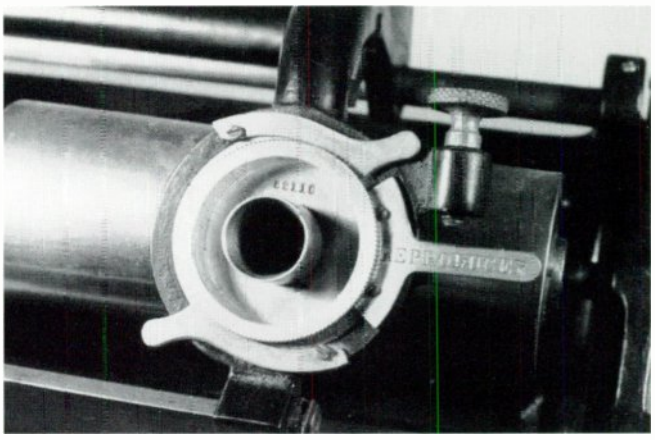
The model C.



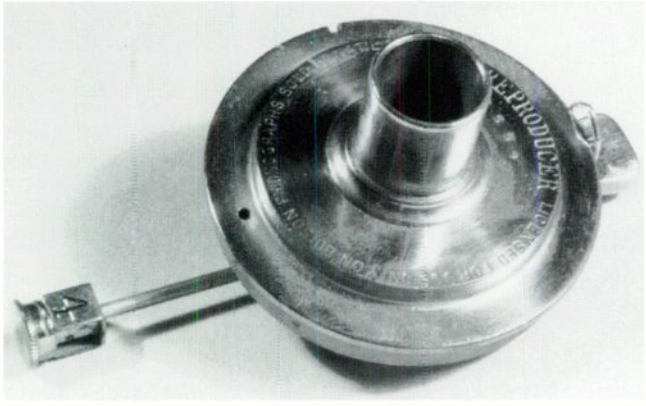
The model H.



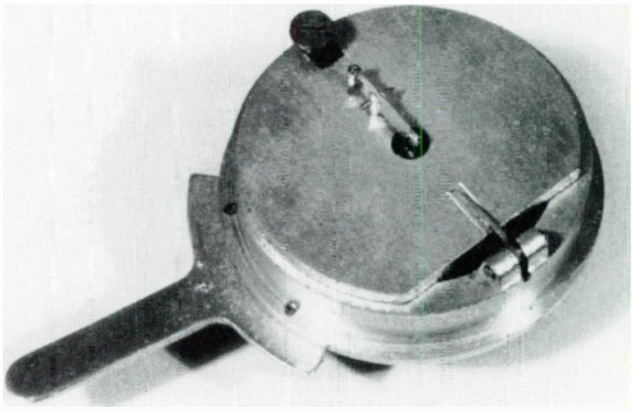
The model K. The center revolves so that either two or four-minute cylinders can be played.



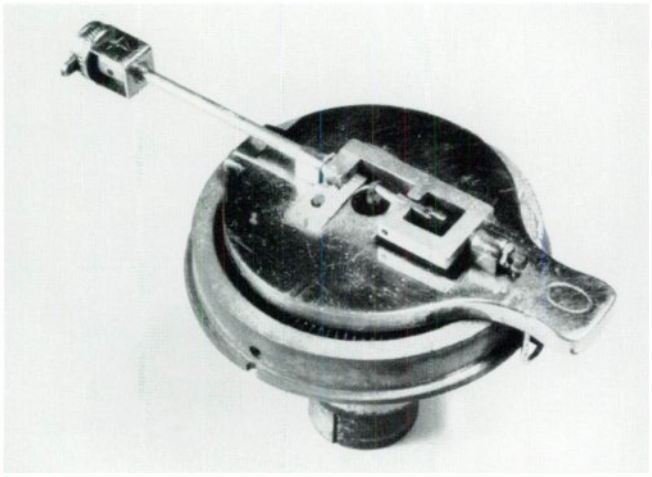
The early Edison Automatic reproducer has a recessed front. The long arm out to the side and the knurled screw on the carriage are used to align the stylus for optimum performance.



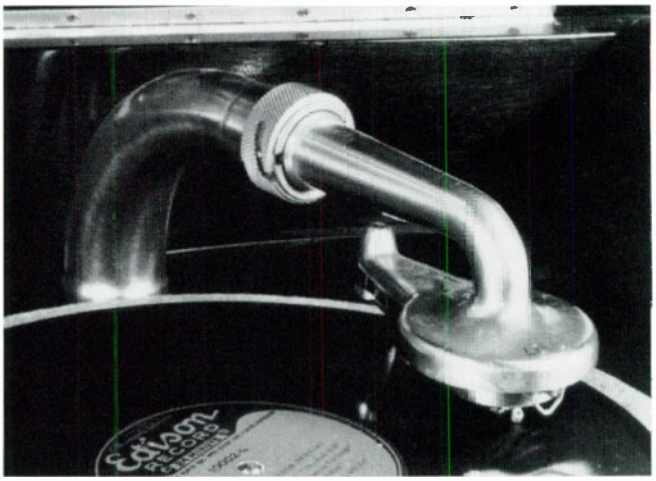
The Edison model O reproducer.



The Edison Automatic reproducer.



The stylus bar on the model O can be flipped by rotating the long arm.

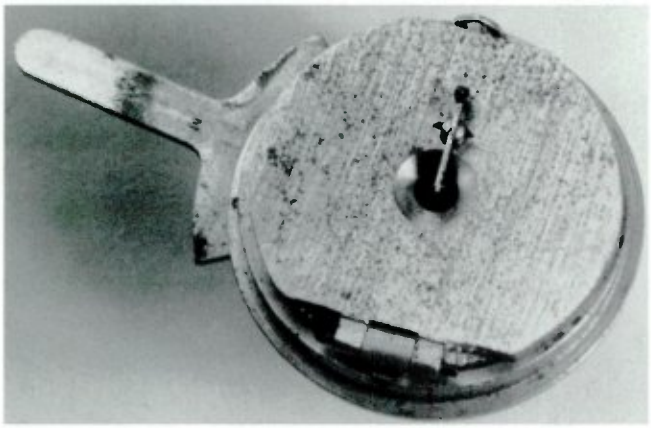


The Edison Diamond Disc reproducer is a refinement of the late-style cylinder reproducers.

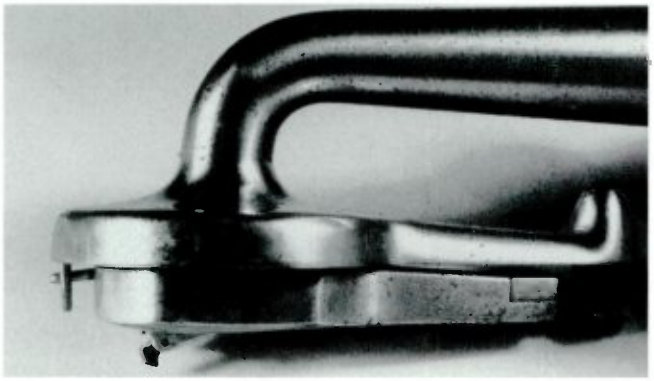
ed a similar floating weight system in 1905 which substituted a spring for the weight. This new reproducer was called the "Lyric" because of its lyre-shaped carriage mount.

Adjusting the floating weight reproducer

Unfortunately, there are few ways in which these reproducers can be adjusted. Naturally, all hinges and pivots must be able to move freely, without excess lost motion. Some Edison reproducers, such as the C, H, and K, have a hinge block which pivots from side to side, providing the weight with some degree of lateral movement. If this block is stiff, the reproducer may repeat or skip grooves during play. The thin diaphragm must not be tight, and the same goes for the pin or screw that attaches the bar to its "fork." If the stylus bar moves



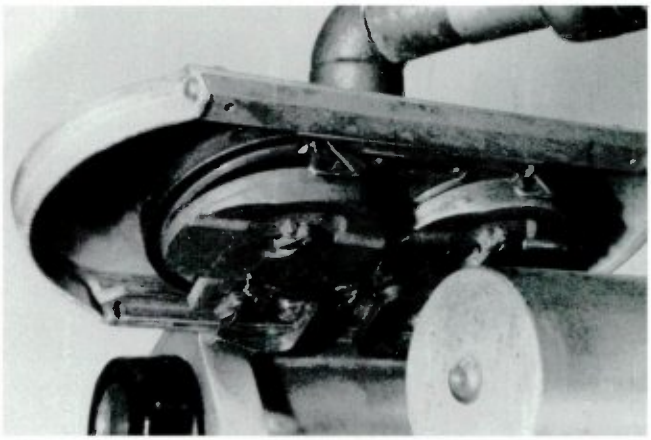
The Edison model B reproducer



Another view of the floating weight Diamond Disc reproducer.

The Columbia AZ reproducer.

The Columbia "Lyric" reproducer.



The U.S. Phonograph Co. of Cleveland, Ohio produced this special dual reproducer for their machines from c. 1910-13.

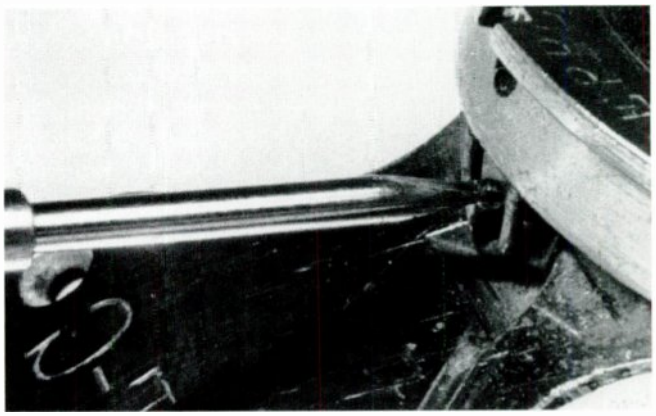
stiffly, reproduction will be poor and there is a risk of ruining the cylinder record.

Repairing the floating weight reproducer

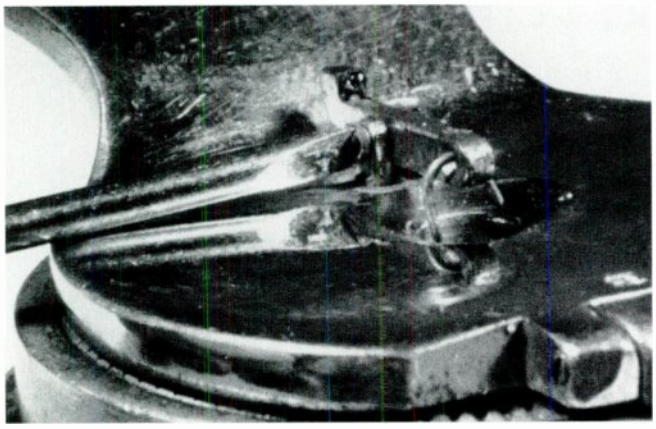
Gasket replacement

Disassembly of the reproducer is accomplished by carefully opening the wire linkage, or removing the pin on which the stylus bar pivots. The pivot can also take the form of a screw passing through the bar. When the bar is free of the weight, the weight can be removed with little trouble. If the weight is attached to a pivoting hinge block, as seen in the common Edison reproducers, the hinge block can be unscrewed by lifting the weight and twisting the entire assembly. It will first be necessary to remove the limit pin, which together with a small loop of wire contain the movement of the weight. The limit pin can either be unscrewed or, if it is stuck or has a broken head, the loop can be bent. In other cases, a hinge pin must be removed. In the Edison Diamond reproducers, the weight is attached to a flat, removable spring.

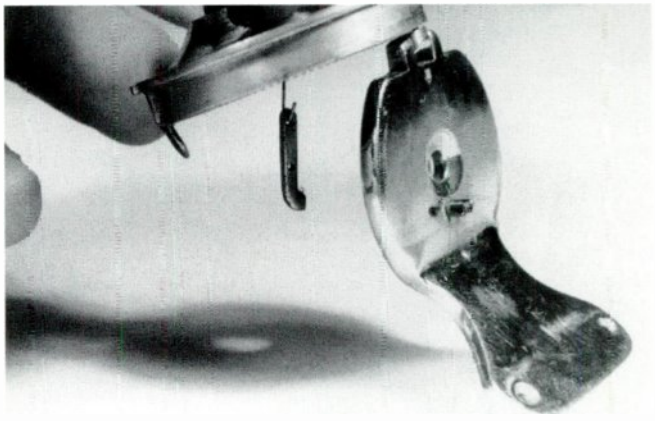
Underneath the weight, there is invariably a metal ring, screwed into the reproducer housing. This ring holds the gaskets and diaphragm in place. Unscrewing the ring can be very difficult if the housing or ring itself is made of pot metal. This can be a problem with the Edison O and Diamond reproducers. Generally, the ring is equipped with grooves or a number of holes which allow the repairman to insert some tool for turning. Needlenose pliers can often be used to unscrew the ring, but if it is stubborn or the pliers don't fit, it may



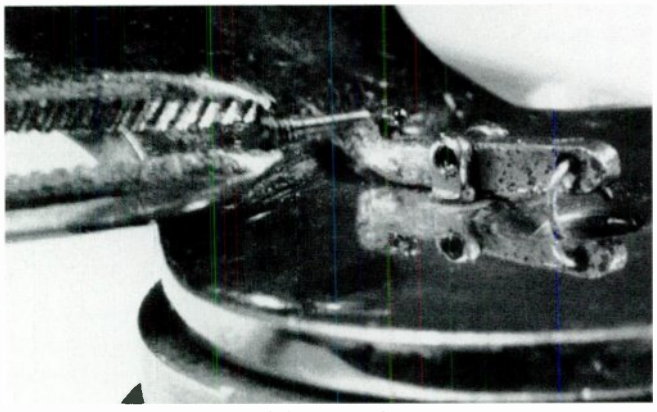
Removing the limit pin.



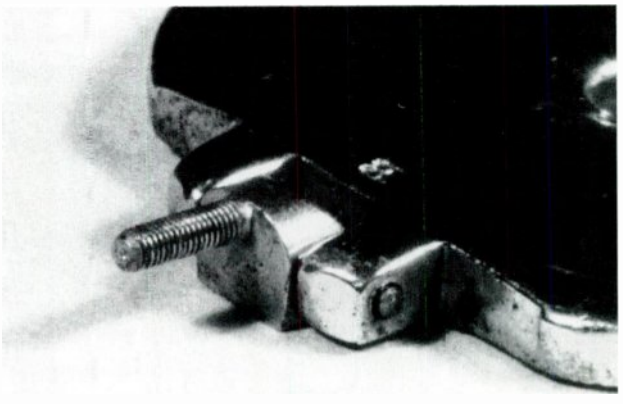
The first step in the disassembly of an Edison reproducer—removing the stylus bar screw.



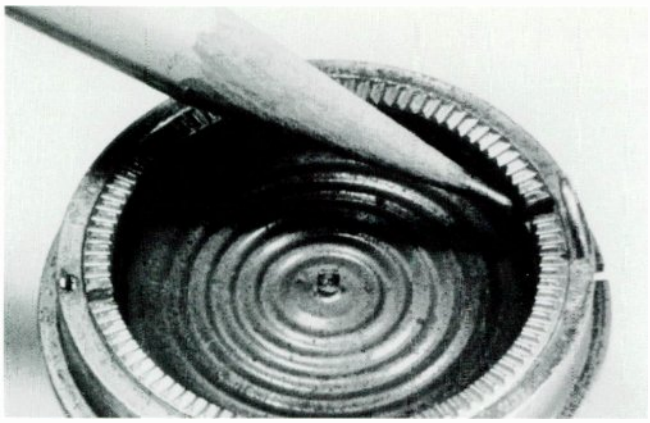
The stylus bar and link can now be unhooked.



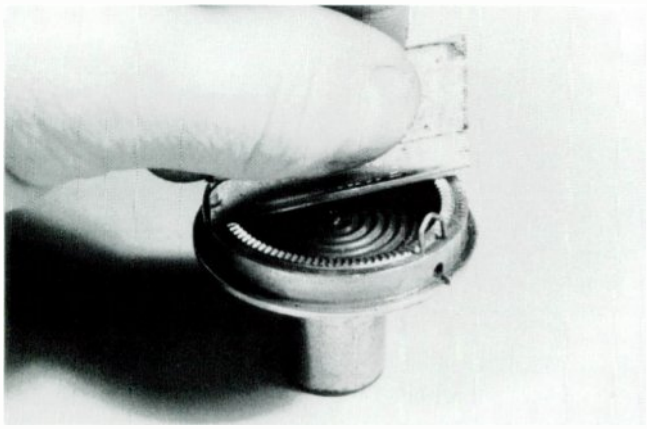
The stylus bar screw is withdrawn with tweezers.



The Edison hinge block is easily unscrewed.



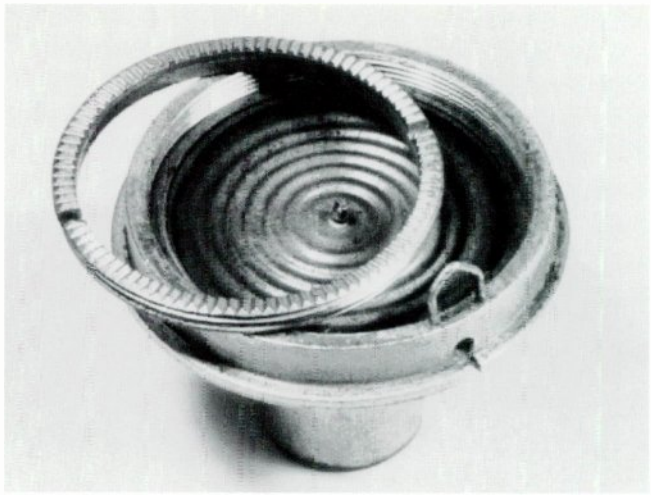
These two indentations in the retaining ring will accept a flat metal "key" which can be used to unscrew the ring.



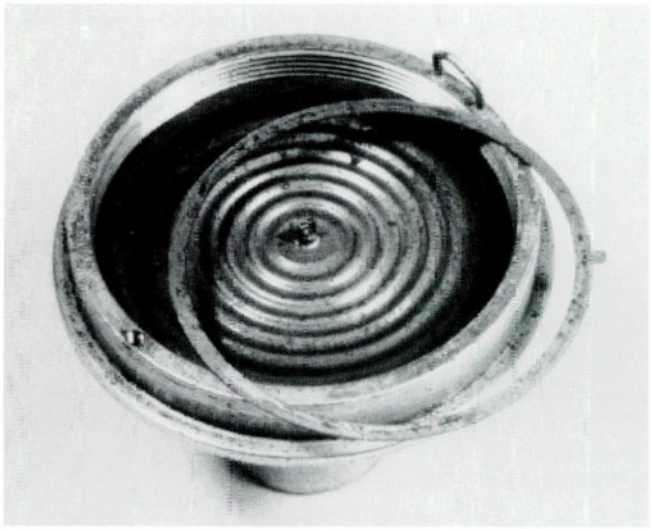
In many cases, any flat object will catch the indentations, even though this particular tool is too long to be used as a proper "key."

be necessary to make a special "key" out of sheet metal to fit the holes or grooves. This also reduces the risk of puncturing the diaphragm or marring the ring. If the ring won't unscrew, even with a key, it is best to send the reproducer to a competent repairman. Repairing any damage made during a botched repair attempt often costs more than sending the reproducer to service from the start.

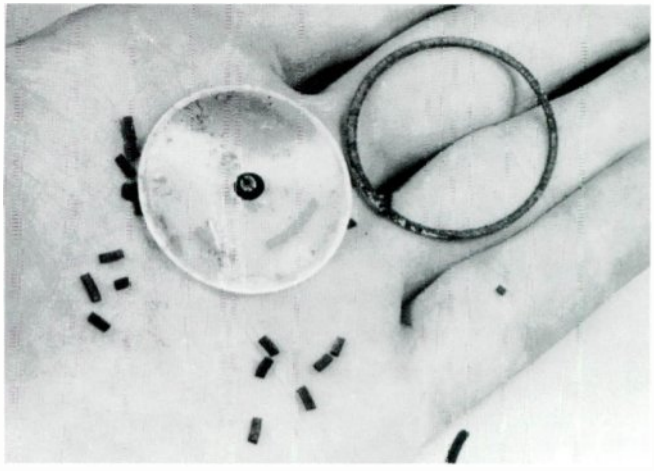
If you have been able to remove the ring, the rest is easy. Frequently, there is a thin metal washer between the outer gasket and the ring. This prevents the ring from deforming the upper gasket as the ring is screwed into place. This metal washer usually has a small tab which fits into a slot in the reproducer body. Note the position of any paper washers placed between the gasket and diaphragm. These are often found if the diaphragm is made of copper and prevent the copper and rubber gaskets from reacting chemically, which causes rapid deterioration of the gaskets. The paper washers can be reused. The careful observer will note that these paper rings are slightly "dished." If they are put back properly, their shape helps center the



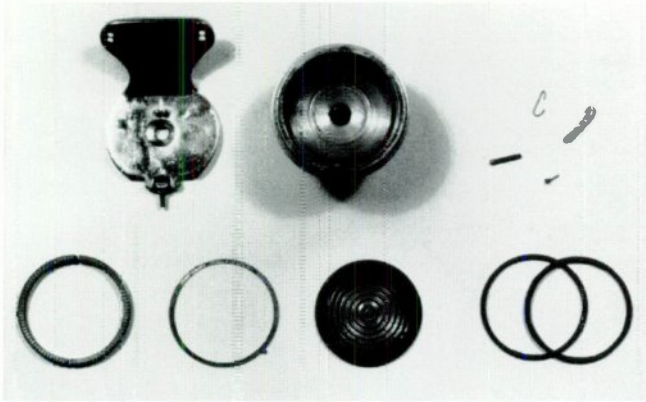
After the ring is out, the rest is easy!



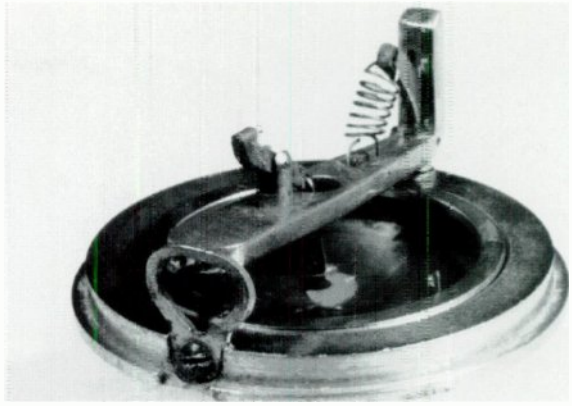
This flat metal ring separates the gaskets from the screwed-in ring and prevents their deformation.



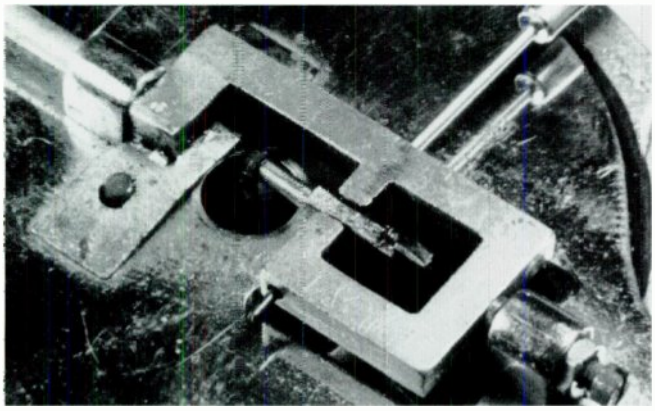
Blowing down the neck of the reproducer is a good way to unstick the diaphragm and the thin ring from hardened gaskets. The small black things are the remains of the old gaskets.



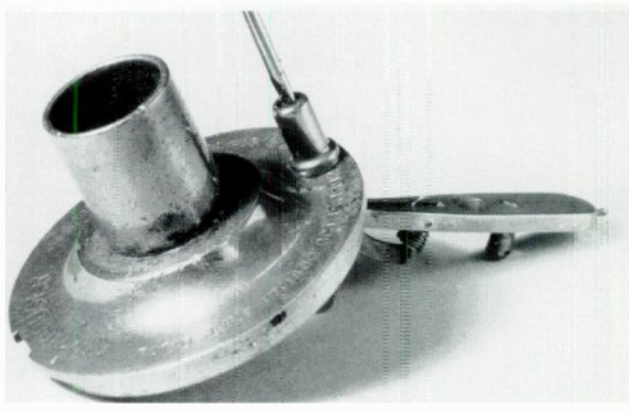
The component parts of the Edison model C reproducer.



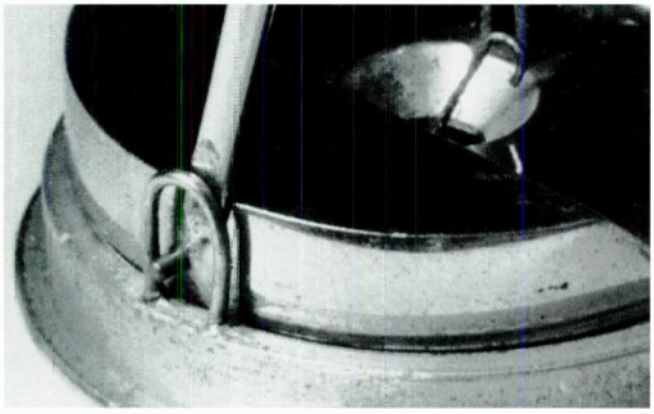
The Lyric reproducer has a screwed-on limit loop.



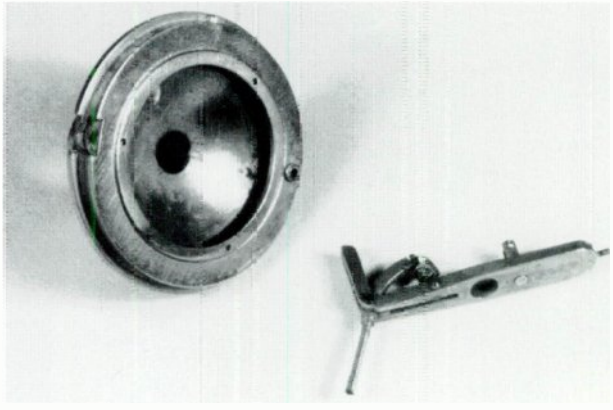
Removing the stylus bar from an Edison O is accomplished by pushing out a pin with a thin screwdriver or similar tool.



Removal of the spring tension device is accomplished by unscrewing the tiny screw at the top of the raised cylinder.



The limit pin on the Columbia AZ reproducer cannot be removed, so the limit loop must be bent out of the way.

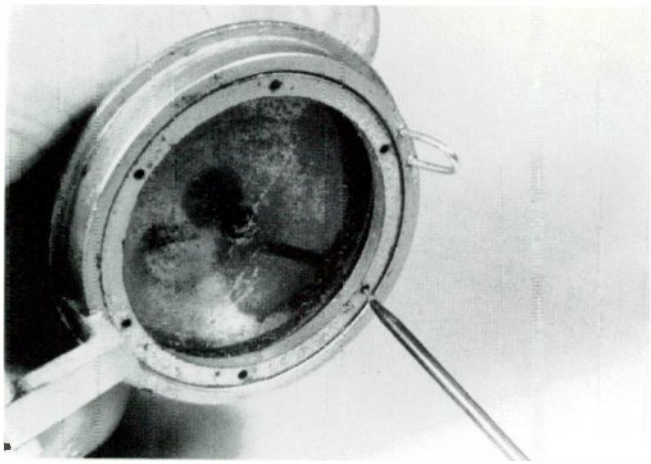


The spring assembly comes off in one piece.

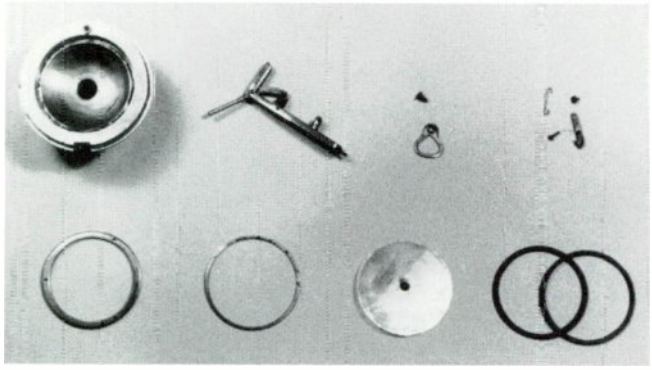
diaphragm. In some Edison reproducers, the gaskets are made of cork, and paper washers are not used. If you have difficulty removing the diaphragm, you might try blowing down the neck of the reproducer.

New gaskets are available from most suppliers at very little cost. The correct thickness is about .031" for smaller Edison and Columbia reproducers and .034" for Edison O and Diamond models. Edison Diamond Disc reproducers are about .036" thick. Should you wish to make your own gaskets, any reasonably soft, flat rubber sheeting of the proper thickness can be used.

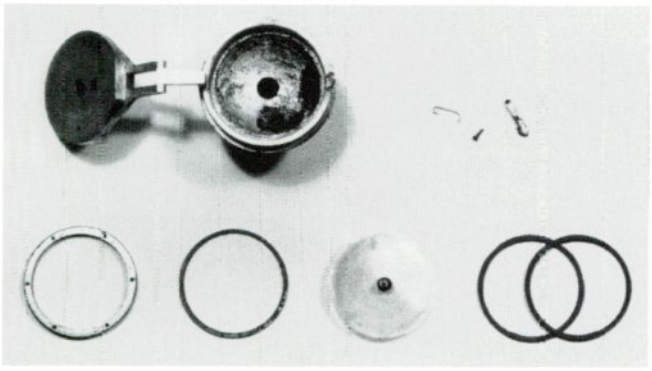
When reinstalling the ring, do not screw it down too tightly, or the sound may become thin due to the stiffly held diaphragm. Also, the small eyelet in the center of the diaphragm must be positioned correctly before you screw down the ring. This eyelet should be rewaxed if it has come loose.



A sharp pointed tool can be used to turn the bezel on Columbia reproducers.



The component parts of the Columbia Lyric reproducer.



The component parts of the Columbia AZ reproducer.

Diaphragms

The earliest Edison diaphragms were made of thin glass. This gave way to the "stepped" mica diaphragm, which was built up every so slightly in the middle. These "steps" face the neck of the reproducer. However, most Edison reproducers have an embossed copper diaphragm, and the early Diamond reproducers have a rice paper laminate. Late model Diamond reproducers have a cork-stiffened copper diaphragm. These rarely need attention other than rewaxing the eyelet in the center. Replacements are available if the diaphragm is

A "stepped" mica diaphragm.

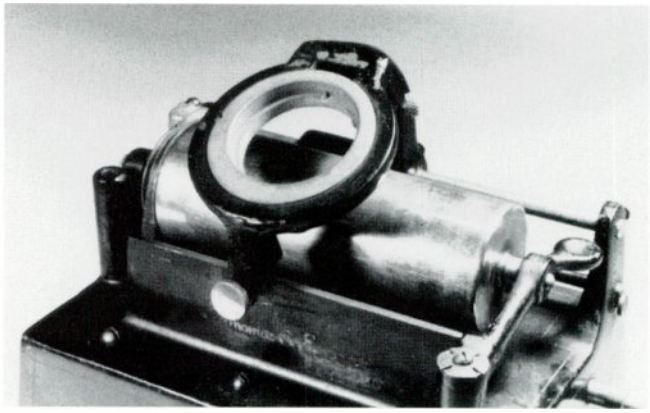
missing, damaged, or in the case of rice paper laminates, if they have become too stiff due to hardening of the shellac glue over the years.

Pot metal reproducer problems

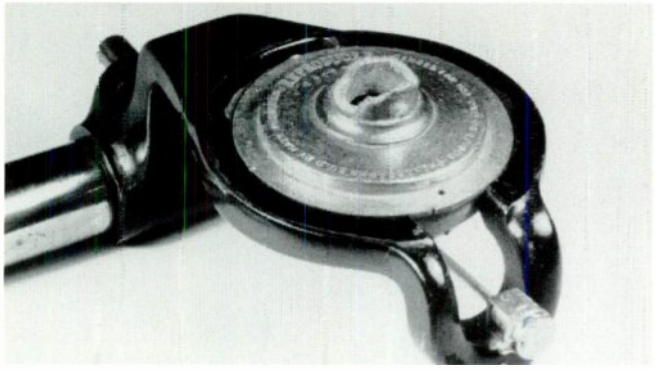
As mentioned earlier, Edison used pot metal for some of his reproducer bodies. Internal damage is usually minimal and you should try not to inflict more. However, the reproducer neck is frequently broken and must be repaired on a lathe for proper results. An experienced repairman should do this work. Removing the reproducer from the carriage in order to sent the reproducer off to the workshop is the next problem. Pot metal swells and, as often as not, the reproducer is stuck good and fast.

One method is to put the whole assembly in the freezer for about an hour. I've been told that the reproducer "pops out" easily. Frankly, I've never had one "pop out" as described here, but maybe you'll have better luck.

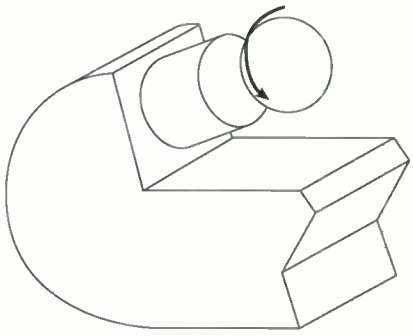
A time-consuming alternative is to remove the carriage and turn it over, supported at two or three places along the perimeter. Next, *gently* tap the edges of the reproducer with a blunt rod, such as an old hinge pin, and a hammer. Continue all around the reproducer, alternating from side to side. At one point, the reproducer will start to move. Don't rush things! Continue to tap and eventually the reproducer will fall out. It's a good idea to put some old rags underneath the reproducer to cushion the fall.



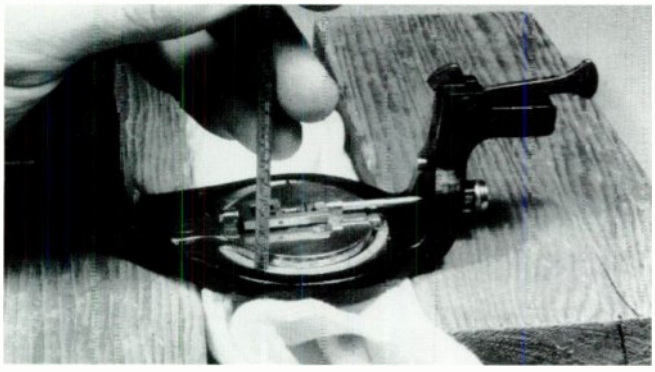
This Edison Gem is equipped with an oversize carriage designed for an N reproducer. The light colored ring inside the carriage is an adapter, which allows the use of a recorder or a smaller reproducer. The adapter is often made of pot metal and may be difficult to remove.



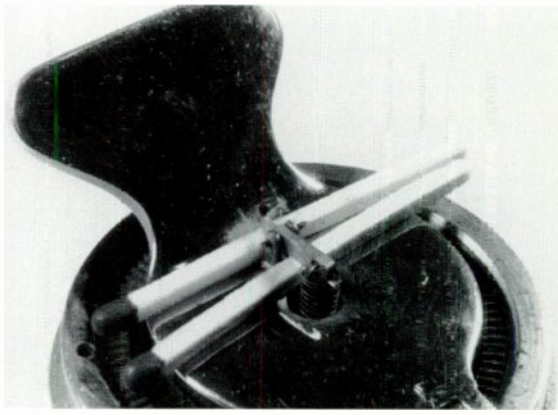
This pot metal O reproducer has a broken neck. In order to send it off to be repaired, it is necessary to free the swollen reproducer from the carriage.



A bad stylus can sometimes be rotated 120° so that an undamaged section can be used.



Gentle tapping around the edges of the reproducer with a hinge pin and a small hammer will eventually cause the reproducer to fall out. This is a time-consuming process that cannot be rushed.



Matchsticks can be used to shim the stylus bar during repairs. This reproducer is an Edison N.

This entire process can take up to an hour, but it's well worth the effort, considering how much it costs to buy a new reproducer should you smash the old one.

If you are sending the reproducer out for repairs, ask the repairman to turn down the edges of the reproducer so that it will fit the carriage properly. This should also be done on a lathe. If the reproducer is only tight, but not stuck, it is possible to file down the sides by hand. This does not produce as pretty a result, but works just as well.

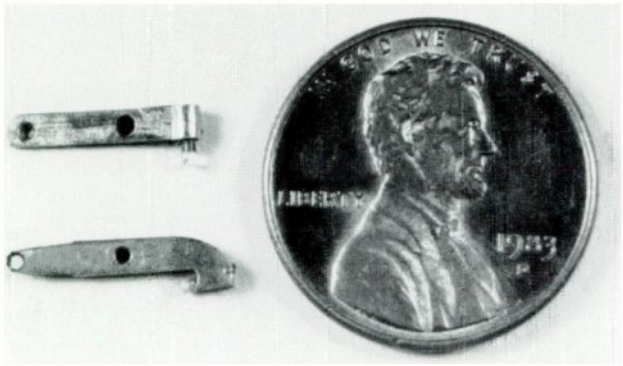
Edison phonographs equipped with a large carriage designed for the later model reproducers (O, N, Diamond B, etc.) are sometimes found with an adapter ring which permits the use of a recorder or smaller reproducer. These, too, are generally made of pot metal, but problems and solutions are similar to those described above.

Replacing styli

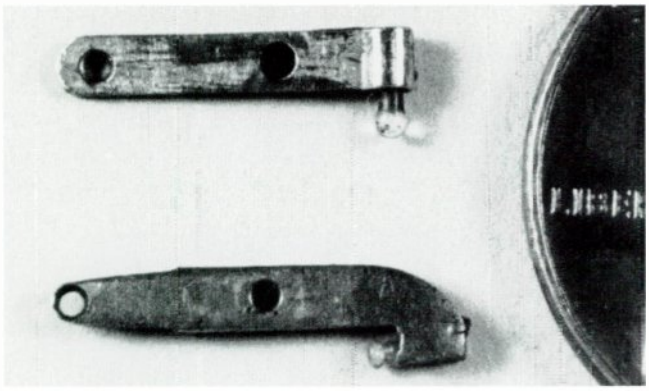
Edison's two-minute sapphire stylus (on C, K, and O models) is slightly flattened or "doorknob" shaped. This shape gives slightly better high frequency response than the earlier ball stylus. It is mounted at an angle so that the elliptical side of the "knob" is in contact with the groove. If there is any sign of wear or chipping, the stylus must be replaced or rotated in the holder. Any audible "echo" is usually an indication that the stylus is worn out or improperly installed. I find it easiest to set the stylus while the stylus bar is still attached to the weight. This holds it nicely during repairs. A few matchsticks can be used as shims to hold the bar steady if necessary.

If only one portion of the stylus edge is damaged, it is possible, with a steady hand, to melt the old wax or glue with the tip of a soldering iron, and turn the stylus with tweezers. If you are very careful, you ought to be able to get three "sides" out of the stylus. However, make sure that no portion of the damaged side still rubs the record surface or you will ruin the grooves. Also, be certain that no one has beaten you to it and already turned the stylus. If there is no way to rescue the old stylus, a proper replacement is necessary. If you do not choose to replace the stylus yourself, Edison styli of all types can be purchased already mounted in the stylus bar. Often your old bar is taken in trade.

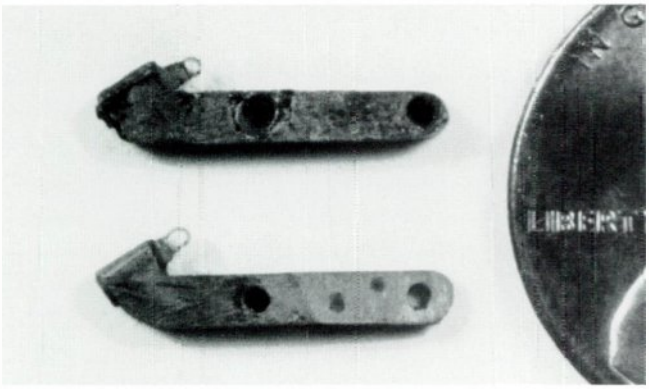
The earliest Edison reproducers used a ball stylus



Top: an early Edison two-minute stylus
Bottom: the later type Edison "doorknob" stylus, as found on the model C.



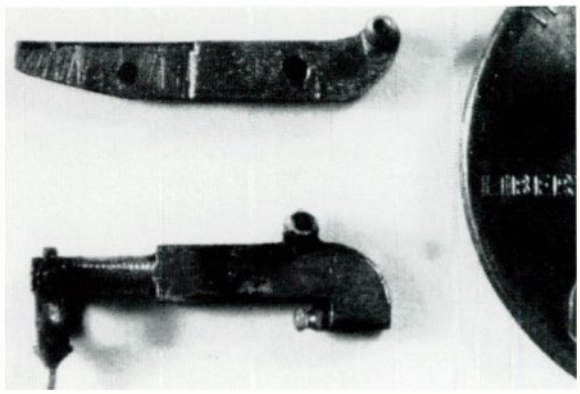
A close-up of the same two styli.



Top: the Columbia AZ stylus and bar.
Bottom: the Lyric stylus and bar. These two bars are not quite the same.

identical to that of the floating reproducer. The earliest types are recognized by the absence of the fan-tailed weight, which is only found on later models. These, as well as most Columbia reproducers, can be equipped with the homemade two-minute styli described earlier.

Replacement of the four-minute stylus on Edison reproducers is approached in much the same manner as that of the two-minute doorknob. The only difference is that its edge sits parallel to the groove and is *very tiny*. I have found that it is well worth the cost to buy these



Top: Edison model H stylus and bar.
Bottom: The Edison O combination two- and four-minute stylus bar.

styli already mounted in a bar by someone who has had more practice than I have. The same applies to diamond styli. If you do attempt to replace them yourself, make sure you don't soil the surface of the sapphire with wax or cement.

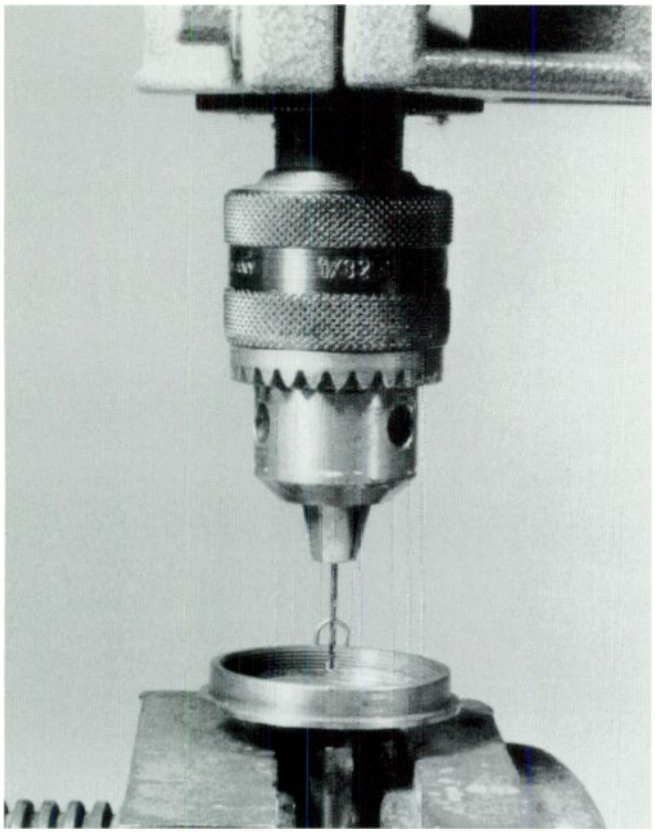
Some machines are fitted with a "combination" stylus. This should not be confused with the dual-speed K and O reproducers which have *two* styli. The combination stylus is supposed to work well with both two- and four-minute records. My experience is that it does neither job very well and tends to echo on four-minute records and wear out two-minute ones. A second reproducer is a far better investment.

Fixing broken hinges and other physical damage

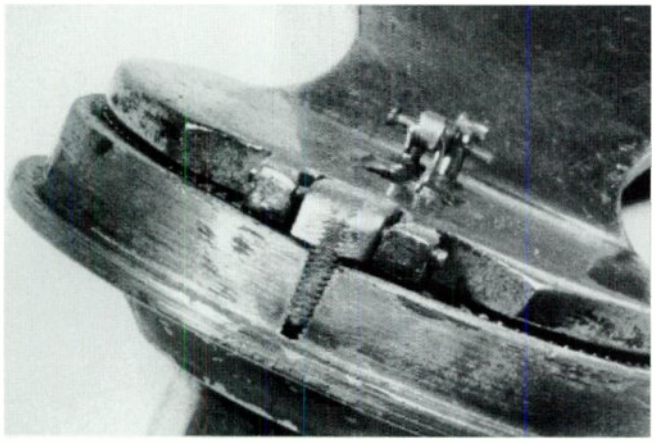
Edison reproducers would appear to be more prone to damage than Columbia types. I suspect that this is due to the frequent changing of reproducers necessary when playing cylinders of different speeds, a need rarely encountered on Columbia phonographs, which are almost always two-minute machines. Unless you are pretty handy with tools, your best course of action is to send a defective reproducer to a repair shop. However, on the common Edison reproducers, the C, H, K, and a few others, some repairs can be done at home.

Apart from the broken neck, which was mentioned earlier, the most frequent problems are broken hinge blocks, broken limit pins, and broken limit loops. Missing wire diaphragm linkages are also encountered.

To take the last problem first, a new linkage is easily made from a very thin piece of steel wire. Copper wire is generally too soft, but clippings from electronic components work well and are easy to obtain from a TV repair shop. The proper length of the link, measured inside the loops, is 5/16". The C reproducer link is "C"-shaped, while the H reproducer link is "S"-shaped. The



Drilling out a broken hinge pin requires precise alignment.



This hinge pin was drilled out improperly and broke through the thin wall of the reproducer. Although the repair functions well, a little extra effort would have produced much better results.

K reproducer link is rarely missing as it is permanently fastened to the eyelet on the diaphragm. This is the same length as the C and H link, but must be able to swivel in the special eyelet.

Replacing the limit loop is also a relatively easy job. The old loop is soldered in place, and, if it is possible to grip the broken ends, slight heat from a propane torch will allow them to be pulled out. A new loop can be made from a paperclip and either sweat soldered or glued in place. The loop is slightly pointed and measures about ½" on the C, H, and K. Loops on other reproducers vary a little in size and shape, but repair procedures are pretty much the same.

If the limit pin is stuck or has a broken head, it is possible to twist it with small pliers. This will usually free it. If the pin has broken off flush with the reproducer body, it will be necessary to drill out the hole and rethread it. If you do not buy a new pin, which is strongly advised, cut a piece of stiff piano wire that will fit tightly into the hole. Don't glue it in place—otherwise it can't be removed at some future time. Naturally, there is no reason to rethread the hole if you use this method.

When dealing with a broken hinge block, you should try to unscrew the broken portion of the pin with pliers. If not enough pin sticks out of the reproducer body to permit this, you will have to use a tiny 3/64" bit and drill it out. If you drill from the face of the reproducer body (where the writing is), you may find that the drill will catch the pin at some point and unscrew it. Use a fairly low speed. If the pin is long enough and has not sustained too much damage, it can sometimes be reused. If you had to drill all the way through, tap the thread from the face, too. This unwinds the old thread rather than cutting a new one. Of course, if you only drill part way through and then try the tap, you may succeed in rescuing enough of the pin to make the repair. The original thread was a Waltham watch thread, but it is unlikely than anyone has the tools to cut this nowadays. A 0x80 tap is about the closest modern equivalent.

The hinge block itself must also be drilled out and rethreaded. If you have been able to save part of the old pin, this can be screwed into the hinge block and held with either Lok-Tite or superglue. When dry, the block will be ready to install. If you have no pin left, you will need to buy a brass bolt with the correct thread. File off any portion of the pin that extends out beyond the curved top of the block.

When drilling tiny holes, it is critical to hold the drill at the proper angle and to hit the old hole dead center. This applies to governor repairs and needle screws as well. The only suitable way to hit center is to file the broken screw flat and to make a dent with a center punch. Try not to rely too much on the remains of the old hole to guide you when drilling. This just ruins the old threads. Hand-held electric drills are difficult to steer when drilling tiny holes and there is a good chance that the hole will be deformed or the bit will break.

Attachments for converting an electric drill to a drill press can be purchased at a reasonable price. A good vise to hold the part while drilling, either by hand or in a drill press is an absolute must!

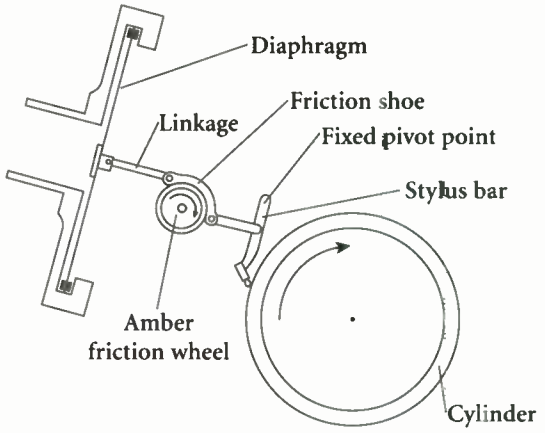
The Columbia friction reproducer

Columbia produced a friction-amplified reproducer in 1905, which had a huge four-inch diameter diaphragm connected by means of a friction shoe to the stylus bar. This special device was installed in two of Columbia's products, the large BC "Twentieth Century" and the smaller BM "Home Premier." This reproducer type is commonly know as the "Higham" reproducer, named for its inventor, Daniel Higham.

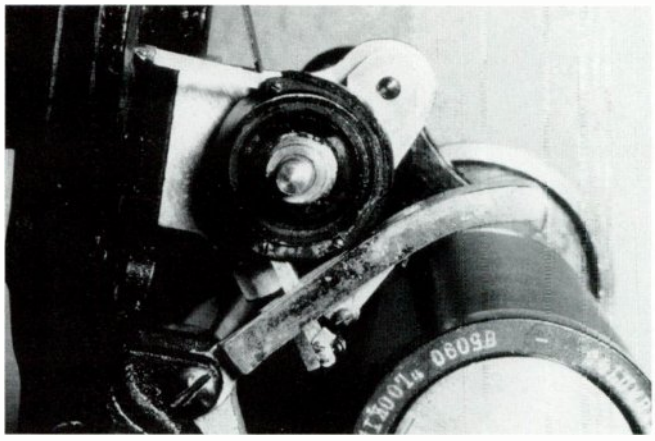
An amber wheel connected to the feedscrew, rotates while the machine is in operation. This rubs the friction shoe, which is a simple strap of vulcanized rubber. As the stylus moves up and down in the groove, the tension on the shoe changes, affecting the amount of friction between the shoe and the wheel. The increased friction between the wheel and the shoe gives the stylus a little aid in tugging the diaphragm.

Columbia claimed that these machines had 16 times the volume of other phonographs. This was based on the rather loose assumption that a four-inch diaphragm, having 16 times the surface area of a one-inch diaphragm, would produce 16 times as much sound. In fact, 16 times the volume represents an increase in sound pressure of 12dB. This may not sound like much, but imagine hooking 16 speakers up to your stereo! The result will be the same. In actual tests conducted by Mike Field for the City of London Phonograph and Gramophone Society, the friction reproducer was minimally better than an Edison Standard with a C reproducer of the same vintage. There was a better bass in the Columbia machine, but this is quite probably due to the large diaphragm and not the amplifying mechanism.

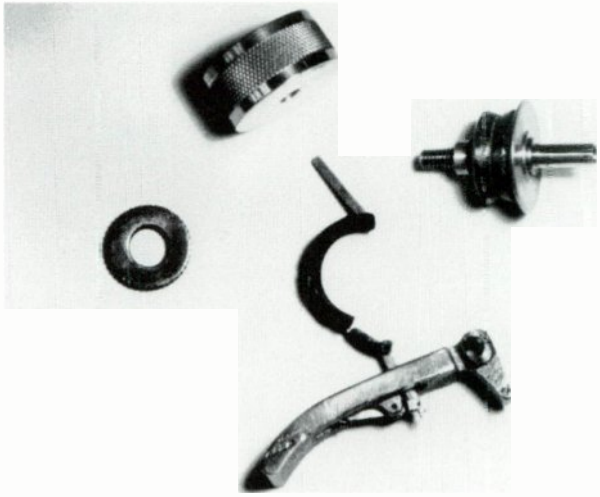
I recently heard a very good BM and an Edison "Home" with an O reproducer at the home of a Miami collector, Reid Welch. Although the BM was noticeably louder than the Home, what impressed me the most was the *quality* of the sound from the Columbia machine. Even though the Edison had the advantage of the more modern O reproducer, the BM reproduced orchestra instruments that were not audible (or distinguishable) on the Edison machine. Naturally, we used the same cylinder on both machines. I rather think Mr. Welch's phonograph would fare better in a serious test than the one Mr. Field used, but this is only conjecture on my part. Perhaps one of the reasons for the success of the BM is described below.



A schematic drawing of the Higham friction amplifier.

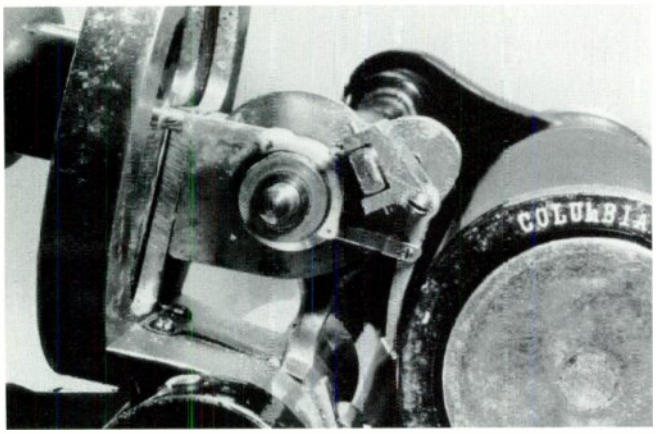


A detail of the Columbia BC reproducer. The large knurled knob has been removed for clarity. (Ernie Bennett collection)

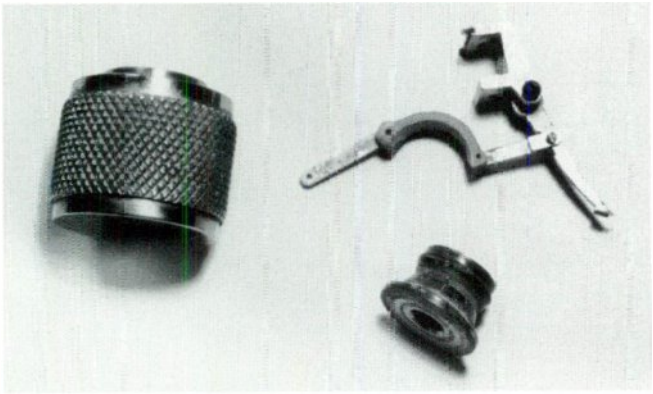


The component parts of the BC reproducer.

The Higham friction device is difficult to keep in adjustment, and adjusting technique is much discussed by today's owners. About the only things anyone can



A detail of the Columbia BM reproducer. The friction shoe is a replacement. Again, the knurled knob has been removed for clarity. (Reid Welch collection)



The component parts of the BM reproducer.

agree on are that the shoe and wheel must be clean and absolutely free from grease. Also, the drag on the amber wheel should not cause the rest of the machine to slow. Since there are a number of critical linkages, it is important that there be as little lost motion as possible. Bearings should also be inspected for wear and, if necessary, rebushed.

The real key to getting good results from either the BC or BM (they are slightly different, but the basic principles are the same), is to replace the friction shoe. Exactly what the friction coefficient of the original rubber shoe was, is not clear in the patent specifications. However, after ninety years, the rubber is almost always hard as a rock and resembles old leather.

After some experimentation, Mr. Welch molded a new strap in a semi-elastic plastic car putty known as "Bondo." After carefully turning down the amber wheel on a lathe in order to remove chips and scars, the putty was formed around the wheel and left to dry. Afterwards, the new strap was filed and fitted to the rest of the mechanism. The improvement was astounding—although certainly not 16 times as loud.

I would like to mention one small detail to the prospective repairmen: the large, knurled nut present on both the BM and BC reproducer has a *left-hand thread*, so don't reach for the pliers.

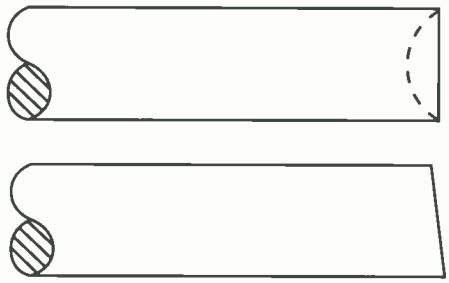
For those who are interested in reading further on this subject, copies of the original Higham patents can be purchased from the U.S. Bureau of Patents. The relevant patent numbers are: No. 678,566, No. 712,930, No. 783,750, No. 808,052, No. 876,350, and No. 1,036,235.

Recorders

Every cylinder phonograph equipped with a feedscrew is able to record as well as reproduce sound—if you have a recorder. The remains of recorders are not hard to come by, but unfortunately, the fragile cutting stylus, along with the even more delicate stylus holder has often disappeared. However, with a little patience and a steady hand, it is possible to make a usable recorder stylus and holder.

The cutting stylus is, in its most primitive form, a small glass rod, about .042" in diameter, which scrapes off a layer of wax as the cylinder revolves. This is for two-minute records. A four-minute Edison version, recognized by its transparent green lacquer, was produced for a short period after 1912 and has a stylus that is about half as thick. The stylus is generally mounted in a thin aluminum holder glued directly to the recorder diaphragm. The earliest Edison recorders, though, used the floating weight method, and the stylus was mounted on a small bar. This stylus was indented slightly at the tip to provide better frequency response, but the more common flat tip works satisfactorily. Often the original owner was given a choice of flat or cupped stylus when he bought a recorder. Modern experts agree that the cupped stylus is better.

The early Edison recorders are assembled in the same manner as the floating weight reproducers, and repairs follow the guidelines mentioned in the preceding section. Columbia recorders are built like their floating reproducers, but without any lateral movement. The only difference is a glued-on recording stylus and holder instead of a dome or spider. You should refer to the section on floating reproducers for diaphragm and gasket information. The later Edison recorders have a hinged diaphragm holder with no lateral movement. A small tube or sleeve rides on top of the hinged diaphragm, supported on the sides by the neck of the recorder. This reduces sound pressure loss out the sides of the recorder. Apart from these details,



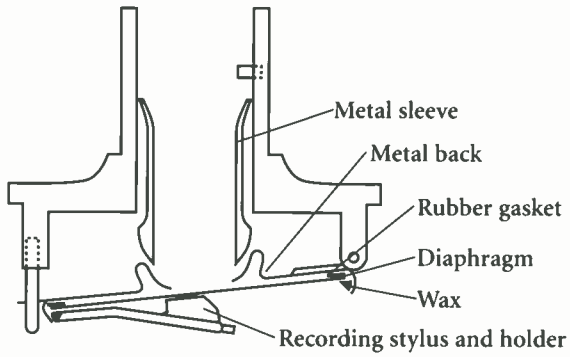
Cupped and flat recording styli

the diaphragm is placed on a gasket and waxed in place in the same manner as that of the floating reproducer.

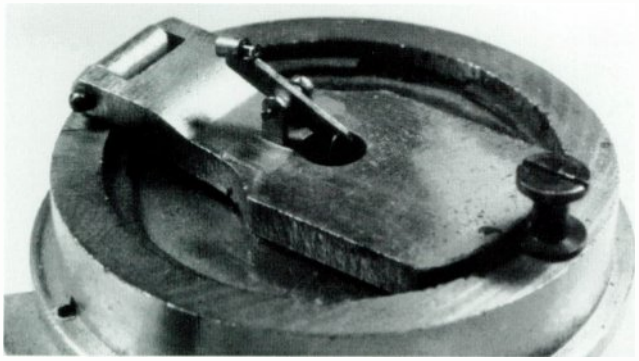
To make a stylus for the later Edison and Columbia recorders (as well as some Pathé products), find a glass rod measuring between .041" and .043" in diameter in the test tube you bought when making reproducing styli. If you simply break the glass rod, you will find that, except for one small chip, the end of the rod is sharp and flat. The chip will not interfere with the function of the recorder as long as the stylus is installed so that the side with the chip faces the diaphragm and not the record. Although the original styli were cut at a slight angle, the stylus you have just produced will work almost as well. Next, take about a square inch of thin aluminum (about .01" thick), and fold it over one end of the glass rod. You may want to glue the rod in place with a little shellac.

Using needlenose pliers, pinch the metal together, just underneath the rod, so that the rod is firmly held in the fold. Be sure to position the rod as shown in the diagram before pinching the metal. The "tail" of the stylus holder is now formed by clipping off the excess metal with a wire cutter.

The tail can now be bent to the correct angle with pliers, breaking the rod inside. This section of the rod really has no function—it just makes it easier to fold the metal and form the tail. The "wings" can now be folded out and excess metal cut off with scissors. The holder is now ready to be glued onto the diaphragm, as indicat-



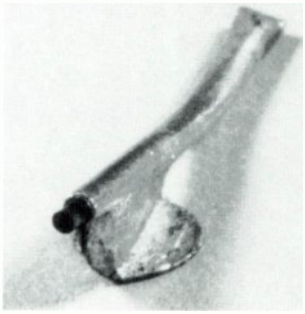
A cross-section of a late-style Edison recorder.



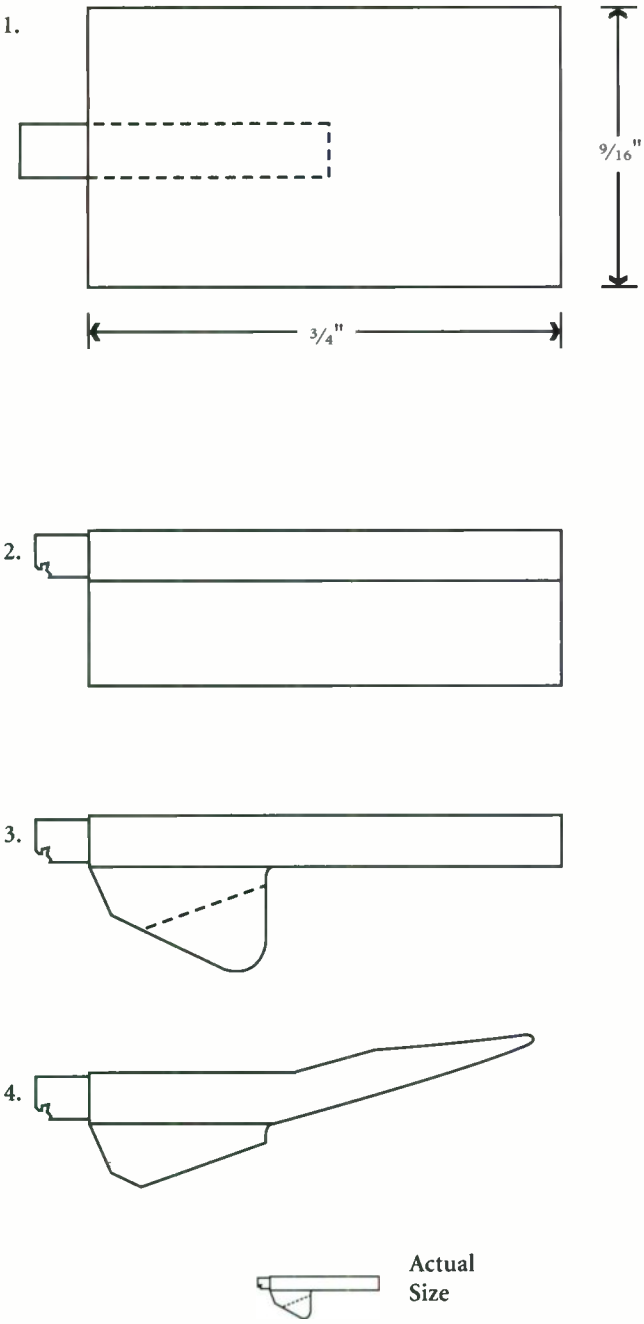
An early Edison recorder from the mid-1890's, equipped with a cupped cutting stylus.

A Columbia-type recorder of the pre-1906 period.

The more common Edison recorder from the 1901-12 period.



Two recorder styli and holders.
Left: Edison, Right: Columbia



Steps in the construction of a recording stylus holder: 1. a piece of thin aluminum is cut to size and a glass stylus is positioned; 2. the metal is folded around the stylus and pinched so that the stylus is held firmly; 3. "wings" are cut out with scissors; 4. the wings are folded and the tail is crimped and bent.

ed in the drawings.

As far as *using* the recorder is concerned, I refer you to one of the reprinted booklets on recording technique, which are available from a number of sources. Actually, recording is easier than you think, and a little experimentation will soon put you on the right track. However, recording *well* is an art and requires an expertise that only comes with practice.

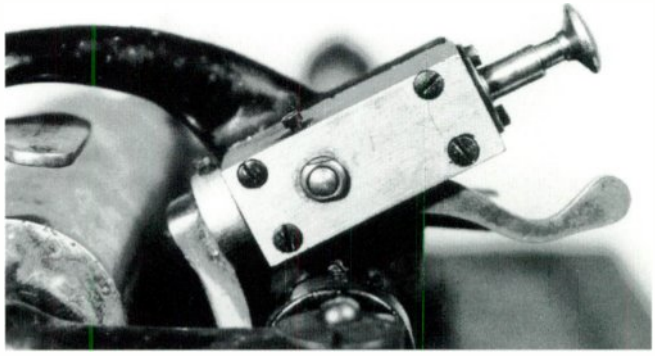
Naturally, you can't record without a blank cylinder, and if you don't have a shaving attachment on your machine, you will have to find another collector who is willing to help you make blank cylinders. Be *very* sure that the record you destroy is not worth saving. Unless you know what you are doing, stick to chipped and moldy cylinders that cannot otherwise be played.

Cleaning and restoring cylinders

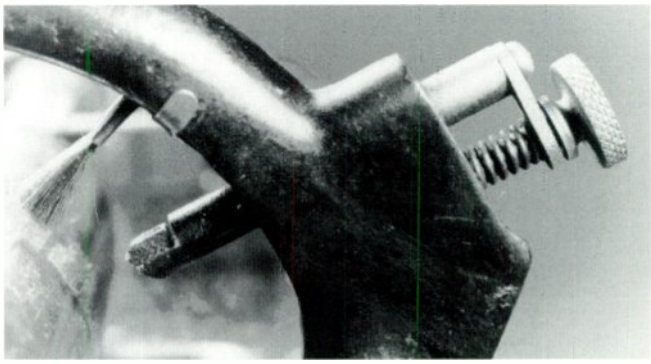
The care and storage of sound recordings is the subject of many books and articles. Repair of 78's is also frequently discussed in various magazines catering to the record collector. As it would seem that little has been written regarding cylinders, I would like to pass along a few tips.

Wax cylinders should be handled gently. Avoid touching a cylinder on the outside. Rather, hold it by the ends or by spreading two fingers inside it. If the cylinder is dirty, wash it only in distilled water and let it air dry. Don't try to polish it with a cloth. You will only ruin the grooves.

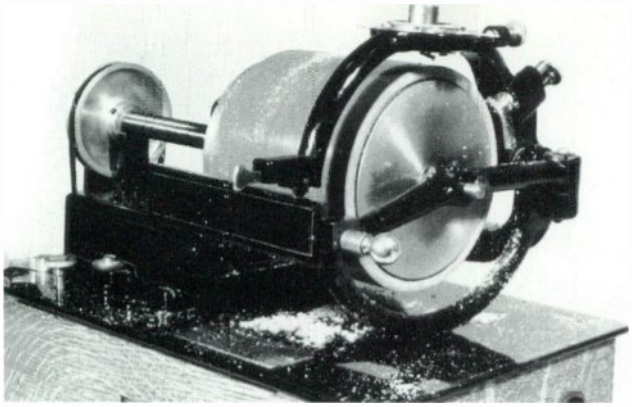
Never leave a cylinder on a machine after use. Dust, sunlight, and a host of other enemies are waiting to attack! In addition, make sure the cylinder and the phonograph are pretty much the same temperature before you put on a recording. Moving a machine from



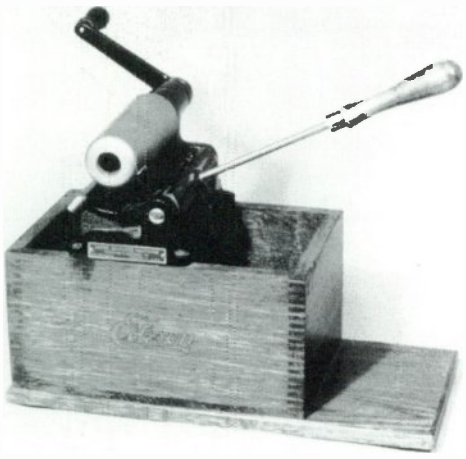
An early Edison shaving attachment.



A later Edison shaving attachment.



Shaving cylinders at home can be very messy!

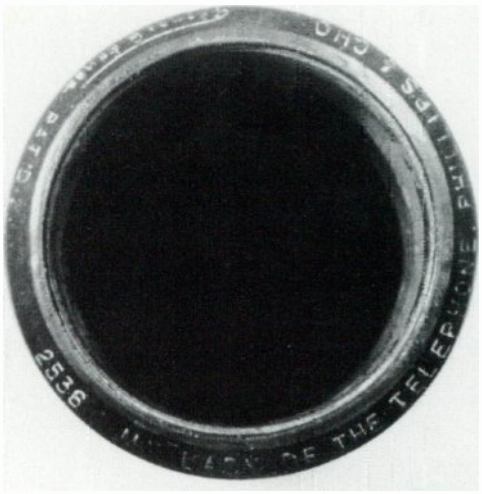


An Edison "Amberol" shaver from 1912. (Walter Bellm collection)

The proper way to hold a cylinder.

a cold room to a warm one can crack a "warm" cylinder when it is pressed onto the cold mandrel. The metal expands, the cylinder doesn't and that's that. If the machine is playing when the cylinder breaks, you also risk snapping off the stylus.

Celluloid cylinders can be washed in lukewarm water and mild detergent. After towel drying, some collectors—myself included—give cylinders a little spray wax/cleaner, such as Johnson's Pledge and polish with a



The embossed lettering on Edison Blue Amberol cylinders can be enhanced with a white crayon.

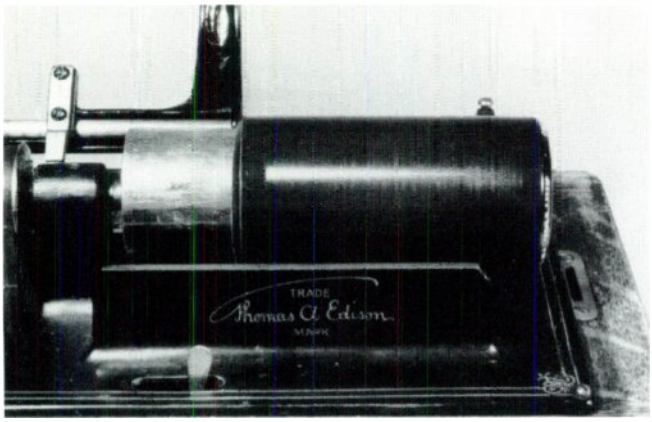
soft cloth. Some spray silicone applications contain solvents and should be avoided. I think Pledge removes dirt and reduces surface noise, but I should mention that many collectors feel that polish of any kind just fills up the grooves with new gunk and is a stupid thing to do. The decision is yours.

Repainting white lettering

If the white lettering on the end of the cylinder is too dirty or worn to be read, it is possible to apply white shoe polish with a cotton swab and wipe the excess off with a rag. The polish remains in the indentations and effectively repaints the letters. A considerably easier method is to rub them with white crayon. The excess wax is easily polished off with a piece of felt.

Swollen plaster cores

The plaster core used in Blue Amberol cylinders has often swollen to such an extent that the cylinder cannot

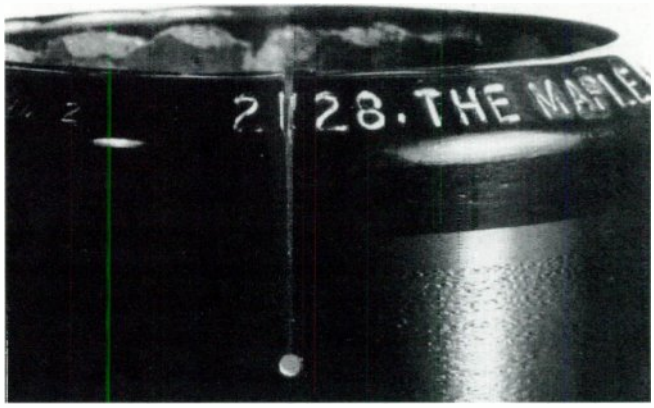


Often the plaster core of a Blue Amberol cylinder has swollen and won't allow the cylinder to sit properly on the mandrel.

A cylinder reamer, available from many parts dealers.

Reaming a cylinder.

go on the mandrel. Special reamers are available to grind away excess plaster, which I highly recommend. You might want to wipe the inside of the reamed cylinder with a damp rag before playing it in order to avoid getting plaster dust all over the machine. You can also glue a layer of sandpaper on the mandrel with Spray Mount or a similar spray adhesive (art supply or hardware stores), and use the mandrel itself as a reamer. In order to avoid removing too much plaster, mark a suitable stop position on the sandpaper, using a cylinder which fits the phonograph properly, as a reference. The system works well but is pretty messy.



Cracks in Blue Amberols can be arrested by drilling a tiny hole at the base of the crack. In this case, the crack has ruined the first few bars of the music. However, had the hole not been drilled, the chances are that the record would have split its entire length in a year or two.

To aggravate the problem of swollen plaster cores, celluloid slowly shrinks. At one point, the celluloid starts to crack and can actually split the entire length of the cylinder with an audible "pop." If you see cracks starting at the edges, they can be arrested by drilling a tiny hole at the base of the crack. The cylinder may split anyway, but it will do so somewhere else.

Repairing chips

A dropped Diamond reproducer can make a nasty chip in the surface of a celluloid cylinder. By filling the hole with a wax china marking pencil, the grooves can often be "rebuilt." This repair will not hold, however, if you continue to use a Diamond reproducer. Switch to an O- or H-type, which is not as heavy. I've also tried to fill such nicks with shellac, but the result was not good. Maybe you'll have better luck.

Horns and tone-arms

Shapes and sound

Horns and tone-arms steer the concentrated sound from the reproducer. It's rather like putting blinders on a horse. The horse, like soundwaves, follows the path in front of him. The horn makes sure that the sound is pointed in a direction, instead of being spread around the room.

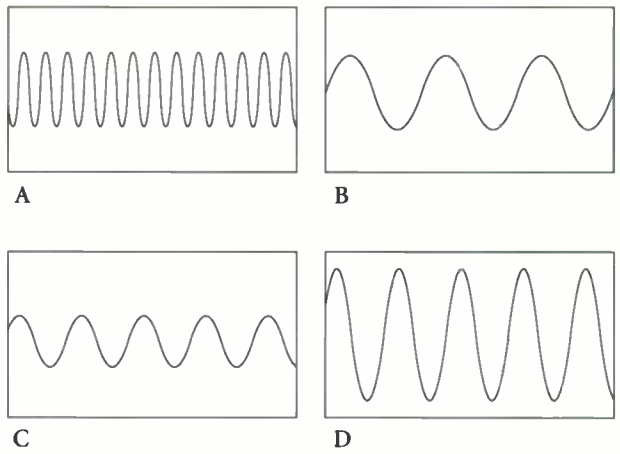
If you imagine a pebble dropped in a quiet pool of water, concentric waves spread out over the surface from the spot where the pebble hit. The length from the top of any one wave to the top of its neighbor wave is

always the same. If you dropped a small pebble, the length between waves will be smaller than those produced by a big rock. This distance is called a "wavelength."

If instead of dropping stones, you plucked a string, it would vibrate up and down a certain number of times per second. One complete vibration is called a "cycle." The "frequency" is the number of cycles per second. A short string will vibrate faster than a long string and therefore has a higher frequency. Just to be difficult, cycles are measured in units called "Hertz" (Hz). 100 Hz is 100 vibrations (or cycles) per second. The higher the sound frequency, the higher the tone. The longer the wave, the lower the frequency, and the lower the tone.

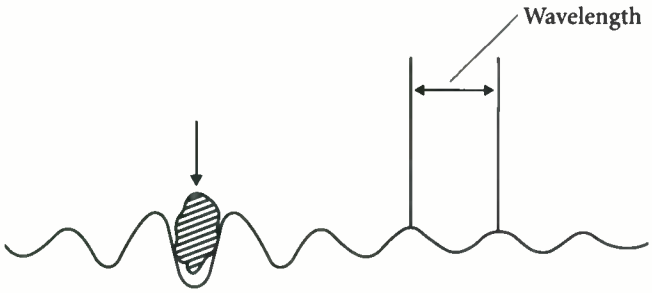
To go back to the water for a moment, if you count the number of waves over a distance of three feet, there are, naturally, more little waves than big ones. The little waves are "high frequency." If you stick your hand in the water, it is easy to stop small waves. On the other hand, a big wave can knock over an ocean liner. Sound waves work the same way, except that in a talking machine, they move air and not water. Instead of a rock, the reproducer diaphragm sets the wave in motion.

Soundwaves bounce when they hit something hard, just like the waves bounce off your hand. However, the little high-frequency waves give up the ghost if they have to bounce around too much, whereas the big low-frequency waves just keep on bouncing. The softer or rougher the reflection surface, the quicker the soundwaves are absorbed and lose their energy. If they find a hole, they slip out and some of the sound energy is lost. That's why tone-arms and reproducers must be smooth and airtight.

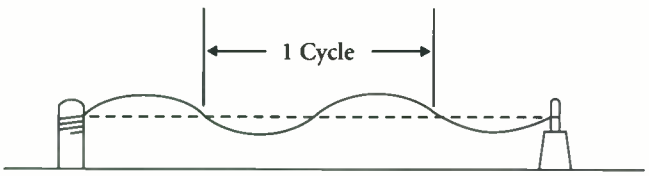


A: A high frequency sound wave.
B: A low frequency sound wave.
C and D: both diagrams show the same sound wave. However, D has a higher intensity, i.e. it is louder.

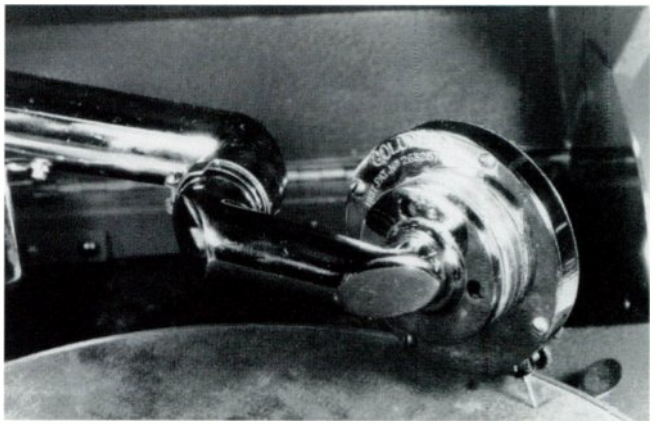
If the sides of a tone-arm are not parallel, the sound doesn't have to bounce around so much to get out of the tube. Eldridge Johnson, Victor's founder, took out a patent on this type of "tapered" tone-arm and took the oomph out of a lot of people's waves by forcing them to make inferior tone-arms with straight sides. Columbia managed to swap some patents with the Victor company and, as a result, Columbia is about the only company other than Victor and Victor affiliates (HMV, Zonophone) legally allowed to make tapered arm machines.



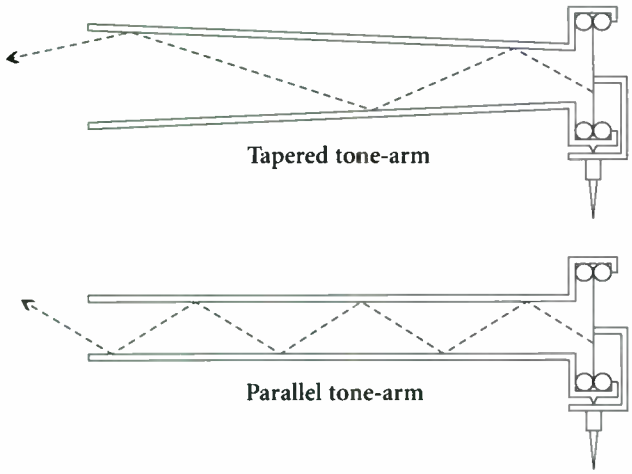
If you drop a rock in a quiet pool, waves radiate out from the spot where the rock hits the water. The distance between the top of any two adjacent waves is always the same.



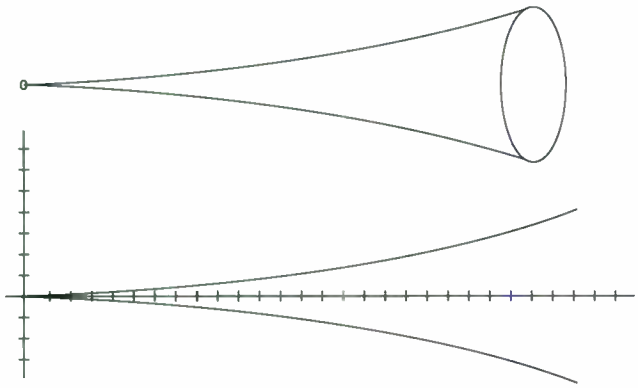
If you pluck a string, the number of times it vibrates per second is the "frequency." One complete vibration is called a "cycle."



A Columbia plano-reflex tone-arm from an English model 202 from 1929. The flat surfaces direct the soundwaves more efficiently than a curved tube.



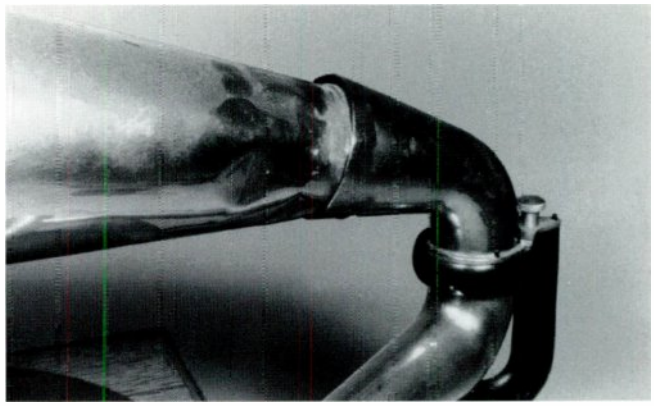
The tapered tone-arm allows soundwaves to escape with fewer reflections than the parallel tone-arm.



The exponential horn

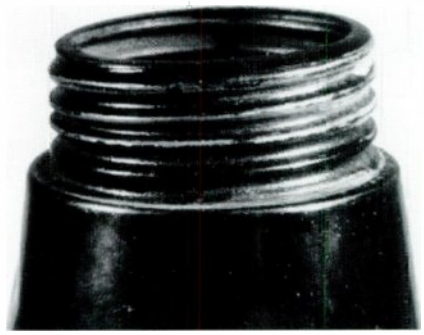
For really good results, the horn, too, should continue this taper. This continuous taper makes up what is known as the "exponential horn" because of the mathematical calculation used to work out the proper flare. This type of horn looks rather like a long morning-glory. Most horns don't actually follow the mathematical specifications slavishly for aesthetic and practical reasons, but the form is similar. Horns with straight sides, such as the early brass witch's hat, just don't direct the soundwaves as well.

The longer the horn, the better the bass response. That's because bass wavelengths are very long and the horn must be even longer if it is to control them. That is why a short horn lacks the quality of a large (longer) horn. In order to save space, a long horn can be folded or curved (not to be confused with folding horns), as seen in the Victor Orthophonic gramophone and the Edison Cygnet horn. "Cygne" is French for "swan."



A poor horn fitting on a Victor Machine

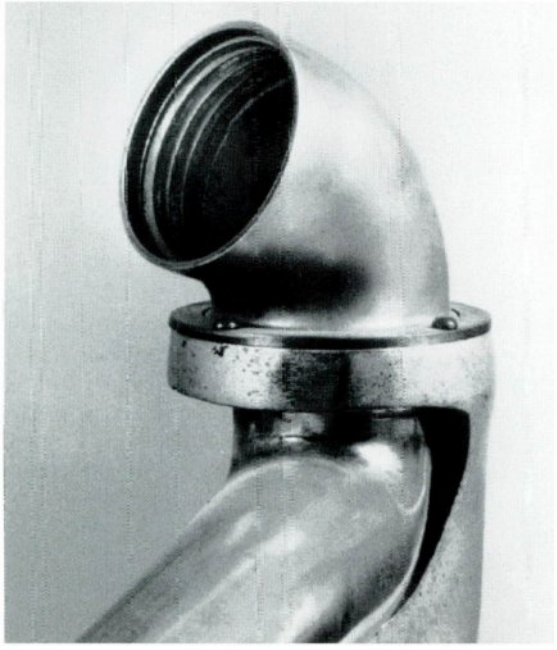
A fairly good Victor horn fitting.



A Columbia threaded horn fitting.

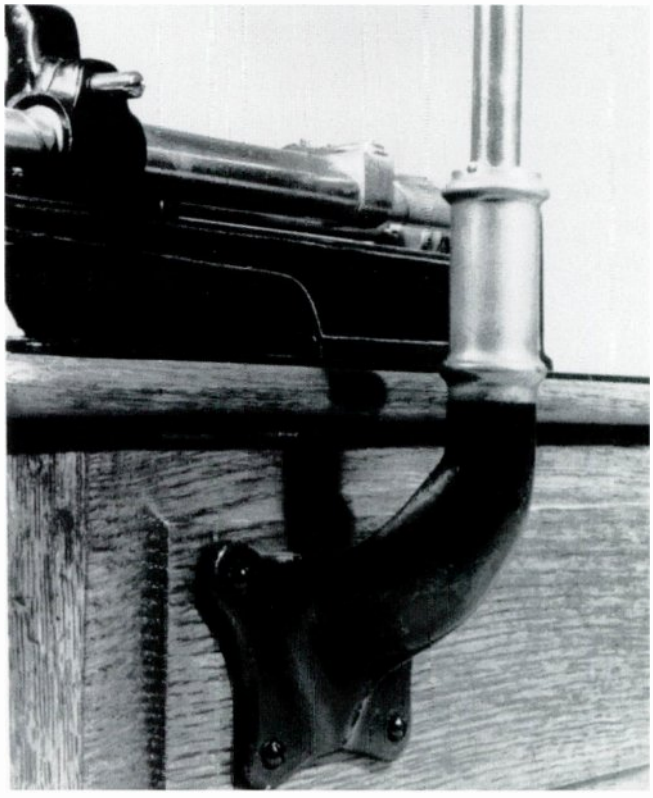
The Talk-O-Phone has a special threaded flange inside the horn which screws into the elbow.

The rivet on the horn fits into a diagonal slot in the Victor elbow.

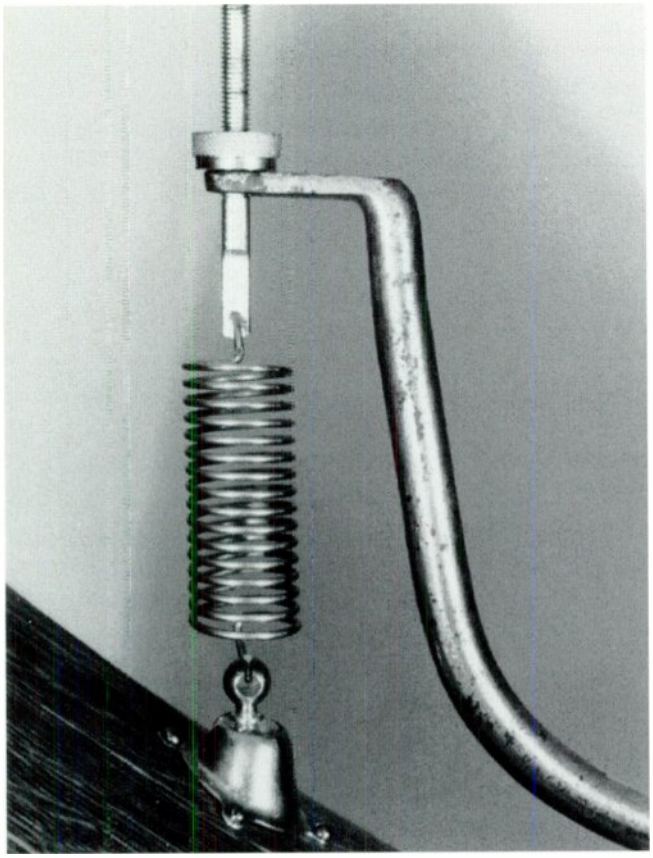


The special threaded Columbia elbow.

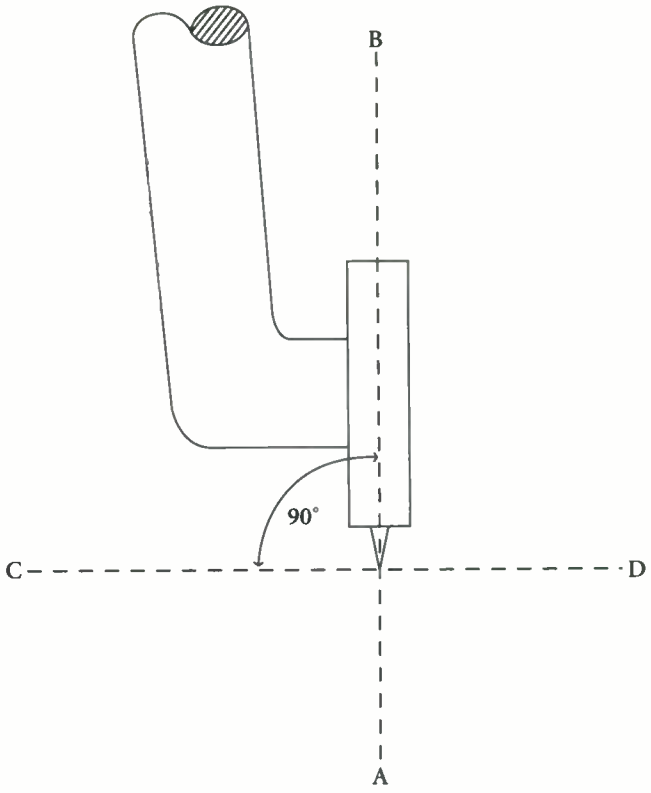
The Edison Cygnet horn.



A detail of the Cygnet crane mounting. Four screw holes on the rear of Edison cabinets usually indicate that a similar crane was used at one time or another.



This spring keeps the weight of the Cygnet horn off the carriage.



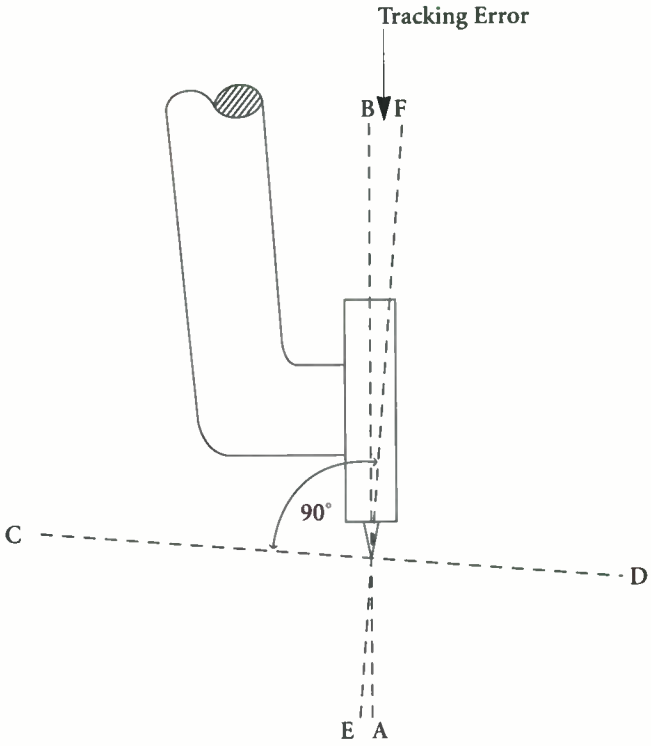
What a tone-arm should do, but rarely does! Line C-D ought to pass through the spindle at all times as the tone-arm travels across the record.

Tone-arm tracking error and offset

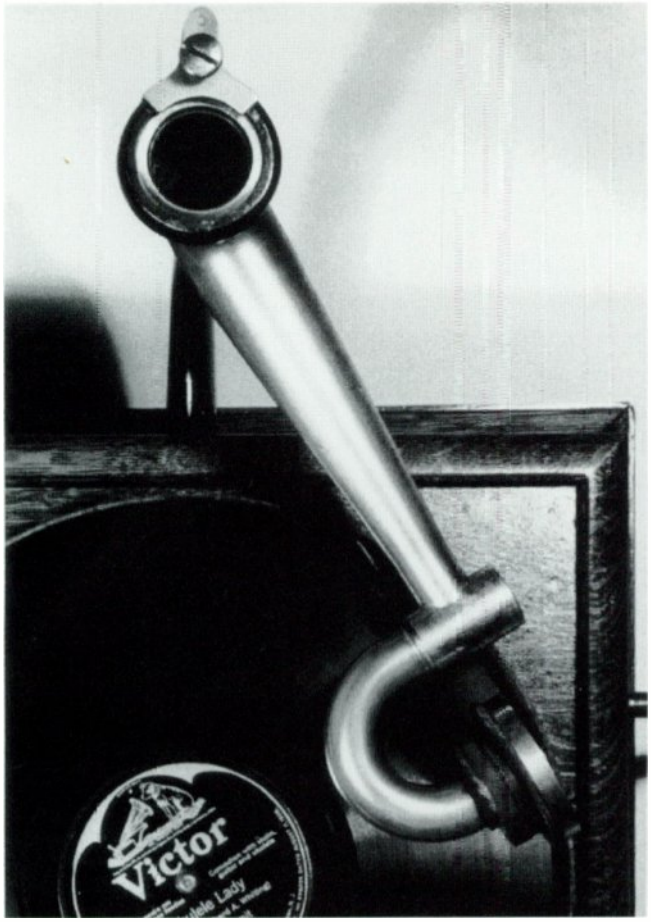
When disc records were originally recorded, the cutting stylus moved in a straight line from the edge of the record towards the center spindle. For the reproducer needle to track correctly, it should, ideally, follow the same path as that of the recording stylus. Modern tangential-arm turntables do just that. Because the conventional tone-arm swings in an arc from the edge of the record to the center, the tone-arm length and the angle of the reproducer are very critical, the idea being to keep the degree of error from the ideal reproducer angle and that of the actual angle to a minimum.

If you draw a line through the tip of the needle, parallel to the reproducer diaphragm, and draw a second line at 90°, also through the tip of the needle, this second line ought to pass through the center of the spindle. As the reproducer moves across the record, the line should continue to pass through the spindle. Well, the sad fact is, it rarely does in machines made before about 1925. Failure to track in the proper manner results in chewed up records and *audible* distortion.

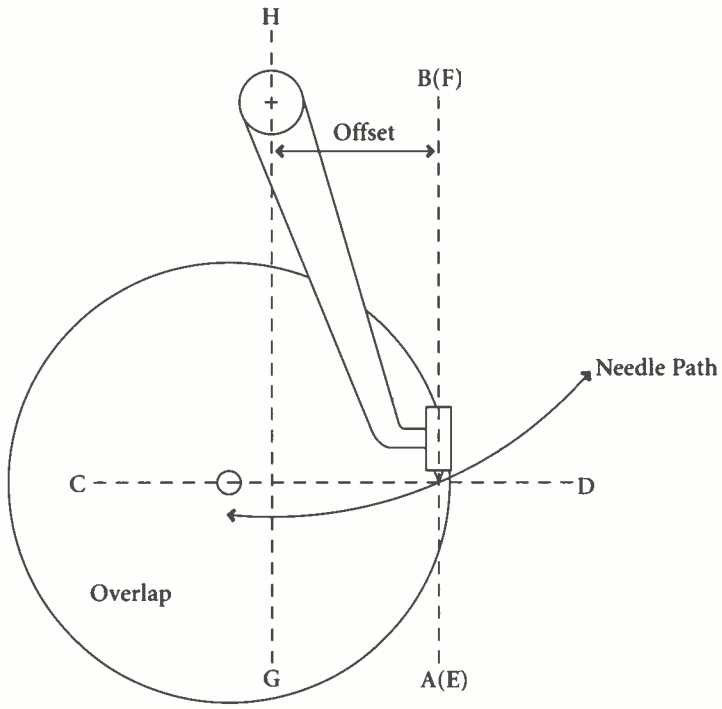
Now that you know what the tone-arm *should* be able to do, let's see how bad things actually are on any given machine. To start, draw a new line through the



In this diagram, line C-D passes through the spindle, but is at right angles to line E-F rather than A-B!



The Victor II has no offset whatsoever!



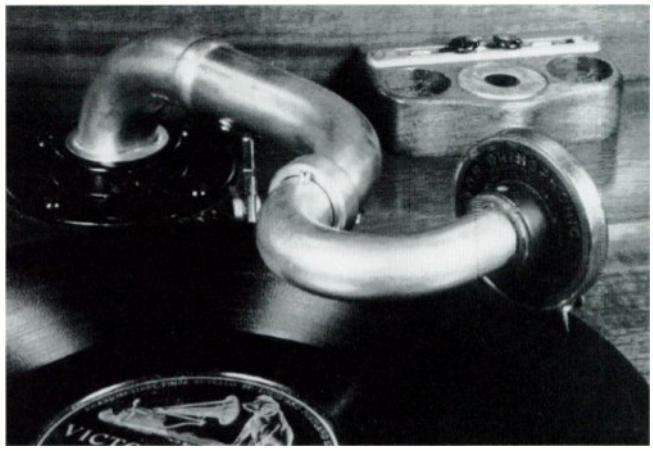
This diagram shows a tone-arm with "ideal" offset. Try tracing the tone-arm onto a piece of thin paper and see how the reproducer remains at right angles to the spindle as the arm travels across the record. There is almost no tracking error until the reproducer is very close to the spindle.

needle, parallel to the diaphragm and call it A-B. Next, draw a line from the spindle, passing through the tip of the needle and call it C-D. Finally, draw a line through the needle at 90° to the line C-D. Call this last line E-F. If lines A-B and E-F are one and the same, things are looking good. If they aren't, measure the angle formed at the needle by lines A-B and E-F. This will give you the tracking error. Anything higher than about 2° will result in a great deal of record wear. Anything above 12° is a disaster. The Victor II, despite the fancy tapered tone-arm, has a tracking error in excess of 17°! This then, is *not* a machine to play rare records on!

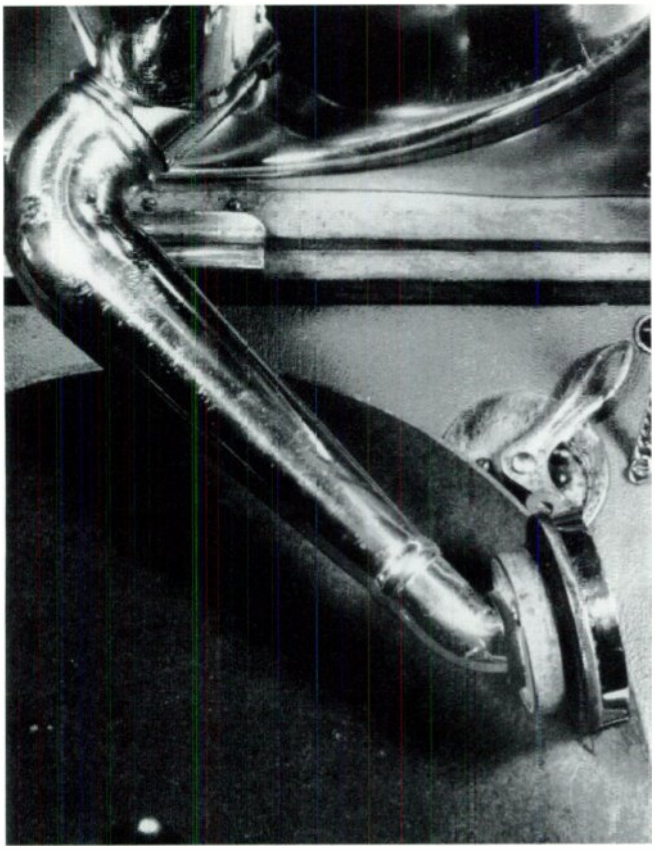
Before we can pass final judgment on the tone-arm, we need to know one more thing—the offset. If we draw yet another line, G-H, parallel to line A-B, passing through the tone-arm pivot point (this will be the same as line A-B on most early machines), we can now measure the offset. The offset is the distance between lines A-B and G-H. The "ideal" offset will be 3 ¾". 2 ¾" is acceptable and anything less than this is awful. Two strikes against the Victor!

In light of the fact that Victor, Columbia, and many others made such a fuss about tapered tone-arms, it's surprising that little was done about tracking error and offset for almost 25 years! The Gibson tone-arm found on some Zon-O-Phones, is one of the few early attempts to correct matters.

Tone-arm length, measured in a straight line from the tip of the needle to the pivot, is important if the ideal offset is to be achieved. Any tone-arm with a length under 8" cannot have an ideal offset. The chart



The Victor Orthophonic of 1925 has a much better offset and less tracking error than its predecessors.



Despite the short tone-arm, this Decca portable from about 1914 has a fairly good offset and minimal tracking error.

shows the relation between offset, tone-arm length, and the resulting "overlap," an indication of how far the needle goes past the center spindle. The chart comes from an English magazine called *The Gramophone* and was worked out by their committee of experts during the late 1930's.

Although it is certainly not my intention for you to butcher tone-arms in order to correct the offset, the Victor tapered tone-arm, by virtue of its easily removed gooseneck, lends itself to experimentation. I understand that some dealers are considering making replacement goosenecks for Victor machines which will change the reproducer angle and reduce the tracking error. *Please don't destroy original parts!* I'm only interested in preventing you from destroying records on badly-designed machines.

Tone-arm length in inches

Offset in inches	8	8 1/2	9	9 1/2	10	10 1/2	11	11 1/2	12
2	0	0	0	0	0	0	0	0	0
2 1/4	3	3	3	3	3	3	3	2	2
2 1/2	6	6	6	5	5	5	5	4	4
2 3/4	9	9	9	8	7	7	7	7	6
3	13	12	11	11	10	9	9	9	8
3 1/4	16	15	14	14	13	12	12	11	11
3 1/2	21	20	18	17	16	15	15	14	13
3 3/4	25	24	23	21	20	19	18	16	16

all overlaps indicated to nearest 1/32"

The great "Wooden Horns Are Better" controversy

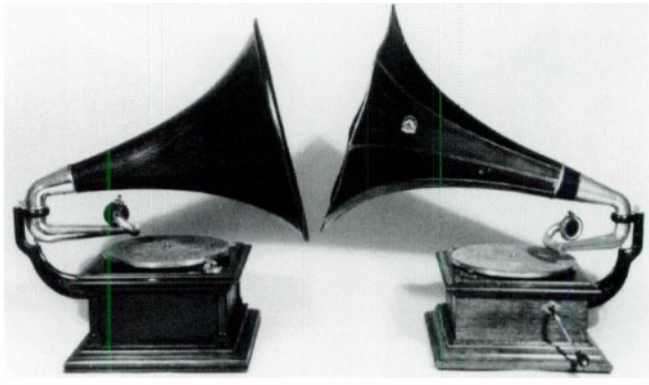
Every collector "knows" that wooden horns are better—at least when the time comes to sell a machine. Most of them also know that wooden horns also sound better. Actually, "better" is a matter of taste. Wood is softer than metal and therefore absorbs more energy from the soundwaves. As high frequency waves are more easily absorbed, a wooden horn will remove more of the hiss and scratch on a record. It's kind of like the high-frequency filter on your pre-CD stereo.

In curved horns such as the Cygnet, the soundwaves don't have a chance to escape directly out the bell, but *must* hit the horn at one point or another. Again, some of the high frequencies are absorbed before they can escape.

Before the era of electrical recording, most of the high frequency range simply didn't register on the recording stylus. This means that if you play a good electric recording from the 1940's on your mahogany-horned Victor from 1906, the high frequencies on the record get muddied or lost, along with the hiss—and a little music.

In short, if the recording is poor and scratchy, a wooden horn works wonders. With a good recording, you may well find that a metal horn sounds clearer.

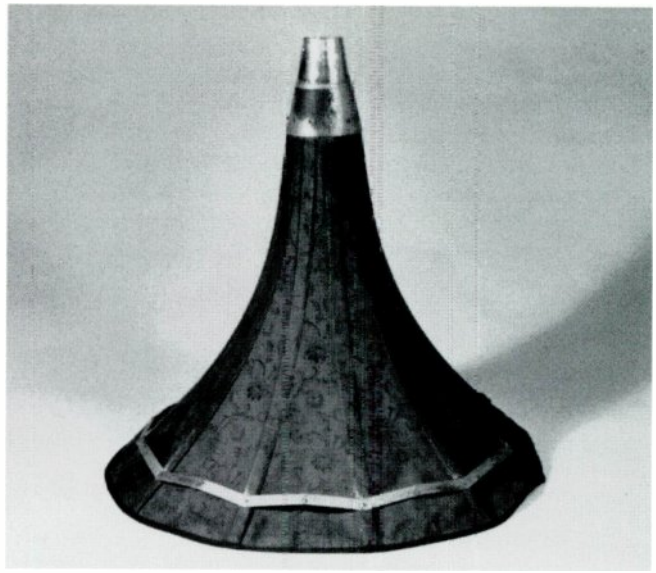
If you think about this business of sound absorption and reflection for a moment, you will also understand why rust, dents, and bad horn connections in particular, affect the acoustical qualities of your machine. Some of these faults can only be heard by the electronic "ear" and not the human one, but nonetheless, they *all* make a difference.



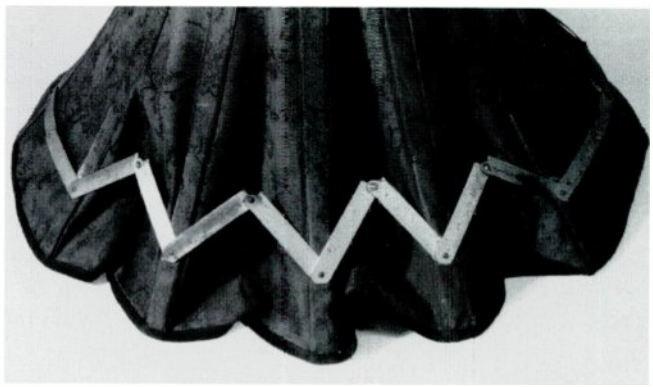
Everyone knows that wooden horns are better...or are they just more expensive?

This Decca portable from 1922 has a folded horn—actually a simple concave reflector.

Other interesting horns from the turn of the century are made of cloth, papier-maché, leather, or are steel with a silk covering. The cloth horns are generally of the folding variety and are lightly shellacked to provide a harder reflective surface. Although the construction is interesting, and they may have been practical on a picnic, they don't really sound very good since most of the bass soundwaves pass right through them and the treble is absorbed. The fact that they can fold is a neat party trick, but usually they are much too fragile to play with. The papier-maché and leather horns are about equal in acoustic performance, but are often structurally too soft to do a really first-rate job. The silk covering on steel horns was meant to absorb resonances in the metal. The audible difference is minimal.



An early folding horn. (Walter Bellm collection)



A detail of the folding horn. A nice party trick, but an acoustically poor invention.

Cosmetics

A great controversy rages as to how far to go with regard to cosmetic repairs. Some collectors are annoyed by a single marred screw and take great pains in order to obtain a "perfect" machine. The other extreme is best represented by a fellow I know who refuses even to dust his relics. "Nobody's monkeyed with this baby since it left the factory!", he says with pride.

Far be it from me to tell him what to do with his collection, but I think that normal cleaning and adjustment is no great crime. What *is* a crime, however, is to allow machines to deteriorate even further or to "over-restore" them.

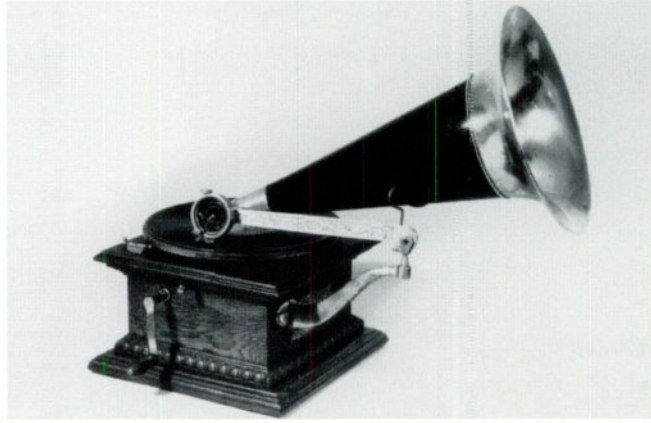
Over-restoring is a little difficult to define, as everybody seems to have his or her own opinion on the subject. *My* opinion is that any machine which has improvements not in keeping with the original intentions of the maker should be considered "over-restored." Accessories, such as special flowered horns, cranes, repeating devices, additional gearing for two- and four-minute cylinders, etc., are completely within the realm of options available to the original owner. As such, these are quite permissible. In fact, these extras are often what make a machine interesting. However, chrome plating of nickeled parts or nickel plating of parts that were never plated, as well as high-gloss epoxy finishes are definitely cases of "over-restoring." Removal of plating in order to reveal the polished brass underneath is actually a kind of "under-restoring" but is almost as bad.

Although I don't know of any phonograph "meets" with judging along the lines of antique car competitions, this too may come, and the guidelines used by car restorers in their work are not entirely irrelevant. The key points in judging a car are authenticity, workmanship, and overall appearance.

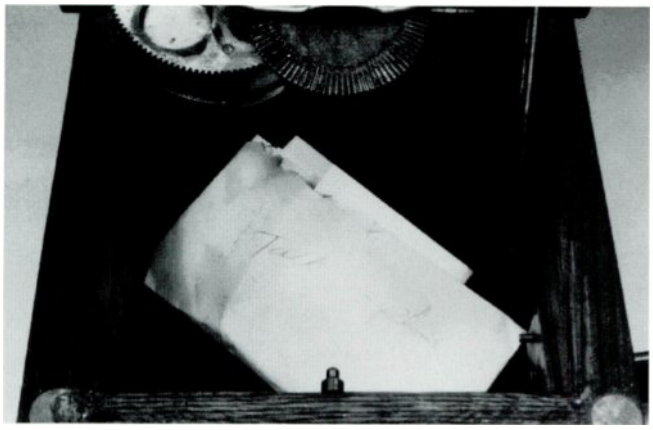
Historical building restorers have coined a word that is perhaps even more relevant. "Reversibility" in a restoration means that whatever repairs are undertaken can be redone (or undone) at a later date without harming the item in question or removing something that cannot easily be replaced.

Perhaps the most irreplaceable things on a phonograph or gramophone are the original finish of the case, original decals, original plating, and the paint on the horn. Removal of any of these things may well result in the loss of historically interesting details, and this can hurt the value of the machine in more ways than one.

A Talk-O-Phone "Brooke" as it was found in an attic.



A tremendous amount of improvement can be made in the appearance of a machine without destroying any valuable features. The "Brooke" cleaned up nicely during the course of a single afternoon.



This envelope contains details of the work done to the machine, plus some pictures. Perhaps this information will be of interest to some future restorer.

Paint, particularly on horns and bedplates, ought to be preserved if possible. Generally speaking, the greater the rarity of the machine, the less you should restore. Tinfoil machines, early electric Edisons, Bell-Tainter Graphophones, etc., are examples of machines that should not be altered.

Before you plunge into a repair job, make sure that the repairs you undertake represent a genuine improvement in the quality of the machine. This is stressed at various points throughout the rest of this section. However, the machine is yours, and if you want to paint the whole thing "hot pink," that's your business.

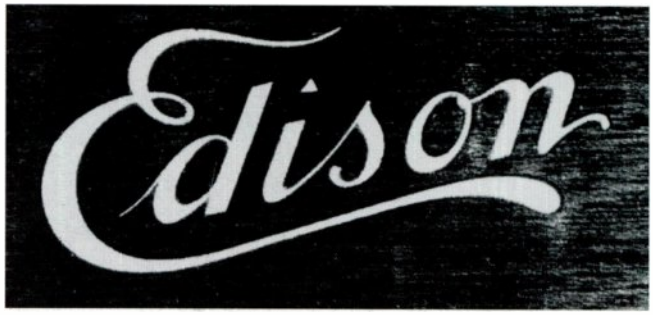
Another thing to keep in mind when starting a restoration is the visual harmony of the finished machine. Restoring things that are not in need of restoration is a waste of time and often harmful, but in certain cases, it may be necessary to replate or refinish undamaged parts in order to obtain uniformity of appearance.

When starting a major repair, I often take "before and after" pictures. These pictures are kept in an envelope, along with a brief description of the repairs I've made and any known details of the machine's past history. Any stripped gears, small screws, etc. that have been removed are also put into the envelope. I then drop the package in the bottom of the machine. I'm not sure how valuable this information will be to a future owner, but it could be interesting in years to come.

Decals

New vs. old

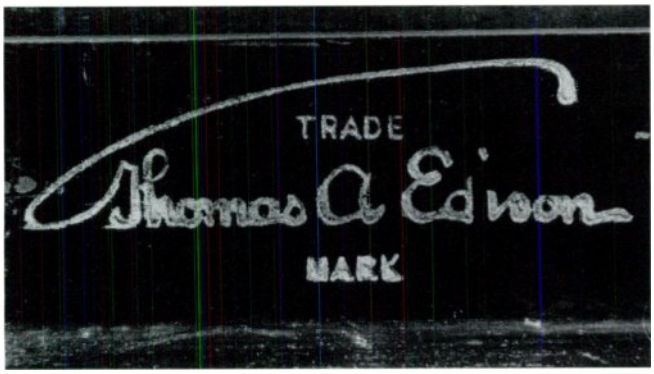
The truth is, most new decals just don't look like the old ones. A lot of old decals simply aren't available and the restorer must either preserve the old decal or make do without. Usually, the old decal can be carefully avoided during refinishing. The question is whether you should preserve it if the decal itself is scratched, worn, or obliterated by cracked varnish. I think most collectors agree that if the decal is on a very rare machine, or is not available in a high-quality reproduction, you are better off saving it.



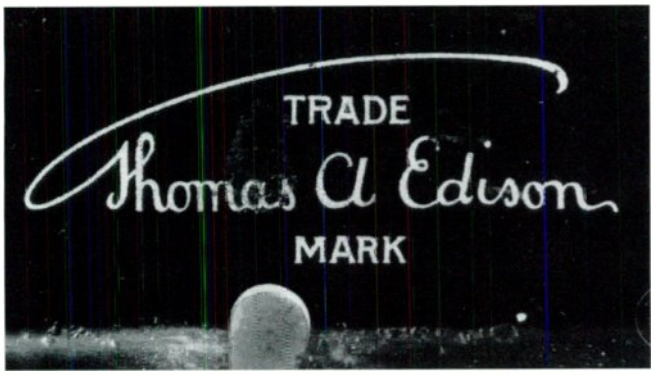
An original Edison decal.

Old decals are varnish transfers, and as such, do not have the visible thickness of the easy-to-apply water transfers available today. Decals on bedplates, such as

Top: extremely poor reproduction decal. Note the thick, clumsy lettering and incorrect dot over the "i."
Middle: slightly better, but by no means good.
Bottom: a reasonable reproduction. Unfortunately, the gold lettering has a greenish cast and is not very pretty.



The pre-1907 Edison signature.



The post-1907 Edison signature.

the Thomas A. Edison trademark, are often not decals at all, but were applied using a silk-screen process.

Very few modern decals have the color and detail of the originals, and some are just plain badly drawn. All in all, there are many excellent reasons for leaving the old decal alone. With the exception of cracked varnish, which is discussed under cabinet refinishing a little later, decal damage usually cannot be repaired satisfactorily.

A few words about new decals

If you decide to replace a decal, make sure that you obtain the best possible reproduction. The well-known "Edison" signature, which appears on the front or inside lid of the great majority of his machines, has been reproduced by many different people. I have yet to see two decals that look alike—despite the fact that Edison managed to make uniform decals for over 25 years! Let me point out a few differences to look for. First, the dot over the "i" in original decals is actually a small triangle. This is often changed to a circle or half circle in bad reproductions. Many bad reproductions also have thicker lettering than the original and lack the grace and "swing" of Edison's own product. This can easily be seen in the "tails" on the "E" and the size of the open parts of the "d" and "o."

This "restorer" has repainted a decal with hobby enamel. An otherwise fine case will now have to be stripped in order to remove the damage.

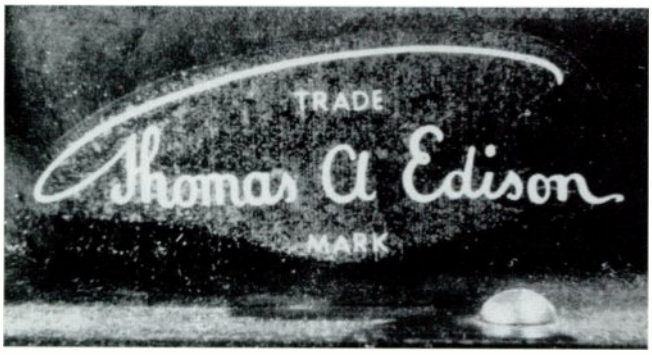
Because of the problems associated with new decals, you are advised to have the reproduction *in your hand* before you remove the old decal. Check for differences in patent information, places of manufacture, etc. For example, if you are lucky enough to own one of the very first Columbia A models, the lower right hand corner of the banner will state that the machine was made in Washington, D.C. As far as I know, all the reproduction decals have a later text that reads "New York - Paris - Berlin - London." It would be a big mistake to remove an original "Washington D.C." decal in *any* condition due to the rarity of that particular model. Columbia had a number of different decal variations and replacements should be checked carefully.

Edison's "banner" transfers changed from time to time, and replacements should be checked for accuracy. To take the case of the Edison "Home," the earliest models had *no* decal at all and should not receive one at the hands of an enthusiastic restorer. Shortly after the start of production, a banner with red lettering was added to the lid, which in most cases does *not* resemble the later banner with black lettering, placed on the base of the case. There are a few exceptions to the rule since

This Talk-O-Phone decal adds a lot to the machine's appeal and would be difficult to replace.

A detail of an early Columbia decal from a model A.

A detail of the Columbia decal from an early model AT.



This reproduction decal was allowed to soak too long before it was mounted. As a result, there are ugly white blotches behind the decal.

Edison apparently started putting banners on the base before he ran out of his old stock of decals.

After about 1907, Edison changed the lettering in his small trademark signature. Again, make sure that the replacement you obtain matches the original decal you destroy. Most American suppliers have a range of decals for the more common machines, and in recent years the quality has improved tremendously. Some excellent varnish transfers are also starting to appear on the market. The City of London Phonograph and Gramophone Society also has an excellent assortment of Edison and Columbia decals, as well as a sheet filled with Pathé, Excelsior and other hard-to-find transfers.

Replacing decals

Most modern decals are water transfers, just like the ones used on model airplanes. After a brief soaking in lukewarm water, the transfer slides off the paper backing and can be positioned on the machine. Small air bubbles should be squeezed out and the decal left to dry. You might want to blot it with a towel.

In order to avoid seeing the clear edge surrounding the decal, it is possible to trim this off with scissors before soaking. In any event, a thin coat of varnish applied over the decal will minimize the visual difference in the surface of the decal and its surrounding area. When applying decals that cannot be cut out, such as the Edison trademark on bedplates, it is important not to soak the decal too long. Otherwise, sections may lose their adhesive qualities, which results in visible white spots underneath the clear portion and may cause peeling later on.

Making decals

If you are a good silk-screener, it is possible to make decals yourself. The basic idea is to silk-screen an area slightly larger than the printed decal area onto a sheet of slick paper with a clear glue. The printed portions are then printed on top of the glue. When the paper is soaked in water, the glue releases the paper and the printing can be restuck onto something else. Special products for making decals and transferring complicated lettering to the screen are available from large art supply houses. Professional decal makers can be found in the Yellow Pages if you do not wish to do the work yourself. Good original artwork is critical in the production of decals and you would be well-advised to talk to someone who has access to a good graphic computer and a scanner for advice and assistance.

If you need to scan an original image, I've been able to take color photos and use these as the basis for the new artwork. Even so, cleaning up the image (I use Adobe Photoshop) is very time-consuming and requires good knowledge of the graphic software involved.

Assuming you have usable artwork and are not interested in producing a series of decals, 3M has developed a product for making pressure transfer letters called Scotchcal. With Scotchcal, you can make a "black on clear" pressure transfer, which can be placed over an area previously painted in the proper background color. This is not inexpensive, but can be used with good results. Details about the materials and further instructions can be obtained from large art supply

stores.

I have heard that it will soon be possible to electronically transfer scanned images to special color printers, which will produce thin, peel-off stickers. However, I haven't seen this in real life as yet.

The cabinet

General cleaning

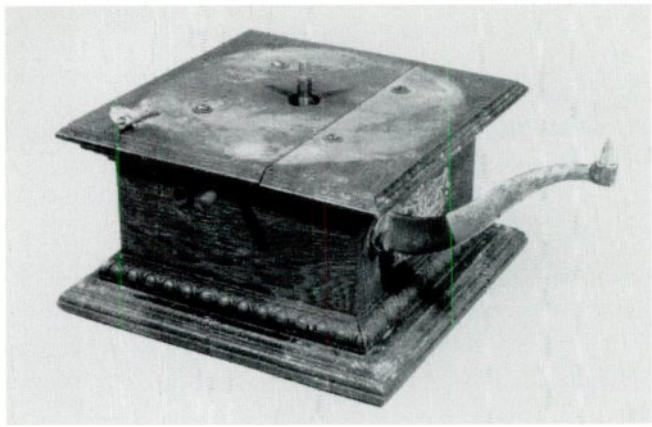
Cabinets can be cleaned up to an amazing degree without resorting to stripping and refinishing, provided the original paint or varnish is intact and hasn't become "alligatored" over the years. There are a lot of products on the market for rejuvenating an old finish. "Kotton Klenser," available from many antique shops, is one of the better-known products. However, you may get better results with one of the following methods, which are also considerably cheaper.

Texize makes a wonderful product called "Fantastik," which I think is one of the all-time great cleaners. What Fantastik does is to slightly soften the paint or varnish on the surface of something and remove the grease and dirt along with some of the finish. By spraying Fantastik on the surface of a cabinet and carefully rubbing with fine steel wool (0000), many small marks and scratches, and even light cracking, will disappear. Further spraying and polishing with a rag will restore a gloss to the surface. This process also works wonders on dirty and dull bedplates and painted horns. Care should be taken around striping and decals so that the steel wool doesn't cut too deeply. If you polish through the old varnish, you will have to refinish—so take it easy.

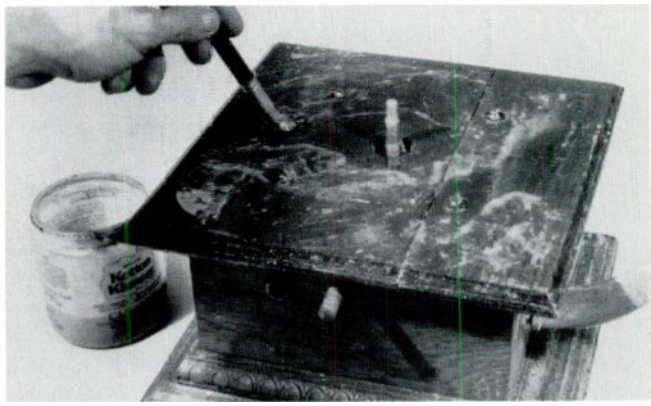
If the finish is very dark, Old English "Scratch Cover" will color in any deep scratches. Another good mixture for cleaning and polishing the cabinet has the following recipe:

26 oz. trichlor-ethylene
1 oz. amyl acetate
1 oz. kerosene (also called paraffin oil)
1 oz. French turpentine (vegetable)

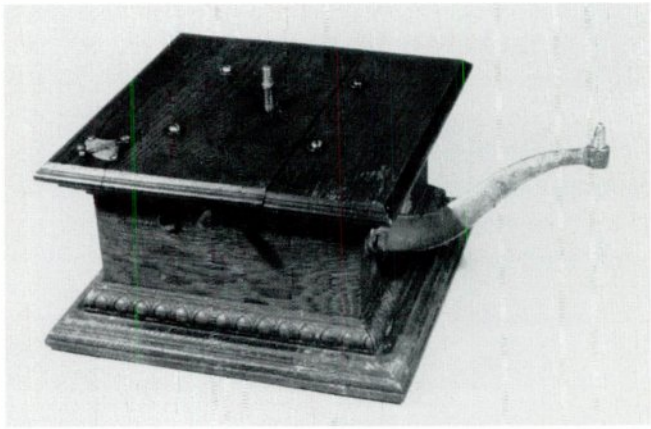
Shake the mixture well, apply a thin layer of the liquid with a cloth and let it dry. Make sure that there is adequate ventilation. After about 10 minutes, the surface is dry and covered with a whitish haze. This can now be polished with a soft cloth to give the cabinet a shine. If you use the mixture over decals or striping, care should be taken not to rub too much until the surface is dry. Otherwise you may rub them off. This concoction can give stunning results and is cheap to make. Paint and hardware stores, as well as some pharmacies, normally have these ingredients in stock. By the way, store it in a glass container. It has a tendency to slowly melt plastic.



A Talk-O-Phone cabinet before cleaning.



Cleaning the motor board. I'm using Kotton Klenser here, but could just as well have used one of the other concoctions mentioned in the text.



I was so inspired by the great results obtained on the motor board that I didn't wait to do the rest of the cabinet before taking the picture! However, I think you get the general idea.

Repairing and refinishing the cabinet

Broken cabinets

Furniture repair and refinishing is discussed at length in other books, and if you are not familiar with George Grotz' *The Furniture Doctor* (or one of his many other books on the subject), I would suggest you get hold of a copy. He is always delightful to read and his books are filled with useful information. The remarks in this section "barely scratch the surface" so to speak.

If the cabinet is broken, it will be necessary to reglue the various pieces. The old glue is usually of a type known as "hide" glue and is very susceptible to dampness. That's why machines that have been stored in damp places so often have peeling veneer. However, hide glue sets up rapidly and joints can be broken apart again at some later date if necessary. Hide glue is made from cow—or horsehide crystals, which are melted in a special glue pot, actually a little double boiler. The glue is applied with a brush.

A simple glue pot can be made by immersing a tin can in a pot of boiling water. The glue crystals are poured into the can and water is added—just enough to cover up the crystals. After a short time (a little stirring helps), the glue has melted and is ready to use. If the glue gets too thick, it can be thinned with a little more water. It's not necessary to clean the can or use up all the glue since it can always be remelted.

After scraping off the old glue and obtaining a good "dry" fit, the cabinet is best reglued with the hot glue just described. If you don't have experience with hot glue and don't particularly care to get any, there are a number of substitutes available which do not require heating. One such product is Weldwood's "Liquid Hide Glue." This also allows the joint to be broken apart at some future time, although this liquid glue requires a fairly long clamping time. Yellow carpenter's glue sets up much faster, and good old-fashioned white glue is something of a happy medium. Excess glue (any of the three named) can be removed with a damp rag. The biggest problem with white glue is that it is very difficult to take things apart again, and the dried glue cannot be sanded down in a satisfactory manner. Superglue is also good for fixing loose joints and veneer.

Extra holes in the case, usually indicating an exchanged motor, can be filled in with plastic wood or a dowel and reveneered. Repaired holes are difficult to hide by means other than veneering.

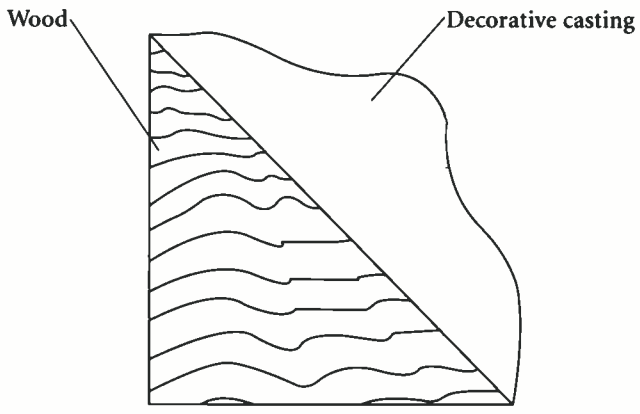
Missing cabinet pieces

I sometimes wonder how parts of cases get lost. I once saw an otherwise perfect floor model machine that had lost an entire side. If you're missing part of the case, you will have to make a suitable replacement. If this is beyond the capability of your workshop, any good lumber mill will be able to do the work for you or refer you to someone who can. I once got a local high school woodshop to mill a piece of molding for me.

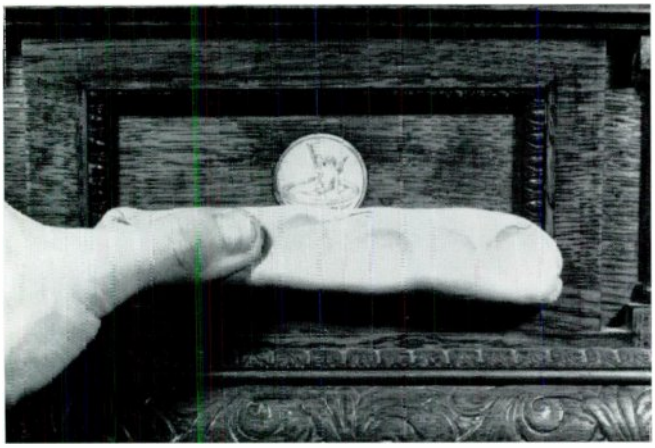
Smaller pieces of molding, often with embossed designs, are frequently missing simply because they fall off and not because of vandalism. These are in many ways easier to make. If any unharmed section of the molding is still intact, it is possible to make a mold in modeling clay and to cast the missing piece in plastic or plastic resin.

To do this, you simply press the clay into the design and carefully peel it off. This will leave an impression in the clay which can be filled with a suitable casting material, plaster for example. It is rarely necessary to cast the entire missing piece, but only those ornaments that would be difficult to carve in wood. The rest of the

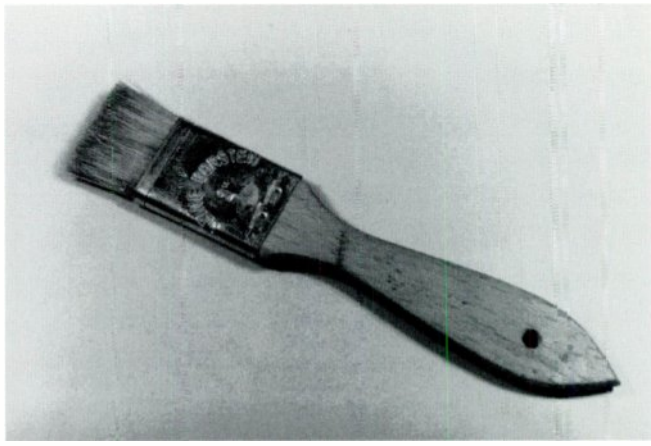
A glue pot and a packet of glue crystals.



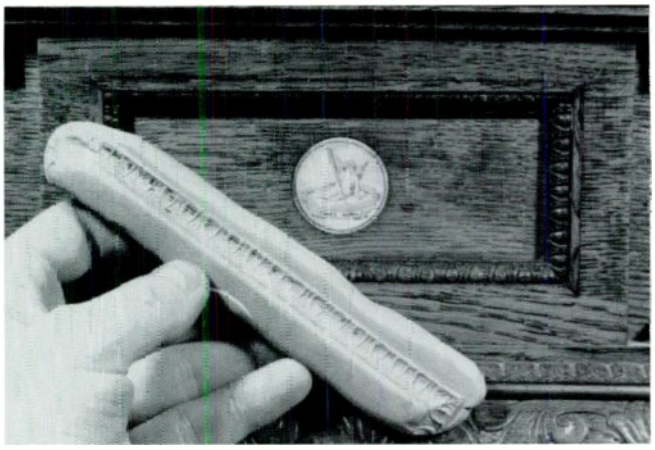
Building up a decorative molding.



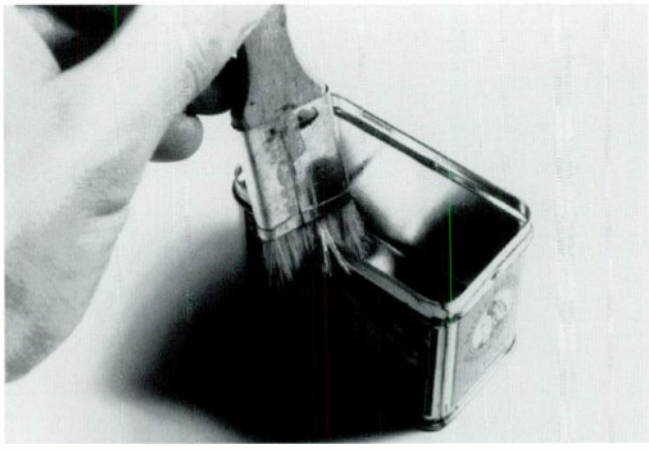
Preparing a clay model in order to cast a missing piece of molding.



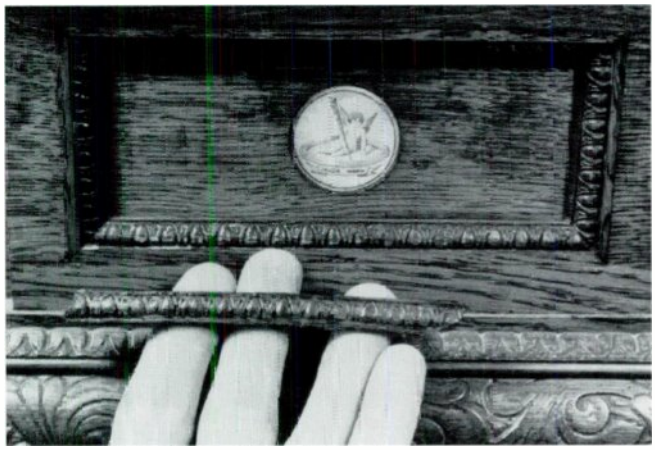
A short-bristled brush such as this is great for simple wood graining.



The impression in the clay can now be filled with plaster, epoxy or any other suitable material.



The bristles can be bent out of shape on the edge of a can in order to produce a coarser grain.



The completed casting (in flexible epoxy), painted and ready to be glued on the cabinet.

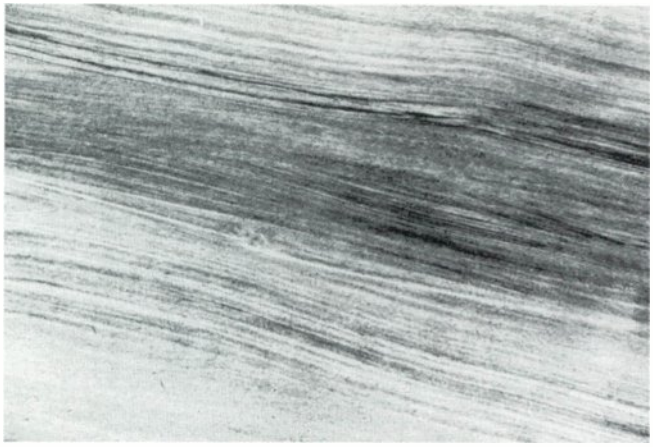
missing piece is made from a suitable length of wood molding to which the casting is glued.

The casting must now be painted to match the rest of the cabinet. You do this by painting the new piece in a shade that is close to the *lightest* shade in the wood you are imitating. Use a flat, turpentine-based paint and seal it with shellac. When this is dry, the grain of the wood is painted on using one or more darker shades. Darker shades can be toned from the lighter one by adding the pigment "raw umber."

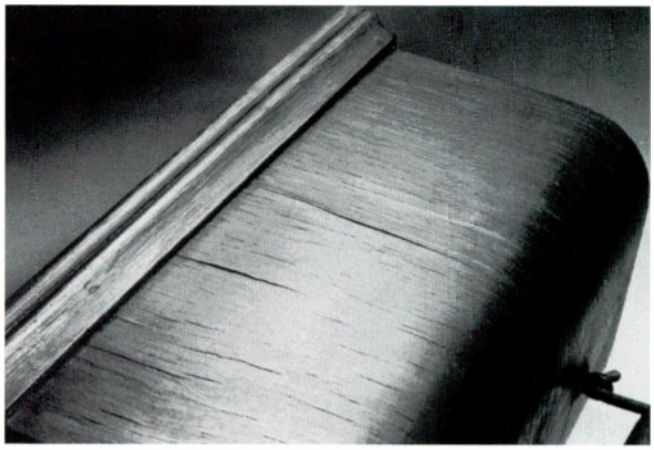
The process is just like using an "antiquing kit" from the paint store, but instead of painting the dark color on and wiping it off with a rag, the darker color (or colors) should be applied with a little more care so that the new piece blends with the old. An old, stiff paint brush with short or cut bristles is excellent for both applying the darker shades and streaking them to produce the grain. Make sure you use a slow drying paint so that you can wash off any botched attempts and start fresh.

Being able to paint wood grain is a very useful talent to have, especially when it comes to mashed corners and other damage repaired with wood filler, which rarely stains properly.

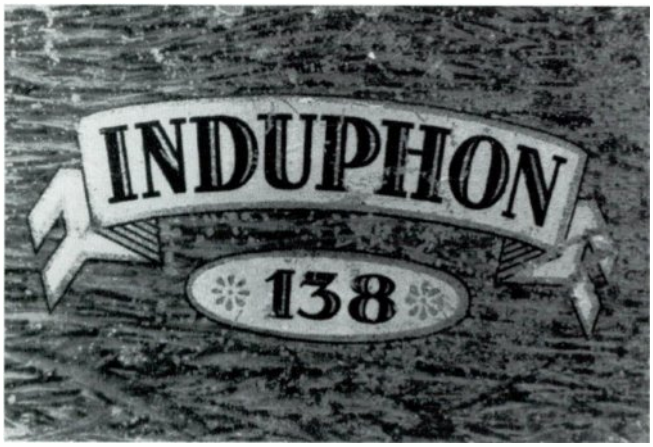
If the case damage is so serious that repair is not practical, reproduction cases, new moldings, and even



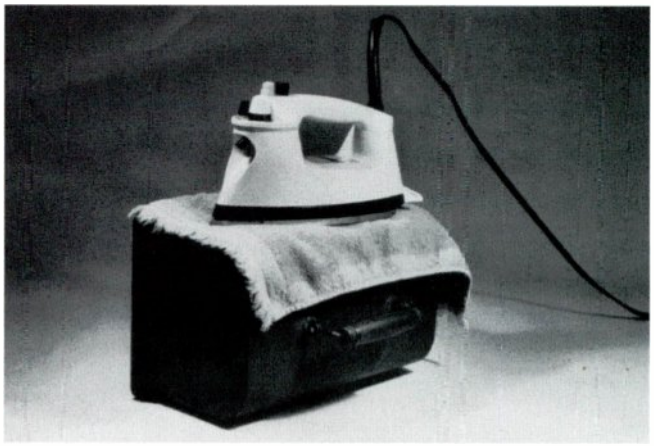
A fairly simple painted wood grain produced with the short-bristled brush. Woods with characteristic grain patterns, such as oak and mahogany, require more artistic ability, especially if large areas are to be painted.



If enough glue remains underneath lifting veneer, it can often be reglued with an iron.



Note the wood grain effect on this inexpensive German tinplate machine. Even though the stylized grain is not well painted, repainting would be a crime.



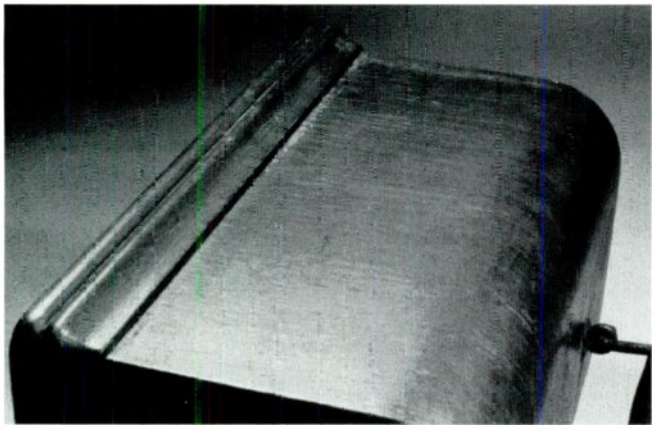
Use a low heat setting and protect the surface with a towel.

some genuine cases are available from several suppliers. These are not always listed in the catalogs dealers send out, so make sure to write and specifically tell them what you need. I never cease to be amazed at what they have stuffed away in their shops.

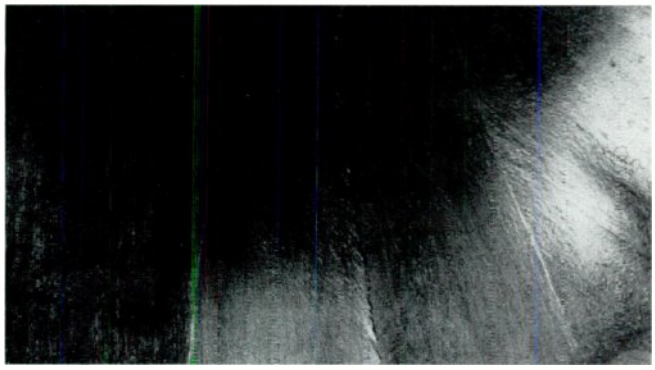
Repairing veneer

Often, veneer is peeling or missing due to water damage. If the veneer is only bubbled up or loose, but not broken, it is sometimes possible to iron it down. I mean this quite literally. Because the old hide glue can be remelted, an ordinary household iron will soften the glue and refasten the loose veneer. Protect the surface of the wood with a few old towels before applying heat. When the glue has melted, either clamp the veneer down or lay a heavy weight on top in order to hold everything in place while the glue cools. Large blisters may need to be cut open with a razor blade and any overlapping of the two sides will have to be trimmed off. Finally, use a very low iron setting or you may melt the finish. Don't let the iron sit on the cabinet very long for the same reason.

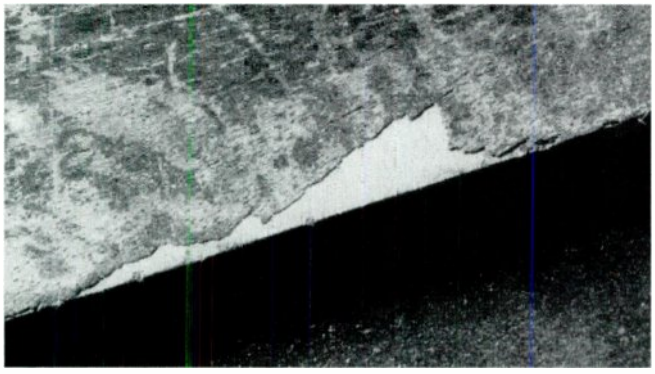
If there isn't enough glue left because it has powdered and fallen out, or if there is too much dirt underneath the veneer to allow it to sit flush with the surface, you will have to break off the old veneer, clean off the old glue, reglue, and clamp. Break the veneer—don't cut it. A break is less visible than a cut when the repair is completed. Blisters don't usually need to be cleaned out and it is possible to use a hypodermic needle to shoot new liquid glue underneath if the blisters are relatively small. Superglue is great for gluing small blisters. Larger blisters may need to be cut open by scoring a large "X" with a sharp knife, neither cut going directly with the grain, so that you can clean under each flap. New glue is applied and the blister is then pressed down



The finished result.



Cracks and bubbled veneer on a wood horn like this, are best left to experienced restorers.

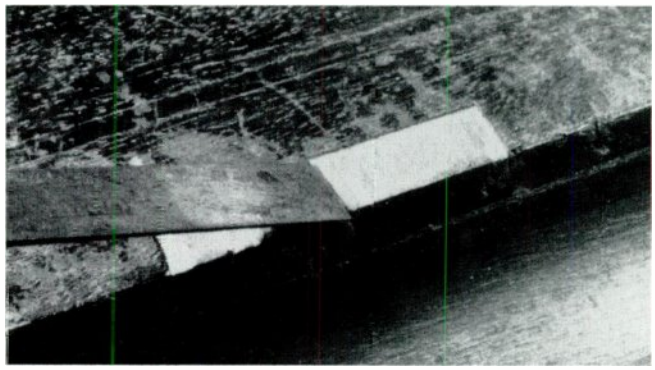


Chipped veneer should be replaced, although shellac sticks can be used to fill the hole if a veneer patch is impractical.

with a roller. A wallpaper seam roller is good for this job. Excess glue is wiped off and the blister is pressed down with heavy weights such as books or bricks.

Larger sections of veneer are usually glued with hot hide glue or contact cement, although ordinary white glue is popular because it gives the restorer more time to work before it starts to set.

If you need to repair a number of damaged sections of veneer on a single panel or side, your best bet is to replace all of the veneer. However, smaller repairs can be made by cutting the rough edges smooth with a *new*



The chipped and loose veneer is cut away so that a regularly-shaped hole is created. A suitable patch is easily cut and glued in place.

razor blade and cutting a piece of veneer to fit. Fitting a new piece is difficult only because it must be cut with such great precision. Make sure that any cuts you make are absolutely straight by using a steel ruler. The patch doesn't have to have any particular shape as long as it fits well.

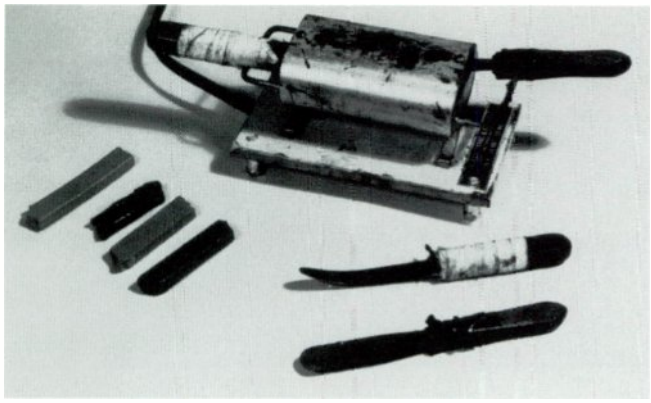
When making a patch to cover an extra crank hole, cut the patch large enough to cover the screw holes on either side of the larger hole. It isn't any tougher to cut a large patch than a small one, and one repair is less noticeable than three small ones.

New veneer is available from most good lumber yards, although you may have to send away for unusual types of wood. Antique dealers who have their own workshops often have pieces of veneer lying around that they are happy to sell. Old veneer, stolen from some other piece of furniture, is also good to use and frequently has a color and grain that matches better.

Nicks and dents

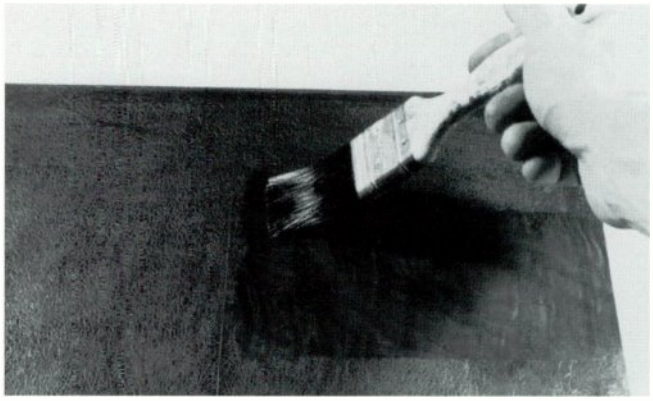
Small dents in the wood can be raised by pricking the surface a few times with a pin and steaming the wood with a hot iron. Put the iron on a damp dishrag placed over the dent. The steam then swells the wood and causes the dent to expand and regain its original shape. This technique is OK if there is no finish to ruin, but if you are not refinishing, your best bet is to fill the dent with melted wax of the correct color and then polish the surface with a piece of felt. The steam from the dishrag will cause most shellac surfaces to become hazy. If someone has drilled holes in a cast iron bedplate for some obscure reason, wax can also be used to fill these holes if painting is otherwise unnecessary.

Crayons are great for filling dents and holes, and different color shavings can be melted together in a teaspoon should you need to mix a special color. This repair may be good enough for your purposes as it is,

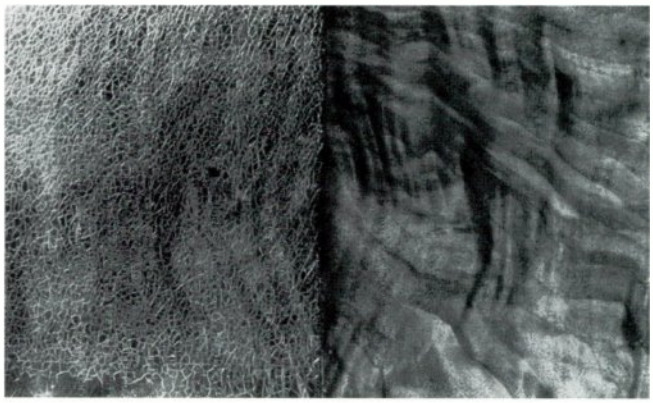


A selection of shellac sticks, knives, and a knife oven. Knives can also be heated over a can of Sterno.

Worm holes waiting to be filled with crayon wax.



Reamalgamation is quick, easy, and generally successful.



Half of this panel has been reamalgamated. All the depth and beauty of the mahogany has been revealed after only a few minutes work!

but if you feel the need to protect the soft wax, a thin layer of shellac can be applied, after which you can varnish, polish, or do anything else you feel like to the surface.

Special shellac sticks for repairing gouges can be found in most hardware and paint stores, but these require a little practice before you can expect to get good results. A shellac stick resembles a stick of old-fashioned sealing wax and is melted on the blade of a hot knife after which it can be pressed into the hole. Afterwards, the repair can be sanded and sealed with shellac or varnish. Although special electric knives are available, I don't care for them. I much prefer the old-fashioned method which is to heat three or four palette knives in a special oven and keep switching knives as they get cold. This also allows me to mix two or three different color sticks high up on the blade and let the finished blend run down the blade into the hole. The blade of an electric knife isn't long enough to permit this. What's more, the electric knife has a very thick blade. The more flexible palette knife is much easier to work with. As an alternative to the knife oven, knives can be heated over a can of jellied alcohol, such as Sterno.

Most furniture stores have someone on their staff who is handy with shellac sticks. This is the guy they send out when the delivery people aren't as careful as they ought to be. You might contact him if you have problems or don't want to do the work yourself.

Worm holes

Although worm holes are uncommon in the U.S., machines purchased in Europe often show signs of infestation. The first thing to do if you discover worm holes is to make very certain that the worms are dead. I've heard a lot of different methods for determining their state of health, but it is easier and quicker simply to buy one of the sprays and liquids available and kill them off once and for all. Follow the directions on the back of the can. Generally this means that the machine must sit for some weeks or months packed in a plastic bag. Since the life cycle of a wood worm is about 30 months, the machine really ought to sit for three years and then be examined for any new holes. However, the makers of many modern treatments claim that the wood is safe after just a few days. The holes are made by

escaping adults who have laid their eggs in the wood.

Once you're sure the worms are dead, the next step is to fill up the holes. Again, the best method is to fill scars of this nature with crayon wax. Just press in the wax, scrape off the excess, and polish. If you are refinishing the cabinet, wait with any hole filling until you have stained and sealed the surrounding wood. The first layer of varnish will change the color of the wood and *this* is the color you have to match. Now fill the holes and seal them with some thin shellac. The rest of the refinishing process proceeds as usual.

Filling worm holes is a little tricky because you have to make sure to push the wax far enough into the hole for it to stick. A screwdriver makes a good spatula as long as you're careful not to gouge the wood. At any rate, by the time you've fixed the first dozen holes, you have pretty much got the knack of things.

Reviving an "alligatored" finish

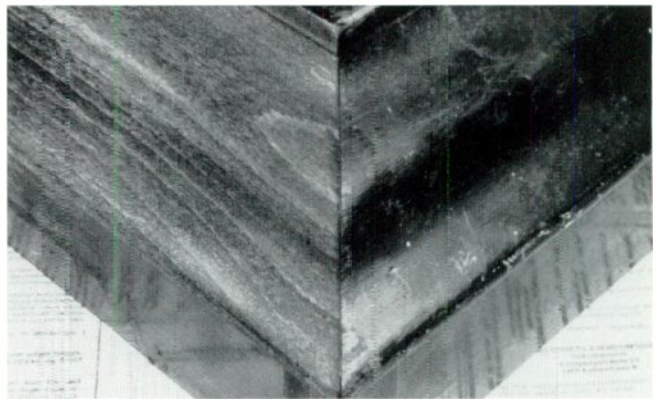
Old cabinets are likely to be "checked" or "alligatored." Humidity, sunlight, and extreme temperature changes are all possible causes for this common condition. This also changes the color of the wood and can darken it to such an extent that some mahogany cabinets look almost black. Before you reach for the stripper, you might like to try your hand at a process called "reamalgamation."

The idea is simply to dissolve the old surface with a suitable thinner and to use a paintbrush to smooth out the cracked finish. Clean off any old wax and dirt on the surface with turpentine before you start. Most of the finishes you encounter will be either shellac, which is dissolved with denatured alcohol, or lacquer, which dissolves in lacquer thinner. Varnish also cracks, but this cannot be reamalgamated. A varnished cabinet must be stripped.

Pick some unobtrusive spot and test some different thinners in order to determine the nature of the surface. Underneath the turntable is a pretty good place to experiment.

When you've found a solvent, take a *new* brush and paint a thin layer of thinner on the surface with light strokes. As the old finish gets softer, your brush strokes can get firmer. Don't worry about smoothing out all the brush marks. These will disappear to some extent when the finish dries. Small imperfections can be removed later by polishing with fine steel wool or a lint-free cotton pad dipped in a little more thinner. If you're working on a flat surface, such as the side or top of a cabinet, it's pretty easy to get good results. On wooden horns

Stripping off an old finish with a mixture of lacquer thinner and denatured alcohol is quick, easy, and cheap!



The left half of this cabinet lid has been stripped. Because thinner doesn't remove as much of the stain as a commercial stripper, restaining is not necessary.

and other curved surfaces, reamalgamation is tougher to do well because the old lacquer may run and drip. Remove any drips with a rag and smooth out the surface as best you can with the brush. The remaining finish can be polished or sanded, and a new coat of shellac or lacquer painted on top, if you think the finish is too thin.

If the decals on the case were applied before the finish, there is a chance that you can fix the surface without destroying the decals. Be careful not to brush too much on top of them, as they too will dissolve. If the decals were glued on top of the finish, then they have undoubtedly cracked along with the rest of the surface and nothing much can be done. You can either work carefully around them or remove and replace them. Wooden horns usually have decals that lie underneath the finish. Some Edison decals do, too. Columbia decals usually sit on top of the finish, as do virtually all distributors' decals.

If the surface is only slightly cracked, dull, or has white spots, it is possible to restore the finish by rubbing with the damp cotton pad mentioned earlier. Rub

in a figure-eight motion and avoid letting the pad stop for any reason. If you hesitate, you will mark the softened finish. This is a lot like French polishing where the pad is wetted with linseed oil and a few drops of shellac instead of thinner. Both techniques require a little practice.

Stripping off the old finish

Finishes are best removed with either alcohol, lacquer thinner, or a commercial stripping product of some kind. Many refinishers use a combination of 50% lacquer thinner and 50% denatured alcohol. Remember to *wear gloves and work in a well-ventilated area*! I am not fond of caustic soda or stripping baths as the amount of water used to wash the piece off often causes the glue to weaken and the veneer to peel. Also, too much of the original stain is removed this way. If you use a commercial stripper, you should not smoke under any circumstances. Not only are some of these concoctions flammable, but the fumes, inhaled through a cigarette are *deadly*.

If you choose to use a thinner of some kind, paint it on and rub off the old finish with steel wool. Small bits of steel wood and old lacquer can be washed off with paper towels or rags dipped in thinner. If you use a commercial stripper, scrape off the bubbled up finish with a spatula and rinse the surface with steel wool dipped in stripper. The final washing is done with thinner and paper towels. Sand the surface lightly with fine sandpaper and steel wool until it is perfectly smooth. Remember to sand *with* the grain of the wood in order to avoid scratches.

If you are preserving decals, make sure that no stripper gets on them or they will be ruined. Strip off the surrounding area, leaving a good bit of room between the stripped area and the decal. A small paint brush can be used to remove the remaining finish, a little at a time. I have tried to mask off decals with tape, but invariably end up pulling them off along with the tape when it is removed. Even if the decal stays put, stripper tends to seep underneath the tape and cause damage.

If you are using caustic soda or a similar commercial stripper, neutralize the surface with vinegar. Do this even if the maker insists that it's not necessary! Otherwise, the surface may bubble up. This is a common problem when repainting metal horns with spray enamel.

Wood fillers

Paste wood fillers are almost always necessary after using a commercial stripper. The problem is that the stripper pulls out the material that was in the pores of the wood. This means that unless you put on lots of coats of varnish, you won't get a perfectly smooth surface. Wood filler does just what the name implies—it fills the open pores in the wood. Oak is particularly open-grained and will almost always need a wood filler. On the other hand, mahogany will not need any special attention.

Fillers are creamy in color and are often quite thick. They are usually thinned with turpentine before use. The filler is applied in a fairly thick layer with a brush and is "scrubbed" into the surface. Excess is then scraped off with a piece of cardboard or similar tool and when the filler is dry, it must be sanded down. Some refinishers simply rub filler into the pores with their fingers. This reduces the need for sanding.

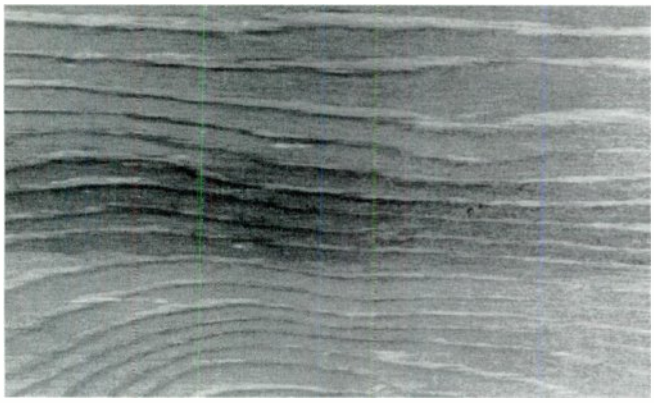
For the most part, fillers are applied before staining, but if you use an alcohol stain, the filler must be applied afterwards. In addition to the neutral, creamy color, wood fillers come in a number of wood tones. Special tints are also available to color the neutral filler. The tint is added after the filler has been thinned.

Staining the stripped cabinet

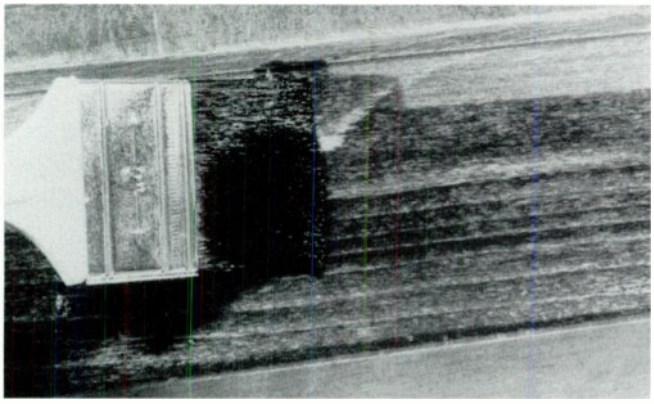
After stripping, the surface of the wood always looks dull and gray. If you want to see how the wood will look when the new varnish is applied, paint an area with some water. If the color is acceptable, then you can go on to varnishing. However, if the color is too faded, you will have to stain.

There are loads of different types of stain on the market. Some of them are pretty good, most of them are awful. In the old days, there were two basic stains—the kind mixed in water, and the kind mixed in alcohol. These are still available in Europe, but are less common in the U.S. Both give excellent results, but the beginner may find them difficult to use. I love them. The best alternative is the modern gelled stain available from Wood-Kote and other companies. If you want a really good finish, don't take shortcuts and mess around with varnish stains and other stuff that only hides the grain. You might as well paint the thing—and in fact, that's just what you're doing! Varnish stain is simply varnish mixed with some powdered color. The color never affects the wood; it sits in the finish *on top* of the wood.

If you intend to finish with an alcohol-based lacquer such as shellac, choose a water-based or gelled stain. If the stain and the lacquer have the same base, the stain will be drawn out of the wood when you apply the fin-



Dark streaks like this occur if you stop and eat lunch in the middle of staining a section.



A coat of varnish brings out the color and character of the wood.

ish and the wood will look spotty and unevenly colored. This is impossible to fix, short of restripping.

When you have found a stain you like, test it on an inconspicuous spot to check the final color. If you are using water or alcohol stains, stain entire sections at a time. If you stop in the middle and eat lunch, you will end up with a dark line where wet stain overlaps the dried area because you have stained it twice. Make sure not to miss any spots along the way for the same reason, nor drip onto sections you are not ready to work on. Overlaps are really quite a problem if you're working with alcohol-based stains since they dry so quickly.

If you use a water-base stain, which I highly recommend, you don't need to work as fast. Water-base stains usually come in little packets containing powdered dye, which is dissolved in boiling water. They are very cheap—so make a big batch, large enough to do the entire staining job as well as slop on your clothes and on the floor. If you have mixed different dyes together in order to get some special color, it is very difficult to match the stain again later should you run out.

Gelled stains are simply wiped on with a cheesecloth pad. Because they take a while to soak in, it is easy to control the color so that everything is stained evenly. If an area is too light, simply rub on a little more stain. However, I don't think that the grain of the wood is accented as well as it is with water- and alcohol-based stains.

Wood fibers usually rise just a bit during stripping and staining, so sand them down with some fine steel wool or 600-grade sandpaper before you apply the finish.

Applying the new finish

If you really want to do a nice job, use a good-quality varnish—though white shellac runs a close second. This *must* be a varnish thinned with turpentine and not the fast-drying kind made with cellulose thinner, etc. Nor can it be "spar" varnish, which never really gets hard. If your paint store doesn't have what you need, scout around. It's out there somewhere and if you use anything else, you're asking for trouble! As far as the gloss is concerned, I'm partial to "satin finish," but the choice is yours. If the surface ends up too glossy, it can always be dulled with a little steel wool.

While you are out buying the varnish, buy a good paintbrush and a can of French turpentine, too—the kind that smells good. Don't use old paintbrushes as they are almost never cleaned properly. In fact, cleaning a paintbrush really well, costs almost as much in thinner as buying a new one!

When you are ready to start, pour some of the varnish in an old jar and thin it about 30% with the turpentine. It ought to have about the same consistency as thin cream. Even if you think the consistency is fine when you open the can, thin it anyway. Wipe off any dirt on the cabinet with a cloth and turpentine and you're all set.

Apply the varnish as quickly as possible with the brush and don't pay any attention to brush marks and air bubbles. When the surface is wet all over, smooth out the varnish with the tip of the brush and wipe off any drips running down the edges. Air bubbles will disappear as the varnish dries. If you use lacquer, shellac, or a fast-drying varnish, you can't work in this manner and all brush strokes must be made very carefully. If you don't thin the varnish, it may dry too quickly and the brush strokes may not settle properly. Shellac is less of a problem than lacquer, especially if it has been thinned. Nevertheless, it certainly requires a more careful application than varnish.

When the varnish is dry, smooth the surface with fine steel wool and turpentine. Wipe down the cabinet again with turpentine and apply the next coat. After

you have repeated this three or four times over the space of two or three days, you will have built up a smooth, durable finish. If you are still not happy with it, add a few more coats.

Finally, before the last coat is completely hard, but dry to the touch, take a lint-free cotton rag or piece of felt and rub the surface with a mixture of turpentine and raw linseed oil. This puts a nice shine on the cabinet and smoothes out any small imperfections. If you want a "piano" finish, which is *very* shiny, rub the new finish with rottenstone mixed with mineral spirits. This is also a good way to remove water rings and other surface blemishes from older finishes.

In between coats of varnish, you don't need to clean the brush. Just drop it in a jar with turpentine. Before continuing to varnish, brush out the excess turpentine on an old newspaper. When you are done varnishing the cabinet, throw the brush away, use it for painting the bathroom ceiling or cleaning the barbecue—but *don't* use it for more refinishing!

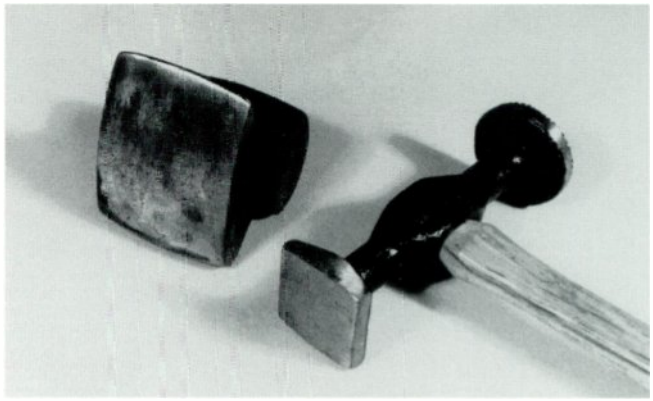
Horns

Fixing dents

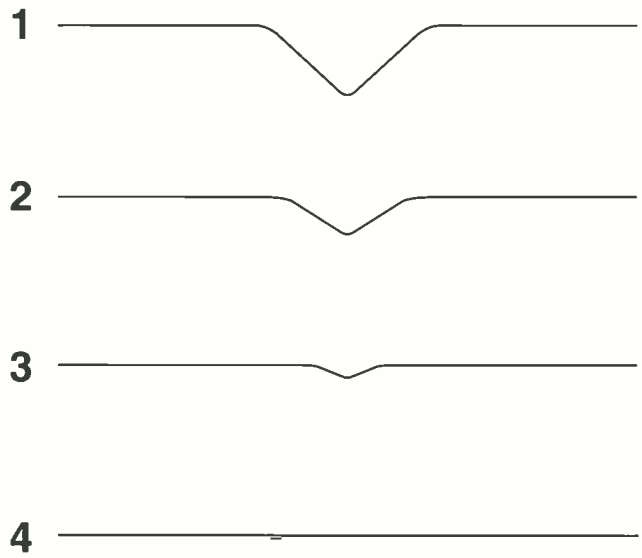
Personally, I think that a few dents in a horn add character, but there are limits. Small dents can sometimes be straightened by pushing them out with strong fingers. These dents have not usually stretched the metal to any great extent and repairing them is easy. If the metal is really bashed or is creased, you will have to reshape the metal.

The tools needed for this type of work are a good hammer, with a slightly rounded head, though *not* a ball-peen hammer, and some kind of an anvil to support the back of the metal with a shape conforming to the desired curve of the horn. Stores that sell car accessories and some hardware stores have suitable anvils (called a "dolly") and special hammers. The key thing to look for when buying these tools is rounded and polished striking surfaces. If the surface is rough, you will mar a soft brass horn and leave an impression of the marks or rust on the tools in the surface of the horn. If you have used the hammer to drive nails, you will have to repolish the surface. The hammer head has to shine like a mirror, though this is not quite as important if you are fixing horns that are to be painted.

Usually, horn damage is in the form of dents as opposed to creases or folds in the metal. Hit the dent in the middle so that you have two smaller dents. Keep making smaller and smaller dents until at one point,



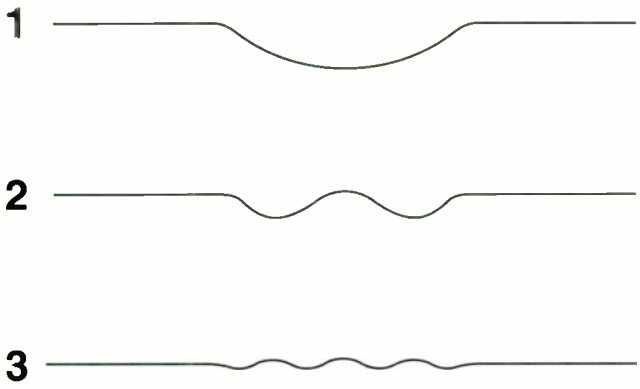
A dolly and hammer used in body and fender (and horn) work. If you are working on a brass horn, both tools must be polished to avoid marring the brass.



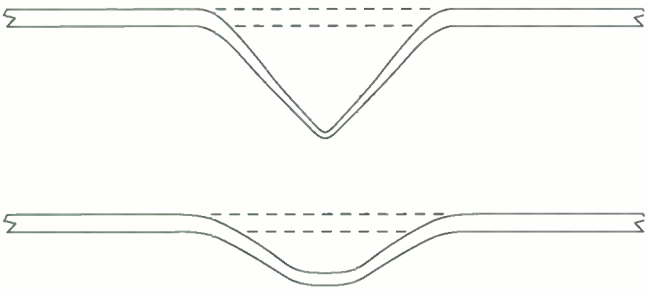
Straightening a crease. The crease is worked in towards the middle—never hammered directly on the fold. Any remaining marks are burnished out.

the metal has been smoothed out completely. If the dent has actually stretched the metal, you may have to heat it with a torch in order to "shrink" it again. When hammering out a crease, work your way in from the sides. Otherwise you will just make a lot more creases in the metal. There really isn't that much more to say about the subject. It takes long practice to straighten dents really well, but even beginners can easily make real improvements—so don't shy away from it.

Smaller brass and aluminum horns can be straightened by turning a hardwood core on a lathe and using this instead of a metal dolly. The wooden form has to be very precise if this is to work properly. Rather than hammering the metal, it is best to rub it with a suitable tool and "iron out" the dents and creases. Heating a brass horn helps when doing this.



Straightening a dent. The dent is pressed out in the middle to create two smaller dents. These dents are also pressed out until finally the surface is smooth enough to be burnished successfully.



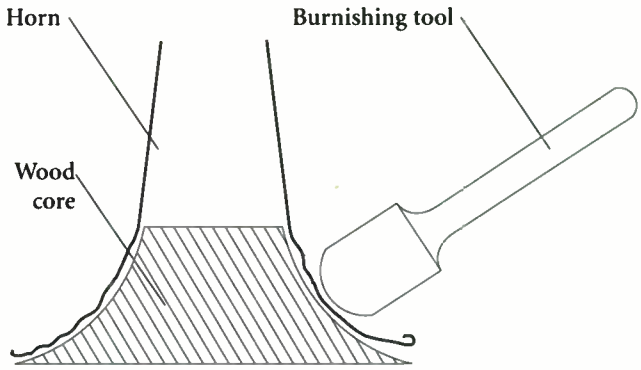
Shrinking metal. If a dent is sufficiently deep, the metal may have stretched. It will be necessary to heat the metal during straightening in order to work the metal back into its original form.

For ironing out dents along the body of a horn, it is possible to hang up a horn on a suitable piece of pipe. Just stick the pipe down the horn and support the pipe at either end with sawhorses. Using a wallpaper seam roller or similar tool, you can repair a lot of difficult-to-reach dents.

If you don't feel like buying the equipment needed, a body and fender man can fix most dents in steel horns, and musical instrument repair shops can make most brass horns look almost like new.

Polishing brass horns

If your horn was recently polished, then all that is needed is a little Brasso and elbow grease to restore the shine. Of course, if the brass is sealed with lacquer, polishing a newly-restored horn is unnecessary, and if the original lacquer is still intact, though spotted and stained, this should on no account be removed. If you don't like the horn with the original lacquer, trade it



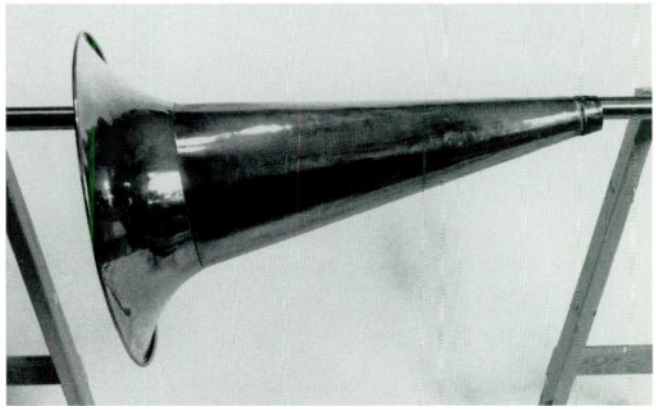
Burnishing a metal horn to remove small dents.

with another collector for a horn you *do* like. But don't ruin the irreplaceable patina of an original lacquered finish.

Brass horns that have been stored for years and years often have a rusty brown color. Frequently, there are signs of corrosion in the form of green spots on the surface of the metal. The first step in polishing the horn, is to clean off as much corrosion as possible.

Citric acid (lemon juice) will chemically remove much of this rust and can be painted on with a brush. Steel wool will help remove the loosened dirt and start the polishing process. Make sure not to let the acid eat into the good metal or you may end up with pink spots that are almost impossible to polish off. Another method is to mix a paste of vinegar and salt. This, and a good rubbing, will remove much of the gunk from the surface.

After the corrosion is off, a good scouring with a sandy polish, such as "Barkeeper's Friend" or rubbing compound, will restore the familiar brass color, but scratches the surface. These scratches will disappear after further polishing with Brasso. If the scars are too deep, the horn can be buffed on a buffing wheel,



A straight-sided horn can be suspended on a pipe in order to remove dents in the body.

described later on. All this takes a great deal of time and effort, but even the most miserable horn can be made to shine like new.

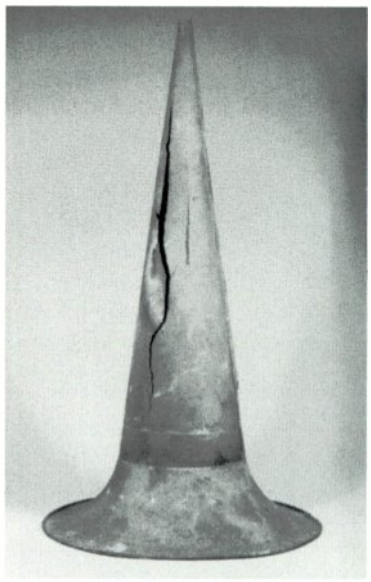
I don't usually seal the surface of my brass horns and have found that as long as the horn isn't handled, it isn't necessary to polish more than about once a year. Subsequent polishings take but a few minutes—even for big horns.

If you wish to relacquer the brass, make sure that you have removed all the dents you will ever want to and shined the horn as well as possible. Clean the surface with acetone to remove any remaining polish and use a clear spray lacquer to complete the job.

Serious corrosion damage

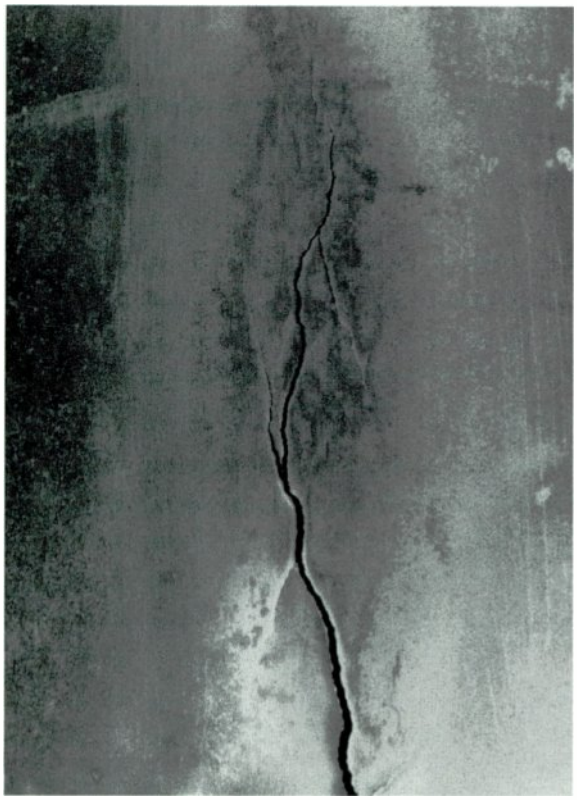
One of the saddest sights to a collector is a big brass horn that has cracked and split due to corrosion. It is entirely possible to solder cracks and clean the piece, but the big problem is that the brass is often too brittle to work with.

If there is just one long crack in the body of the horn, you may be able to hold the pieces together by wrapping wire around the horn. When you have soldered as much as possible, remove the wire and solder the remaining gaps in the split. You can also use tape instead of wire if necessary. The wire or tape reduces the need to bend and fiddle with the fragile brass while soldering.

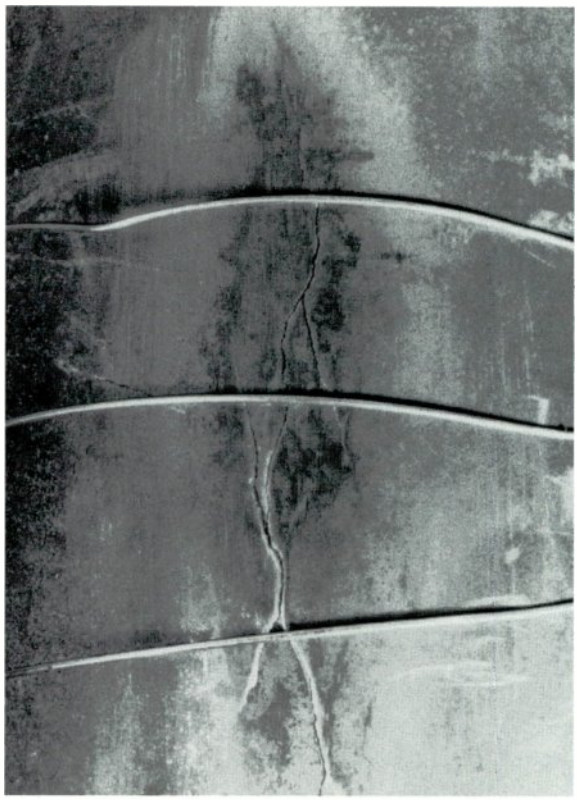


A badly corroded brass horn.

I have managed to soften brittle brass a little bit by heating the metal with a propane torch. This process helps, but is not usually enough to allow large dents to be straightened. As soon as you start pounding or bending, the metal usually splits or breaks off. One good point, though; the pinkish color of the softened



The crack is first sanded to clean the surface and prepare it for soldering.



The horn is bound with wire to close the gaps in the metal.

metal is easy to polish off.

If your horn is very badly cracked, a musical instrument repair shop might be able to suggest possible repairs after inspecting your particular horn. In general, repairs on horns in this condition are very difficult and require skills beyond the ability of most collectors.

Repairing rust holes

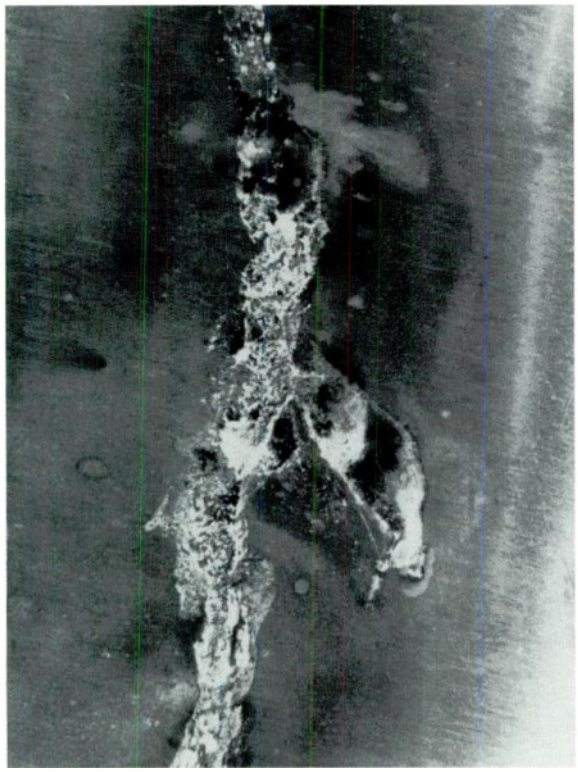
When dealing with serious rust damage, you will almost always have to repaint a steel horn. The alternative is to leave the holes as they are. Assuming you decide to repaint, there are two ways to repair the damage. If you are a good welder, or know a welder, you can pretty much take care of things yourself. For those of you who cannot weld, I have found that plastic resins, such as those used in cheap car repairs, are great for fixing rust damage on horns, too. If your friends don't go around with magnets checking for this type of repair, no one will ever know the difference. Repairs made in this way are cheap, easy, and almost always less visible than welding.

Any store selling car accessories can supply you with a big tube of repair paste, a little tube with a hardener, and a hunk of plastic screening for supporting the paste when repairing a big hole. Before you start the repair, remove as much rust and loose metal as possible, either by sanding or by bead blasting. If the hole is small, you might get by with just the paste, but for most repairs, particularly along the edges of the bell, you will have to use the screening to provide a firm foundation.

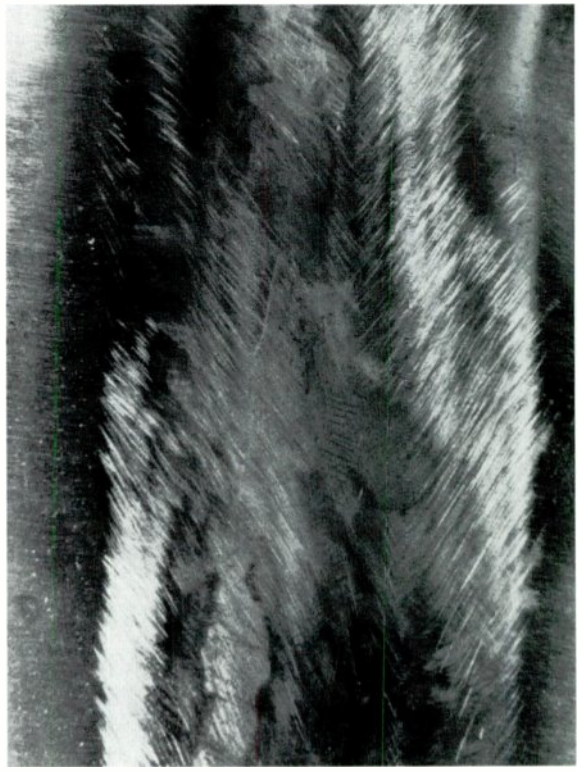
To fix a large hole, you first mix up a small batch of the paste and cut a piece of screen that covers the entire hole, plus an overlap of about ¼" around the sides. Glue the screening over the hole by pressing paste through the weave and onto the horn. This assures that the thickness of the patched area is as thin as possible.

Smooth any excess paste out over the edges. The paste usually dries in about 10 minutes, or at least gets pretty hard. During these 10 minutes, try to form the patch so that it matches the original contour of the horn. More paste is used to fill out the weave and feather out the edges. The raised lip on the edge of the bell can either be molded in paste or built up with a piece of wire or plastic tube. When you think the patch looks about right and is good and dry, sand it smooth.

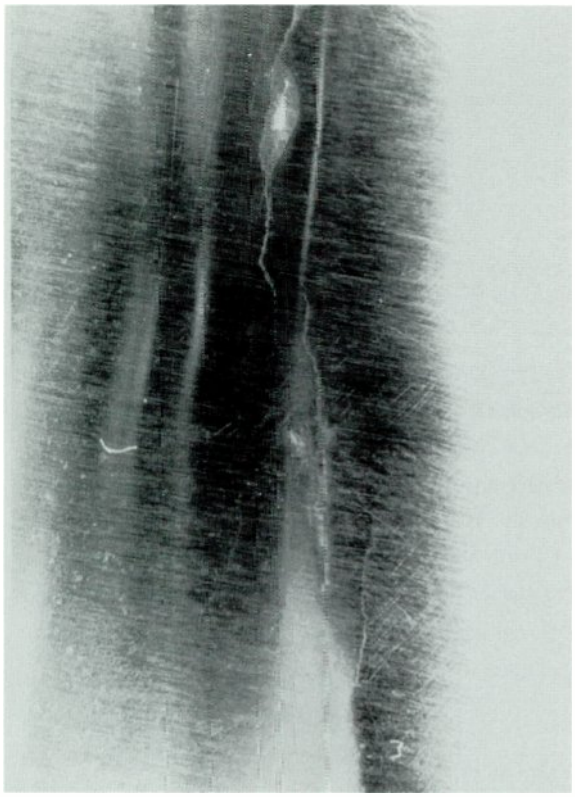
Sanding is a little tricky because it is tough to tell if the surface is smooth enough. If you painted the horn, the glossy surface of the paint would quickly reveal any bumps or dents. This isn't very practical at this stage in the game—so paint the surface with water. If you add a little dishwashing detergent to cut the surface tension, the water goes on just like varnish and gives you a pretty good idea of the quality of the patch. When painting a patched horn, it is a good idea to give it a prime coat first.



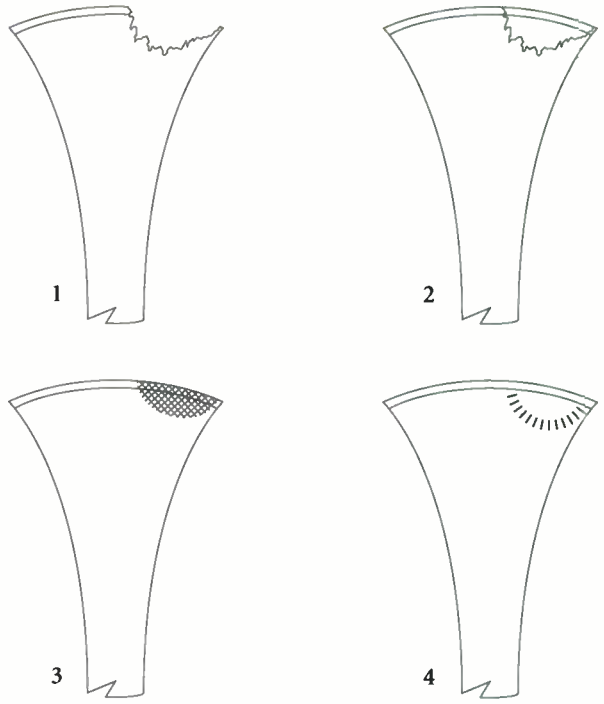
The crack is fluxed and soldered.



After removal of the wire, and some hand filing, the crack is pretty much invisible.



Buffing and polishing will remove most of the remaining scars.



Fixing a rust hole in a horn petal. 1. Loose rust and paint is sanded off. 2. A new wire rim is soldered in place if necessary. 3. Plastic netting is glued over the hole and car body filler is applied and modeled to shape. 4. The patch is sanded smooth after the filler has hardened.

Repairing the tapered end

Back in the good old days when horns cost next to nothing, a distressing number of people truncated cylinder horns to fit disc machines, or sawed off Columbia's threaded end and tacked on something that fit another make. There are still a few of these clowns running around who make these kinds of "improvements" rather than locating a proper replacement. What I think of this practice is best left unprinted.

If you have one of these unfortunate horns, you will have to solder on a new end or sell the horn to someone else. New cones, which can be soldered or welded on, can be purchased from most suppliers. Don't use rivets as these don't make a very pretty repair. Remember to smooth out the inside of the horn as well as possible or it may not sound very good.

If you have the wrong horn for your machine, *please* trade it rather than attempting some amateurish repair.

Repainting the horn

Sometimes old paint can be cleaned up pretty well with Fantastik or a paint reviver from the car shop. Some of the new "Liquid Luster"-type colored car waxes can also do an amazing job. If you must repaint, your best course of action is to strip the horn first. This can be done with stripper or by sandblasting. If you want to reproduce an iridescent color, you *must* use stripper. Sandblasting will make the surface dull and it will not shine through the translucent paint the way it should. Always neutralize the surface with vinegar after using a stripper and wash well.

When the surface is clean and properly prepared, you are ready to paint. Horns that have had major repairs with plastic resin ought to be primed and sanded before the color is painted. This seals the surface of the patch, which otherwise soaks too much thinner out of the paint and reduces the gloss.

The best results by far are achieved with cans of spray paint. The subtle shading effects seen on old horns are easy to duplicate and there are no brush marks to worry about. Don't rush the job. Three or four thin layers of paint produce better results than one thick and runny one. For added gloss, the horn can be polished with rubbing compound after it has dried for about a week.

When buying spray paint, make sure that you stick to *one and only one brand.* Some spray paints react in odd ways when they are painted on top of other brands. I once wound up with a beautiful crackly finish on an Edison Gem when I switched brands in the middle of repainting. It was actually a very pretty effect, but not

Original flowers on a cylinder phonograph horn.

Rather mediocre flowers on a repainted horn purchased from a dealer.

quite what I had in mind.

Transparent colors are getting harder and harder to find. In the old days, you sprayed on a layer of silver or gold (if the metal underneath wasn't shiny) and painted a clear color on top of it. I guess people are getting lazy and the good old clear "Candy Apple Red," which gave such good results now contains small bits of metallic glitter. This may look great on a hot rod, but it's pretty awful on a horn. Testor's Hobby Enamel still has a real Candy Apple Red, although the cans are very small. It takes about eight of these small cans to do an average 20" horn—so make sure you have enough paint on hand. You may have to raid a number of different stores to get enough. Testor's paints mix well with Ilbronze spray paints, which have a good color range and dry quickly.

As an alternative to hard-to-find transparent colors, it is possible to dissolve aniline dye in white shellac and brush this on. The effect is *very* good and I suspect the shellac/dye combination is quite similar to the paint originally used by the horn manufacturers. I think the colors are better than spray paint, too, although the shellac is a little more difficult to apply. When you paint the shellac on the metal, it streaks. Don't worry about this—the streaks of color tend to even themselves out. However, there is one thing you *do* have to watch out for and that is keeping a "wet" edge. This means that you cannot go back and correct mistakes in shellac that has started to dry. Keep painting in such a manner that new brush strokes always overlap wet shellac. Also, you will probably have to strain the shellac through a coffee filter in order to remove any small dye crystals that haven't dissolved. I know of no good way to spray shellac.

Let me just add a short word about flowered horns. You had better have a *very* good reason for repainting a flowered horn. It takes someone with a great deal of talent to paint flowers as well as the girls who sat in the factories for 10 or 12 hours each day and did nothing else. Of course, if you have a *repainted* horn without flowers, there's no harm in adding a few. For those who don't feel that they can paint flowers by hand, some terrific decals can be purchased in arts and crafts stores.

Pinstriping the horn

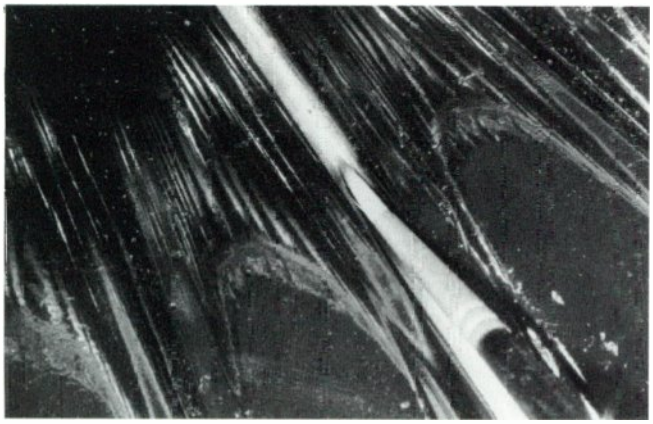
Pinstriping horns is really very easy and I've never understood why people make such a fuss about it. On the other hand, I never seem to be able to glue on the adhesive stripes bought at the car shop, which are so often recommended—so I guess that makes us even.

To do striping, you need two *good* watercolor brushes, sizes 4 and 5, and some gold paint. The paint ought to be turpentine-based.

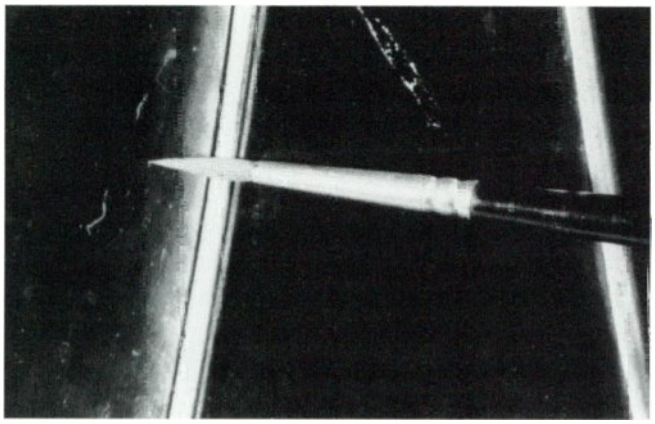
To paint the strips on the inside of the horn, use the smaller number 4 brush. Load the brush with paint and, starting deep in the bell, rest the tip of the brush in the valley formed by the two adjacent petals. Then draw the stripe. The valley prevents you from making a crooked line and the thickness of the brush pretty much fills the crease. When the brush runs out of paint, dip it again. You will probably need to stir the paint frequently to keep the small flakes of metal in suspension.

The stripes on the outside of the horn are painted with the *side* of the larger number 5 brush. This will paint the top of the ridge formed by the petals. If you keep a fairly constant pressure on the brush, the stripe will be perfect. If you make a mistake, just wipe off the gold paint with a rag and some turpentine, and try again.

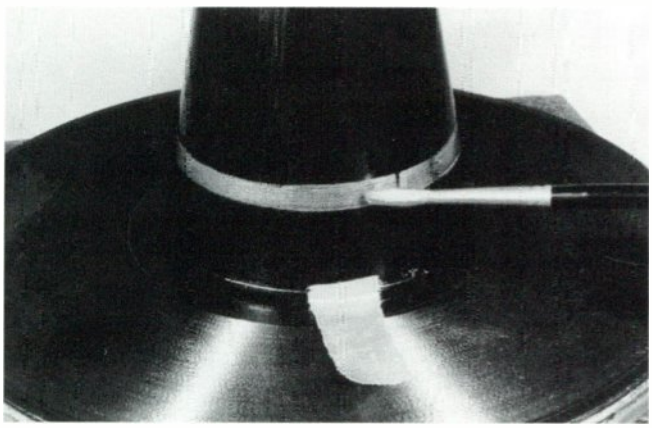
The edge of the bell can also be painted with the side of the brush, but if the strip has to be thicker or has a different curve from that of the end of the petal, as is seen on pointed Columbia horns, you will have to make



When painting stripes on the inside of the horn, the brush rides in the groove created by two adjoining petals.



Stripes on the outside of a horn are best painted with the side of the brush.



Bands are painted by taping the horn to the turntable and using it as a kind of potter's wheel.

a pattern. Draw the correct shape with a compass on a piece of stiff paper. Cut the curve out and scratch the pattern onto the horn with a pin. If you have a steady hand, you can simply fill in the area to be painted. If you have problems, it is possible to support the card on a spool of thread or something similar in order to raise the pattern off the surface of the horn. The raised pattern can be used to guide the shaft of the brush while you paint the critical edge.

The gold band painted on the small cone-shaped horns for Edison Gems, Columbia Qs, etc., can be painted by centering the horn on a turntable , taping it in place, and holding the paintbrush against the horn as it slowly revolves.

The bedplate

General cleaning

Cleaning a painted bedplate can be a lot of fun because an enormous amount of improvement in its appearance can be made with minimal effort. Over the years, dust mixed with oil and grease forms a dull, black, sticky mess on the top of the casting.

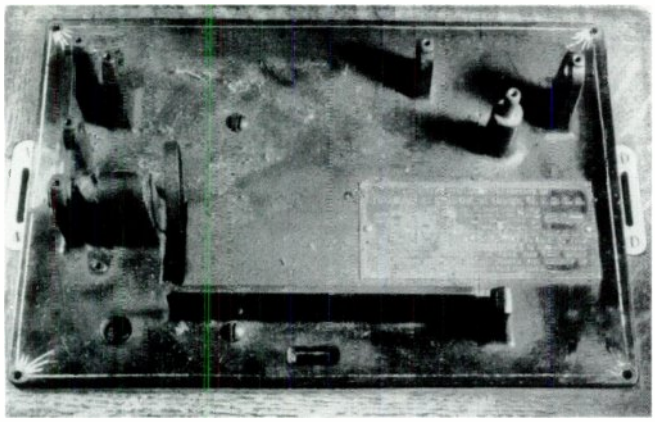
The first step in cleaning is to remove as much hardware from the casting as possible: gears, the mandrel and so on. If you've ever attempted to dust a phonograph, you know how much dirt collects under these parts and how tough it is to get it all off with a dust rag. You may want to cheat and leave the patent plate intact since the small retaining pins often break.

When the bedplate has been stripped of all the shiny parts, it usually looks pretty awful. Don't despair! Most of the gunk comes off easily with soap and water. If the old grease is really stubborn, naphtha, trichlor-ethylene, or even gasoline can be used to soften and remove the remaining dirt. At this stage, the bedplate usually has a very dull finish. If you wipe the surface with the cleaning formula detailed in the section on cabinet cleaning, and polish the paint with a piece of flannel or felt, you will be amazed at the results! Just be careful not to polish off any of the striping or other decorations. Plated bedplates can also be polished with metal polish or buffed as described in the section on cleaning metal.

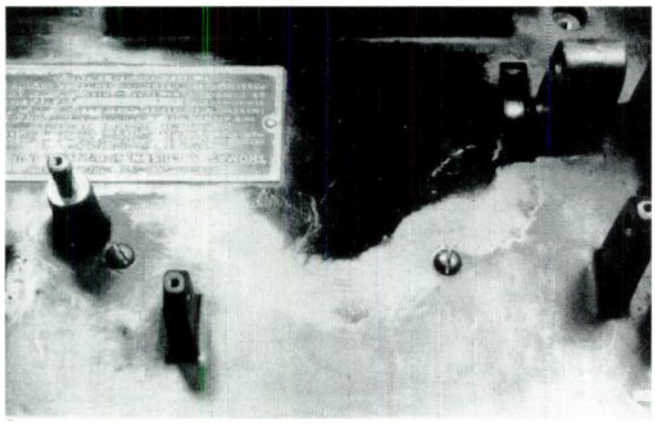
When cleaning up an old casting, keep in mind the fact that some of them were not always all that pretty to begin with. Cheap cast machines such as the Gem or Pathé "Gaulois" were "born" with a number of imperfections and nobody expects you to make improvements on the original workmanship. The thickness of the original enamel, which hides minor surface flaws, was often *too* thick and small puddles of enamel are visible at the base of the support pillars. This is perfectly normal.

Filling pits and chips

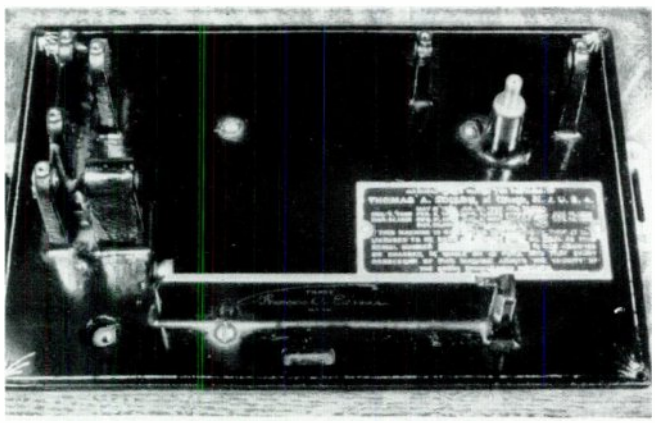
Small nicks and pits can be filled with 4 lb. orange shellac, tinted with nigrosine, a blue-black aniline dye. Chip



After eighty or ninety years, a lot of gunk and grime accumulates on a phonograph bedplate.



The dark black portion of this photo shows the cleaned section. I used fine steel wool (0000) and my trichlor-ethylene concoction to get off the hardened grease. (See page 91)



An hour later, the bedplate looks very respectable and is ready for reassembly.

off any loose paint around the nick and use a small brush to fill the hole with a drop of the tinted shellac. As the shellac dries, a small indentation will appear in the center of the pit. Apply more drops of shellac at intervals until the surface has been filled in. After the shellac has dried for four or five hours, carefully shave the surface of the repair with a razor blade in order to even things up. When the shellac has dried overnight, the surface can be further smoothed and polished with rottenstone. Repairs made in this manner are practically invisible.

If you find that there is just too much pitting and rust, and too little remaining striping for your liking, then you may have to repaint the bedplate. Remember, repainting is *not reversible*—so think twice before you do it. Of course, if the machine has already been repainted once, then go right ahead with the can of stripper.

Repainting the bedplate

If you have not already done so, strip the bedplate of all screws, rods, bolts, and take off the motor, too. If there are any decals or designs which must be replaced, make a good drawing to guide you after the casting is repainted. A camera is a great help. The only thing you cannot do is trust your memory. Invariably you will forget details you will need to know later on. Even if you are using another machine as a guide, look for any small differences between the two to avoid any surprises.

Next, remove the old paint with paint stripper and coarse steel wool. If there are badly rusted spots, you may want to remove the finish by bead blasting. Bead blasting can roughen up the surface of the straight edge on many cylinder machines. As these are difficult to polish, they should be kept out of the line of fire during blasting.

Rust and small pieces of paint can be polished off with a rotating wire brush mounted in a bench grinder or electric drill. If you have the energy for it, sandpaper works well, too.

When the casting is smooth and clean, wash it in warm soapy water to remove any stripper hidden in the

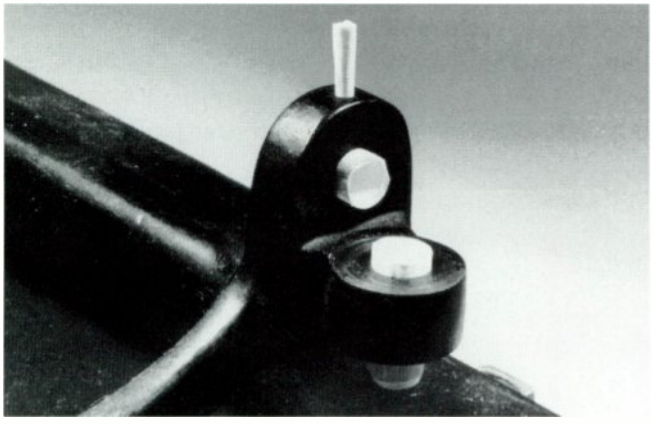
A small nick in a bedplate has been filled with shellac, tinted with nigrosine. Polishing with rottenstone will remove most of the surface imperfections.

corners. Use a good stiff brush to scrub the surface. Now rise it in vinegar to neutralize the stripper, which invariably sits in the pores of the metal. Wash it in soap and water again and dry it off.

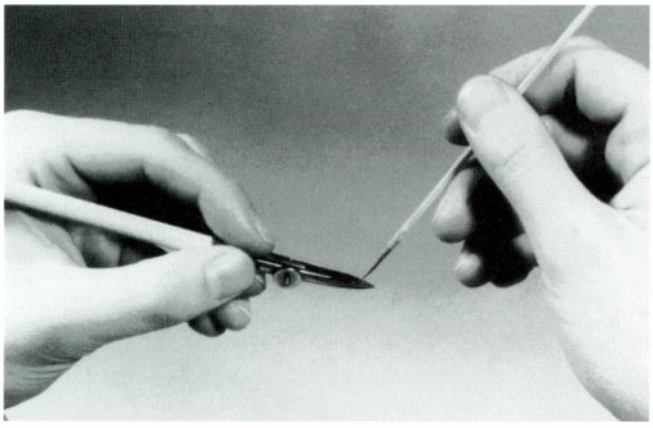
If you don't get the last bits of stripper off the metal, you may find that the new paint will start to deteriorate after about a year, and the surface will become a little rough. In some cases the paint will start to peel.

Before you start to paint, make sure the straight edge is polished and free from rust and pitting. Cover the polished part with masking tape. Use a razor blade to remove the excess tape so that it doesn't "shadow" other parts of the bedplate when you spray. All the small holes in the casting should be plugged with wooden matchsticks or small rolled up pieces of paper. This prevents the paint from clogging the holes.

A coat of metal primer is not a bad idea at this point, but is not absolutely necessary. At any rate, spray on any base coats and the final color coats with a little light sanding in between. As mentioned in the section on painting horns, remember, three or four thin coats are better than one thick and runny one. Again, stick to one brand of paint and provide for adequate ventilation.



Small strips of paper can be rolled up and used to plug holes before spraying a bedplate.



Preparing an engineer's pen for striping. A small drop of paint is placed between the two "wings."

After the final coat, let the bedplate sit for a day or two and then carefully polish it with a piece of felt. This cuts the surface lightly and removes small imperfections as well as a little bit of the shine. If you've worked carefully, you should now have a good-looking bedplate. All that remains to do is the striping.

Striping

There are no two ways about it, striping is not particularly easy. However, it is not impossible, provided you have a little patience and a steady hand.

Stripes and corner designs can be painted with either a very thin brush (000), a steel-nibbed pen, or an old-fashioned mechanical drawing pen. If you choose to use a brush, get one which has very long bristles. The longer the bristles, the more paint it can hold at one time. This means that even the longest stripes can be painted in one stroke. However, the longer the bristles, the more difficult it is to steer. A steel pen is much easier to use, but can scratch the paint.

By far the best striping tool is the mechanical drawing pen. This has two adjustable "wings" that regulate the thickness of the line. To use a pen like this, just place a drop of paint between the two wings with a match or toothpick. Get the paint flowing by drawing on a piece of paper. When you've adjusted the thickness of the line and the pen is loaded with paint, you're ready to stripe.

The best paint for striping must be reasonably thin and preferably thinned a bit with turpentine. Turpentine-based paint dries slowly and is easy to remove with a rag if you make a mistake. Unless you bear down too hard with a steel pen, you will not mar the surface in any way, so you can practice right on the machine. Some folks use quick drying cellulose paint and remove mistakes with metal polish. I don't like this since I am forced to work dangerously fast, but the choice is yours.

Corner designs

Corner designs are painted free-hand and must be painted with a certain degree of confidence. If you hesitate, the design will be shaky and will not look "right." In the case of a reasonably complicated design such as that found on Edison Triumphs, try to figure out the order in which the brush strokes were made and in which direction they were painted. When you have a reasonably good idea as to how the design was constructed, start to practice. When you can paint the design with free and easy strokes and think it looks

good, you are ready to paint on the machine. If the design is complicated, you are better off marking the corners with a ruler to make sure that the spacing is correct and then painting the corners first, before you paint the long lines. Long lines are pretty easy to paint, so the chances are that if anything needs to be "erased," it will be the corner. Any striping you have made previously will just get in the way when you wipe off a botched corner.

Fortunately, the corner designs are pretty simple on most machines; just a collection of rays fanning out from the corner. Here, it is probably better to paint them last so that everything is aligned properly. These corners are so simple to make, that there is little chance of a mistake.

Later Edisons have transfers in the corners as well as for some of the lines. These transfers, plus some hand-painted designs, are now available as decals and application is straightforward.

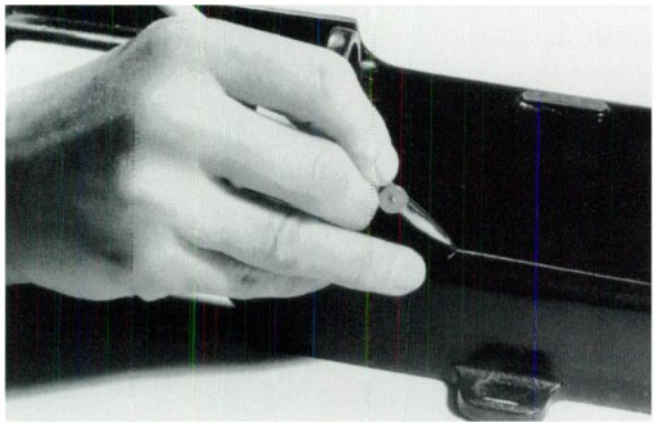
More about lines

When drawing lines, hold the brush in the same manner as a pencil. Use the third and fourth fingers to guide the hand (and brush) along the edge of the object to be pinstriped. As long as the line follows some similar contour on which you can rest your ringers, the brush can be held steadily. Unfortunately, the edge of the casting may not be long enough for you to draw the entire line. The easiest thing to do here is to prop up a long ruler on a small block of wood on top of the bedplate and to use this rather than the edge of the casting as a guide. Raising up the ruler also allows you to paint straight lines between two posts or in other places where there are obstructions. When painting curved lines, a cardboard template can be made to guide your hand instead of a ruler.

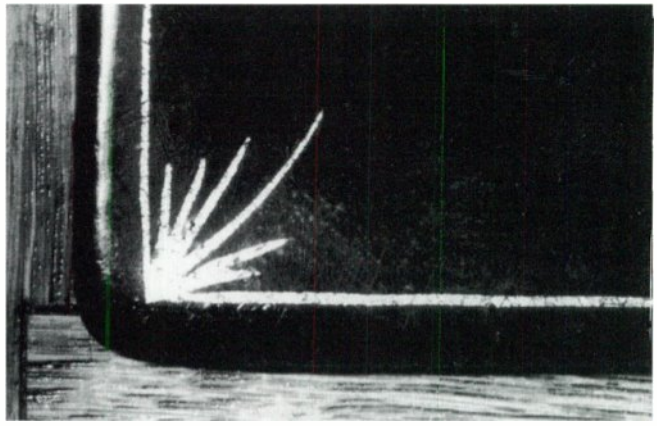
Turntables

Felt

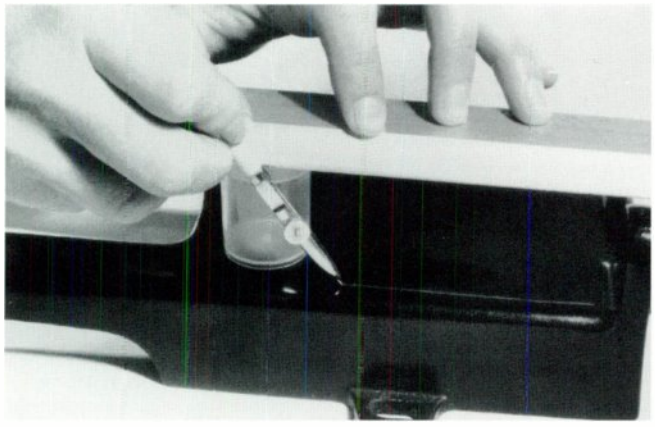
If the turntable felt is not badly worn or faded, there is really no reason to replace it. If there are oil spots or other dirty areas, these can usually be cleaned with naphtha or, if you can carefully peel the felt off, you can



Striping a bedplate using the edge of the casting and the fingers to guide the pen.

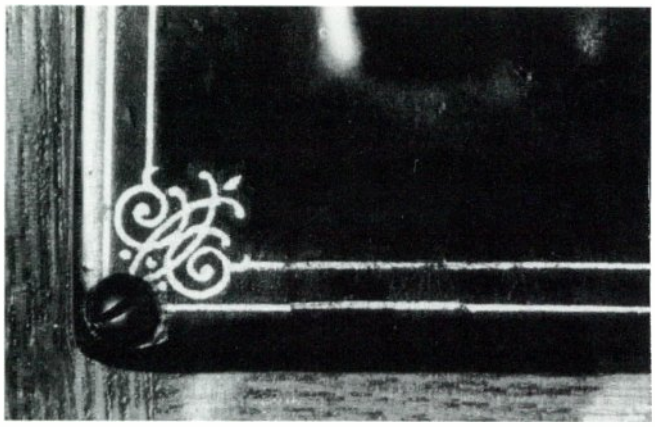


The common Edison corner design found on most Gems, Standards, and Homes.

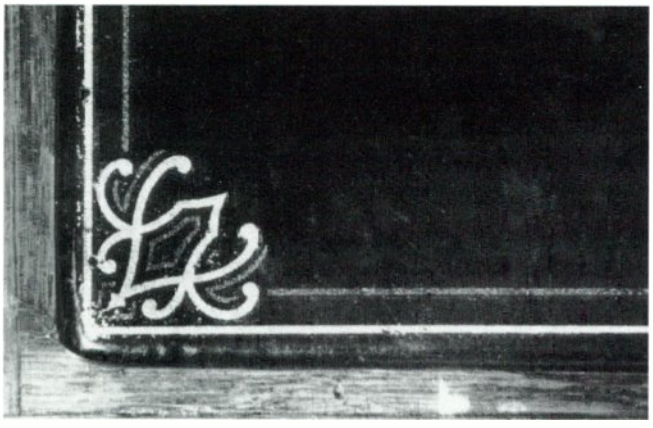


Propping up a ruler on some suitable object provides a guide for the pen if there are obstructions.

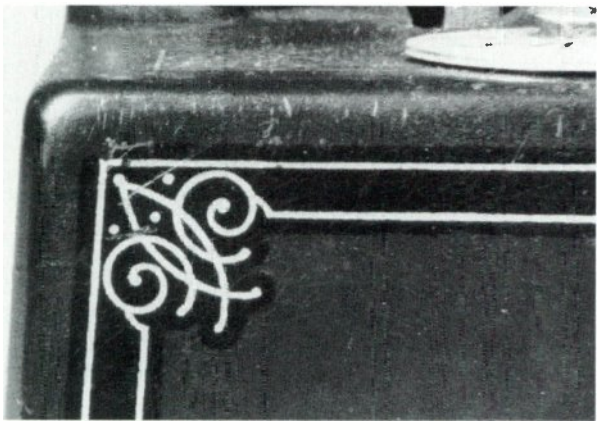
The hand-painted corner design found on Triumphs, Operas, Concerts, and other large machines.



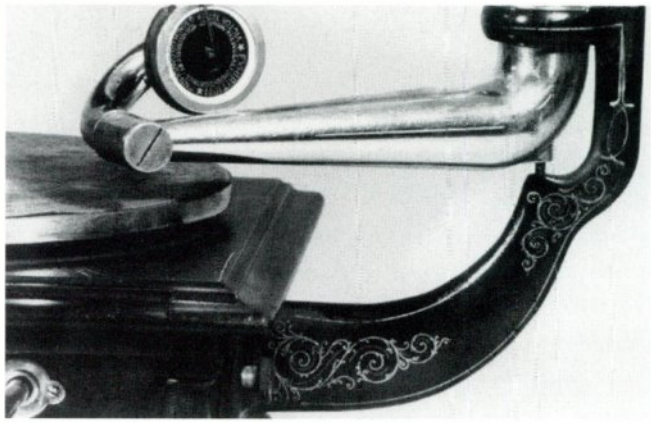
The decal design found on Model D (and later) Standards and Homes.



The decal found on all but the earliest Firesides.



The Model D and E Gem decal.



A detail of the Victor back bracket striping. These designs were usually hand-painted and are beyond the ability of most restorers. However, excellent decals are available.

have it dry cleaned. Just don't wash it in water or it will shrink and may fall apart.

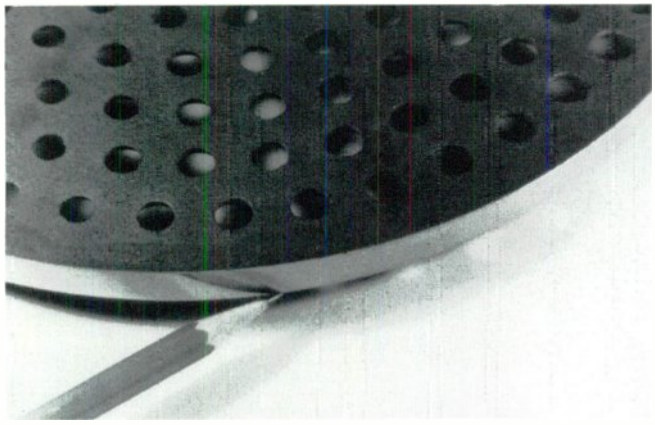
If you choose to replace the felt, shop around for a color that matches that of the old felt. Nothing looks worse than a turntable covered in pool table material!

Cut a piece of cloth about two inches bigger than the diameter of the turntable and punch or cut a hole for the spindle. In order to glue on the new felt, I like to use spray glue such as 3M's "Spray Mount." It is easy to rinse off again with benzene, provides a smooth foundation for the new felt or velour, and doesn't bleed through the cloth. However, thin Elmer's glue works pretty well and thin hide glue is even better.

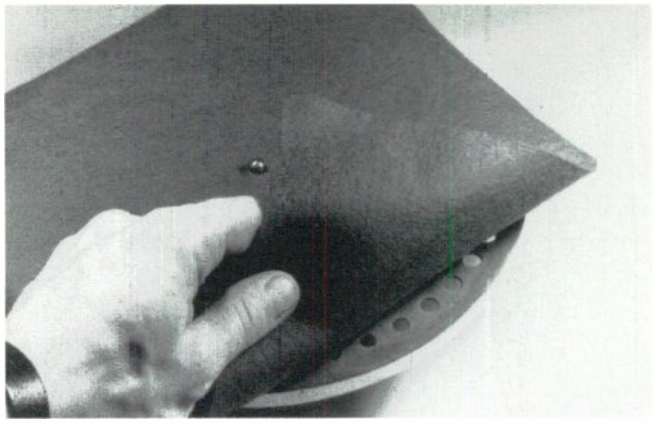
Once the glue is tacky, replace the turntable on the spindle and put on the cloth. Start smoothing any wrinkles from the center and work your way out to the edge. When the glue is dry, cut off the excess felt with a knife or razor using the edge of the turntable as a guide. If you use scissors, remove the turntable and turn it over. This way you can see if you are cutting all the way in to the edge.

On many later model machines, particularly portables, the turntable is covered with velour, often in colors that match the case. In order to prevent the velour from unraveling, the hole in the center is frequently protected by a metal eyelet and the rim of the turntable has a protective metal band around it. Replacement eyelets can be purchased at most arts and crafts stores and usually present no problem. If there is no eyelet in the middle, you will have to cut a circular piece of tape and stick it on the back before you punch the hole. The outline of the tape will probably show through the velour, so cut it out carefully and punch the hole dead center. None of this is very tricky. Turntable rims, however, are a little more difficult.

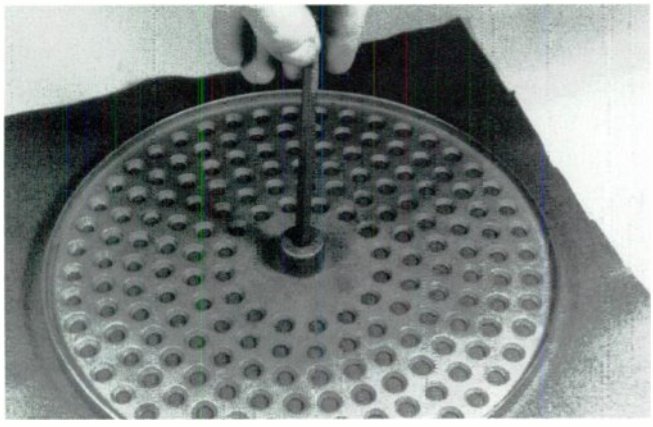
This metal rim is usually attached in one of two ways. There may be some kind of a joint on the ring, in which case a soldering iron will melt the solder holding the joint together, which allows the ring to be removed. On better quality machines, this ring is a seamless hoop of soft brass. In order to hold it in place, a lip is usually bent under the bottom of the turntable. You can open up the metal lip by running a thin screwdriver blade



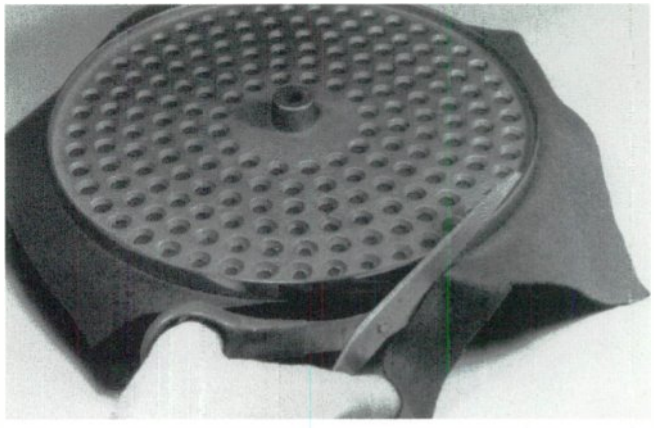
Make sure to polish the rim of the turntable before replacing the felt.



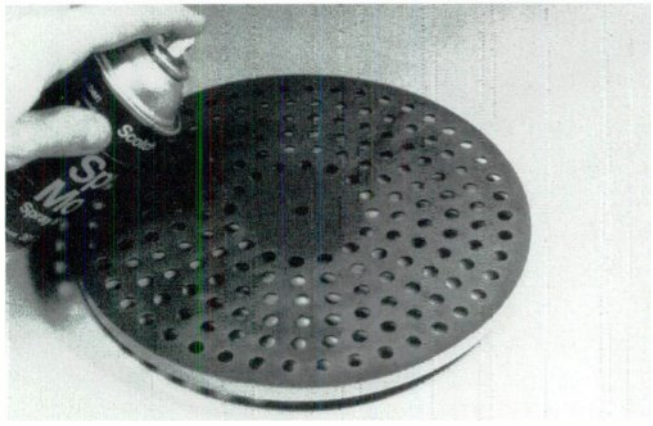
Smoothing out the new cloth. It helps to mount the turntable on the spindle so that the center hole is positioned accurately.



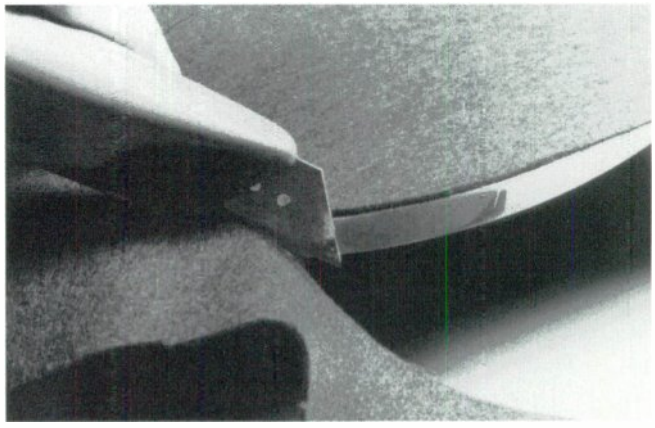
Marking the position of the spindle hole with a pencil. The cloth has not been glued at this point.



Trimming the new cloth with scissors is easiest to do if you turn the turntable upside down.



Applying glue. Although spray glue is quick and easy, carpenter's glue and hide glue work well, too, when thinned.



Trimming the cloth with a knife should be done with the turntable right side up.

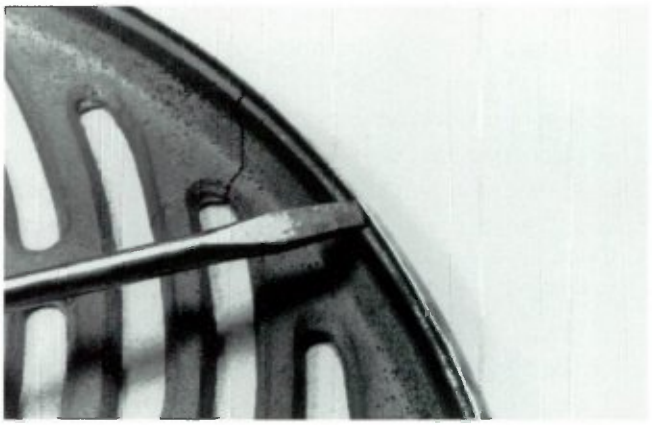
around the circumference between the ring and the turntable. Don't pry the ring off or use pliers or you will crease or mar it. By increasing the angle between the screwdriver and the turntable, you will eventually raise the lip enough to allow the ring to slip off.

When the velour has been replaced, the ring is relocked by pressing down on the raised lip with the butt of a screwdriver. Of course, if you unsoldered the ring, you will have to resolder it. All this takes a little time, but the results are well worth the effort. If the ring needs to be polished or rust needs to be sanded off, it is far easier to do this *before* the ring is removed. Otherwise, there is a chance that the ring will catch on the polishing wheel and bend out of shape.

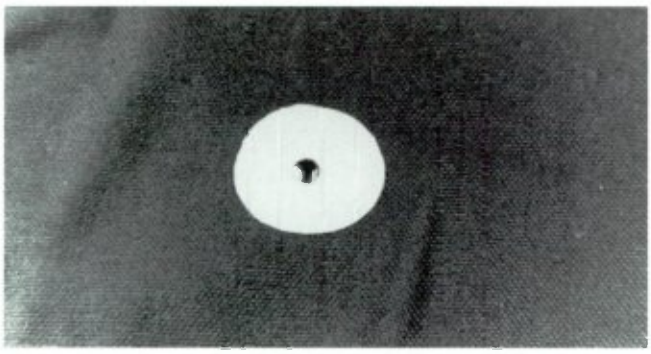
An eyelet around the center spindle prevents velour from unraveling.

This turntable rim can be removed by melting the solder at the joint.

A new eyelet. Small folds in the cloth around the edge of the metal ring are easily smoothed out.



A one-piece rim must be carefully pried open with a screwdriver. The rim can be refastened by pressing the rim down with the butt of the screwdriver.



A ring of tape applied to the back of a new piece of velour prevents the cloth from unraveling if there is no eyelet.

Remember to replace the thin paper often glued between the velour and the turntable. This paper prevents any holes in the turntable from showing through the cloth. These holes serve to decrease the overall weight of the platter.

Cleaning and polishing metal parts

A word about tools

A lot of parts are easily cleaned with metal polish. Unfortunately, many machines are plagued by rust, pitted plating, or damage from previous repairs. The polishing tools needed consist of various grinding and buffing wheels, as well as rotating wire brushes. This are fitted to a threaded spindle mounted on a motor, a bench grinder, or even a power drill. A second-hand ¼ horsepower motor, which turns at about 3300 RPM can be picked up at a swap meet for under 10 dollars. European motors, (50 Hz.) run either at 1450 rpm or 2590 rpm, but either speed is acceptable. Whatever your choice, you will need some kind of electric tool—it is almost impossible to get good results using elbow grease alone.

When you polish metal, you remove all the small surface imperfections that reflect light at odd angles, which cause the surface to look dull. By grinding the metal part with increasingly finer materials, these imperfections are gradually removed. A hard rubber wheel with interchangeable sanding belts is ideal for this type of work. These are a little difficult to get hold of but can usually be ordered through hardware stores.

A buffing wheel and buffing compound will remove any tiny scratches left by the grinding process and will give the part a mirror finish.

Grinding

For the most part, grinding is restricted to iron and steel in order to remove surface rust and pitting. Brass parts are best buffed rather than ground, although very fine grade belts can be used if you are very careful. Grinding will often remove too much brass too quickly, and the part may become deformed. Naturally, feedscrews must not be treated with any kind of abrasive.

The motor you use for grinding and buffing must be firmly fastened to the workbench—and the workbench itself needs to be pretty sturdy. Fastening a bench grinder to a card table with a C-clamp is not a good idea.

Before you start the motor, *always* put on a pair of heavy-duty goggles. Small bits of debris fly off grinding and buffing wheels regularly. Also, make sure that the wheel turns so that the front surface pushes parts towards the floor and not at your face. This probably won't be a problem with a bench grinder, but can occur with electric drills and motors where the machine has no predetermined front.

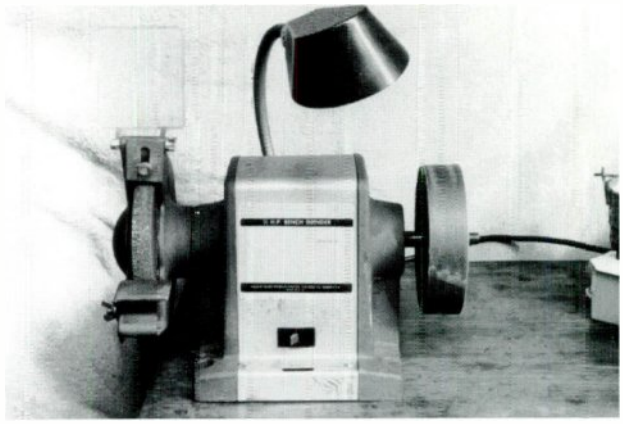
The grinding belts you will need most will be between 220 grade and 600 grade. 220 grade is still fine enough to prevent you from making too many mistakes such as flattening the sides of a rod. Mistakes like this occur if you neglect to keep the part in motion while it is in contact with the wheel, thus removing too much metal in a particular section. Round parts such as rods, or even turntable edges must be constantly rotated for best results. The final grinding before using the buffing wheel should be with a 600 grade belt so that the need for buffing is kept to a minimum.

If the part has deep pitting, you will have to grind off a great deal of the surrounding metal in order to smooth out the damage. An alternative is to fill in the pitting with solder and to grind off the excess. In this way, the dimensions of the part are not radically changed. Badly pitted plated bedplates of the Columbia variety also benefit from this method.

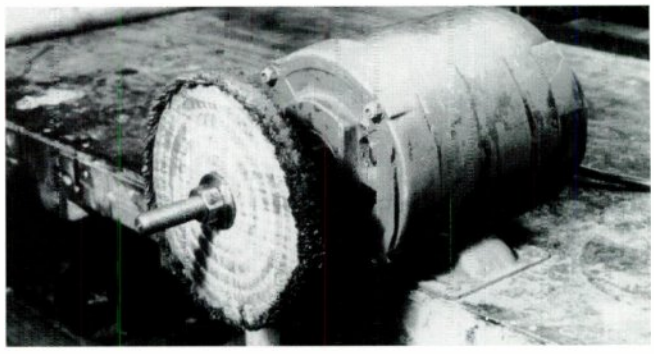
Finally, hold parts firmly, preferably with both hands, so that you have absolute control over them. Small parts such as screws can be held with a pair of pliers.

Buffing

Buffing wheels are made from discs of cotton or felt,

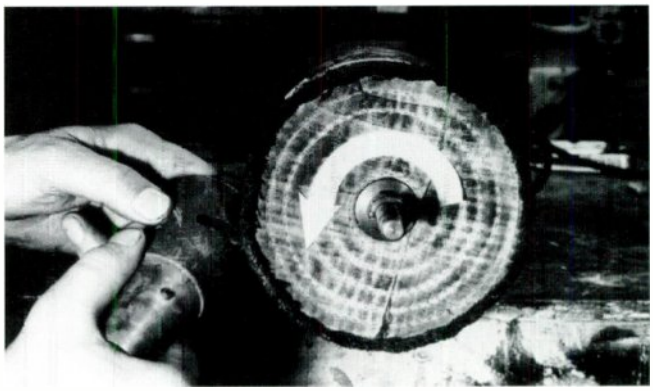


An inexpensive bench grinder equipped with a grinding wheel (left) and a sanding belt.

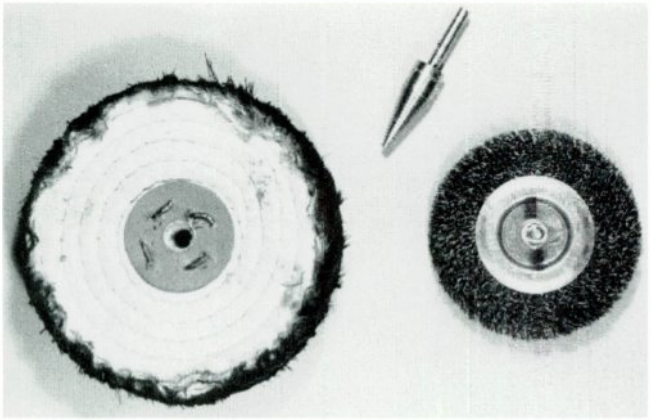


An old electric motor makes a great buffer and costs very little.

A stick of buffing compound.



Make sure that the buffing (or grinding) wheel pushes parts in the direction of the floor and doesn't fling them in your face!



Left: a cotton buffing wheel and the conical spindle that holds it. Right: a rotating wire brush.

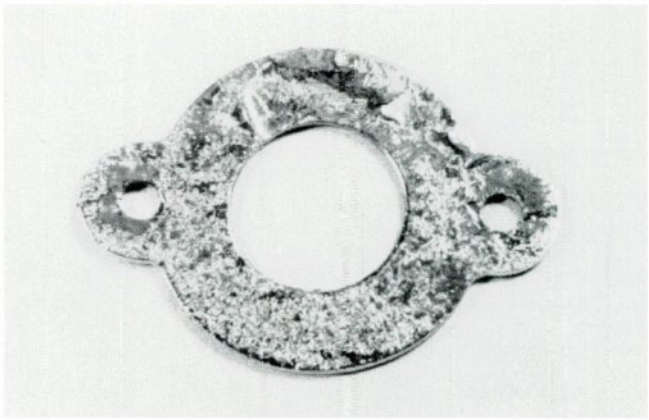
sewn together to form a wheel. Felt is slightly more abrasive than cotton and is good for polishing pitted brass. These wheels don't buff very well on their own, so an abrasive such as jeweler's rouge is applied to the wheel while it spins. These buffing compounds come in thick sticks or bars made of wax which contains an abrasive powder. The sticks can be purchased in varying degrees of abrasiveness. You will probably need two grades—a coarse and a fine. Sears sells a single-grade compound called "white rouge" which works well on most metals. The wheel will have to be reloaded with abrasive periodically when it is in use. Ideally, each abrasive should have its own separate wheel.

The key to good buffing results is not to concentrate on one section too long. Keep the part moving in order to avoid buffing grooves in the metal, or buffing off nickel plating. Make a series of short passes rather than one slow one. Avoid burning thin metal parts such as brass or aluminum horns through excessive buffing. This will cause the metal to become discolored and brittle due to the heat generated by the buffing wheel.

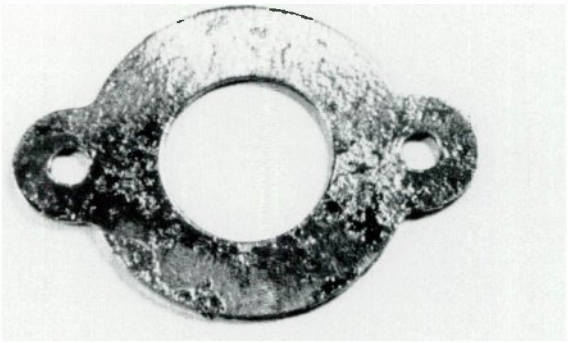
When buffing soft metals such as brass, avoid rounding corners and edges with the buffing wheel. On small items such as patent plates, it's probably smart to stick to hand polishing to avoid spoiling the details. It's far too easy to buff off the lettering when using an electric wheel.

Wire brushing

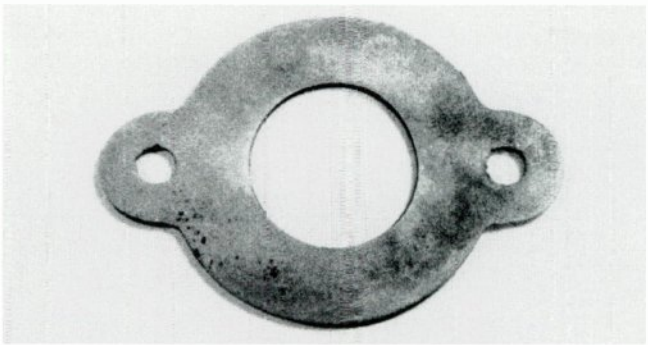
A number of types of rotating wire brushes are available that fit on the threaded spindle of your motor. Both brass and steel brushes can be used to knock off old rust and dirt before grinding. In many cases this is preferable to grinding because the old plating is preserved. Wire brushing is also ideal for cleaning up rusty screws.



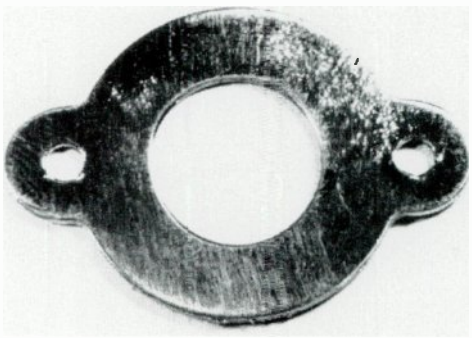
An unrestored crank escutcheon.



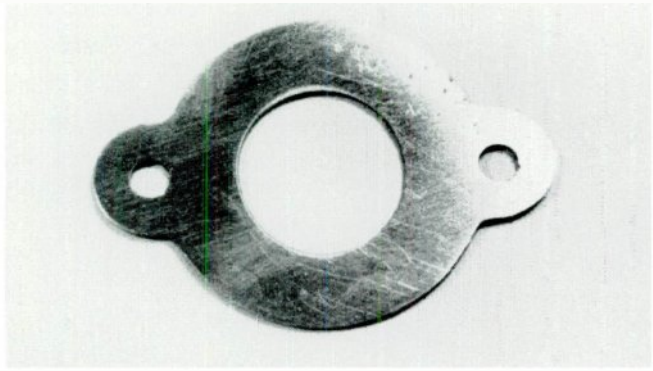
After wire brushing, loose plating and most of the rust has been removed.



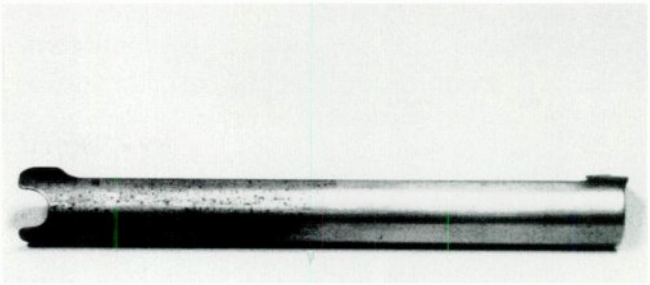
If you remove the rest of the plating with nitric acid (see "electroplating"), the finish will be dull and rough.



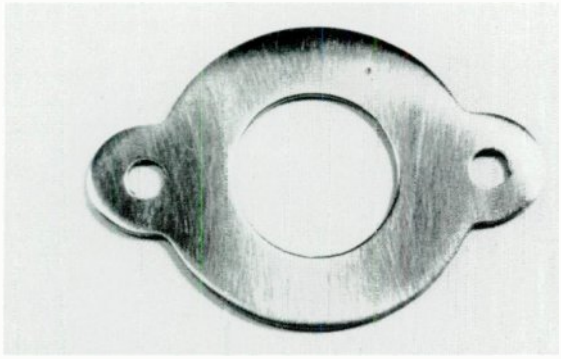
After careful grinding, most of the minor damage is gone.



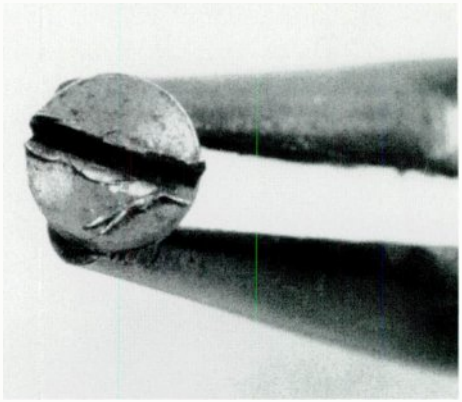
Further grinding starts to remove the deep pitting.



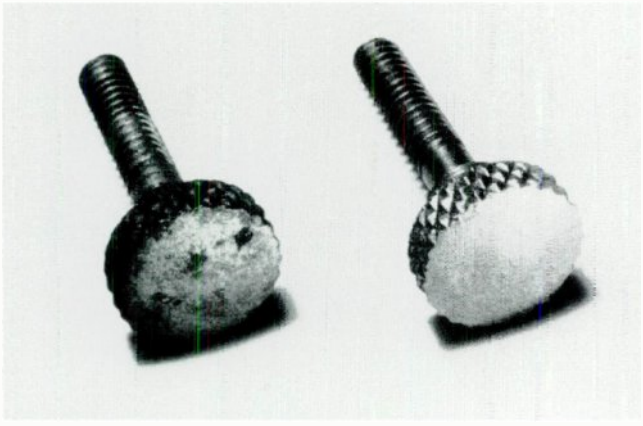
The right side of this feedscrew guard from an Edison Standard has been cleaned by wire brushing followed by buffing.



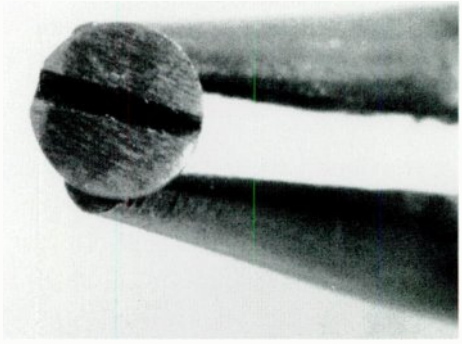
The escutcheon has been ground and polished and only one tiny pit remains. Because the part would get dangerously thin if this blemish were to be removed, it must be filled with solder. Actually, it is more visible in the photo than it is in real life, so I decided to quit. At some point you simply have to say, "Enough is enough!"



This is what happens when you don't use the right screwdriver!



Two bolts, before and after wire brushing.



After a little filing, the screw is almost as good as new. Yes, this really is the same screw!

Steel brushes are normally quite stiff, but special brushes that are very soft can be found in tool catalogs. These soft brushes are marvelous for giving a newly polished or plated surface just a little bit of wear. This is a good remedy if you think a part looks too "new" to be believable, particularly after replating.

When wire brushing, it's not necessary to push the part deep into the wheel. In contrast to the other types of polishing, there is very little abrasive action. Instead, the surface is pounded by the tips of the wires, knocking off tiny bits of dirt, rust and loose plating.

Screws

Butchered screws are a constant source of irritation for the restorer. It would seem that in years gone by, would-be repairmen have only had one size screwdriver—the

wrong size. I realize that many of you will think that this is slightly hysterical on my part, but I just can't see that there's any reason to ruin the head of a screw. Good screwdrivers just don't cost that much! If you feel, as I do, that burred screws are unsightly, take comfort in the fact that many of them can be cleaned up to an amazing degree.

The first step is to buff the screw with a wire brush to get rid of the gunk in the slot, plus any rust. The head of the screw can now be filed with a fine single-cut file. A single-cut file has teeth running in one direction only. If you use a double-cut file, you will cut tiny grooves in the metal.

When the head has been reshaped, a very tiny file can be used to clean up the screwdriver groove. Light buffing on the buffing wheel or wire brushing will finish the job.

Many screws originally had a bluish/black oxidized finish. In order to recreate this color, you can either heat the screw with a propane torch until the metal gets dark, or, if you're really fancy, you can dip the screw in the following solution:

7 oz. nitric acid
10 oz. alcohol
4 oz. copper sulfate
½ gal. water

Another, and far easier method is simply to heat the screw up with a torch until it is red hot and drop it in some engine oil. This gives an appearance very similar to that of original Edison set screws.

Restoring patent plates

Should you have to restore the paint on a Victor, Edison, or any similar embossed patent plate with a painted background, start by stripping off the old paint with stripper and an old toothbrush. Clean out any lettering with a blunt pin or toothpick. When the plate is absolutely clean, you must either replate it, or, if the plating is still good, polish the surface carefully with a soft cloth and metal polish. Clean off any remnants of polish with your blunt pin. Now the entire plate should be clean and shiny.

The next step is rather discouraging as you must spray this entire beautiful surface with the proper background coloring, usually black. Make sure that you give the plate a fairly thin coat—just enough to completely obliterate all the work you've done up to this point. Put the plate aside for a few days until it is good and dry.

After removing the remains of the old paint and some slight buffing, the plate is ready to be painted. Buffing should be kept to a minimum in order to preserve fine details.

The entire plate has been covered with black spray paint.

After careful sanding, a little scraping, and some polishing, the plate is ready to be remounted.

When the plate is dry, get out some 600 grade wet-and-dry sandpaper, tape it to a piece of plate glass to provide a flat surface, and start to sand the plate. At one point, the nickel plating on the raised edge and lettering will start to appear. Now is the time to switch over to a soft rag and some rubbing compound so that you don't sand right through the plating. You may want to use a cotton swab to get at small details. All this sand-

ing takes some time and is sort of a pain in the neck. However, if you want a pretty plate, this is the way it's done!

If your particular plate is too bent or bowed to be sanded in this manner, it is possible to scrape off the excess paint with a very sharp wood chisel. This has to be done before the paint has cured completely—usually within 24 hours of spraying. Scraping requires a steady hand and a lot of patience, but gives good results. Also, the chances of cutting through the nickel plating are reduced considerably.

If you've been working on an Edison plate, the chances are that one or both of the little bent pins that hold the plate broke when you removed them. If they aren't broken, they will no doubt break when you try to put them back! I've tried to heat them up before bending them, but they break anyway. My advice is to reinstall the little devils with a drop of superglue and don't tell anyone you cheated.

Electroplating nickel

A short introduction

In the 1890's, lots of people did nickel plating in their basement and no one made any great bones about it. In the 1990's, electroplating would appear to have become a mysterious kind of alchemy. The would-be electroplater is confronted with dire warnings and lots of secret formulas, and in general is not encouraged to pursue the matter. Well, let me tell you, it just isn't all that difficult!

The first kind of nickel plating, the kind found on most gramophones and phonographs produced before WW I, was dull nickel. This means that the plating was dull when it came out of the plating bath and needed to be polished up with a buffing wheel in order to make it shine. All that buffing took time, so some bright chemists figured out how to make a "bright" bath—one where things were shiny right out of the tank. This saved a lot of buffing time and money. The time required to plate a part was also reduced by adding other chemicals to the solution. This is all well and good, but the present-day restorer will probably find that the color of this modern, quick, shiny plating is too white—more the color of chrome. Such is the price of progress. The slightly golden hue that is present in old nickel plating is very difficult to obtain in most of these bright baths. What's more, modern nickel seems to get dull and pitted much faster than old nickel. I think the reason for this is that the buffing of the dull nickel sealed some of the pores in the metal and prevented corrosion. This is, however, just a theory. Anyway, the color is the important thing. If you decide to send your parts out to be plated, remember to ask for *dull nickel* and buff the parts up when you get them back. The color should be a pretty good match for the original.

How electroplating works

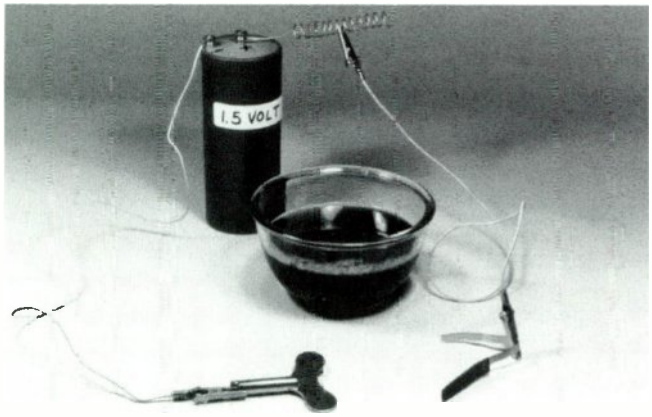
In order to electroplate something, it has to be able to conduct electricity, or at least have a conductive surface. You also need a DC power source, an electrode made out of nickel (or whatever material you want to plate), and a solution (electrolyte) which contains dissolved metal of the same type as the electrode. When the power source is hooked up with the metal electrode on the positive side (anode) and the part to be plated on the negative side (cathode), and both are suspended in the electrolyte, metal from the bath is deposited on the surface of the cathode—your part. At the same time, the metal anode is slowly dissolving in order to replenish the weakened electrolyte.

Probably 98% of the parts you will want to plate will need to be nickel plated, so the rest of this section will be devoted to nickel alone. If you need to plate other colors (metals), the chances are that you will go to a professional plater rather than invest in the chemicals needed for chrome, copper, brass, and so on. If you are really interested in learning more about the subject, I can recommend *A Textbook Of Electroplating*, by R.S. Ingwersen and D.G. Davis, published by Tropic House, Palm Bay, Florida. This is a wonderful manual written specifically for the hobbyist in clear, everyday language. As opposed to most other books on electroplating, you don't need an advanced degree in chemistry to understand what's going on.

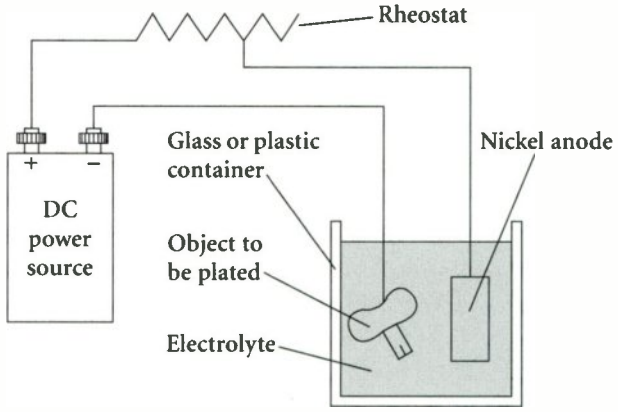
The work area

Electroplating can really be done anywhere in the house. The only requirements are good ventilation and a nearby source of water. Ventilation is the prime consideration as the fumes given off by the electrolyte are not good for you. If you attempt to plate other types of metal, some of the fumes are downright deadly—so take care. *This is no joke!*

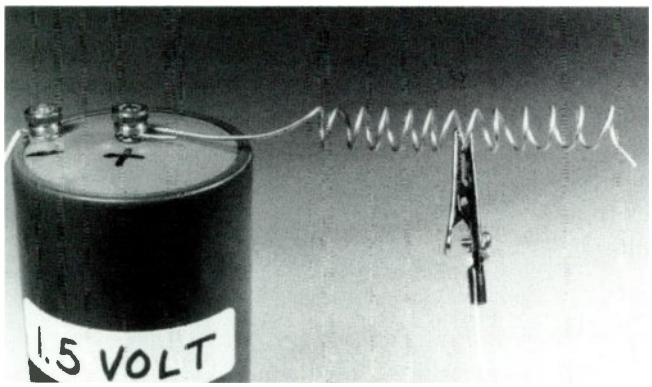
The kitchen is really ideal for electroplating but because of the chemicals involved, you probably ought to find someplace else rather than risk poisoning your family. Some of the plating baths have lovely colors—just like Kool-Aid—and children might be tempted to drink them. Keep them well out of reach!



A simple electroplating setup such as this costs under 20 dollars.



A schematic diagram of a simple electroplating system.



A simple rheostat made from nichrome resistance wire. The further the clip is placed from the pole of the power source, the less current is transmitted.

When working with chemicals of this nature, always wear rubber gloves and wash them before you take them off. Just to be on the safe side, don't eat, smoke, or engage in any other activity where your fingers get anywhere near your mouth. Just use common sense and you'll have no problem.

The tank

Any non-metallic container, such as a plastic bucket or glass bowl can be used as a plating tank. If you can get a bucket with a plastic lid, you won't have to pour your solutions into other containers when you are through for the day. This saves some clean-up time and reduces the risk of spilling chemicals.

The power source

One of the best DC power supplies is a 6V car battery charger. Together with a rheostat to regulate the precise current, this will pretty much take care of all your needs. A car battery itself is also a good power supply and in its simplest form, the power source can be an ordinary dry cell.

If you're using a dry cell, a simple rheostat for regulating current can be made out of nichrome wire. Wind a long, spring-like spiral and attach one end of this spring to the positive terminal on the power source. Using an alligator clip attached to the wire leading to the anode, the clip can be positioned at various places along the length of the nichrome spring. The less spring used to complete the circuit, the more electricity is transmitted to the anode.

The anode

The anode for nickel plating can either be a square of sheet nickel, or a piece of cast nickel, rather like an ingot. As long as the metal is relatively pure, about 92%, it will work fine. Sheet nickel anodes are often pop-riveted to a piece of steel so that the copper wire needed to hook the anode up to the battery does not come in contact with the plating bath. Otherwise, the copper will dissolve in the bath along with the nickel and contaminate the electrolyte. This will ruin the bath in nothing flat! Cast anodes have a tendency to crumble after a while. Therefore, they are frequently suspended in the bath in cloth bags in order to catch any small pieces that may

The peeling plating on this crane is due to improper preparation of the plating surface—and probably an improper nickel bath.

drop off. You can have any number of anodes distributed around the tank, in any shape or size. Generally speaking, the surface area of the anode should be slightly larger than that of the part to be plated.

Preparing the electrolyte

When preparing the plating solution, use only distilled water to avoid impurities in the bath. Don't just use some bottled mineral water—you have to get real distilled water! In order to get the chemicals to dissolve, it is often necessary to heat or even boil the water while stirring in the various powders. This should be done in a Pyrex bowl and not in a metal pot. You ought to buy a bowl specifically for this purpose and not risk contamination of kitchen utensils. When you stir the solution, use a plastic or glass rod. Under no circumstances should you use anything made of metal.

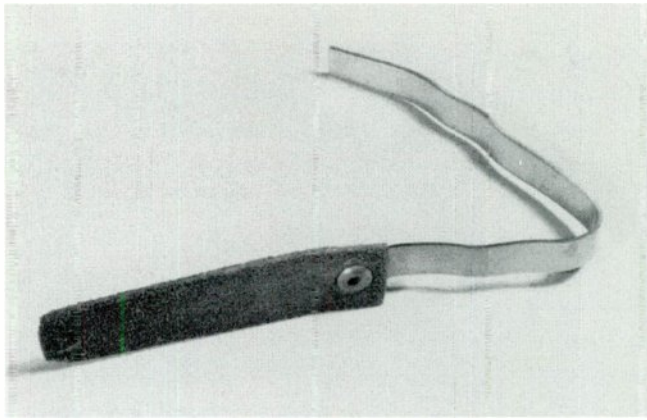
Nickel baths

For really high quality plating, iron and steel ought to be plated with copper before they are nickel plated. This prevents them from rusting underneath the nickel—one of the most frequent causes of peeling plating on cheap machines. Brass, on the other hand, does not require any pre-plating. As long as the nickel plating bath does not contain chloride or nitrate salts, copper pre-plating is not absolutely necessary on iron or steel either. The plating process just takes a little longer. The nickel baths that are described in the following can be used directly on iron and steel.

The simplest nickel electrolyte contains 14 oz. of nickel ammonium sulfate dissolved in one gallon of water. The solution will work well for some time, but will eventually get too weak. This can be fixed by adding a little more concentrated solution. However, due to the various impurities that enter the electrolyte each time you plate, you will have to throw out the old bath at one point and make a new one. Nonetheless, it's cheap to make and can be used at room temperature. Don't make the bath more concentrated than necessary or the plating will come out dark and spotty.

A bath that is self-sustaining and therefore doesn't need replenishing contains the following:

24 oz. nickel sulfate
3 oz. ammonium sulfate
1 ½ oz. magnesium sulfate
2 oz. boric acid
1 gal. distilled water



A simple sheet nickel anode, riveted to a piece of steel.

This bath needs to be heated to about 100-130° F in order to function properly. The plating time will be shorter as the temperature increases. You will have to use this electrolyte in a Pyrex container and keep it on a hotplate while you work. An aquarium heater can also be used to warm the bath if you disconnect the thermostat first.

Since the chemicals used in the nickel bath are often packaged in larger quantities than you will need, you might want to contact a jewelry supply house. They usually have ready-made electrolytes in quart containers at reasonable prices, as well as small nickel anodes. If you cannot find a jewelry supply house, contact a local jeweler. They can usually help.

Acidity

For best results, the electrolyte bath should be pretty close to neutral, although it can be very slightly acidic. You can measure the acidity of the solution with litmus paper. Litmus paper comes in two colors: red and blue. It can be purchased at a drug store. Blue litmus paper turns red if it is dipped into acid, and red litmus paper turns blue in an alkali. If neither change color, the electrolyte is neutral. To change the acidity of a nickel electrolyte, add either sulfuric acid or nickel carbonate (or ammonia) as needed. Adding acid naturally increases the acidity. The electrolyte is constantly changing and should be checked periodically to keep it working properly.

Preparing a part for plating

Plating a part will not hide any imperfections in the metal. If you plate a pitted or scratched part, the pitting and scratches will be visible in the finished work. Therefore, it is necessary to polish the work to a high gloss *before* you plate if you want good results.

Polishing probably represents about 90% of the work in a good plating job. Rust and other types of corrosion will not accept plating.

When the part is polished to your liking, take a scrub brush or toothbrush and scour the part in soapy water. Any traces of grease or polish will result in peeling plating or no plating at all. If there is a lot of grease on the part, you may want to rinse it in trichlor-ethylene in addition to soap and water.

Iron and steel can be cleaned or "pickled" by dipping the part in a solution of 8 oz. sulfuric acid in 1 gallon of water. Another pickling bath contains equal amounts of hydrochloric acid and water. Soak the parts for about a minute to remove rust and oxide scales. When you take the part out, dip it alternately in boiling water and cold water in order to squeeze the last bits of acid out of the pores in the metal. The pickling bath is not absolutely necessary, but usually gives better results than simple soap and water when dealing with ferrous metals.

After you have washed the parts, they should *not* be touched with the bare hands until after they have been plated.

Stripping off old nickel plating

If you need to clean off old plating, there are three ways to do it: you can grind it off; you can dissolve it in nitric acid; or you can strip it off electrically.

To strip nickel electrically, make a bath with 1 pint of water, three pints of sulfuric acid and 1 oz. of glycerin. Instead of hanging the part on the negative (cathode) side, use the part as the anode and hang a piece of lead from the cathode side. Stripping takes very little time with this bath and a 6V power source. If you take the part out as soon as the plating is dissolved, there is less pitting than if you use nitric acid to dissolve the nickel.

Nitric acid is good for removing any nickel fouling threads on nuts and bolts after plating. If you use it to strip brass, the metal will often become rough and pitted—so use it sparingly. Remember, the fumes from the acid are not good for you! Also, keep in mind that acid can badly burn you, so be very careful in how you handle these dangerous liquids.

Current

Current has to be pretty accurate in order to achieve good results. If the current is too low, the deposit gets hard and brittle. If it is too high, the metal gets gray and dull, and may powder. As a rule of thumb, if you see small bubbles of hydrogen forming around the cathode, the current is too high. At the other extreme, if no plating has occurred after about three minutes, the current is too low. These ought to give you some easy guidelines for judging the power requirements. The right current is usually the maximum you can provide without forming any bubbles. Keep records of what you plated and how, in order to judge the correct current with minimal experimentation the next time you plate. The correct current is approximately 0.1 Ampere per square inch of cathode surface.

Putting it all together

The only thing left to discuss is the plating itself. The nickel anode is suspended in the electrolyte and attached to the positive side of the power source with 18 or 20 gauge copper wire. Don't get the copper in the electrolyte! Tie the part to be plated, or a series of parts, to another piece of copper wire and hook it up to the negative (cathode) side. Copper won't harm the bath as long as it is on the cathode side—it just gets plated like everything else.

When the cathode is dipped in the electrolyte, the plating process will begin. If the current is properly regulated according to the guidelines mentioned earlier, the parts will be beautifully plated in about 20 to 40 minutes. The anode and the cathode mustn't come in contact with one another or the system won't work.

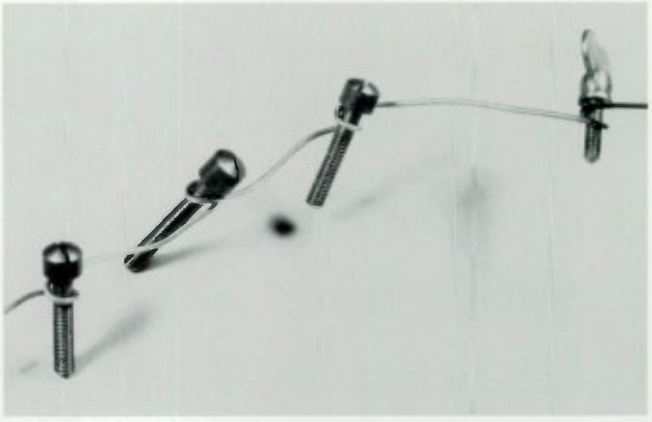
Nickel plating will take on a slightly bluish color when the proper thickness is reached. Too thick a deposit may become rough and difficult to buff.

When the plating is done, wash the part alternately in hot and cold water. Once again, this serves to clean the pores in the metal. Although the plating is dull when it comes out of the electrolyte, a little buffing will bring out the shine. If you think the part is too shiny, a soft wire scratch brush will dull the finish slightly.

The part of the cathode that is closest to the anode tends to get plated first. This depletes the electrolyte in this area of the bath. If you stir the electrolyte, you will only succeed in building up an extra thick deposit where the cathode is closest to the anode. You also risk stirring up sludge from the bottom of the tank. If you have a part which needs to be plated on all sides, such as a mandrel, it is better to hang a series of electrodes around the sides of the tank so that all sections of the part are facing an anode at the same time. As an alternative, you can rotate the part periodically.

If the entire part won't fit in your tank, it is possible to plate the piece a section at a time by dipping only half of the part in the electrolyte, for example the two halves of a long rod. Note how long you plated each sec-

Bubbles at the cathode indicate too much current.



Small parts such as screws, nuts, bolts, etc. can be strung on a piece of copper wire and plated all at the same time.

tion so that the deposit is pretty much the same thickness all over. Any overlapping will usually be invisible after the part is buffed.

I sincerely hope I haven't scared you off with all these do's and don'ts. Electroplating isn't that scary after you've played with it for an afternoon. There are many more formulas that you can use, but I've found those already mentioned to be suitable for most purposes. Even if you prefer to send larger things out to a professional plater, it's nice to be able to plate a few bolts or other small items you come across during the course of restoration, without wasting time or money going to the plater.

The very simplest setup costs under 20 dollars and consists of a quart of simple electrolyte, a bowl, a little sheet metal anode, some copper wire, some nichrome wire, and a 1.5V dry cell. As an alternative to a rheostat or nichrome wire, you can also regulate the current in a simple system like this by dipping less of the anode in the solution. This will also lower the current. The results are just as good as those from any professional plater.

IDENTIFICATION

A short note about the pictures

Over the years, a number of superb books have been published which help collectors identify their machines. These books are listed in the bibliography and are highly recommended. This brief section cannot hope to compete with these detailed and scholarly works. However, I feel that pictures of a representative cross-section of American machines might be appreciated by collectors who are not familiar with these other books, which are often out of print.

As far as possible, the machines illustrated are shown with correct equipment. However, cranks, reproducers, etc. have a way of getting lost, tone-arms are sometimes replaced (or added), and early Edison machines have frequently been converted to play four-minute cylinders. I have tried to note any discrepancies so that the reader is not misled. Whenever possible, I have taken my information from original catalogs.

Early talking machines changed a great deal during production. In fact, a machine such as the Edison Gem can be shown in a hundred variations. Columbia disc machines went through a number of cabinet and motor changes, and Zon-O-Phone machines come in a vast number of bewildering permutations. In short, just because your machine doesn't look exactly like one of the pictures here doesn't necessarily mean that it is incorrect—it just means I didn't take a picture of it!

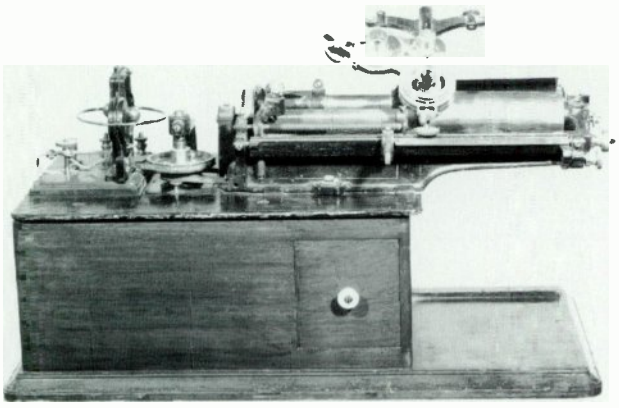
Edison

Edison's original tinfoil machine of 1877 was marketed in limited numbers by the Edison Speaking Phonograph Co. and his "Perfected" phonograph (wax cylinders) of 1888 was marketed by both Edison and Jessie Lippincott. However, Edison's machines didn't really have wide distribution until the introduction of the "Spring Motor" phonograph of 1895. After 1895, over 45 distinct outside horn cylinder machines were produced, some in huge numbers. A wide variety of internal horn "Amberolas" were produced after 1909, and 1913 saw the introduction of the first "Diamond Disc" machines.

With the introduction of four-minute cylinders in 1908, special conversion kits became available to owners of older machines so that they, too, could enjoy the new cylinders. Edison also sold repeating attachments, which allowed the machine to play the same selection over and over again, limited only by the power of the spring and the tolerance of the listener.

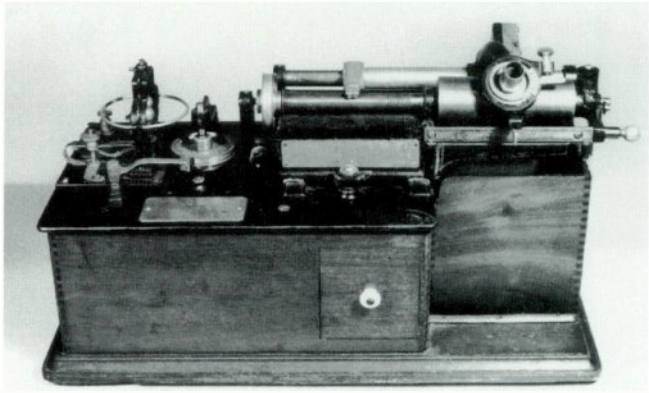
Despite all these special devices, Edison was slow in supplying larger horns for his machines. Indeed, before the introduction of the black flower horns in 1908, all Edison phonographs were equipped with simple "witch's hat" horns, all brass before 1901, and black-and-brass during the period 1901-07. Because of the poor reproduction qualities of these short horns, owners were forced to purchase better horns and cranes from outside manufacturers. What this all boils down to is this: few Edison machines are found in their "original" state and dating must be done on the basis of machine design rather than on the type of gearing, reproducer, carriage, etc.

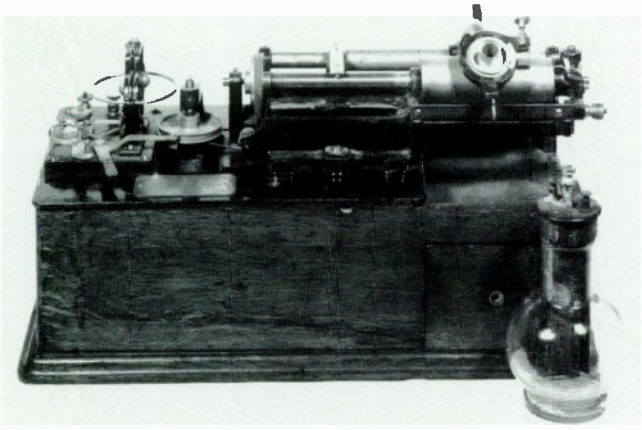
All machines shown here have oak cases and are "factory issue" unless otherwise indicated. Details of reproducers, gearing attachments and a number of other special features are illustrated in other parts of the book. For further information on Edison machines, I highly recommend George Frow's outstanding *The Edison Cylinder Phonograph Companion*, which is listed in the bibliography. Mr. Frow has also written an excellent book on Edison's Diamond Disc machines, which is also listed.



Class S, c. 1888-1893. The Class S was the first Edison phonograph to achieve any degree of commercial success. Also known as the "Perfected" phonograph, the Class S was designed for office dictation and has a characteristic "spectacle" mounting which holds both a recorder and reproducer. The machine was leased to users and was only rarely sold outright. (Photo courtesy of Christie's South Kensington)

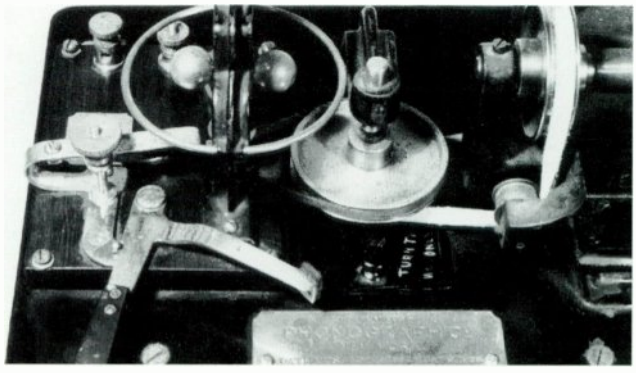
Class M, c. 1893. The electric Class M shown here, once the property of phonograph historian Oliver Reed, was marketed during the Lippincott era and is a direct descendent of the Class S. The Class M survived until late 1909 under the names "Victor" and "Balmoral." All of these machines were powered by a 2 ½V wet cell battery. Class E machines, similar in appearance, used 110/120V from a DC wall socket. The Class M cost $150.00 when first introduced, falling to $60.00 by 1900. The reproducer is the Edison Automatic Speaker. (Allen Koenigsberg collection)

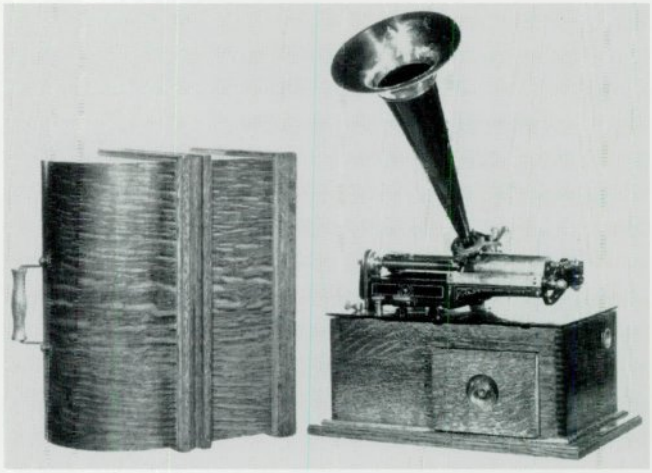




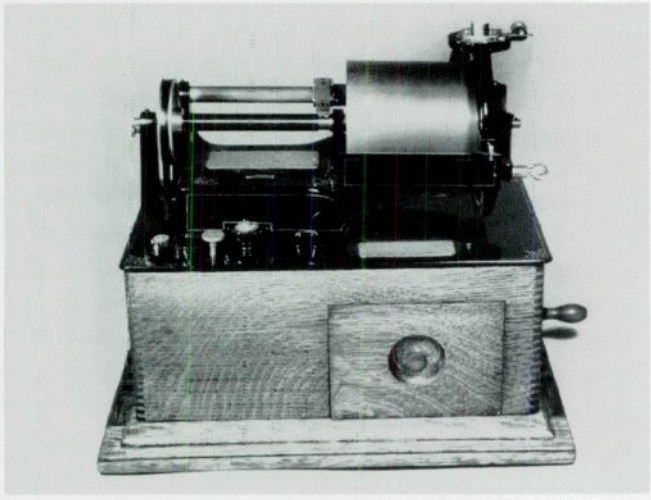
Class M, c. 1900. A later version of the previously mentioned model featuring the more common restyled flat-front case. The glass bottle is the original wet cell battery. (Photo courtesy of Christie's South Kensington)

A detail of the governor and on/off switch on a Class M. (Dennis and Patti Valenti collection)



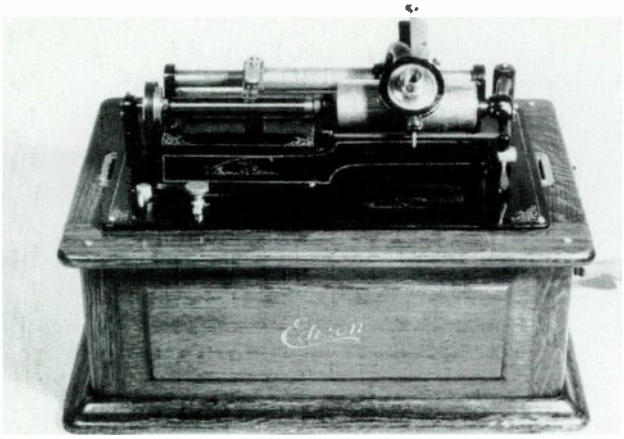


"Spring Motor," 1895-1900. The Spring Motor has a heavy duty triple-spring motor and a large lid that covers the entire machine. Note the adjustable knife edge and shaver. The drawer provides storage for oil cans, recorders, and other paraphernalia. The reproducer should be the Edison Automatic rather than the model B shown here. The Spring Motor cost $100.00, falling to $50.00 by 1900. (Photo courtesy of Christie's South Kensington)



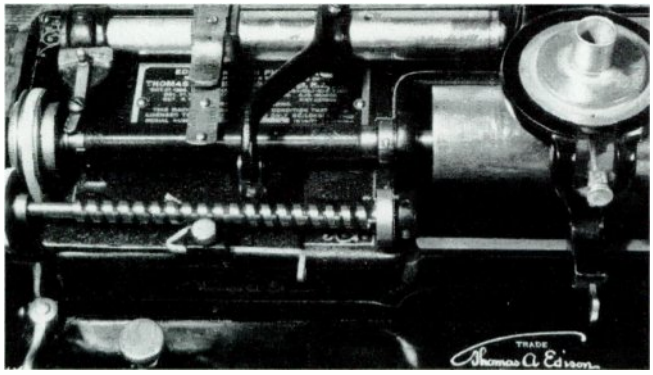
"Concert" model A, 1899-1900. The Concert is essentially a Spring Motor machine with a large 5" mandrel. Later model Concerts resemble the Triumph A, and a final model from 1906 resembles the Triumph B. After 1906, the Concert was withdrawn. Conversion kits were available for many years in order to allow owners to play standard cylinders. The early Concert cost $125.00, falling to $75.00 within a few months. (Ernie Bennett collection)

"Triumph" model A, 1901-05. The Spring Motor acquired the name "Triumph" in 1901, along with a restyled "green oak" cabinet. In 1903, the corner posts were rounded (as seen here), the earliest models having sharp, square corners. The model A sold for $50.00 and was equipped with the new model C reproducer after 1902. (Bob and Susan Lloyd collection)



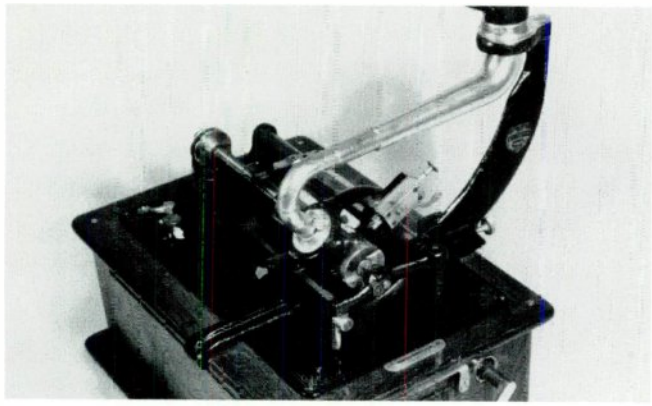
"Triumph" model B, 1906-08. The model B is essentially the same as the model A, but features a restyled case and endgate lock. After 1907, the machine came with a 12-panel 33" black flower horn, as did the model C and D. The model B cost $50.00. The model C (1908, not shown) is essentially a model B without the endgate. (Peter Dilg collection)

This model B Triumph has been converted to play both two and four-minute cylinders. As a result, the carriage has been changed to accommodate an O reproducer and gearing has been added. This machine also has a repeating attachment. Although production of these special parts stopped in the early 'teens (1911 for the repeater), dealers still had upgrade kits on their shelves during the 20's. (Bill and Peggy Robbins collection)



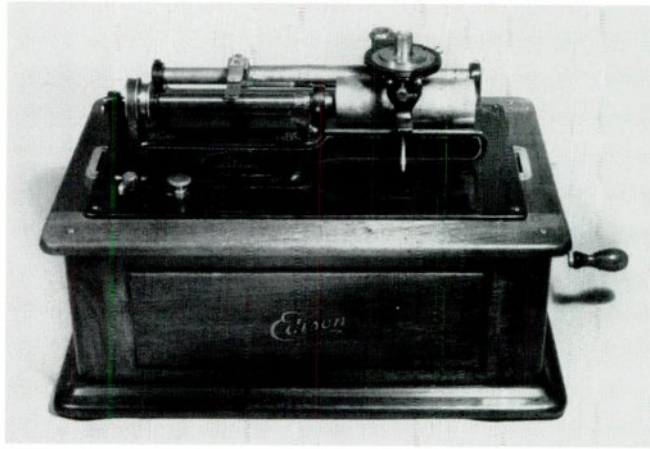
A detail of the repeating attachment and 2/4 minute gearing on the model B Triumph.

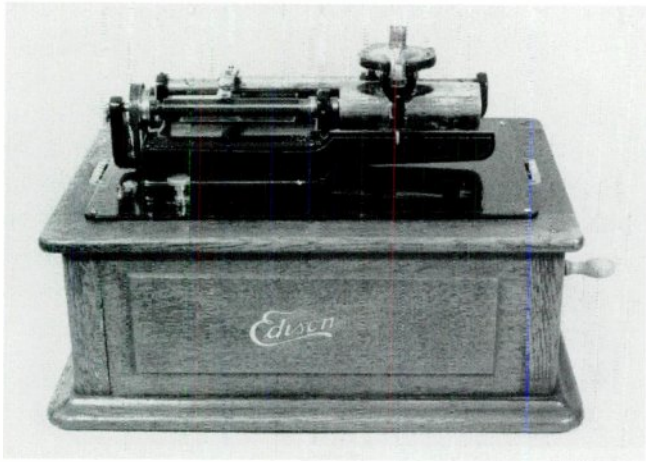
This Triumph B has an interesting, and definitely non-Edison back-bracket and horn, made by the Phon-arm Co. of Chicago, probably around 1908. (Mike Patella collection)



A detail of the Phon-arm attachment.

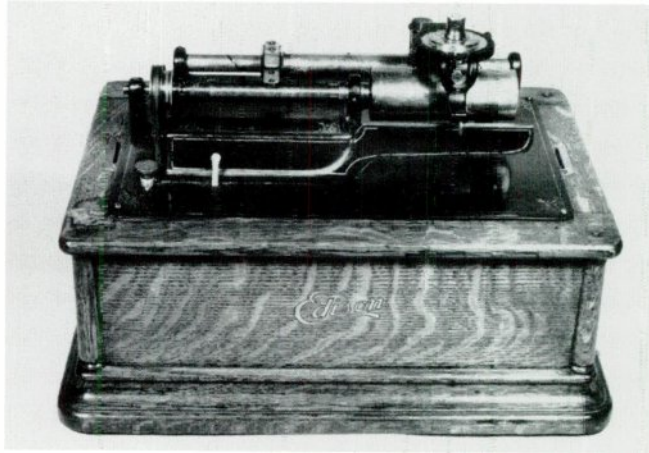
"Triumph" model D, 1908-10. The model D is equipped with 2/4 minute gearing as standard equipment and like the short-lived model C, has no endgate. The governor has four weights rather than three. With a standard 12-panel horn, the machine was known as the D1 and with an 11-panel Cygnet horn as the D2. The model D came in both oak and mahogany (as shown here). Mahogany added an extra $15.00 to the basic cost of $60.00. The machine shown here has been upgraded by adding a horizontal carriage and O reproducer. Standard-issue machines have C and H reproducers. (Bill and Peggy Robbins collection)





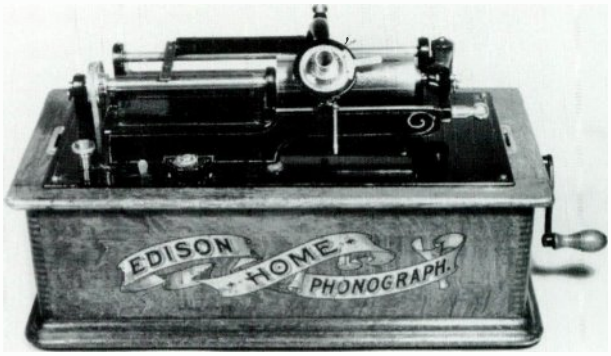
"Triumph" model E, 1910-1911. The model E is essentially a model D with an O reproducer as standard equipment, although the machine in the picture has a Diamond B reproducer. With an 11-panel Cygnet horn, the model E originally cost $70.00. (Author's collection)

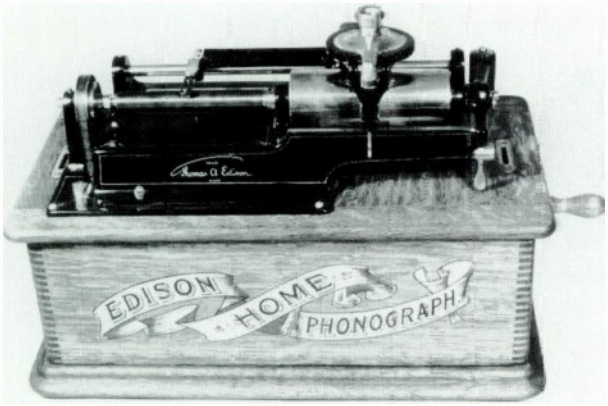
"Triumph" model F, 1911-12. The F has an oak version of the Opera case and came with an oak "Music Master" Cygnet horn and O reproducer as standard. The model G of 1912 substituted a Diamond B reproducer for the O, but otherwise the machine remained unchanged. The machine pictured here has the earlier O reproducer. Both the F and G have double-spring motors rather than the earlier triple-spring type. The model F cost $75.00. (Dennis and Patti Valenti collection)



"Home" model A, 1896-1901. The "Suitcase" Home was the first Edison machine to carry a decal, although some early models don't have one. The simple single-spring motor is effective and was inexpensive to produce. The crank is of the slip-on variety and is "S"-shaped. The Home cost $40.00. (Ernie Bennett collection)

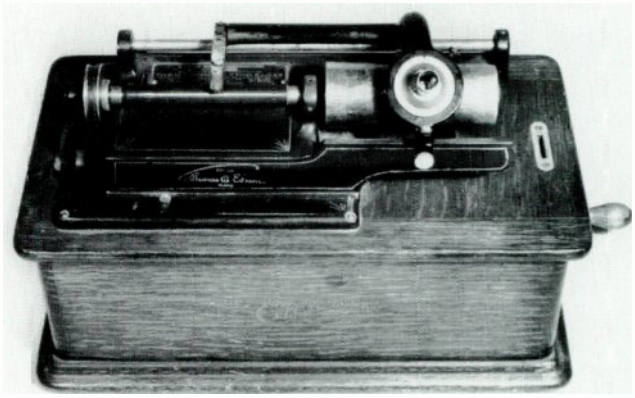
"Home" model A, 1901-05. Like the Triumph, the Home was restyled in 1901 with a "green oak" cabinet. Early versions still have the old lid transfer from the suitcase style machine, but when the old decal stock was used up, the new style decal shown here was used. The price of the model A fell to $30.00 in 1901. (Bob and Susan Lloyd collection)

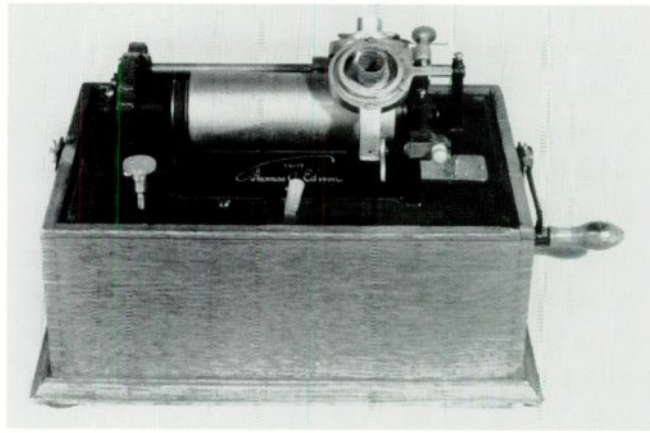




"Home" model B, 1905-08. The model B has a restyled endgate latch, screwed-on crank, shorter case and a one-piece bedplate. Also, the shaver was dropped at this time. The B can be found with the banner decal, although later models have just the Edison signature. The machine shown here has been adapted for 2/4 minute cylinders and has a large carriage. Originally, the carriage was slanted and came with a C reproducer. The model B cost $30.00. (Author's collection)

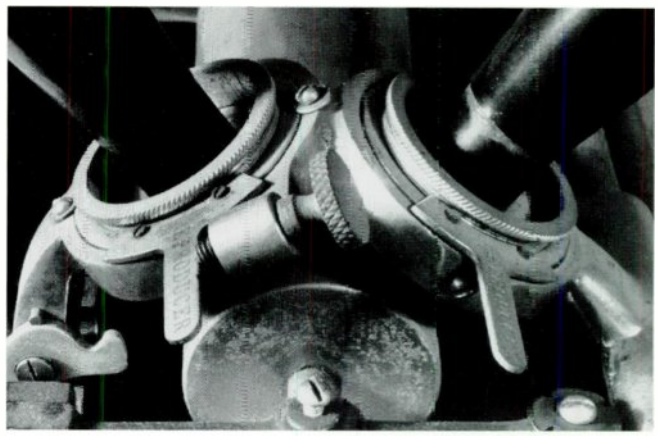
"Home" model C, 1908. The model C is simply a model B without the endgate and with a push-button rather than a lift lever on the carriage. The model C cost $35.00 with an 11-panel horn. Model D, E, and F Homes follow the same development as the Edison Standard with regard to horn, reproducer and case changes. (Mike Patella collection)





"Standard" model A, 1898-1901. Until the introduction of the Gem in 1899, the Standard was Edison's least expensive machine. The model shown here is equipped with a Polyphone attachment, which allows two reproducers to ride in tandem, thus increasing the volume. The Standard originally cost $20.00. (Walter Bellm collection)

Another view of the Edison Standard with the Polyphone attachment. The horns are typical for the Polyphone (and some early Columbias). Polyphone attachments were made for a number of Edison and Columbia products in the years 1899-1901.

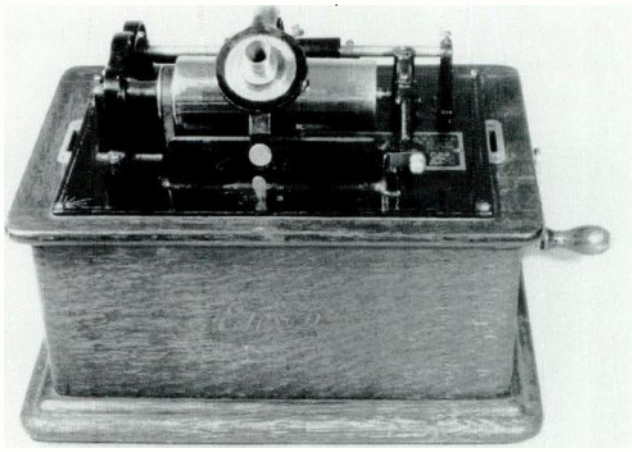


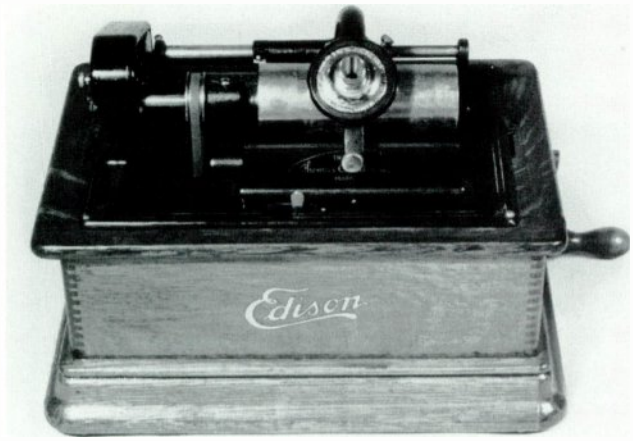
A close-up of the Polyphone attachment.

"Standard" model A, 1901-05. The restyled Standard of 1901 has a "green oak" case and either the model B or (later) model C reproducer. The Standard remained priced at $20.00. The early style lift lever was replaced with a push-button around 1903. (Author's collection)

A detail of the Edison Standard decal.

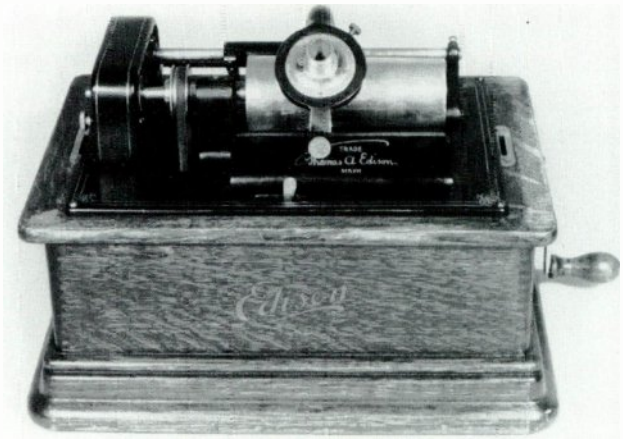
"Standard" model B, 1906-08. The model B is a taller machine than the model A. Later model B's have the simple Edison signature rather than the banner decal. Other than the redesigned case and the fact that the speed control was now located inside the cabinet, there is very little difference between the B and the A. The model B cost $25.00 with the new 10-panel horn introduced in 1907. (Author's collection)



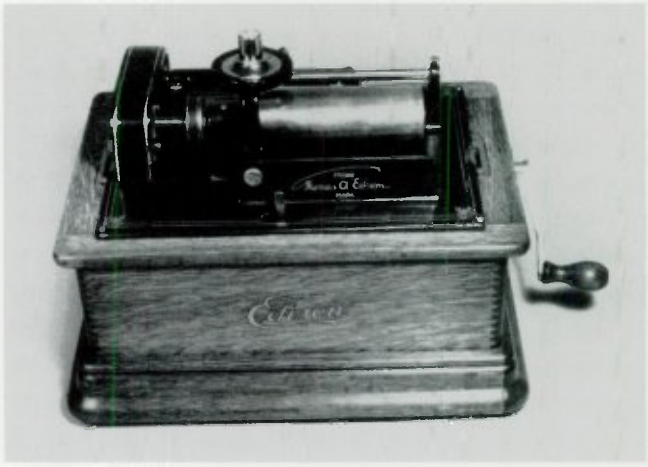


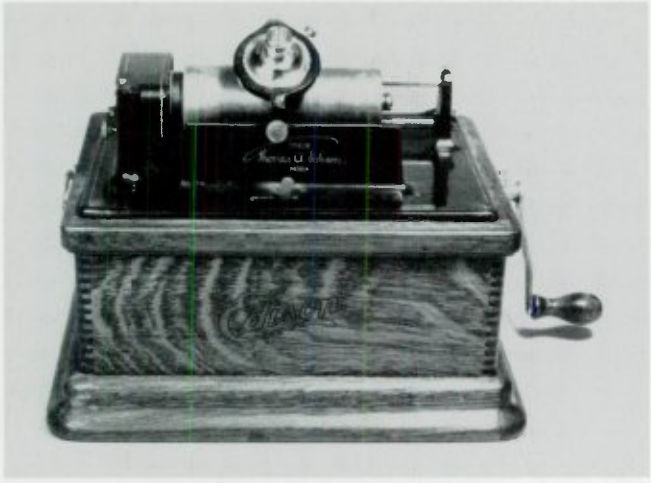
"Standard" model C, 1908. The model C generally resembles the model B, but lacks the endgate. The machine shown here was issued after the introduction of the model D and therefore has a style D case and striping decoration. The 2/4 minute gearing attachment was no doubt installed at the factory. Normally, the C sold for $25.00, but the machine here was sold for $30.00. A special language machine built for International Correspondence Schools resembles the model C, but retains the outside speed control and has a special attachment along the knife edge to permit the listener to repeat the previous grooves on a language cylinder.

"Standard" model D, 1908-11. The model D came in a restyled case and has 2/4 minute gearing as standard equipment, plus both C and H reproducers and a 10-panel horn. The D cost $30.00. (Author's collection)



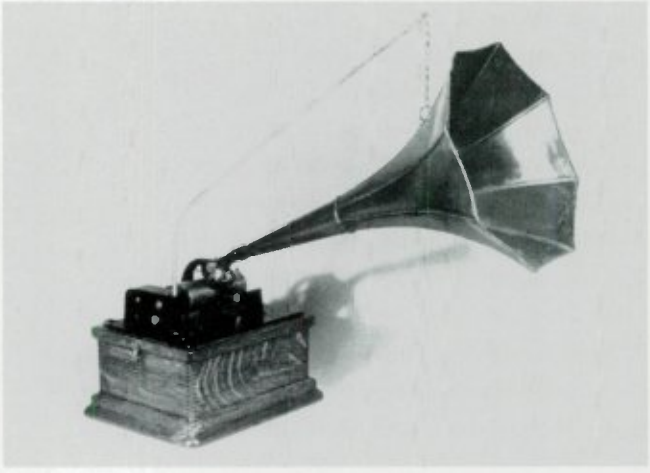
"Standard" model F, 1911. The model E (not shown) and the model F are almost identical to the model D. The only difference is that the E (a pure four-minute machine) uses the large N reproducer and the F (2/4 minute) is equipped with a small diameter, horizontal carriage for an S or R reproducer. Both machines sold for $35.00 with 10-panel Cygnet horns. The model G, also based on the D, is strictly a four-minute machine with a Diamond B reproducer and large carriage. (Bob and Susan Lloyd collection)

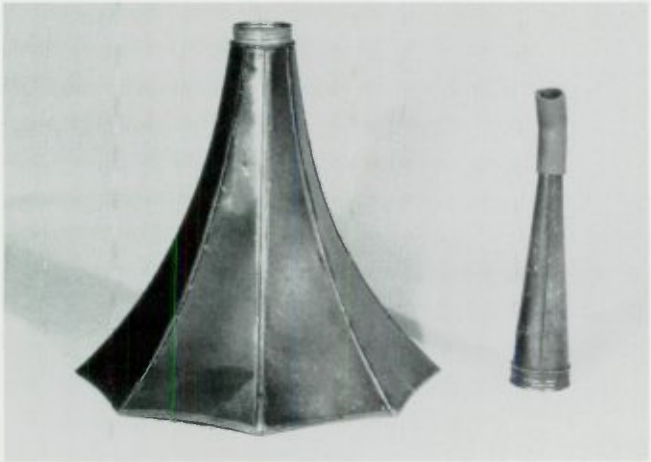




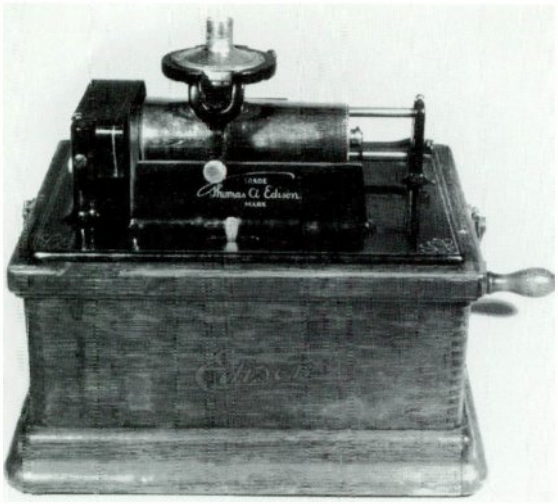
"Fireside" model A, 1909-12. The Fireside is a simple, well-designed 2/4 minute machine which uses Edison's combination K reproducer. Priced at $22.00, complete with a special two-piece 19" horn, the Fireside fit into the Edison line between the larger Standard and the much smaller Gem. (Author's collection)

Another view of the model A with its two-piece crane and special horn. Normally, the horn is of two-piece design, but this early model, identical in all but the decal to the Gem horn, is of single-piece construction.





This picture shows the more typical two-piece construction of a Fireside horn. Although virtually all Fireside horns are red, some have transparent paint, while others are opaque. A very few green horns also exist. (Walter Bellm collection)

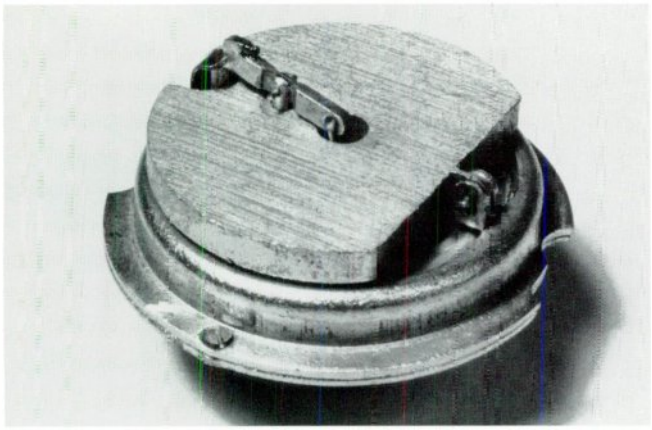


"Fireside" model B, 1912-15. The model B is identical to the A except that it can only play four-minute cylinders and has a large carrier arm. Originally the machine came with an N reproducer, but a Diamond B could be purchased for an extra $5.00 over the basic price of $22.00. (Bob and Susan Lloyd collection)

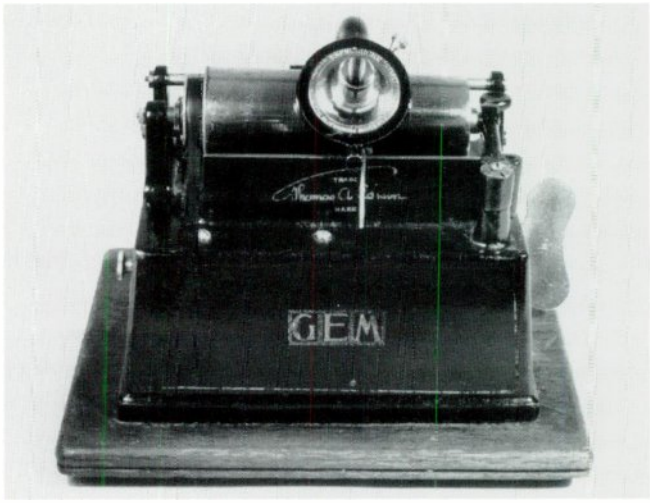
"Gem" model A, 1899-1901. The earliest Gems were caseless and are equipped with a metal drip pan underneath the motor to catch oil from the motor. The model A has a unique built-in reproducer which cannot be removed from the carriage. The early model A cost $7.50. (Allen Koenigsberg collection)

"Gem" model A, 1900-02. The second model A has a different motor configuration, an endgate, and a special "Gem" reproducer. A simple case was provided in place of the drip pan. The improved model A cost $10.00, complete with a simple 10" cone horn. (Bob and Susan Lloyd collection)

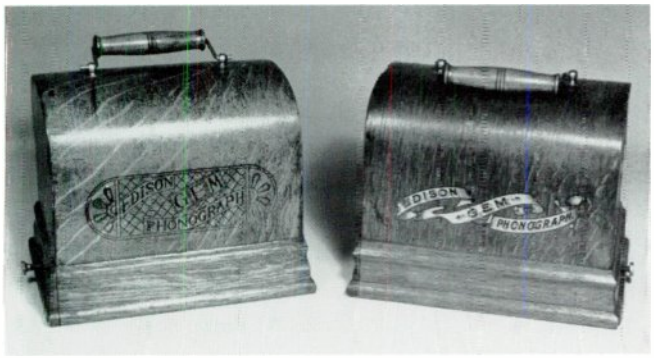
A detail of the Gem reproducer.



The rear of the Gem reproducer. Although the weight design is similar to that of the B reproducer, the stylus is similar to that of the C.



"Gem" model A, 1902-1905. The third and final model A variation features a standard reproducer carriage and a slotted winding shaft which accepts a flat key. (Bob and Susan Lloyd collection)



Two early Gem lids. The one on the left is branded and belongs to the second model A. The lid on the right has the more common decal of the third and final model A. This decal can also be found on some early model B Gem cases. Since the model B (and all subsequent Gems) have cranks, which cannot be removed, later lids have a slot on the right-hand side. (Bob and Susan Lloyd collection)

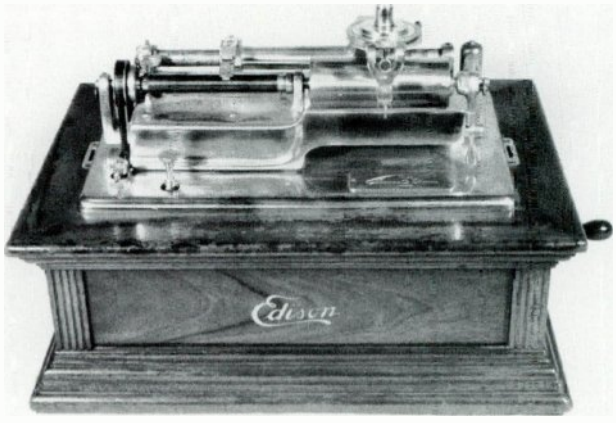
"Gem" model B, 1905-08. The model B has a restyled motor and a permanently attached crank. The machine shown here has a socket on the left-hand end of the casting which accepts the one-piece crane introduced in 1907. Earlier Bs do not have this socket. The Gem was still priced at $10.00. (Author's collection)

"Gem" model C, 1908-09. The model C has a redesigned decal and more decoration than previous models. Other than the cosmetic changes, the only improvement was that the endgate was dropped and a 19" 8-panel horn (black) was added as standard equipment. The price rose to $12.50. (Bob and Susan Lloyd collection)

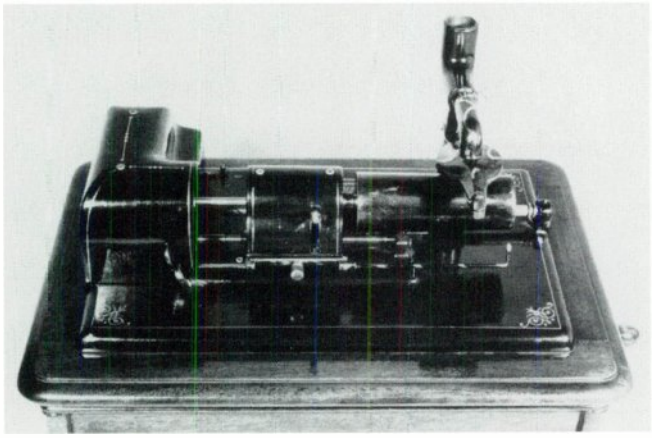
"Gem" model D, 1909-12. The model D has a striking maroon color, 2/4-minute gearing, and K reproducer as standard. A one-piece version of the Fireside horn and one-piece crane were also part of the package at $15.00. Although the machine itself is opaque maroon, the horns are often iridescent red. (Bob and Susan Lloyd collection)

"Gem" model E, 1912-14. The final version of the Gem, also maroon, is strictly a four-minute machine. The only other difference is the large carriage and N reproducer. The small round plaque is a museum identification tag, which the reader may spot on several other machines illustrated in this section. (Walter Bellm collection)

"Idelia," 1907-12. The mahogany Idelia, a glorified Triumph, appeared in four variations between 1907 and 1912. Usually, these have oxidized hardware, but the machine shown here is gold-plated. This very early model, equipped with an endgate, originally had a slanted reproducer carriage, but 2/4-minute gearing and a large carriage have been added. The Idelia sold for $125.00 with an oxidized crane and 11-panel flower horn. The model D1 from 1908 is very similar, but does not have the endgate. The model D2 from 1909 features a metal Cygnet horn, and the late-style model E from 1910 has a horizontal carriage and was equipped with a mahogany Music Master Cygnet horn.

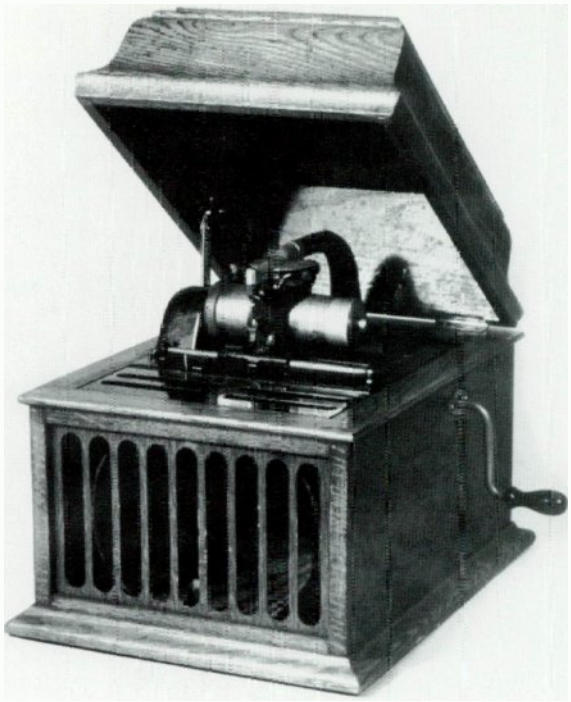


"Opera," 1911-13. The Opera, later called the "Concert" (not the same as the early Concert), is a four-minute machine designed to take the place of the Idelia in the Edison lineup. The mahogany case and dark maroon bedplate were standard, but oak cases were also available. The double-spring motor moved the mandrel underneath the fixed reproducer, which permitted the heavy horn to be mounted without the benefit of a crane. The Opera sold for $90.00. (Peter Dilg collection)

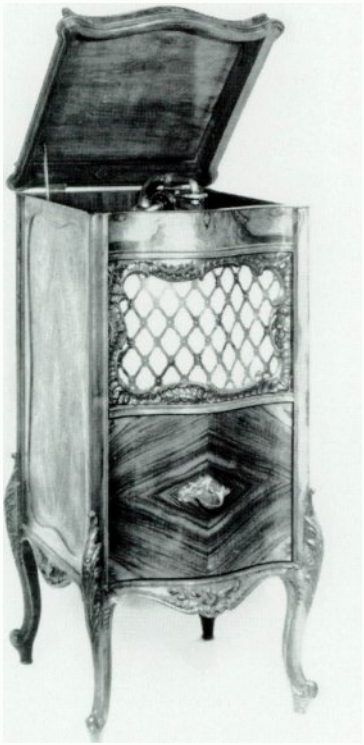


A close-up of the Opera bedplate, identical in construction to that of the internal horn Amberola I and III.

A detail of the Edison Music Master decal.



"Amberola" 30, 1915-29. The little Amberola 30 is typical of Edison's table model Amberolas. The model 30 features a Diamond C reproducer and simple single-spring motor. The model 30 originally sold for $30.00, very much in keeping with the price of similar sized Victrolas and Grafonolas. The "-ola" suffix was always used to denote internal horn machines. (Ernie Bennett collection)



"Diamond Disc" model A-425, "Louis XV," 1912-14. This machine is typical of the vast number of "art style" machines produced by Edison from 1912-29. The Louis XV style shown here was finished in Circassian walnut, and at $425 was a fairly pricey machine for its day. Only about 60 of this particular model were produced. (Photo courtesy of Christie's South Kensington)

"Ediphone" dictation equipment, c. 1938. The Edison "Voicewriter" shown here is typical of the later office equipment produced during the 30's and 40's. The machine on the left is for transcribing, while the machine on the right can both record and reproduce. Both are electrically operated. (Author's collection)

Columbia Cylinder Machines

The first machines were made by the "American Graphophone Company" in 1888, which subsequently became part of the "Columbia Phonograph Company" in 1894. The American Graphophone Company continued to manufacture, while Columbia took over sales and distribution. For the sake of simplicity, I use "Columbia" to indicate both companies throughout most of this book.

Most of the early models, designed for dictation, were dropped in favor of entertainment machines after 1894. See "Lippincott" in the section on historical names for further information. Columbia continued production of cylinder machines until 1910, after which the company concentrated solely on their line of disc models, although the manufacture of cylinder dictation units continued for many years.

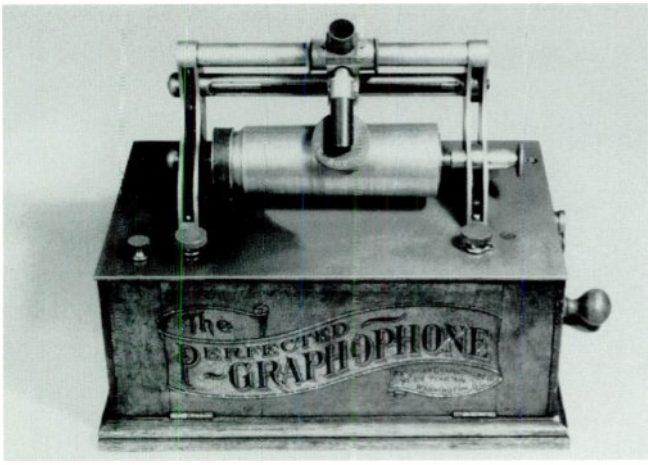
With the exception of the tone-arm machines of 1908, all other Columbia cylinder phonographs originally came with either listening tubes or short horns of the "ride-the-reproducer" variety. Larger horns were available as options, but these relied on table or floor stands for support. As a result, very few Columbia machines are found with attached horn cranes, although some rear-mounted cranes were available from outside suppliers.

About 1897, listening tubes gave way to short 10" conical horns, similar to those supplied with the Edison Gem. Within a short time, these, in turn, gave way to 14" aluminum horns, which were original equipment on all machines with pot metal carriages. Machines with brass or steel carriages came with either black, black-and-brass, or nickeled "witch's hats."

Although I have indicated dates for the end of production of some models, these dates are not strictly accurate. Columbia had a habit of shipping off machines to mail-order houses long after production had officially stopped. These machines were made up from Columbia's supply of spare parts and often vary from "standard issue" machines. Therefore, any cut-off dates should be viewed more in terms of when machines were officially on the market rather than precise production periods.

All Columbia cases are oak unless otherwise indicated.

I am indebted to Howard Hazelcorn for assisting me with the Columbia cylinder and disc phonograph sections. For further details regarding Columbia's cylinder machines, horns, reproducers, etc., I highly recommend Mr. Hazelcorn's excellent Guide to the Columbia Cylinder Phonograph, which is listed in the bibliography. This, along with Mr. Hazelcorn's personal comments, forms the basis for much of the information contained herein.

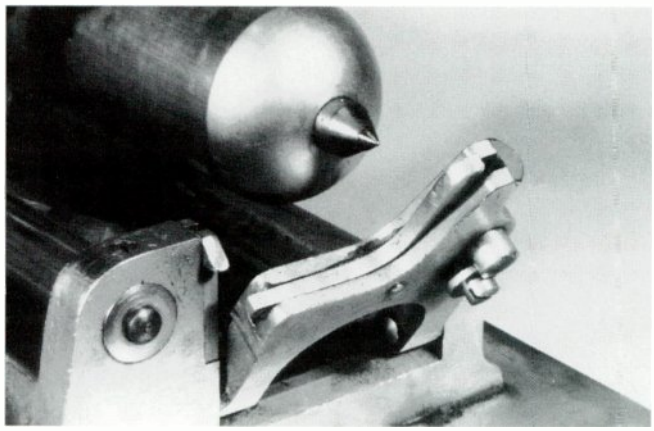


Model G "Baby Grand," 1894. This was the first Columbia machine designed specifically for home entertainment. The Baby Grand plays the standard wax cylinders made by both Columbia and Edison, and was the first machine designed by Thomas MacDonald (see the section on historical names). The price on introduction was $75.00. (Allen Koenigsberg collection)

Model I, 1895. The model I is an adaptation from the earlier treadle-powered dictation machines. The large pulley wheel is typical of these early conversions. Although the machine pictured here is shown with an Edison-type mandrel, this can be removed so that the earlier Bell-Tainter cylinders can be used. The original Bell-Tainter feedscrew was altered (at the factory) for one cut to the Edison standard of 100 threads per inch. The model I is powered by 110V DC "mains." The cabinet front is hinged for motor access. (Allen Koenigsberg collection)

Model K "Standard," 1895. The top casting of this machine was also designed to play the early 6" x 1 ⅝" Bell-Tainter cylinders, but comes with a separate Edison mandrel adapter like the model I. However, in contrast to the I, the large pulley wheel has been reduced in size and the machine is equipped with a spring motor. The cabinet front is hinged. An electric version also exists. The model F, introduced the year before, is very similar, but lacks the shaving knife. The machine in the picture is shown playing an early Bell-Tainter cylinder. (Allen Koenigsberg collection)

Model N "Bijou," 1895-96. This machine was the first of Columbia's entertainment machines to be produced on a large scale—also a MacDonald design. The interesting feature is the fold-down endgate. The N (and the later GG) are the only Columbia machines equipped with endgates. Fitted with the later model A motor, the N was sold by Montgomery Ward as the "Thornward." An electric version which uses a 2V wet-cell also exists. The N cost $40.00 when first introduced. (Ernie Bennett collection)

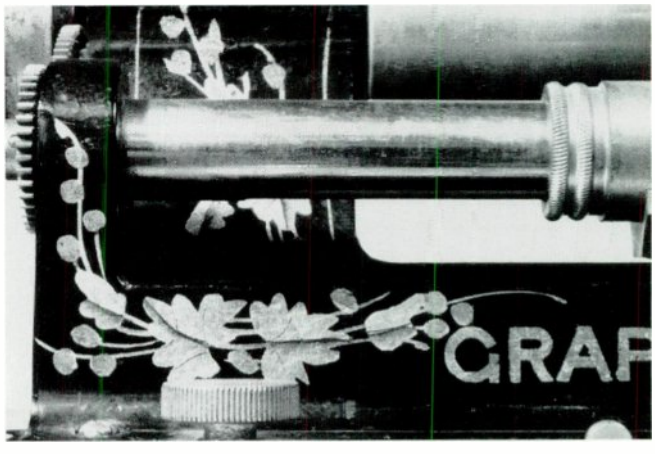


A detail of the unique bullet-end mandrel and endgate on the model N.

Model A, 1896-97. The model A machine exists in two distinct forms. The earliest models were made while the company was still based in Washington, D.C. (shown here), while later machines were produced in New York. The only differences between these two models, aside from the address on the patent plate and front decal, is the change from gold leaves with red berries (Washington) to gold stems and red flowers (New York). Often, the lower portion of the front decal indicating Columbia's address, is covered with a decal from a local distributor, as seen here. A model AN "Bijou," was produced for a short time in 1897 which resembles the model A but has a type N motor. These machines are recognized by the position of the on/off switch, which is located in the right-hand corner of the upper casting. (Walter Bellm collection)

The New York Model A, 1897-98. Both the New York and Washington model A's originally cost $25.00. (Author's collection)

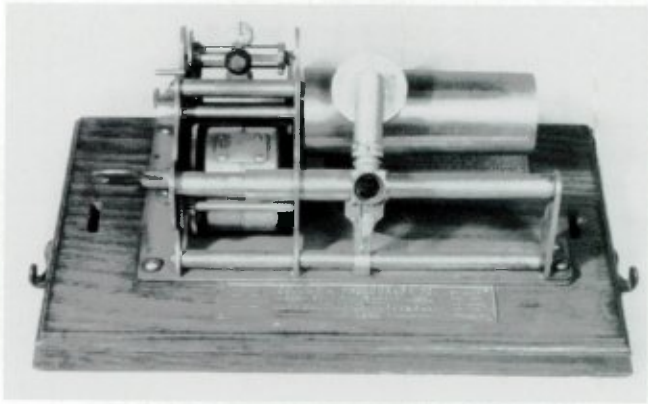
A close-up of the hand-painted "berry-and-leaf" decoration on the Washington A.



The flower decoration decal on the New York model A. Note the change in typography in the word "Graphophone" compared to earlier models.

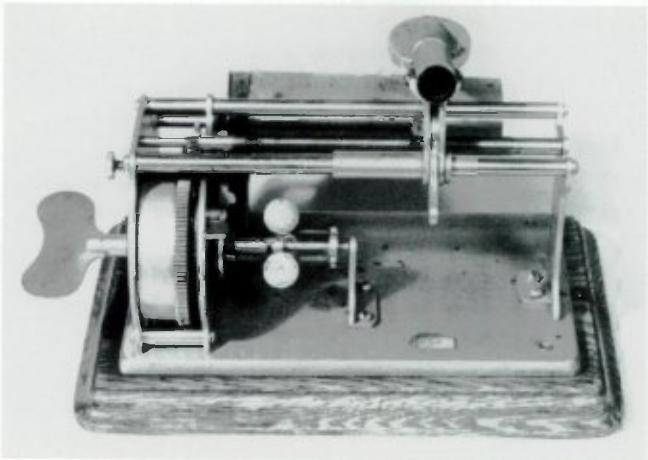
The word "Washington" from the original Columbia decal can just be made out underneath a distributor's decal, added sometime later.

Model B and BX "Eagle," 1897-1906. For the first three years of production, this machine was known as the B in caseless form and the BX when enclosed in a bentwood cabinet. All later machines had cases and therefore have a "BX" patent plate. This double-spring machine is remarkably sturdy and the simple, robust design was widely copied by other makers, notably Pathé. Since the purchase of a case was an option, this model often turns up in cases not designed by Columbia, especially in Europe where importers were inclined to build inexpensive cases themselves in order to save transportation costs on machines imported from the U.S. Caseless models have the patent information stamped on the belt cover since they have no patent plates. The Eagle cost an "eagle," a $10.00 gold piece. The case was $2.00 extra. (Walter Bellm collection)

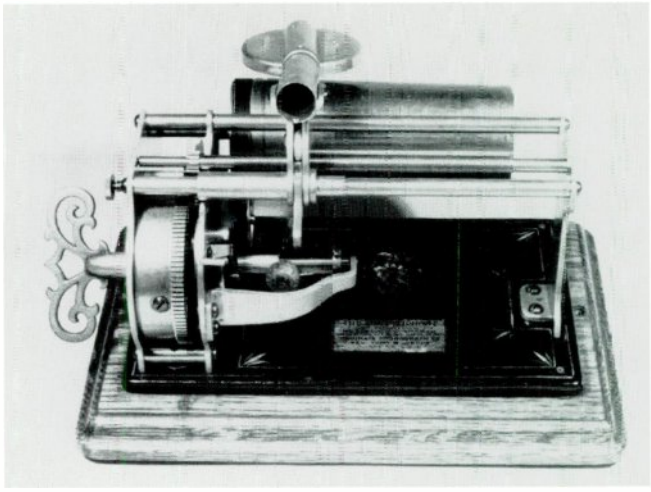


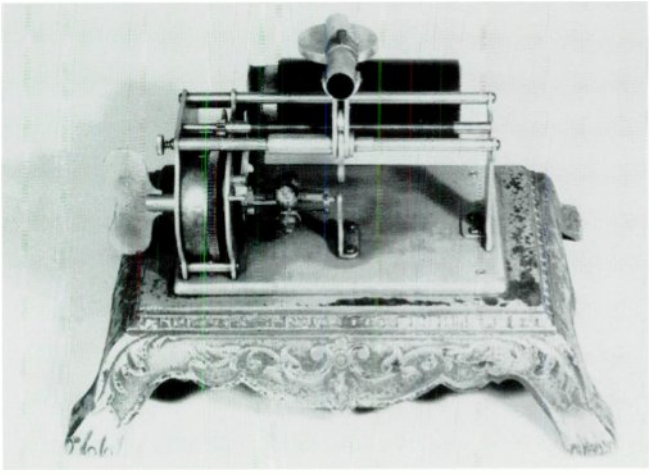
A detail of the patent information from an early caseless Eagle. (Author's collection)

Model Q "Mignon," 1898-1903. The simple, open-works Q is found in two distinct versions. The early nickel bedplate model shown here has a plain, flat key, while later machines have a cast key with a filigree design. When supplied with an oak case, the model was called the QC and with both the case and a recorder, the QQ. Although it is almost always seen with a simple black conical horn, similar to that of the Edison Gem, European models sometimes have a small flowered horn, or a brass horn with a separate table-top crane. The original price for the caseless Q was $5.00. The cabinet was $2.50 extra. (Walter Bellm collection)



Model Q, 1903-08. The later Q has a black bedplate, revised governor support, and a filigree cast key. (Author's collection)

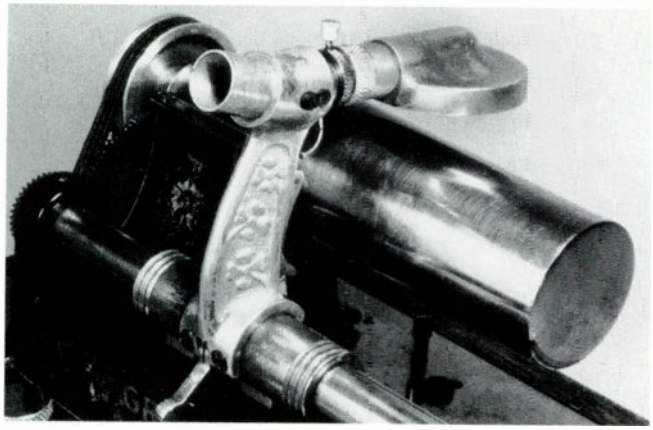




In 1904, Sears, Roebuck and Co. sold a fancy cast base to dress up caseless Q's. A large number of these bases have been reproduced in recent years. (Allen Koenigsberg collection)

Model AT, 1898-1903. The AT is a double-spring machine, just a step up from the "Eagle." This model is essentially a dressed-up model A with a little more power. The AT replaced the A in the Columbia line at the same price, $25.00. (Walter Bellm collection)

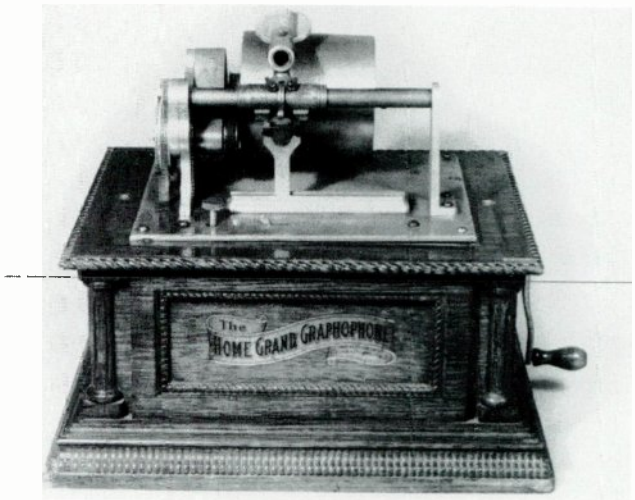
Model AT, 1903-06. Towards the end of the AT production run, the trunnion design was changed to incorporate a fancy bracket. The later machines, such as the one shown here, are known to collectors as "high trunnion" phonographs for obvious reasons. Although the AT was dropped from American catalogs after 1905, the model seems to have survived for at least another year in Europe. (Bob and Susan Lloyd collection)



A detail of the high trunnion AT.

Model GG "Graphophone Grand," 1898-1901. The GG was the first Columbia machine designed to play the large 5" diameter cylinders (120 rpm). Designed by Thomas H. MacDonald, who was also responsible for the G, N, B, Q, as well as the rest of the 5" mandrel series, the GG is a mammoth machine and had superb sound for its day due to the increased surface speed of the record. Besides the large size, the GG also had a large $300.00 price tag. After the introduction of the Edison Concert at $125.00, the GG was repriced at $150.00. Edison responded by knocking an extra $25.00 off the price of the Concert. The GG has a flip-down front door and a heavy-duty triple-spring motor. (Ernie Bennett collection)

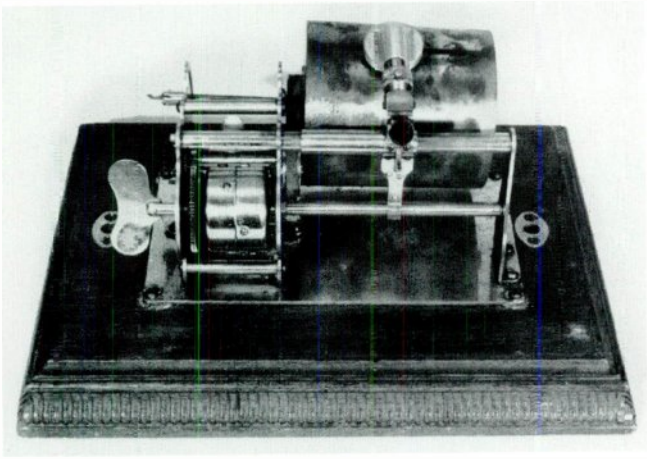
Model HG "Home Grand," 1899 and model AG "Columbia Grand," 1899-1901. Both of these models have AT-type double-spring motors and AT-style cases. In 1899, the HG was restyled and the earlier HG was renamed the AG. The only difference seems to be that the bedplate changed from nickel plated to black enamel when the model designation changed. The price of the AG in 1901 was $50.00, half the HG's introduction price two years earlier. The model shown here is the AG. (Walter Bellm collection)



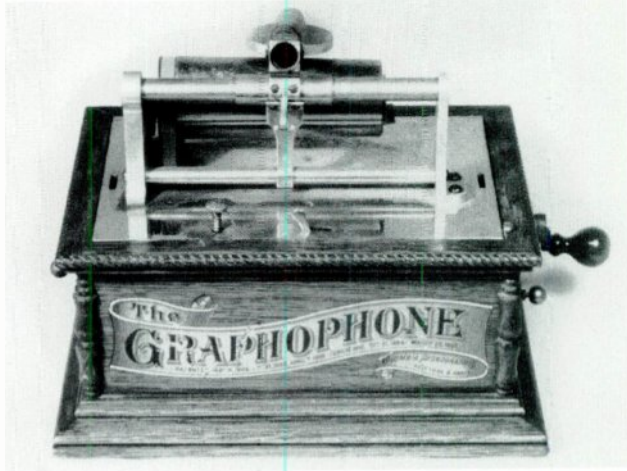
Model HG "Home Grand," 1899-1901 and AD "Royal," 1901. When the early model HG was restyled in 1899, it received a powerful six-spring motor and a fancy golden oak case. In 1901, the AD "Royal" was introduced, essentially an HG equipped with a special mandrel arrangement, which allowed the use of both standard and 5" cylinders. The AD shown here originally sold for $75.00. (Walter Bellm collection)

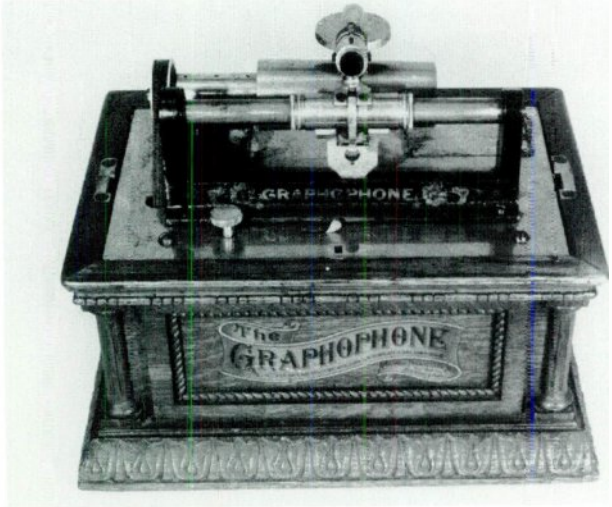
Model AF "Elite," 1901. The AF, also a combination machine for both Grand and Standard cylinders, was a step down in styling, power, and price from the elaborate AD. The AF had an AT-style cabinet and motor, and cost $50.00. The floating reproducer and left corner column are missing from the AF in the photograph. (Walter Bellm collection)

Model AB "Combination," 1901. The AB, also called the "Double Eagle" or "MacDonald" by modern collectors, was the bottom of the combination line. The motor is very similar to that of the Eagle. The AB was priced at $25.00. (Ernie Bennett collection)



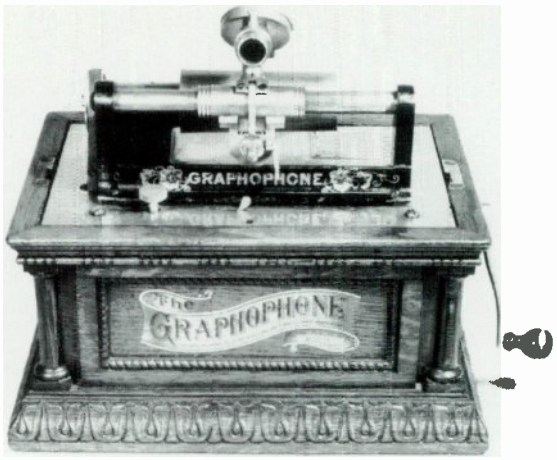
Model AA, 1901-02. This tiny machine was priced at $18.00 and is basically a crank-wound Eagle in a fancy case. (Walter Bellm collection)





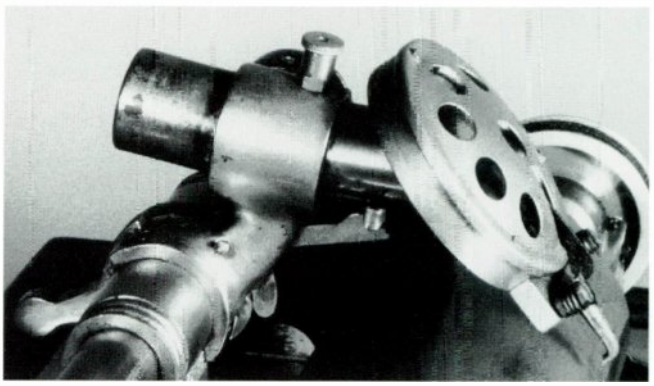
Model AO, 1902-04. The triple-spring AO used a case similar to the late style HG. the original price was $30.00. (Ernie Bennett collection)

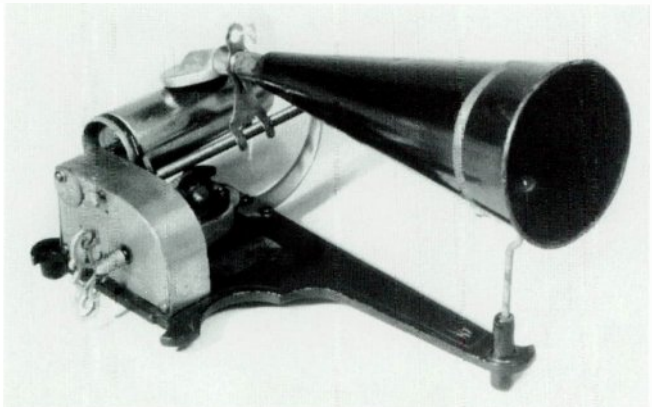
Model AO/AW, 1904. Although this model still has an AO patent plate, it is equipped with the newer AW-type reproducer, which cost $5.00 extra. (Peter Dilg collection)



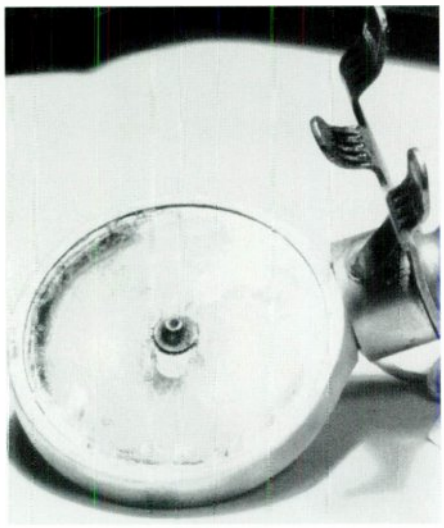
Model AW, 1904-06. This photo shows the standard issue triple-spring AW. Some late model AOs can also be found in this cabinet style. The AW cost $35.00. (Peter Dilg collection)

A detail of the AW "Spring Pivot Sound Analyzing Reproducer," very similar in construction to a disc reproducer.



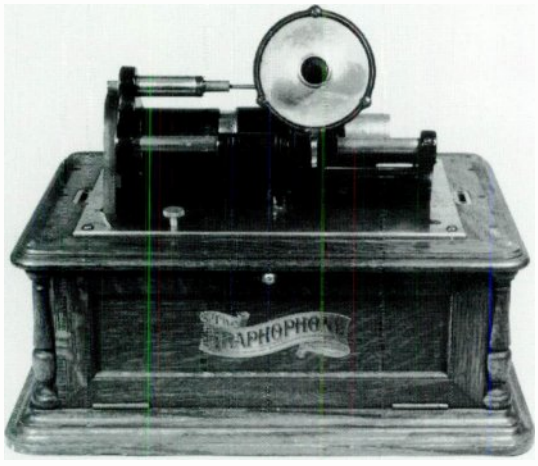


Model AQ, 1903-10. The trivet-base AQ has a Q-type motor and at $3.00, it was the cheapest cylinder phonograph ever sold by Columbia. A similar machine introduced the same year, the AP, does not have a feedscrew. The AQ show here has an AP-style horn, but Sears sold this machine in 1908 as the "Oxford Jr." with a small brass-belled horn for $8.75, including 24 two-minute cylinders. (Walter Bellm collection)

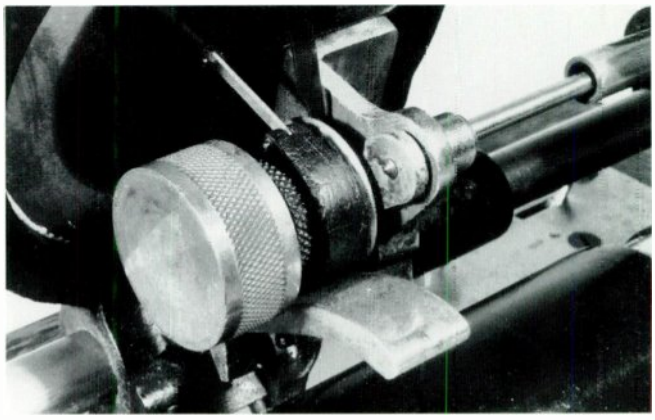


A detail of the AQ reproducer and the unique forked half-nut.

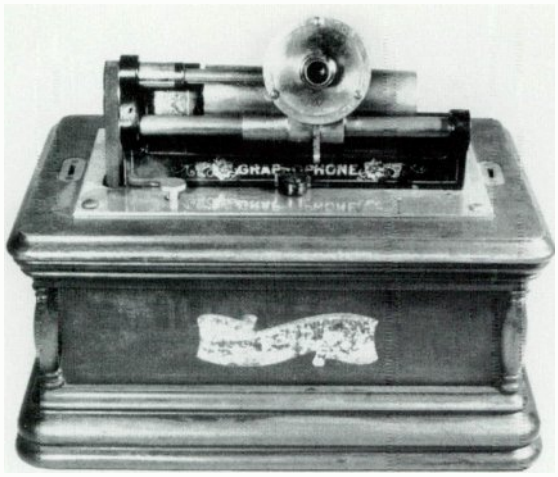
Model AZ, 1905-07. The AZ, the last of the A-series, is for all intents and purposes a late-style AT with a different reproducer carriage. The new reproducer was Columbia's first floating weight model and was called the "Lyric." This designation lasted for about a year until Columbia came out with its spring tension reproducer, which took over the "Lyric" name. The AZ cost $25.00 when first introduced. (Ernie Bennett collection)



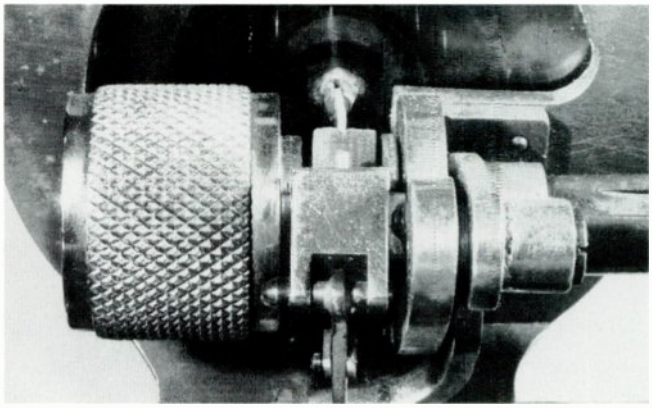
Model BC "Twentieth Century," 1905-10. This is the first machine to utilize the Higham friction reproducer. The BC was also the first machine to use the 6" long "Twentieth Century" cylinders from Columbia, which played for three minutes. The cabinet has a flip-down front, a throwback to the early case designs, which was the last time this feature was seen on a Graphophone. The initial cost was $100.00. A silk covered 36" morning glory horn with floor stand cost $12.00 extra. A 56" brass horn and stand cost $17.00 extra. (Ernie Bennett collection)



A detail of the BC friction reproducer with its large 4" diaphragm. Further pictures and details of the reproducer can be found on pages 74 and 75.



Model BM "Home Premier," 1906-10. The BM is a smaller, mahogany version of the BC. The motor is a powerful four-spring unit capable of playing eight records on one winding. The original price was $75.00, but a similar machine, the BG "Sovereign," with a standard "Lyric" reproducer cost only $50.00. (Reid Welch collection)

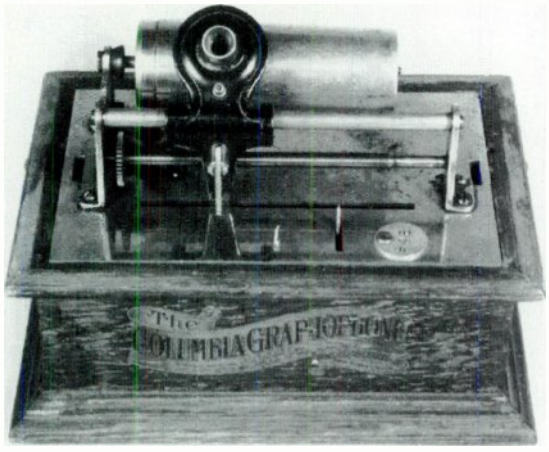


A detail of the BM reproducer. See pages 74 and 75 for additional information and photos.

Model BK "Jewel," 1906-09. The double-spring Jewel was the least expensive of the new 1906 line of Graphophones, featuring the "Improved Lyric" spring tension reproducer. The case was inherited from the AZ, which was being phased out. The Jewel cost $20.00 when introduced in March, 1906. (Dennis and Patti Valenti collection)

Model BE "Leader," 1906-10. The triple-spring Leader has a serpentine cabinet typical of late Columbia models, and a Lyric reproducer. Although the machine was sold with a 14" "witch's hat," early catalog illustrations show this machine with the characteristic Columbia aluminum "witch's hat," an oft-repeated error in early Columbia literature. The BE used standard cylinders and sold for $30.00. (Walter Bellm collection)

Model BF "Peerless," 1906-10. The main difference between the Peerless and the Leader is the motor (four-spring) and the fact that the Peerless has a longer mandrel in order to accommodate the 6" "Twentieth Century" cylinders. The price was $40.00 in 1906. (Ernie Bennett collection)



Model BV "Royal," 1908-10. This inexpensive and diminutive machine has a unique spring-loaded reproducer built into the carriage. The Royal can also be found in other versions as the "Home Queen" and the BVT "Oxford Talking Machine," the latter equipped with a tone-arm. Both of these machines were sold by Sears Roebuck. The BV Royal was sold in 1908 (by Sears) for $15.95, including 12 standard cylinders. The tone-arm version BVT sold by Sears cost $14.95, without the cylinders. Note that Columbia cylinder machines made after 1907 have decals which read "The Columbia Graphophone" rather than simply "The Graphophone." (Walter Bellm collection)

Model BO "Invincible," 1908. After the introduction of their tone-arm disc machines in 1906, Columbia used standard disc parts to adapt some of their cylinder models. The BO has a triple-spring motor capable of playing four 6" cylinders on a single winding. The motor and cast aluminum chassis are very similar to the BK. The BO sold for $45.00. (Ernie Bennett collection)

Model BQ "Rex," 1908-10. The BQ is virtually identical to the BK, but has the BO reproducer carriage. The iridescent red horn is identical to that of the BH disc machine in all except color. The BQ sold for $30.00. (Walter Bellm collection)

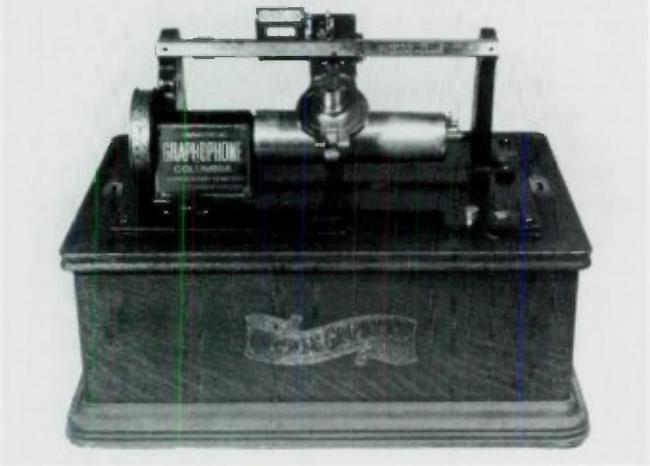
Model BKT "New Leader," 1908-10. The BKT, a tone-arm version of the BK Jewel (the T stands for tone-arm), originally had a black, 8-petal horn, similar to the red one used on the BQ. The machine shown here has acquired a nickeled horn from a larger Columbia machine. The crank, too, comes from another machine, probably a late disc model. Late model BKTs sometimes have 2/4-minute gearing—one of the few Columbia models to have this feature. Note the reproducer carriage, which is not quite the same as that of the BK. The BKT carriage is black and the "wings" are bent back slightly so that they don't interfere with the tone-arm. The original price was $35.00. (Ernie Bennett collection)

Model BFT "New Peerless," 1908-10. The BFT, like the BKT, can also be found with 2/4-minute gearing. The large knob, just visible on the left-hand side of the casting, changes the feedscrew speed. Normally, the BFT came with an 8-panel nickeled horn. The one shown here probably comes from a BVT. The cabinet decal (missing from the machine in the picture) should read "The Columbia Graphophone." The BFT sold for $55.00. The smaller BET "New Invincible," based on the BE, sold for $10.00 less. (Walter Bellm collection)

Model BGT "New Sovereign," 1908-10. The BGT, based on the BG Sovereign, was Columbia's top of the line tone-arm cylinder Graphophone. Late BGTs have 2/4-minute gearing arranged in the same manner as on the BET and BFT. The BGT has four springs, a 9-panel nickeled horn, and a mahogany cabinet. It originally cost $70.00. (Walter Bellm collection)

Model C "Universal," 1897-1905. The Universal was designed as an office machine, but was recommended for phonograph exhibitions because of its powerful triple-spring motor, which Columbia claimed could run for an entire hour at 120 rpm! That's the equivalent of 30 two-minute cylinders—quite a lot for most triple-spring machines. The cabinet is "black oak" and has a flip-down front for motor access. An electric version was also produced. The Universal sold for $50.00. (Ernie Bennett collection)

The Commercial Graphophone, 1906-14. This large electric machine replaced the Universal as the standard dictation unit marketed by Columbia. A number of variations exist. The version shown here dates from about 1910 and has a 110V electric motor and special dual-purpose reproducer, which is equipped with both recording and reproducing styli. (Ernie Bennett collection)



The Dictaphone, c. 1915. The Dictaphone shown here is also an electric machine. The reproducer is a variation of the "Lyric" and is not capable of recording. This machine remained, with minor variations, the basic dictation unit sold by Columbia until the early 1950's. (Author's collection)

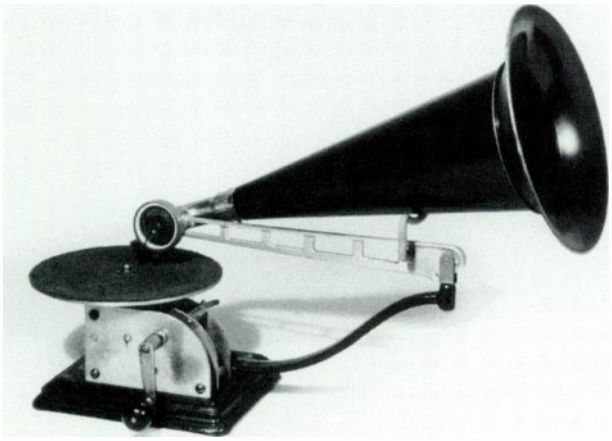
Columbia Disc Machines

From 1902 until 1913, Columbia produced a wide range of outside horn disc phonographs. During the early years of production, particularly in the pre-1906 era, Columbia changed motor design frequently. Even if you have a machine similar to one illustrated in the following section, you may find that the crank sticks out of the other side of the cabinet, or the decal is placed differently. To be quite frank, it takes a bit of searching to find two machines that are absolutely identical! Columbia aggravated the problem by piecing machines together for the mail-order market, and outside horn machines made from an odd collection of components were shipped well into the Grafonola era. Since these didn't appear in Columbia's own catalogs, identification is almost impossible. However, I've tried to illustrate the basic models as best I can. I leave it to others to write the definitive Columbia history!

Only a handful of Columbia's disc models have marks of any kind to help the collector identify them. Columbia had a habit of placing a small, easily removed sticker on the base of their early models. This is worth looking for if you have something unusual, but usually the sticker has long vanished.

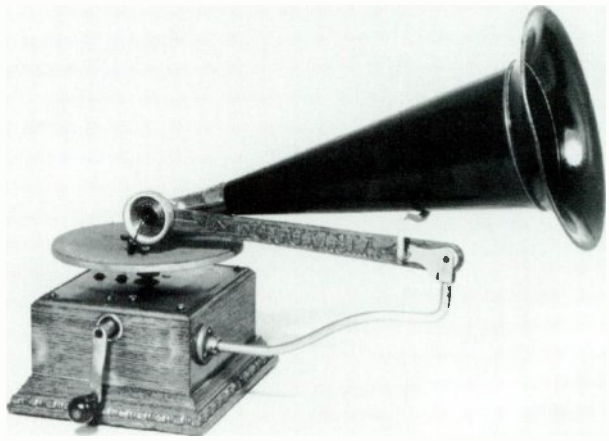
Columbia produced outside horn disc machines in the United Kingdom for a number of years after U.S. production had gone over to internal horn machines exclusively. The English models are not illustrated in the following section.

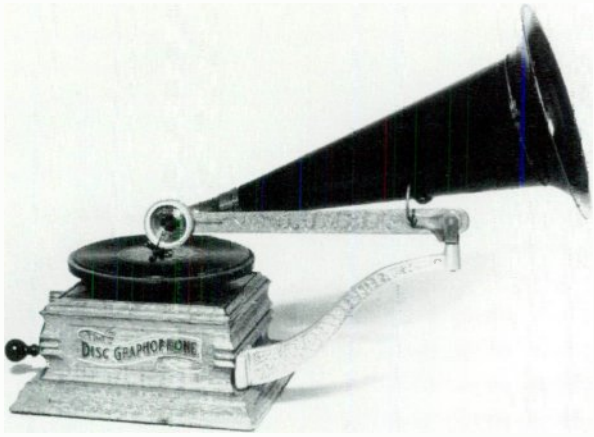
Again, my sincere thanks to Howard Hazelcorn for helping me fill in the gaps.



Model AU, 1904-09. The little AU was made in two versions, one for the Standard Talking Machine Co. of Chicago, with a large center spindle, and the AU pictured here. Apart from the spindle design and the name, there is no difference whatsoever between these two machines. The traveling arm is usually associated with other Standard machines, but was used by Columbia on a series of front-mount models in 1907, very similar to the Standard X2. The AU has a 7" turntable and originally sold for $12.00. (Peter Dilg collection)

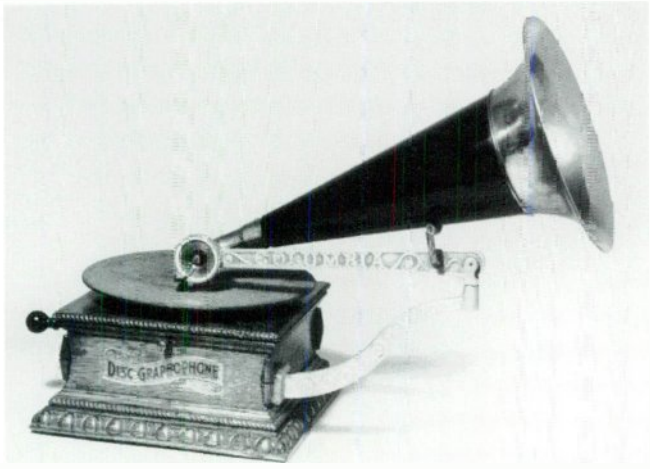
Model AK, c. 1903. This simple single-spring machine with its 7" turntable is the only Columbia machine to use a wood traveling arm. The AK shown here is the earliest of five variations based on two case designs and a variety of tone-arms. The 16" black japanned horn with its characteristic short bell and analyzing reproducer are the same as those used on the AU. All early AK turntables sit very high in relation to the case, although the one shown here is unusually high. The AK sold for $15.00 (Peter Dilg collection)





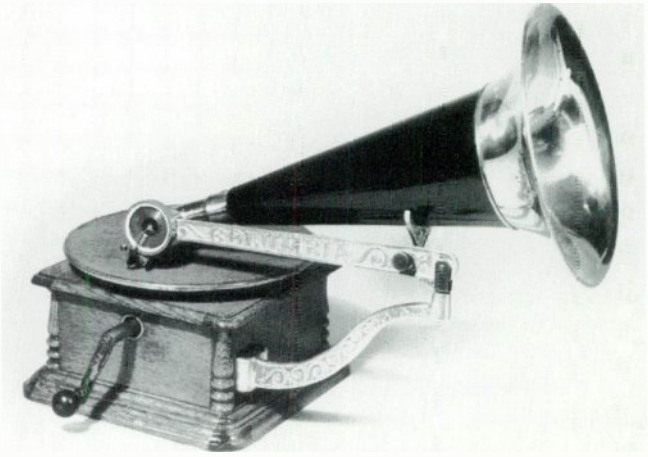
Model AK, 1904-08. The AK shown here has a more typical Columbia extension arm and a restyled cabinet. Although the machine was not officially produced after late 1905, the AK, with a nickeled belled horn, was sold as late as 1908 in New Zealand under the name "Challenge" for what would be the equivalent of $16.00. (Peter Dilg collection)

Model AJ, 1902. The AJ was one of the two first disc models introduced by Columbia, the other being the AH. The AJ is also the only model to feature a vertical crank. The leather elbow is also unique to these 1902 models. The AJ has a single spring, which can just manage to play a single 10" record if you remove the crank. Note the decorative handle, a feature on all AJs and AHs. The reproducer is a very early Columbia product, a blatant copy of the Victor "Concert." This early AJ sold for $20.00. (Allen Koenigsberg collection)



Model AJ, 1903. The second of the three AJ styles incorporated a brass elbow and 10" turntable, although the machine still had power problems. This second AJ version almost always has the crank in the rear. The 16" brass-belled horn is reduced at the end in order to fit the new style elbow. The extension arm on later AJs is identical to that used on the late AK. The decorative handle is on the far side of the cabinet and is therefore not visible in the photo. The price in 1903 was raised to $22.50. (Peter Dilg collection)

Model AJ, 1904-05. The final version of the AJ has a restyled case and is wound from the side. The spring is stronger than that of previous models. Again, the decorative handle is hidden, this time at the rear. (Bill and Peggy Robbins collection)



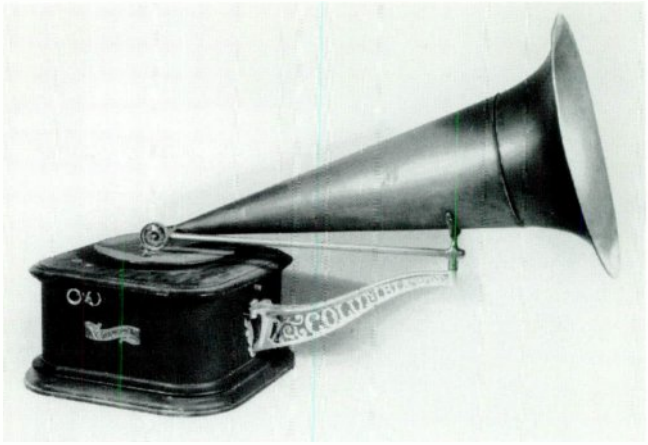
Model AH, 1902-03. This, along with the AJ, was the second inaugural model of 1902. Early versions can be found with leather elbows, but this quickly gave way to the brass elbow shown here. Very early versions also have a crank hole which is slightly left of center. The double-spring motor was a vast improvement on the AJ, and the 22" horn improved the sound quality. This machine has a decorative handle on the rear of the cabinet. Note the extension arm which has no writing. The filigree traveling arm dates from about 1905, but this model should have a solid arm. The AJ sold for $30.00 when first introduced, $5.00 less than the comparable Victor "Monarch." (Mike Patella collection)

Model AH, 1904-05. The final AH style represented, by and large, a cosmetic change. Although the machine shown here has the later filigree arm, both solid and filigree traveling arms can be found on this model. The extension arm now bears the Columbia name. This case style became the BI tone-arm model in 1906. (Walter Bellm collection)

A detail of the late AH case showing the decorative handle.

The Columbia AH shown here is one of the very early models (note the off-center crank hole), but it has been converted to a tone-arm model sometime after 1906, probably by the original owner. Adaption tone-arm brackets are often japanned rather than nickel plated and have an "I" cross-section rather than the more common oval shape of the standard bracket. The bracket shown here is a genuine Columbia product. (Bob and Susan Lloyd collection)

Model AR/AY, 1903-05. The triple-spring AR was the top of the Columbia line. The machine has a mahogany cabinet and a 30" brass horn. A less powerful version, the AY, was marketed at the same time. Although the machine shown here has a replacement 10" turntable, this model originally came with a 12" turntable in order to accommodate Columbia's huge 14" records. Oddly enough, Columbia made a 14" record before it made a 12" one. The arms are unique to this model. The AR cost $65.00 (later $75.00) and the AY cost $50.00. (Walter Bellm collection)



Model BI "Sterling," 1906-10. The Sterling (also known as the "Regal" in the UK) was one of the first of the standard issue tone-arm models of 1906. The motor and cabinet are essentially the same as those used for the late AH, although the decorative handle has been dropped and a turntable guard added. The knob sticking out of the back of the reproducer is a "Dolcher" volume regulator, an adjustable pad that could be used to mute the reproducer. The BI originally sold for $45.00. The crank on the machine in the photo is not correct. (Author's collection)

Model BD "Majestic," 1906-10. The BD is a tone-arm version of the mahogany AR. Like the AR, the triple-spring BD came in a less powerful version, the BJ "Imperial." The 11-petal nickeled horn was the largest produced by Columbia. The BD sold for $100.00 and the BJ sold for $75.00. Both machines have 12" turntables. (Ernie Bennett collection)

Model BY "New Imperial/Improved Imperial," 1908-11. The quadruple-spring BY is yet another mahogany machine with a 12" turntable, this time with a serpentine cabinet—Columbia's largest outside horn disc machine. The 23 3/4", 11-petal horn is the same as that used on the BD. Note the new decal style adopted by Columbia in late 1908 when production of cylinder machines was coming to an end. The "New Imperial" was produced in 1908 and had the old style on/off/speed control, but in 1909, under the name "Improved Imperial," this was replaced with one which passed through the motor board. The earlier "Analyzing reproducer" was changed to the "Columbia Grand" in 1909. (Walter Bellm collection)

Model BII "Improved Sterling," 1909-11. The BII is an oak double-spring machine with a 10" turntable. Aside from the redesigned cabinet and speed regulator, the BII is very similar to the BI. Note the restyled crank. This crank style is also used on the BY and represents the last of the "typical" Columbia cranks. The BII cost $50.00. (Walter Bellm collection)

Model BZ "Bijou," 1910-12. At $17.50, the BZ was the least expensive of the new outside horn machines introduced in 1911. The BZ has a mahogany cabinet—unusual for an inexpensive model—but the price and style indicate that this machine was designed to compete with the Victor O introduced a few years earlier. The BZ was the last Columbia machine to use the old style speed control and reproducer. The horn in the picture here is incorrect. The proper horn has only seven petals and is finished in shaded red enamel. The BZ has a single-spring motor and a 10" turntable. (Bill and Peggy Robbins collection)

Model BNW "Improved Royal," 1909-13. The BNW and the mahogany version BNWM both have double-spring motors and the improved Columbia speed control. The BNW originally came with a 9-petal black horn (18 ¼") but the oak "Symphony" horn shown here was available as an option for $11.00 extra. The quartered-oak BNW cost $35.00 and the mahogany BNWM cost $50.00. The reproducer shown here is a late-style Columbia "Concert Grand." (Walter Bellm collection)

A close-up of the Columbia decal introduced in late 1908 when production of cylinder models was coming to an end.

The machine shown here has a plaque which reads: "American Women's League, University City, Missouri." This model can also be found with a variety of other plaques as it was sold on special order to dealers and organizations for special purposes such as promotions or membership drives. The machine here dates from about 1910. (Mike Patella collection)

Grafonola "Favorite," 1911-25. Early internal horn models had double doors similar to those used on the Victor Victrola, but already in 1912, this was changed to the characteristic louver design seen on all subsequent Grafonolas. The Favorite cost $50.00 when first introduced in 1911. It has a 12" turntable, triple-spring motor, and a mahogany cabinet. (Walter Bellm collection)

This elaborate Grafonola from about 1910 can also be found in a combination talking machine/music box version, known as the Reginaphone style 240. (Walter Bellm collection)

Columbia-made parts are found in a large number of cabinets produced and sold by others. This baby grand phonograph from the early '20s is an interesting example. (Ernie Bennett collection)

The Gramophone

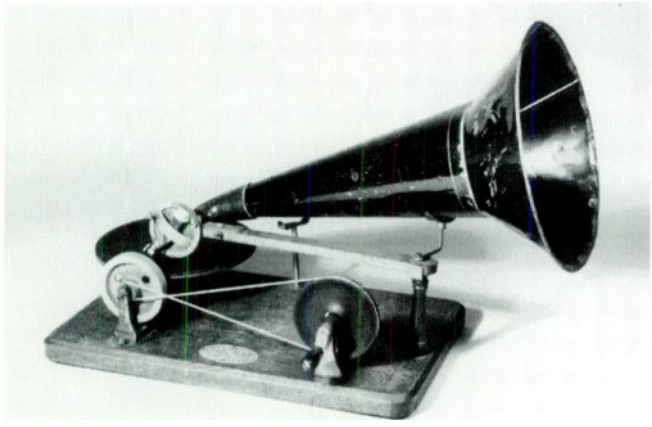
The Gramophone, invented in 1888 by Emile Berliner, was produced and distributed in turn by three companies in the United States: Berliner's own National Gramophone Company, Eldridge Johnson's Consolidated Gramophone Co., and finally, Johnson's Victor Talking Machine Co. A number of affiliates, notably the Gramophone Co. in London, took care of overseas production and distribution.

American model identification is fairly easy on all but the earliest machines since each model was equipped with a patent plate which provided all the relevant information. Some Victor machines also have a small paper sticker on the base of the case that has a printing date. It is fairly safe to assume that the machine was manufactured within a year after the date on the sticker. Foreign machines have neither a patent plate nor a sticker, and identification can only be accomplished by referring to old catalogs.

All the machines in this section are of U.S. manufacture and have oak cases unless otherwise indicated. The prices indicated here are the prices at the time of introduction. Since many of these models had long production runs, price increases during the ten or fifteen years they were sold were not unusual, particularly during WWI when raw materials were at a premium.

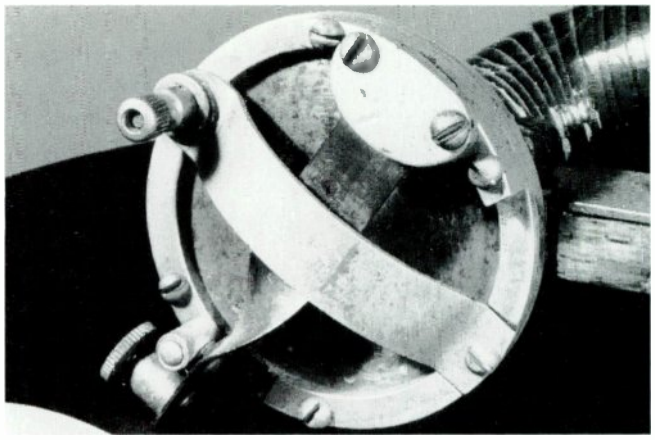
For further information, please refer to Robert Baumbach's excellent book, *Look For The Dog*, which is listed in the bibliography.

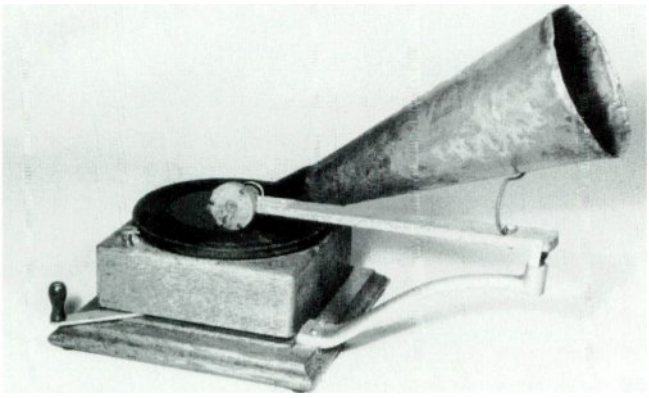
Kammer und Reinhardt, c. 1892. The Gramophone, as a commercial instrument, began its life as a German children's toy with a simple papier-maché horn. It cost about $10.00, including six 5" "plates," as the records were then called. (Photo courtesy of Christie's South Kensington)



Berliner Gramophone, 1894-96. This string-and-pulley model is typical of Berliner's first products. A number of variations exist as changes appear to have been made almost daily during the first months of production. The machine shown here originally sold for $12.00. (Allen Koenigsberg collection)

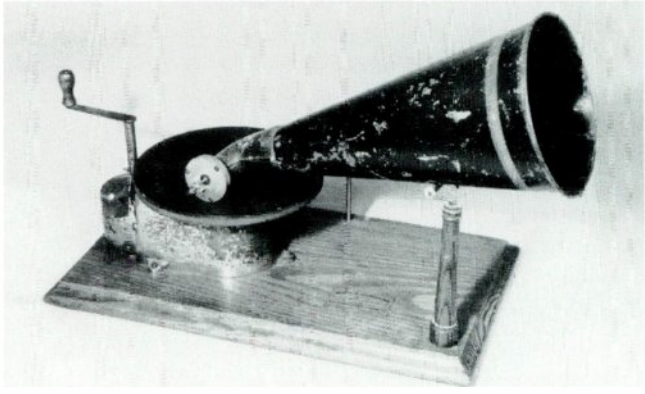
A detail of the early Berliner reproducer. Again, a number of variations exist.



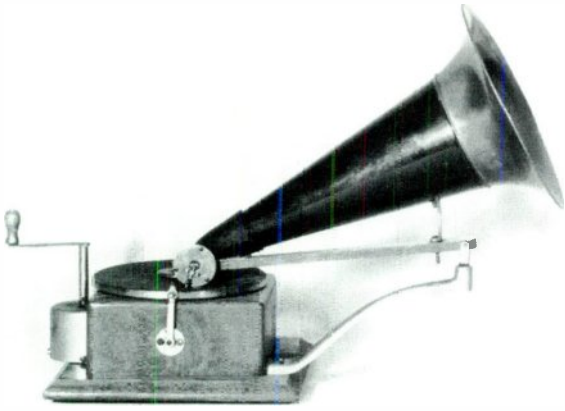


Berliner, c. 1896. This unusual machine has a ratchet winding mechanism similar to those used on disc music boxes. The short horn shown here is similar to the horn pictured in period advertising for this machine. (Allen Koenigsberg collection)

Berliner model JS, c. 1897. The model JS is essentially a less expensive version of the famous "Trademark" machine. A similar model with a square baseboard and more typical extension arm was sold by the Consolidated Gramophone Co. in 1900 as the model A. In 1901, Victor gave the machine a 16" black Japanned belled horn before retiring the model. (Allen Koenigsberg collection)



A detail of the Berliner decal.



Berliner model A, c. 1898. This is the famous "Trademark" model, immortalized in Barraud's painting, "His Master's Voice." At least six similar versions of this machine exist, all referred to by collectors as "dog" or "Trademark" models. The basic design, with some changes to the shape of the spring barrel and brake existed until about 1904. In 1901, the model was marketed by Victor as the model B, and in England as the Style 5. Prices ran from $15.00 to $18.00. (Ernie Bennett collection)

Berliner model A, c. 1902. Here is another version of the "Trademark" machine, this time in a Canadian version from Montreal. Note the restyled traveling arm and brake. (Dennis and Patti Valenti collection)

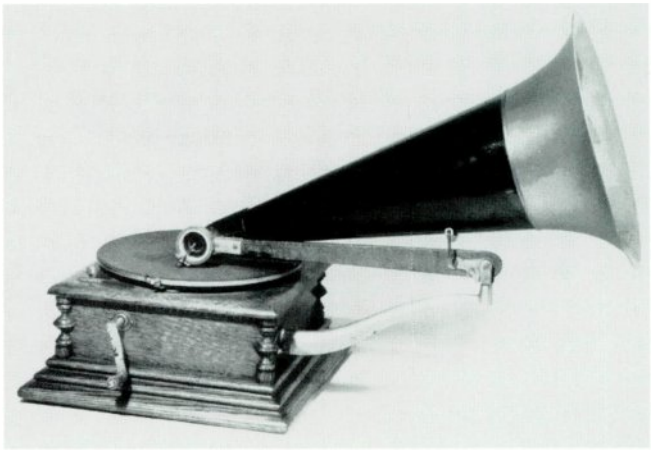
A detail of the patent plate from the Canadian model A of 1902.

Consolidated Gramophone model D, 1900. This was the cheapest of Eldridge Johnson's 1900 models. The model D was hand-driven and cost only $6.00. The following year, Johnson dropped the 16" belled horn in favor of a simple 10" cone, and renamed the machine "The $3.00 Victor." (Peter Dilg collection)

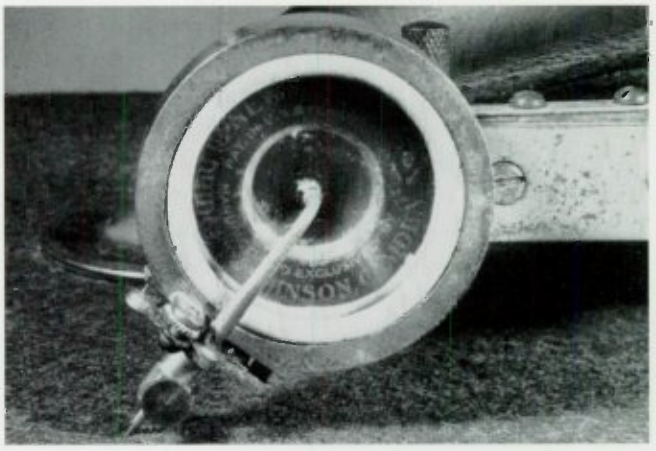
Victor model E "Monarch Junior," 1902-05. This simple double-spring machine was capable of playing five 7" records on one winding. The metal traveling arm on the machine shown here is pictured in catalog illustrations on the model R rather than the E, but surviving examples indicate that the configuration shown here was much more common. Conversely, Victor R's are rarely seen with the metal arm. The Victor E sold for $25.00. (Ernie Bennett collection)

This plate was fastened to the front of many early Victor machines. By removing the plaque, a standard tone-arm and bracket could be attached.

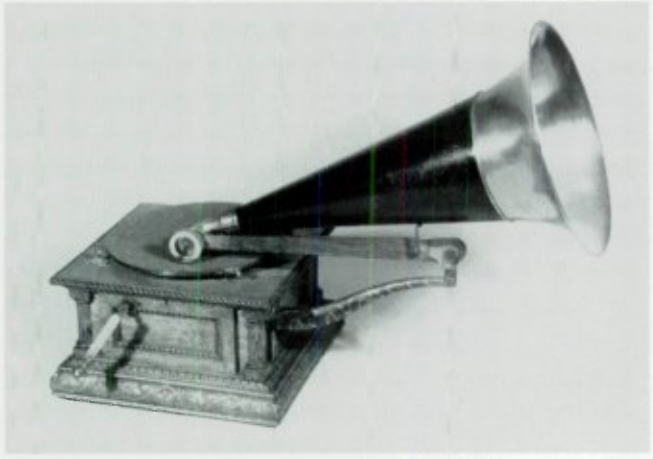
A close-up of the decal found on virtually all original Victor horns.



Victor model M "Monarch," 1901-05. The Monarch shown here is the earlier of two similar models, both with double-spring motors and 10" turntables—the first 10" models produced by Victor. In 1902, the case was restyled and took on an appearance similar to the Victor III. The Monarch originally cost $35.00. (Peter Dilg collection)

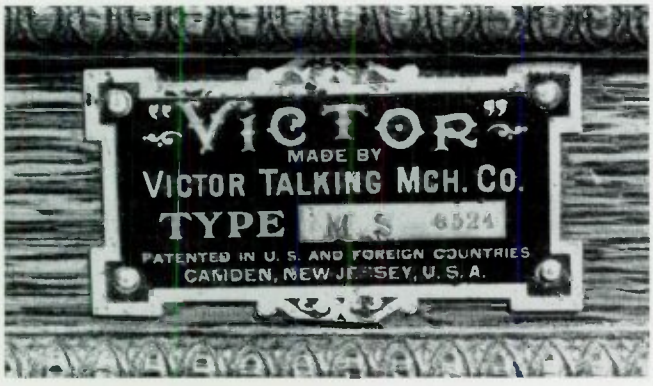


A detail of the unusual Johnson "New Century" reproducer fitted to the Monarch—a forerunner of the well-known "Exhibition." Early Victor machines are normally equipped with an "Exhibition" or "Concert" reproducer.



Victor MS "Monarch Special," 1902-05. The triple-spring Monarch Special was, for a brief time until the introduction of the Victor V and VI, the company's largest model. However, the machine (with a tone-arm) survived in Europe as the "Senior Monarch" until the early 'teens. The MS cost $45.00. In 1906, the MS was restyled and renamed the Victor IV, with a double-spring motor and mahogany cabinet. The machine shown here should have a nickel-plated extension arm rather than an oxidized one. (Mike Patella collection)

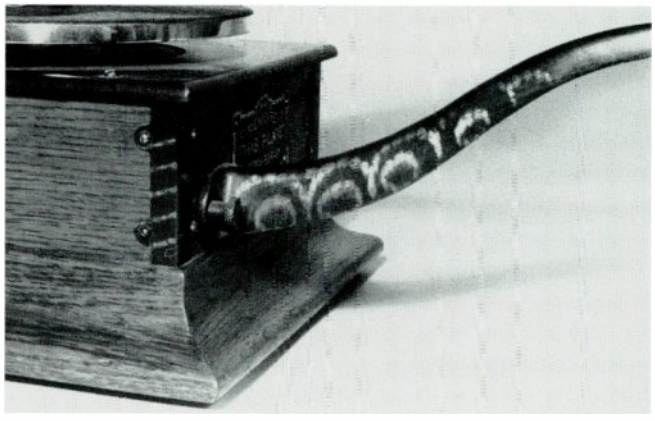
Victor MS "Monarch Special." This MS has been equipped with a tone-arm and oak horn, both added sometime after manufacture. In 1904, Victor provided a brass-belled horn and tone-arm as standard equipment, however, the machine here is of earlier vintage. The Exhibition reproducer is equipped with an interesting decorative cover, probably not a Victor product. (Bob and Susan Lloyd collection)



A detail of the early MS patent plate, prior to the adoption of the "Nipper" trademark.

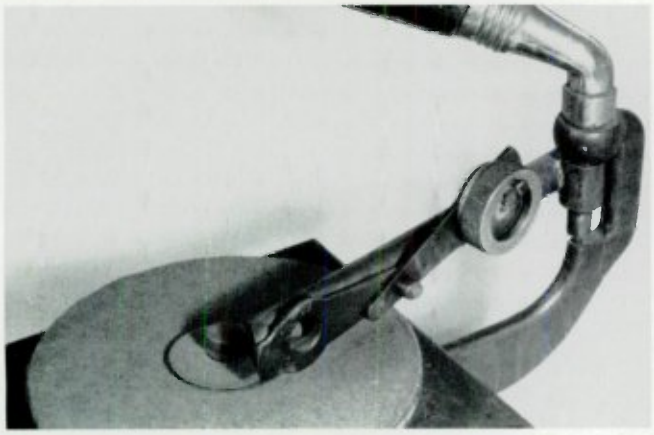
Victor D, 1903-07. The model D is similar in appearance to the MS, but has a 12" turntable and larger cabinet. The D was restyled in late 1906 and became the model V, although some of the early cabinet styles have model V patent plates. The wood horn shown here is a later improvement. Most D's came with a black-and-brass belled horn. The Victor D originally cost $55.00. (Mike Patella collection)

Victor R "Royal," 1902-04. At $15.00, the Royal was Victor's lowest priced machine in 1902. The metal corner hardware and metal motor board are unique to this model. The machine has a simple single-spring motor and 7" turntable. (Bob and Susan Lloyd collection)

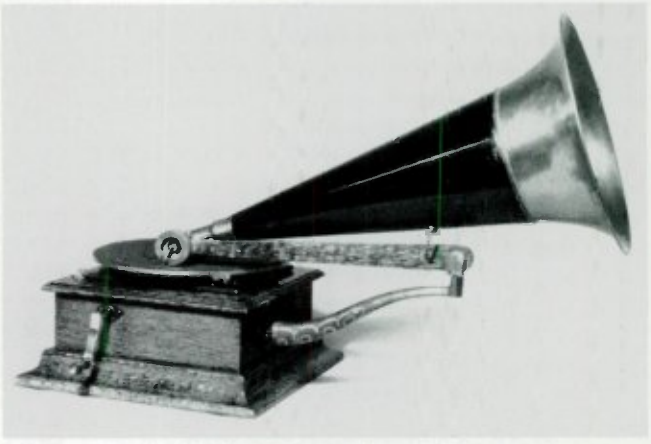


A detail of the oxidized design on the Royal's extension arm. This was produced by oxidizing the entire part and buffing off the oxidation in places to create a design.

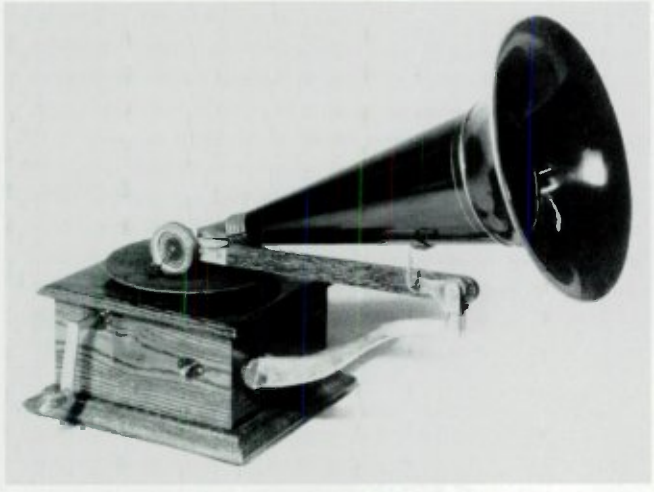
Victor R "Royal." This Royal is equipped with the earliest style "rigid arm" tone-arm from 1903. (Walter Bellm collection)



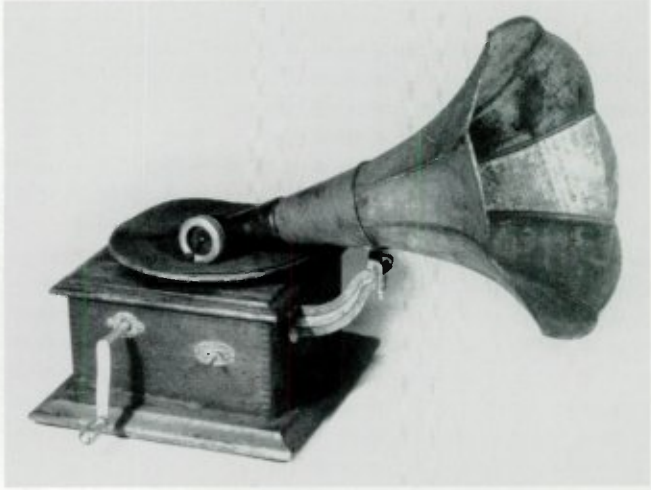
A detail of the early rigid arm.



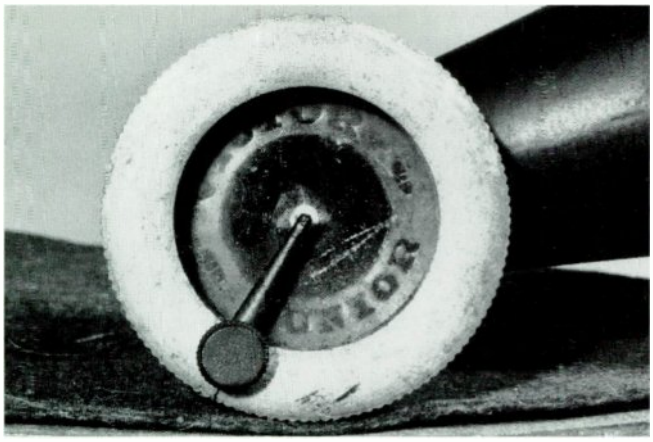
Victor P1 "Premium," 1902-06. The Premium came in two distinct models: a fancy one and a more simple version. The P1 has a 10" turntable and a large and impressive case which contains an inexpensive and diminutive single-spring motor. Since the machine was never sold outright, but designed to be given away, looks were more important than performance. (Walter Bellm collection)



Victor P2 "Premium," c. 1909. This is the smaller of the two Premium models. The machine shown here is based on the Victor Junior and has a 7" turntable. A number of versions of the P2 exist, generally based on the Royal or the Junior. (Walter Bellm collection)

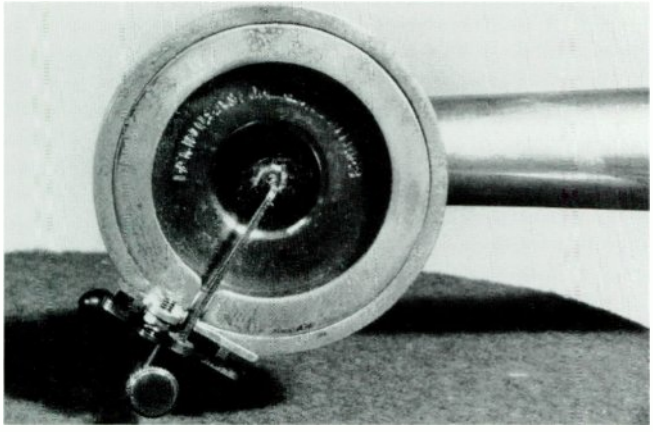


Victor "Junior," 1909-20. The Junior has a simple single-spring motor, iridescent red horn, and special "Junior" reproducer. With its 8" turntable, the Junior was probably the last small, front-mount machine produced in the U.S. Even though it was priced as a mere $10.00, technically the Junior was far inferior to internal horn models costing just a few dollars more. (Walter Bellm collection)



A detail of the special Victor Junior reproducer, a direct descendant of the Concert.

Victor 0, 1908-20. The Victor 0 (zero) was introduced in September, 1908 as Victor's lowest priced model at $17.50. The 0 has a simple single-spring motor, 10" turntable, and shaded amber horn. The 0 is interesting not only for its unique reproducer, (a variation of the Exhibition) but also because it has a mahogany cabinet—unusual for an inexpensive model. (Walter Bellm collection)



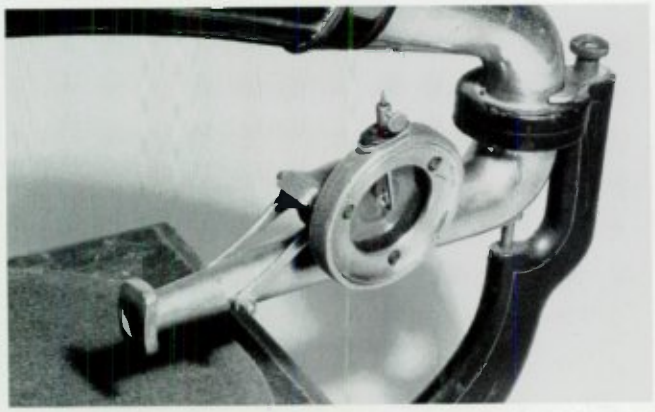
A detail of the 0 reproducer—essentially an Exhibition with a simple pressed-in bezel. This reproducer can also be found on most English Zon-O-Phones. On some inexpensive HMV models, this reproducer is known as the Exhibition Junior.

Victor I, 1903-10. The Victor I has an 8" turntable and single-spring motor. The cabinet was restyled in 1910 in order to incorporate a 10" turntable. The restyled machine is very similar in appearance to the late-style Victor II. Although the black-and-brass horn shown here appears to be too small for the machine, it is absolutely correct on this early model. The Victor I originally cost $22.00. (Ernie Bennett collection)

Victor II, 1902-09. Originally, this machine was equipped with the early style rigid arm, but in 1904, the tapered tone-arm shown here became standard. The motor is of single-spring construction, though not the same as the Victor I. Note the position of the crank. The Victor II cost $30.00 with the rigid arm and the improved model in 1904 cost $32.50. (Ernie Bennett collection)

Victor II, 1909-20. The restyled Victor II has a 23" black flower horn and a well-built single-spring motor capable of playing three 10" records on one winding. The cabinet is similar to the late-style Victor I, but is about 1 ½" larger along the sides. The late Victor II, like its predecessor, cost $32.50. Note the restyled crank. (Author's collection)

Berliner KT, 1903-09. The Canadian Berliner shown here has a motor and case similar to the Victor I, although the machine is physically quite a bit larger. The tone-arm and reproducer are unique to these Montreal models. (Bill and Peggy Robbins collection)



A detail of the special KT goose-neck and reproducer, designed to circumvent Victor tone-arm patents.

A close-up of the Canadian Berliner patent plate.

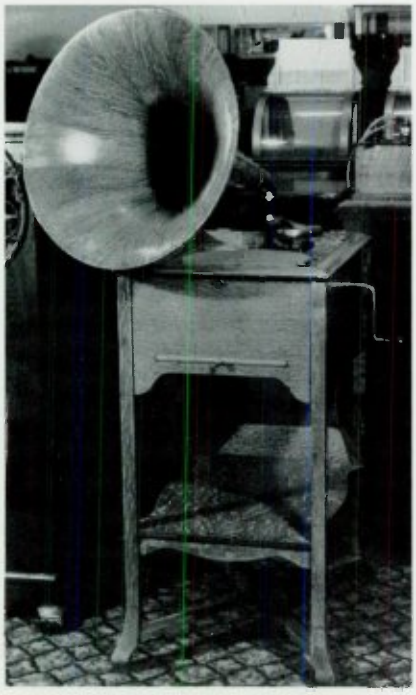
Victor III, 1902-20. The double-spring Victor III started off as a rear-mount version of the Monarch and a step up in power and styling from the Victor II. The restyled model shown here is from the post-1909 period. The Victor III cost $40.00 with a 23" metal horn. (Ernie Bennett collection)

Victor IV, 1906-20. The Victor IV is a restyled Monarch Special with a mahogany cabinet and powerful double-spring motor capable of playing six 10" records per winding. The basic machine cost $50.00. The optional mahogany horn (shown) cost an additional $10.00. The standard-issue black flower horn is 24" long. (Author's collection)

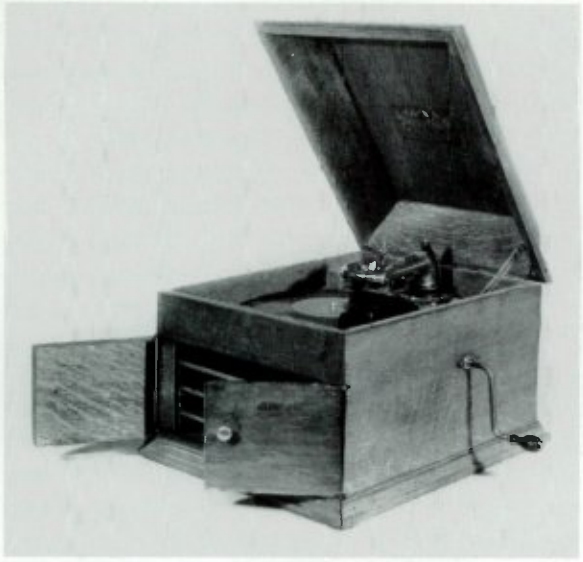
Victor V, 1906-20. The triple-spring Victor V has a 12" turntable, like its predecessor, the model D. The standard issue black flower horn is 26" long, but this model is usually found with the optional oak horn, which added $15.00 to the initial price of $60.00. (Ernie Bennett collection)

Victor V, c. 1925. Although production of most outside horn Victor products officially stopped in 1920, almost 19,000 horn machines were shipped between 1921 and 1928. Most of these were "School" models, but a number of the I-VI line were also produced. The model shown here, the V-V, is quite a bit larger than the standard Victor V and incorporates a number of features borrowed from Victrolas, notably the removable motor board. The back-bracket is more typical of European HMV machines than American Victors. (Dennis and Patti Valenti collection)

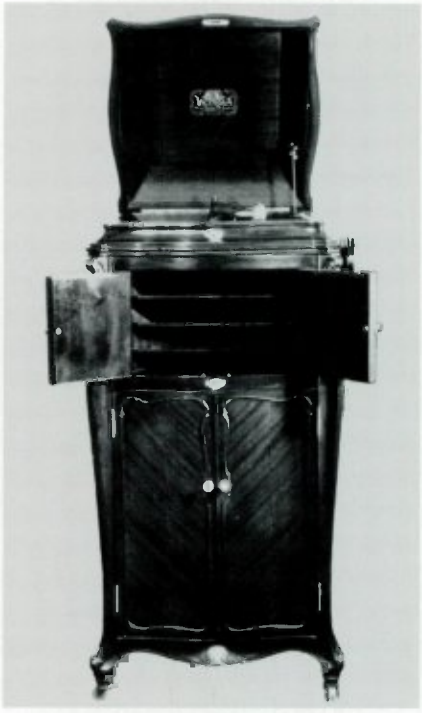
Victor VI, 1904-15. The mahogany Victor VI has a 12" turntable, nickel-plated triple-spring motor, gold-plated hardware, and polished mahogany horn—all as standard equipment after 1906. During the first two years of production, the cabinet was slightly smaller and the horn was either papier-maché or the black-and-brass horn seen on other early machines. After 1906, an all-brass flower horn was available as an option to the wood horn. The initial price was $100.00. (Bob and Susan Lloyd collection)



Victor XXV "School" model, 1913-25. The Schoolhouse Victor has a hinged Victrola-like lid, which is either held by a bracket or can be flipped down behind the machine, as seen on the model in the picture. A number of other minor changes were made to the double-spring motor and tonearm during the 12-year production period. The XXV cost $60.00, rising to a high of $115.00 by 1919. (Walter Bellm collection)



Victrola VIII, 1911-24. Like so many Victor products, the VIII went through many changes during its lifetime. Early models are recognized by the forward position of the crank. The machine here is from about 1918. The double-spring VIII cost $40.00. (Walter Bellm collection)

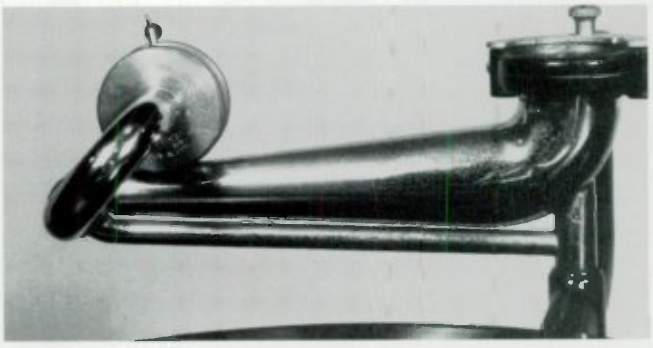


Victrola XVIII, 1915-16. This mahogany Victrola was Victor's finest at the time. The machine has a triple-spring motor and gold-plated fittings. The XVIII sold for $300.00. An electric motor was available for $50.00 extra. (Dennis and Patti Valenti collection)

Victrola 230, 1922-25. The model 230 was at one time Victor's top of the line model at $375.00. Normally, the cabinet was mahogany, but custom art cases such as the one shown here might cost as much as $1500.00! The 230 has a four-spring motor, 12" turntable, and gold-plated fittings.

Victor Auxetophone, 1906-18. The Auxetophone, the invention of the English engineer, Sir Charles Parsons, was one of the early attempts to amplify sound. The machine has a standard triple-spring motor and an air compressor to provide power for the special reproducer. The Auxetophone sold for $500.00. (Ernie Bennett collection)

A detail of the Auxetophone reproducer with its special comb-like valve. Due to changes in humidity and oil vapors from the compressor, these combs frequently became corroded. Therefore, Victor recommended that the reproducer be removed from the machine when not in use.



This photo shows the Auxetophone tone-arm. The tube running underneath the standard arm carries the compressed air to the reproducer.

Another view of the Auxetophone reproducer.

The Auxetophone decal.

The famous dog, Nipper, and the equally famous Gramophone appeared on countless pieces of Victor memorabilia and are much sought after by collectors. The watch and fob shown here, however, are of recent manufacture and are not "genuine" Victor products. (Mike Patella collection)

Zon-O-Phone

A short introduction

The Universal Talking Machine Co. was founded in 1898 and marketed the Zon-O-Phone for about six years, until the company was bought out by Victor in late 1904. The Gramophone Co. in England bought out the European affiliates. After 1905, Zon-O-Phone became the low-priced Victor line, although this connection was not emphasized in any of the advertising of the period. After the takeover, Zon-O-Phone took on a distinctly "Victor" look, most noticeable in the cranks.

Zon-O-Phone machines are found in a bewildering variety of cabinet styles, different in the USA and Europe. Horns, too, were often stuck on machines much at the whim of the dealer or according to the special wishes of the customer. All this, plus the lack of sufficient documentation presents problems when trying to identify machines. Even when old catalogs are available, the "peck order" of Zon-O-Phone machines changed from time to time, which is confusing. However, the basic order, from cheapest to most expensive (in 1905 at any rate) was as follows: Home, Parlor, Grand, Concert, Concert Grand, Grand Opera, and Royal Grand. The machines illustrated here all have American cases, in oak, unless otherwise indicated.

My sincerest thanks to Charles Mandrake for his invaluable help and the loads of hard-to-find Zon-O-Phone information he put at my disposal—the result of years of research on Mr. Mandrake's part.

Some general notes about types A, B, C, and D

Motors—All the single-spring motors on these early models were interchangeable. The bedplate could easily be lifted out of the machine and put in another cabinet, and there is some indication that machines were assembled by dealers according to their specific needs. All machines feature 7" turntables with a characteristic spring-loaded pin to prevent the record from slipping. This, of course, only worked on Zon-O-Phone records, which were equipped with a special notch.

Bedplates—There are four distinct bedplate designs. The earliest is simply a flat square of nickeled steel with an indentation for the square-end extension arm, which was attached with a plain bolt. The next two versions were nickeled cast iron with a raised edge and raised circle in the middle, though type D did *not* have this circle. The extension arm was now rounded at the end where it was attached to the bedplate, and the bolt was replaced by a knurled thumbscrew. The only difference between the two versions is the presence of the word "Zon-O-Phone" in both English and Russian, cast into the round ring. The fourth and final bedplate type has a raised "hump" which holds the winding mechanism. This allows the use of a longer crank and doesn't require a crank hole in the case.

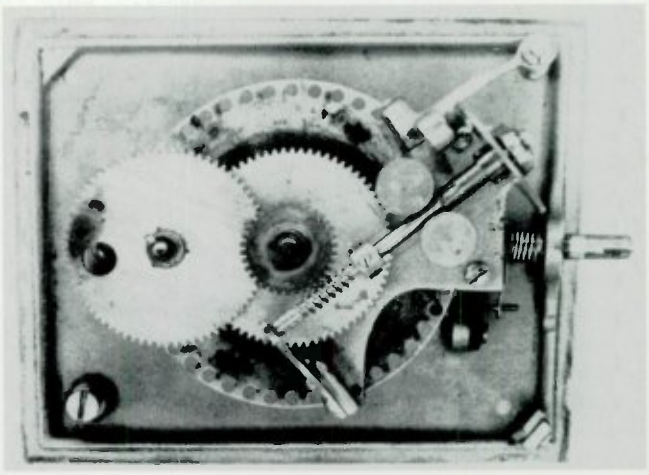
Traveling arms—The earliest type has a tubular construction comprised of two U-shaped pieces, bolted together to give the arm an oval cross-section. This quickly gave way to the more common one-piece cast traveling arm, which also has a U-shaped cross-section.

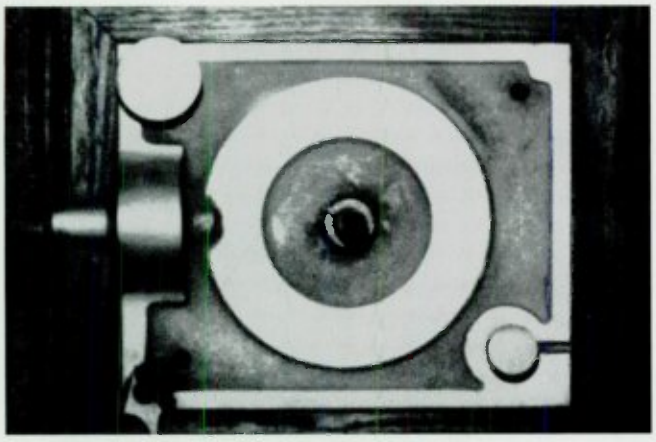
Elbows—Although Zon-O-Phones generally have a brass elbow, which is soldered onto the horn, some of the earliest models were equipped with a leather elbow similar to the Gram-O-Phone. The later brass elbows have a thumbscrew, which is used to tighten the elbow around the neck of the reproducer.

Reproducers—Types A, B, C, and D were originally equipped with a reproducer known as the type "V." This is similar in outward appearance to the Clark-Johnson reproducer, but has a tiny diaphragm, about the size as that in the Edison C, H, etc. In general, the reproducer is very poorly designed and the stylus bar is extremely rigid. This distorts the sound and increases record wear. An extra stylus bar guard may or may not be present. The Concert "V" reproducer is very similar to the Victor Concert and is a much better design. The Concert is usually found on the larger (later) Zon-O-Phones, but was an option on these very early models.

Decals—Very early models have no decals. Rather, they were equipped with small white celluloid plaques, which contained manufacturing data. The plaque was fastened with two tacks on the rear of the case underneath the crank. Some of these plaques are found recessed in the case, but this is unusual.

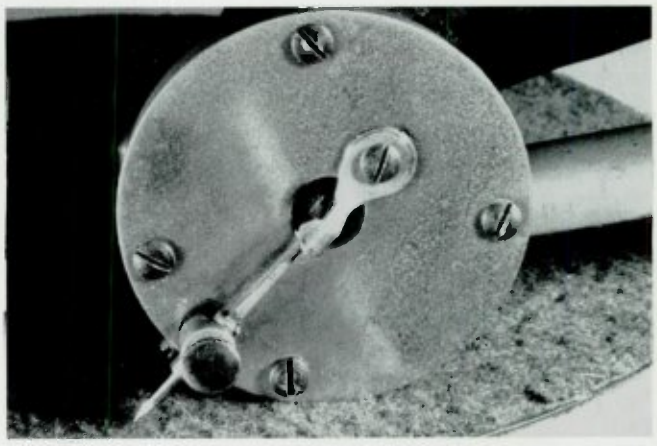
The unit motors on early Zon-O-Phones were completely interchangeable. (Photograph courtesy of Charles Mandrake)

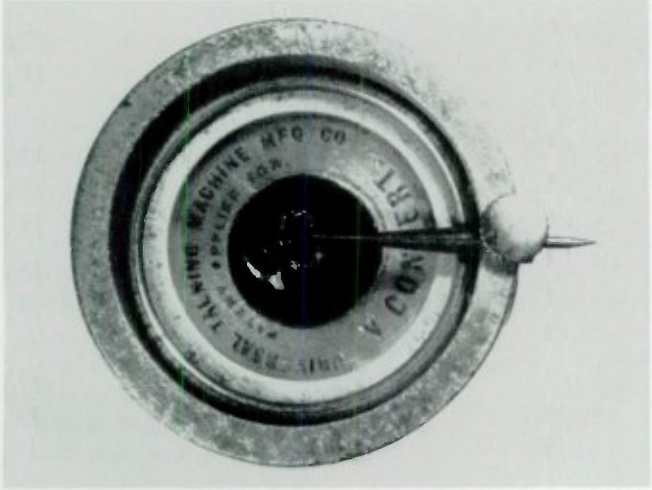




A detail of the late style "humped" bedplate. (Photograph courtesy of Charles Mandrake)

The early Type V Zon-O-Phone reproducer. Due to the small 1 5/16" diaphragm and overall bad design, this reproducer gave very poor results. Note the stylus-bar guard.



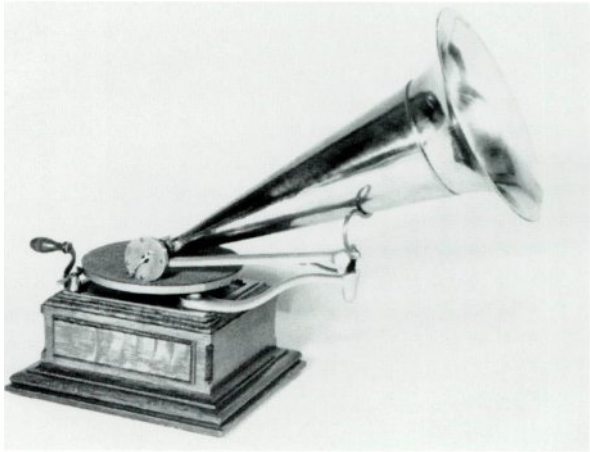


This Zon-O-Phone Concert V reproducer of the 1900-1905 period was available as an option to the inexpensive Type V reproducer. The original ad copy stated "We cannot compare it with any other sound-box because it is so much better that there is no comparison." Compared to the Type V, this is certainly very true!

This photo shows the spring-loaded pin that prevented Zon-O-Phone records from slipping. The pin can be pushed down by the weight of the record to allow other record brands to be played. The feature is actually quite useless as records don't tend to slip that much anyway unless the reproducer is outrageously heavy.

The later style Zon-O-Phone decal. The earliest decals were actually small celluloid plaques and not nearly as decorative.

Type A No. 55, 1899-1901. This 7" turntable model has beveled glass on two sides of the nicely made case. The horn on this particular machine has a slightly longer bell than normal and may be European. The price in 1900 was $25.00. A slightly taller version was also produced in 1900 with the name "Concert Grand." The Concert Grand appears in contemporary illustrations to be a large machine on the scale of the later models. In reality, the first Concert Grand machine is quite small. (Peter Dilg collection)

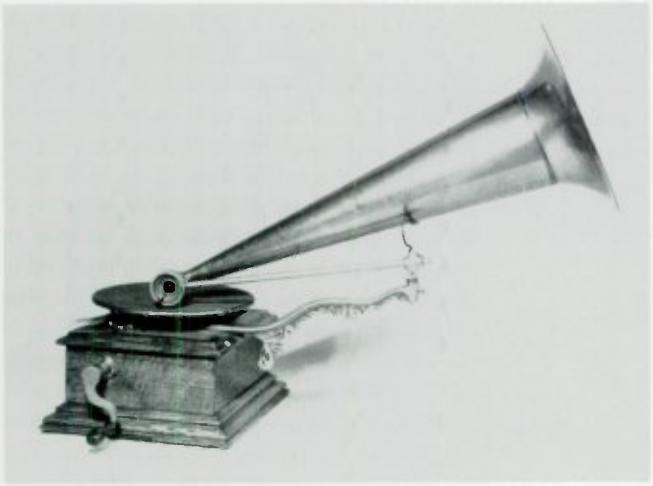


Type B No. 60, 1899-1901. This is similar to the Type A, but with raised wood panels on the sides. The machine was usually furnished with a black-and-brass horn rather than the optional all-brass horn pictured here. The original price was $22.50. 7" turntable. (Peter Dilg collection)

Type C No. 50, 1899-1901. The Type C was originally advertised with a black japanned horn, but the brass horn shown here was available as an option. The leather elbow is unusual, but not necessarily incorrect. The original price was $18.00. 7" turntable. Earlier Type C machines have a case which consists of a series of ridges and has no flat panels whatsoever. The Type D, No. 45 (not shown) was the bottom of the 1900 line at $12.00 and had a very plain square case with flat sides, similar to the Victor "Trademark" machine. (Peter Dilg collection)

"Home," 1905. The early Homes from the 1901-05 period resemble the Type C. The late-style machine shown here was one of the last of the front-mount models, and in fact, the only one advertised in 1905, when it sold for $15.00. The machine is a simple single-spring model with a 7" turntable. Comparison of the crank on this machine with those on earlier Zon-O-Phones shows the Victor influence following the takeover in 1904. (Peter Dilg collection)

"Parlor," 1901-04. Like the Home and the A-D series, the early Parlor uses the same single-spring motor unit. Early catalogs show this machine with a 16" horn and simple extension arm, but the longer horn shown here with its fancy hardware was available as an option. (Peter Dilg collection)

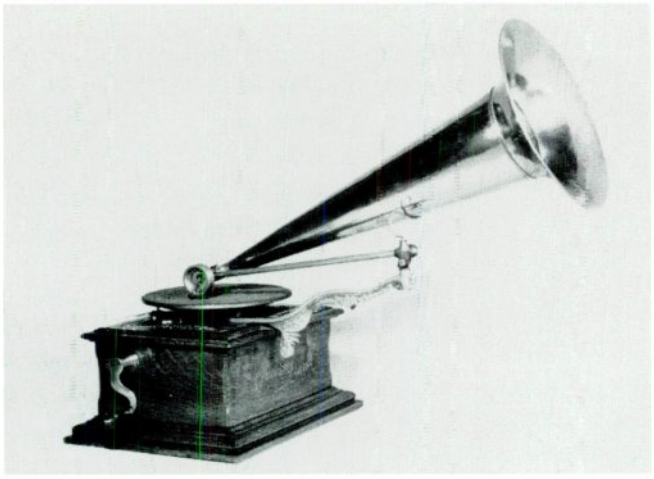


"Grand," 1901-04. This model is slightly larger than the Parlor and is almost always found with the large horn and long arms shown here. The motor is still single-spring, but the turntable is now 9". The case is similar in design to the Concert Grand, but is much smaller. The Grand was discontinued after 1904. (Peter Dilg collection)

"Concert," 1901-04. Although the Concert was advertised with a short 16" horn and plain arms, the fancy arm and long horn shown here was a popular option. The machine has a single-spring motor and can be found with one of three bedplate designs: a plain flat plate; an ornate plate with lettering; and one with a "waffle" pattern like the one here. The machine pictured would appear to be from late 1903 judging by the 7" turntable and bedplate design. The machine cost $25.00 in 1904. (Peter Dilg collection)

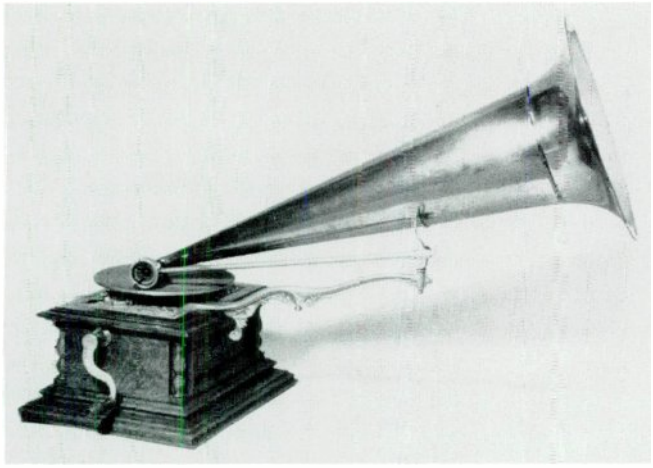
"Concert," 1904-05. Here is a factory produced rear-mount based on the front-mount design. The case has been simplified and has the late style decal. The price was increased to $35.00. (Robert Adams collection. Photograph courtesy of Charles Mandrake)

"Concert," 1906-10. The Concert model of 1901-06 resembled the late model shown here, but retained some of the more prominent Zon-O-Phone features such as the curved crank and exposed bedplate. The machine pictured clearly shows the result of the Victor takeover. The reproducer is very similar to the Victor Exhibition and is typical of later Zon-O-Phones. The horn is a valid Zon-O-Phone option, although similar, but not identical horns, can be found that fit Victor and Columbia machines. The color scheme is bright blue and yellow on the horn here, but other colors were available. (Ernie Bennett collection)



"Concert Grand," 1901-04. This machine was the smallest to come equipped with the large 24" horn and long extension arm as standard equipment. A black-and-brass horn was standard according to early catalogs, but the all-brass horn shown here was a popular option. The machine had a single-spring motor, somewhat larger than previous models, which allowed it to play three 10" records on its 9" turntable. In 1904, this machine sold for $35.00. (Peter Dilg collection)

"Concert Grand," 1904-06. The Concert Grand shown here is essentially the same machine as the previous model; the obvious difference is the new-style "Gibson" tone-arm and later model reproducer—one which closely resembled the Victor Exhibition. Note the repositioning of the decal in order to accommodate the back bracket. The horn is correct, despite the fact that it doesn't seem large enough for the machine. This model cost $45.00 in 1905. In 1906, the Concert Grand received a restyled (Victor-ized) case, a more appropriate horn, two springs and a price hike of $5.00. The later model was produced for a number of years. All but the earliest models show only the word "Zon-O-Phone" rather than the model name. (Peter Dilg collection)



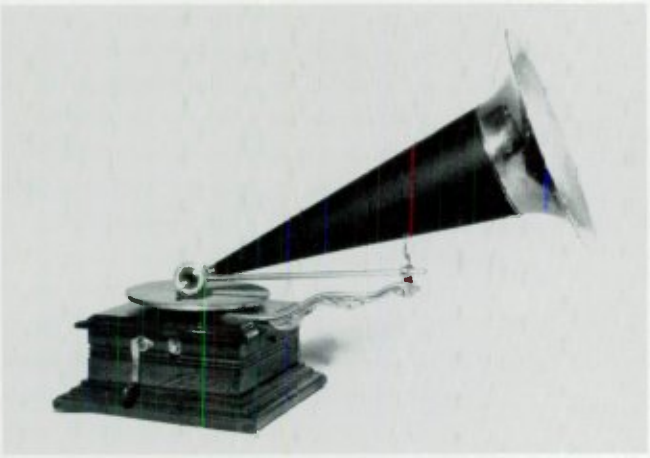
"Grand Opera," 1901-04. Until the addition of the "Royal Grand" in 1905. the Grand Opera represented the top of the Zon-O-Phone line. The fancy oak case has a beveled glass window on either the front or the back. This one is on the back and therefore cannot be seen in the photo. The single-spring motor could play five 10" records. The turntable was still 9" and the horn was 30". The Grand Opera cost $45.00 in 1904. (Peter Dilg collection)

"Grand Opera," 1901-04. This machine is practically identical to the previous machine. However, the crank and traveling arm are quite unusual and possibly of European origin. (Mike Patella collection)

"Grand Opera," 1904-06. This is the tone-arm version of the previous machine. The position of the name decal indicates that this is a factory conversion. Front-mount machines that had been converted by the owner usually cause the name to appear on the rear of the cabinet. The alternative was to save the decal and have the crank on the wrong side of the machine! With the addition of the tapered tone-arm, the price of the Grand Opera rose to $55.00 in 1905. Later models simply have the word "Zon-O-Phone" on the front of the cabinet rather than the model name. (Peter Dilg collection)

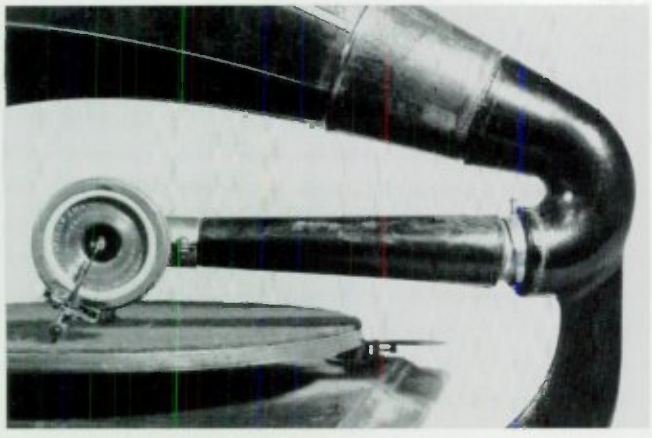
"Grand Opera," 1906-11. In 1906, Victor went to work on this model, too. The number of springs was increased to three, although the machine was still only able to play five records since the springs were quite small. In 1906, the Grand Opera cost $60.00 with a morning glory horn. Wood horns such as the one shown here were first available a few years later. (Walter Bellm collection)

"Royal Grand," 1906-11. The triple-spring Royal Grand was Zon-O-Phone's top of the line machine at $75.00, and was the only Zon-O-Phone to sport a 12" turntable. The matching mahogany horn is actually painted metal. (Norm and Janyne Smith collection. Photograph courtesy of Charles Mandrake)



This unidentified Zon-O-Phone of the Victor era turns up fairly frequently. The interesting feature of this machine is the 24" silk-covered horn, perhaps an option. All indications point to this being the original horn sold with the machine. The turntable is 9". A sticker on the base of the machine from October 1903 indicates the price to be $30.00, which places it somewhere between the Concert and the Concert Grand, but the case style, speed control and crank suggest that the machine is somewhat newer than the sticker date indicates. (Peter Dilg collection)

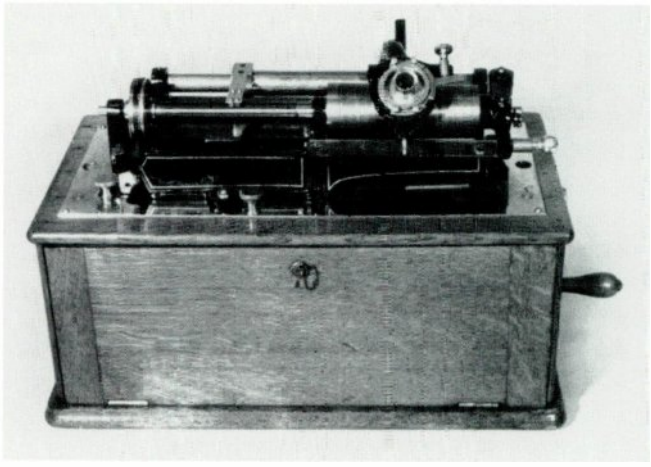
Here is a picture of the same unknown model, this time equipped with a very late style tone-arm. Note the fact that the crank is on the wrong side of the machine—an indication that the conversion was made sometime after the machine was sold, perhaps by the owner himself. (Walter Bellm collection)

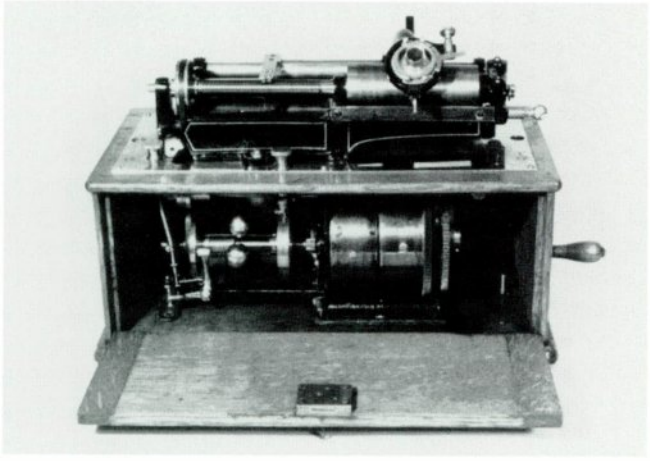


A detail showing the interesting one-piece elbow and back-bracket construction of the late style tone-arm.

Some Other Interesting Cylinder Machines

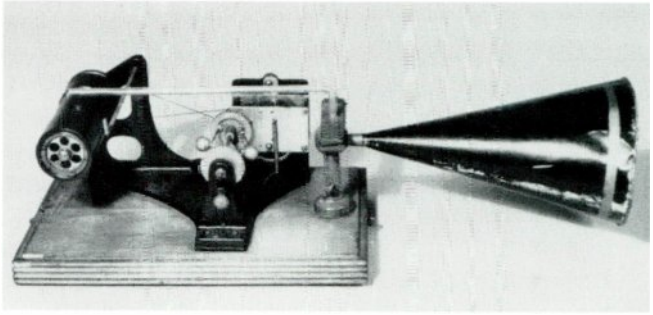
Amet phonograph, c. 1893. Edward H. Amet, an enterprising businessman from Waukegan, Illinois, bought top castings from the National Phonograph Co. and provided them with sturdy spring motors. Both Columbia and Edison machines were adapted in this manner. The machine shown here is derived from an early Edison Class M electric machine. (Reid Welch collection)



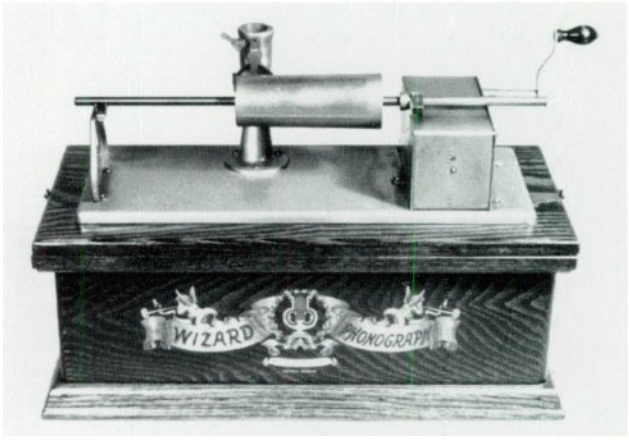


The front of the Amet machine has been opened to show the beautifully-crafted "Peerless" motor.

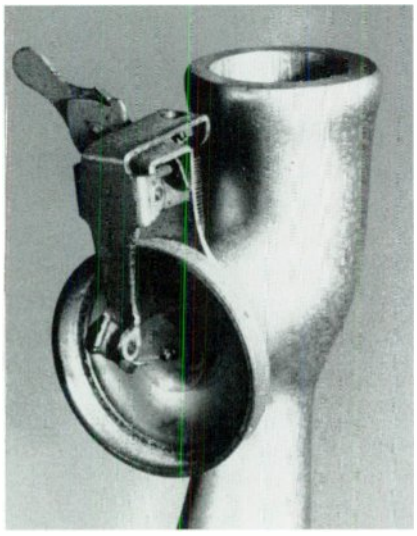
Amet "Echophone," c. 1896. This unusual phonograph (sometimes called the "Metaphone," a simple transposition of "Amet") cost a mere $5.00 when first introduced. The sound is transmitted via a glass rod to a bellows-like arrangement that produced the sound. The glass rod is drawn out at one end in order to produce a stylus, and a spring tension device regulates the amount of pressure on the cylinder. The spring is not attached in this photo and can be seen hanging down from the rod. In actual use, this spring would be attached to a cotter pin at the base of the bellows/horn support. The Echophone was available for a brief six months before Amet was forced to withdraw it due to patent infringements. Unsold machines were given away as premiums by Frank Leslie's newspaper and other illustrated magazines. (Allen Koenigsberg collection)



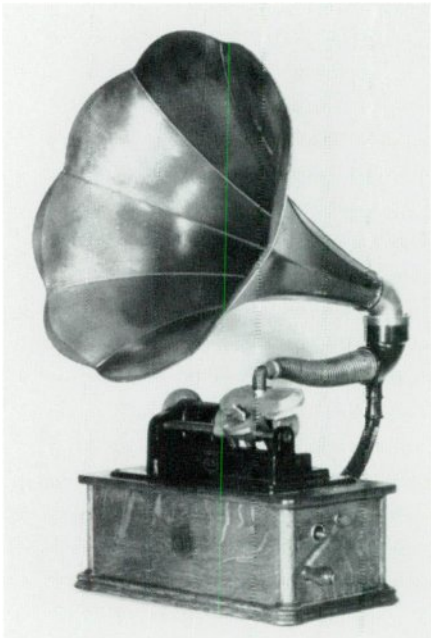
The Wizard Phonograph, c. 1911. Made by the International Phonograph Company of Newark, N.J., the name of both the machine and the mother company are obvious take-offs on Edison, the wizard of Menlo Park and his National Phonograph Co. The machine also turns up occasionally bearing the name "Champion" or "Ellisdon." The case is a simple pine box. The lower portion forms the lid when the machine is not in use. The Wizard was produced for about a year. (Peter Dilg collection)



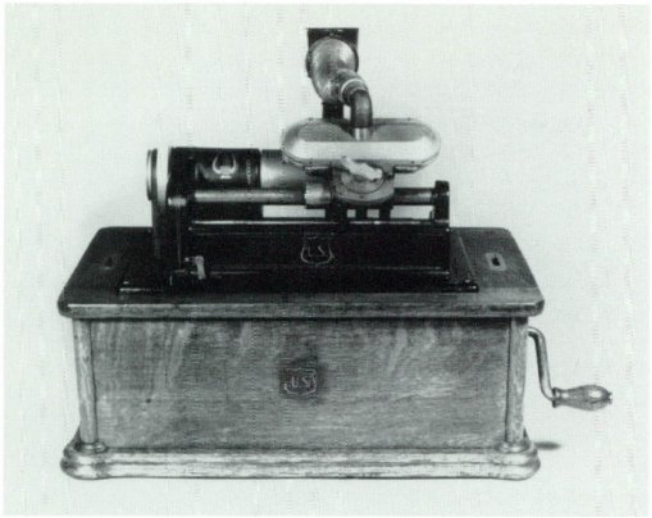
The rod supporting the Wizard mandrel can be lifted off in order to put on a cylinder. The left part of the rod is actually the feedscrew and a primitive drive train is at the right.



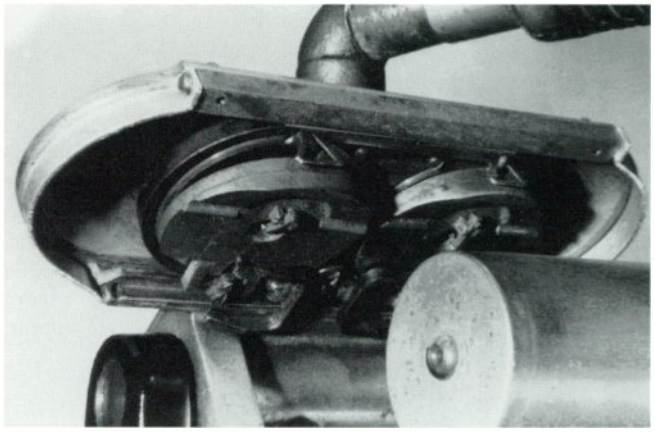
This is a detail of the two-minute Wizard reproducer. The reproducer is marked "2" which would hint at the existence of a four-minute model as well. However, despite the fact that the Wizard was first produced well into the era of four-minute cylinders, I have only seen examples of the two-minute variety.



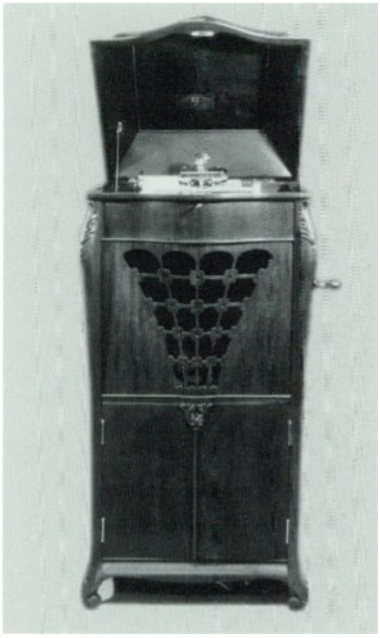
U.S. "Banner" Phonograph, 1910-13. The U.S. Phonograph Co. of Cleveland, Ohio, makers of the U.S. Indestructible cylinder, marketed a number of phonographs with a special dual-speed reproducer (actually two separate reproducers) for two- and four-minute cylinders. Montgomery Ward was a big customer of theirs and U.S. machines often turn up under the name of "Lakeside." The horn on this machine may be a replacement as U.S. horns usually are black and have concave petals rather than the convex type shown here. (Ernie Bennett collection)



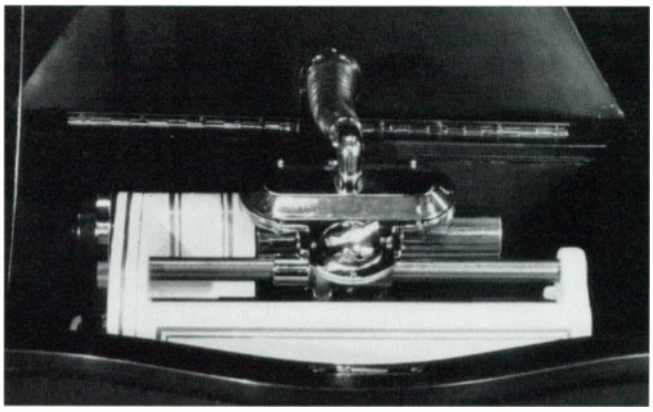
A detail of the U.S. "Banner" machine. The small key mounted on the oblong reproducer housing changes both the feedscrew gearing as well as the reproducer.



A close-up view of the U.S. dual reproducer.

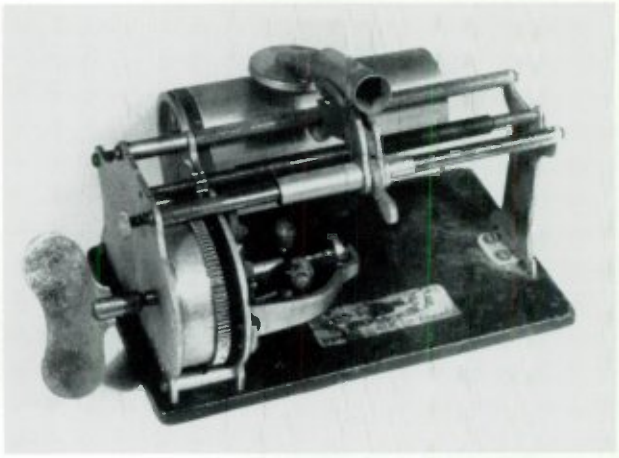


U.S. "Peerless" Phonograph, 1912-13. The was U.S.'s answer to the internal horn machines then coming into vogue. The case is mahogany. (Walter Bellm collection)



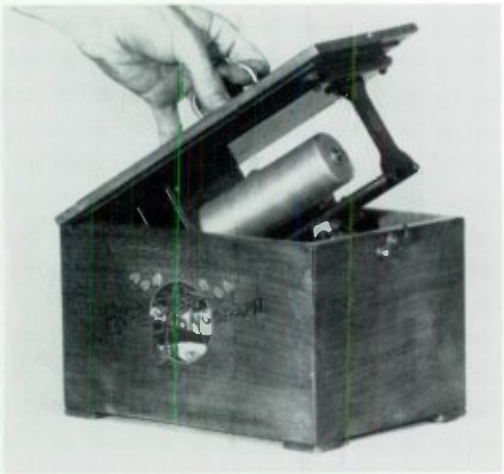
A detail of the "Peerless" showing the white enameled casting and gilt fittings. Other than the color scheme, the casting and triple-spring motor are essentially identical to that of the "Banner."

Busy Bee, 1904-07. Marketed by the O'Neill-James Co. of Chicago, the Busy Bee cylinder phonograph is virtually identical to the late style Columbia Q. However, the Busy Bee has a slightly oversized mandrel that prohibits the use of standard cylinders. The special Busy Bee cylinders were produced for O'Neill-James by Columbia. A larger machine, the Busy Bee "Queen" was available from about 1905 which closely resembled Columbia's BK "Jewel." (Ernie Bennett collection)

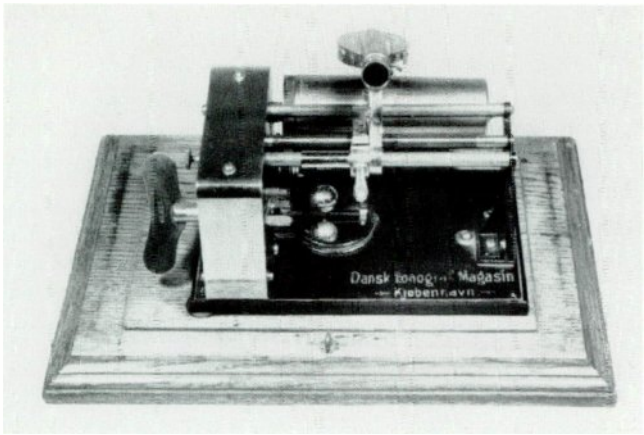


Excelsior Phonograph, c. 1903-14. The Excelsiorwerk of Cologne, Germany produced many thousands of these machines up until WWI. The machine shown here dates from about 1908, one of many different Excelsior models based on the simple Columbia Q theme. The very first models had a vertical crank, but after 1906, most models were key wound. The aluminum "Herald" horn is typical of European cylinder machines. (Ernie Bennett collection)

Because the case is "reversible," a crank can be used on this model rather than a key.



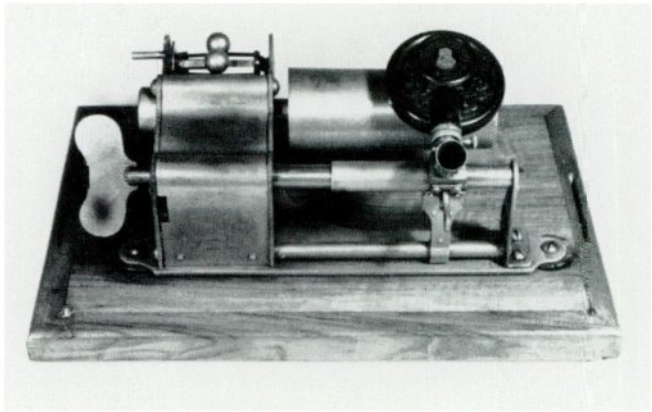
This photo shows the reversible case in use. The lid flips over and is attached to the box/base with small hooks.



Excelsior "Dansk Fonograf Magasin," c. 1909. Yet another version of the Excelsior. This model bears the stenciled name of a phonograph importer in Copenhagen. Excelsior machines were widely sold throughout Europe by many different firms and under many different names. John G. Murdoch and Co. Ltd. of London, sold Excelsior machines in Britain under at least six different names! (Claes O. Friberg collection)

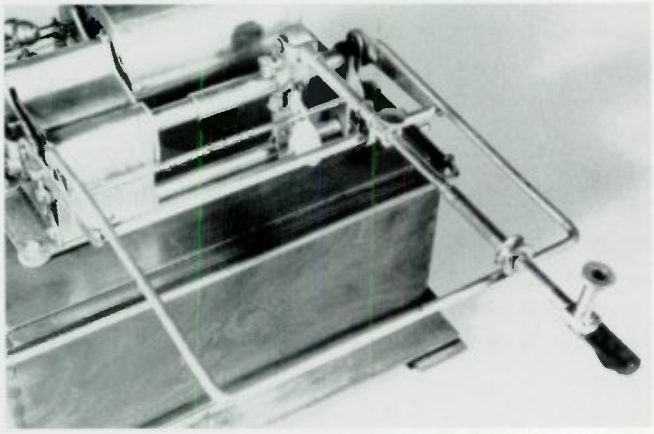
A detail of the EWC decal found on all Excelsior machines. Usually this is placed on the right-hand support, but it can also be found on the gear cover.

Pathé "Coq" No. 25, 1898-1906. One of the first of a long line of Pathé cylinder machines. The horn is known as a "cor de chasse." (Ernie Bennett collection)



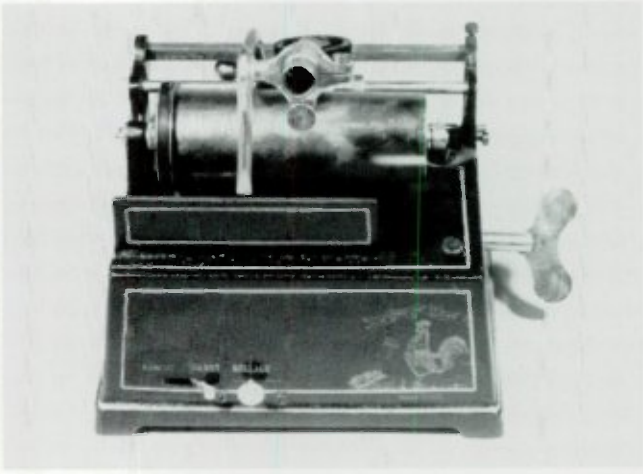
A close-up look at the Pathé "Coq." The similarity to the Columbia "Eagle" is unmistakable. This particular machine is fitted with a Pathé "Rex" reproducer.

Pathé No. 1, 1905-06. Like the "Coq," the model 1 (also called the "New Perfecta" and "Duplex") is an "Eagle" look-alike, though equipped with a special mandrel adapter for "Salon" size cylinders. The machine here is also equipped with an "Orpheus" attachment with which the feedscrew guides the horn rather than the reproducer. The machine has a reversible case similar to the Excelsior. (Emil and Kirsten Sørensen collection)

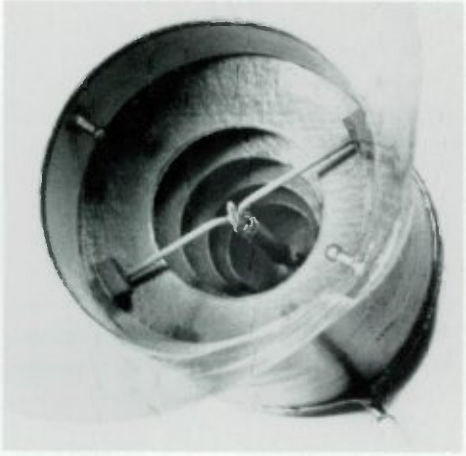


A detail of the Orpheus attachment, the second of two similar styles.

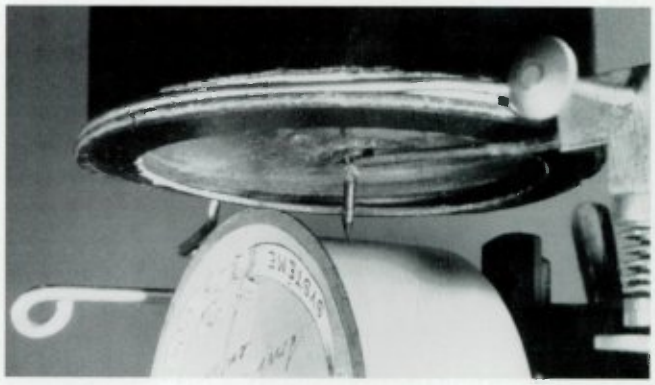
Pathé "Le Gaulois," 1903-06. The similarity between this simple cast iron machine and the Edison "Gem" is fairly easy to see. The Gaulois was made in at least two distinct versions, this one being the earlier of the two, recognizable by the large arm to the left of the reproducer. The Gaulois was available in a variety of colors: red, blue, orange, green, gray, and black, and originally came with a 10" black conical horn similar to that of the Gem. A special flared glass horn can also be found. A few machines were produced with painted wooden cases but these are very unusual and probably not part of Pathé's regular production. (Author's collection)



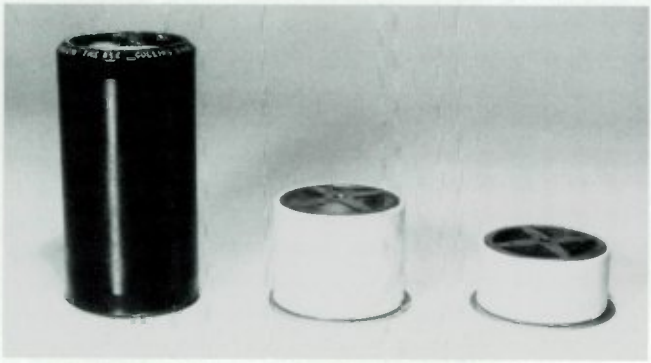
Lioretgraph No. 2, c. 1898. This machine exhibits Lioret's expertise as a clockmaker, although the primitive reproducer and short celluloid horn leave much to be desired acoustically. This is a two-minute machine, although Lioret also produced a four-minute version—the first four-minute machine ever marketed. The special celluloid cylinders that the machine uses were also a Lioret first. (Claes O. Friberg collection)



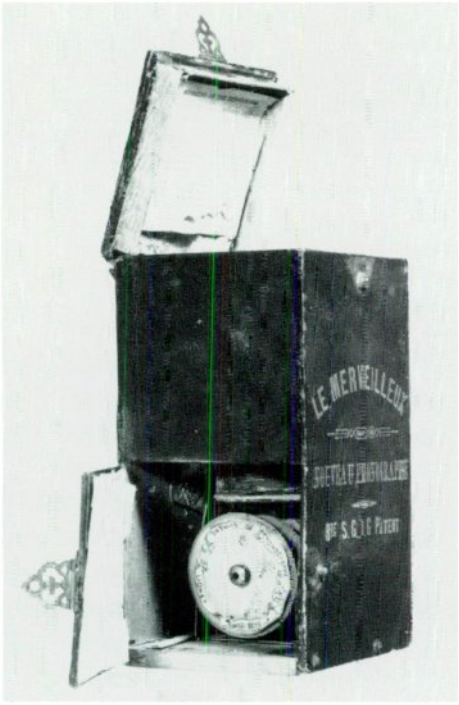
The unique cardboard "sound chamber" on the Lioretgraph.



A detail of the Lioret "bent nail" stylus.

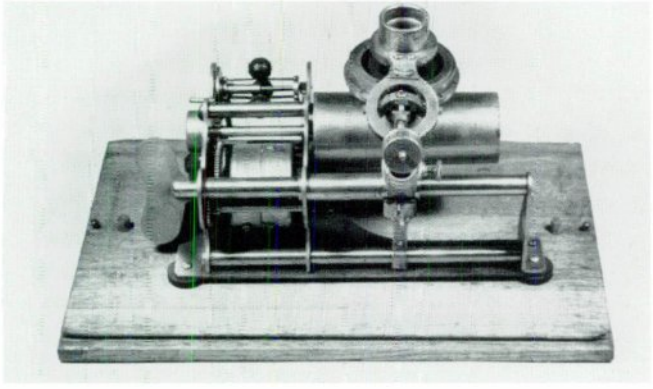


One- and two-minute Lioret cylinders shown with an Edison cylinder. Smaller 30-second and larger four-minute Lioret cylinders were also produced.

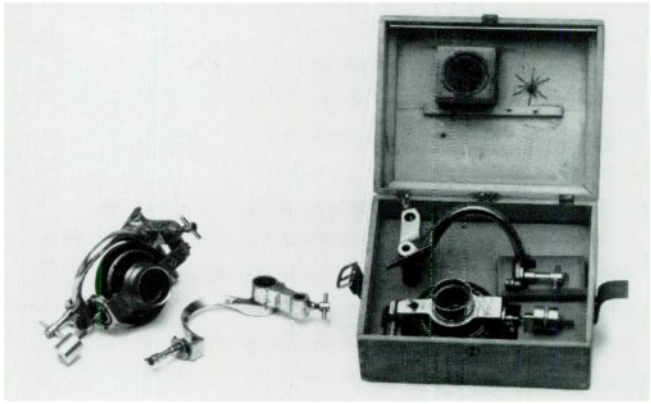


Lioret "Le Merveilleux," c. 1898. This little cardboard box houses a tiny phonograph of the type later to be used in Lioret's talking dolls. The ¾" celluloid cylinder plays for about 30 seconds. (Photograph courtesy of Christie's South Kensington)

Paillard's "Echophone," c. 1903-06. Paillard, a well-known music box manufacturer in St. Croix, Switzerland, produced a number of "Eagle" look-alikes for a short time around the turn of the century. After 1906, production concentrated on their line of "Maestrophone" disc machines. Paillard motors found their way into many portable machines during the 20's and 30's, notably those sold by Decca. Paillard still exists today as a camera maker (Bolex) and supplier of components for stereo systems. (Ernie Bennett collection)



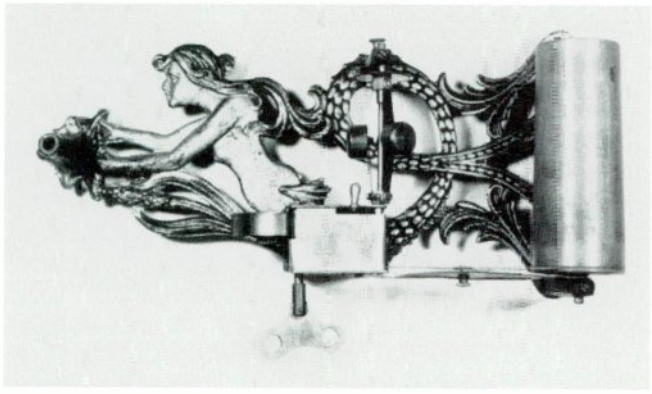
Columbia "Eagle," c. 1898, with Bettini attachment, c. 1898-1905. This early "Eagle" was shipped to Europe without a case in order to save freight costs. On arrival in Europe, it was equipped with a simple wooden box by the distributor. Original Bettini reproducers are nickeled brass and bear the name "Bettini." The example shown here has no markings and is made of pot metal, an inexpensive copy marketed by Pathé, among others. The neck and arm on this example have been repaired by a previous owner many years ago. (Author's collection)



Bettini "Micro-Reproducers," c. 1903. Both of these two reproducers are Type "N" models. The one at the left with the nickel-plated collar is typical of those reproducers sold by Bettini himself already mounted on a machine. The model at the right was sold as a separate upgrade for existing machines. The special Bettini arms shown here fit an Edison machine, probably an early Standard. (Photo courtesy of Christie's South Kensington)

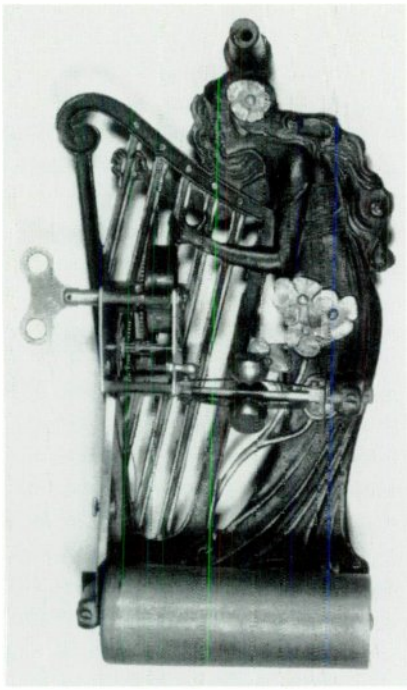
The "Puck," c. 1901-14. Designed by Carl Lindström of Parlophon fame, the simple little "Puck" is probably the most inexpensive machine ever sold—when it was sold. Often it was given away as a premium with the purchase of a quantity of cylinders. The idea was that the owner would soon tire of the primitive "Puck" and invest in something better. The "Puck" was made by many different factories, usually in Germany, and distributed throughout Europe under various names. There are a number of different base designs, but the one shown here is probably the most common. The mandrel is connected to the governor pulley with a twisted loop of string rather than a belt. I mention this simply because many people are not aware of the twist and have trouble getting the machine to function correctly because the cylinder rotates in the wrong direction! (Ernie Bennett collection)

"La Sirena," c. 1906-09. This Puck version sold well in France and features a mermaid rather than the more common lyre base. (Emil and Kirsten Sørensen collection)



A detail of the "Sirena" bedplate.

The "Harpist," c. 1904. This unusual Puck has an art nouveau inspired base. The horn is painted aluminum and is very light-weight, considering its substantial size. (Author's collection)



A detail of the "Harpist" bedplate. The governor weights are possibly replacements.

"Kastenpuck" phonograph, c. 1903-14. The German "Kastenpuck" is a deluxe version of the simple lyre-shaped Puck machine. Machines similar to the one in the photo were sold in England up until WWI, but they are rarely seen in the U.S. However, the American Graphophone Co. did import them at one point. These imported machines often have a paper sticker on the mandrel containing licensing information. (Claes O. Friberg collection)

"Lorelei," c. 1906-08. The lovely "Lorelei" is perhaps the most decorative of the various Puck models. The base is copper plated and "antiqued" while the horn is bright green. (Emil and Kirsten Sørensen collection)

Some Other Interesting Disc Machines

The Chicago connection

Around the turn of the century, a number of companies popped up in the Chicago area which sold machines with non-standard spindles or projecting lugs on the turntable. This prevented the use of records other than those of the maker itself. These Chicago machines were all quite inexpensive and judging by the number of surviving examples, sales must have been brisk, despite the limited record selection. Most of the models bear a strong resemblance to Columbia products—not surprising in light of the fact that Columbia made many of them.

All products sold by the Standard Talking Machine Co. were Columbia products, as were most Harmony machines (a Standard affiliate), although Harmony sold some non-Columbia front-mounts in the years 1906-09. The O'Neill-James Co. (producers of Yankee Prince and Busy Bee machines) and their affiliate, Aretino, sold non-Columbia machines up until 1909. Most of these pre-1909 machines were front-mounts, but a few rear-mounts, made by Hawthorne and Sheble of Philadelphia, were also sold. In 1909, a court case forced both companies to sell Columbia-built machines and existing Hawthorne and Sheble cabinets were adapted to fit Columbia parts.

My warmest thanks to Tim Fabrizio for supplying virtually all of this valuable information about these interesting but poorly documented machines. Tim was also kind enough to check other parts of this section for accuracy, for which I am deeply grateful. Any errors are undoubtedly my own fault, not his.

A number of decals from Chicago machines

Standard Talking Machine Model AA, 1905-09. This simple front-mount machine is identical in all respects to the Columbia AU, with the exception of the special Standard 9/16" spindle. This machine was made by Columbia. (Ernie Bennett collection)

Standard Talking Machine Model X2, 1906-09. The Model X2 shown here is characterized by the morning-glory horn. The earlier Model X has a simple straight black horn similar to that of the AA. The horn in the picture is black, but blue is also quite common. The flowers are unusual, but appear to be contemporary. (Bill and Peggy Robbins collection)

Harmony Talking Machine, 1909-14. The Harmony, marketed by the Great Northern Manufacturing Co., was also a Columbia-built product, this time with a 3/4" spindle. Harmony also marketed a front-mount similar to the Standard X2 from 1906-09. Most (but not all) Harmony machines have blue horns. (Walter Bellm collection)

Standard Talking Machine Model A, 1908-20. The Model A with its characteristic Columbia speed control, appears to have had a long production run. Standard was still in business as late as 1920, selling Model A's. Even though an internal horn Model B was introduced in 1911, the B did not replace the A, but merely expanded the model range. Larger outside horn machines built by Columbia but bearing the Standard name also exist, although these are less common. The Model A has a red horn, often iridescent. The spindle on the machine in the photo has been altered so that normal records can be played, stacked on top of two or three Standard discs. (Ernie Bennett collection)

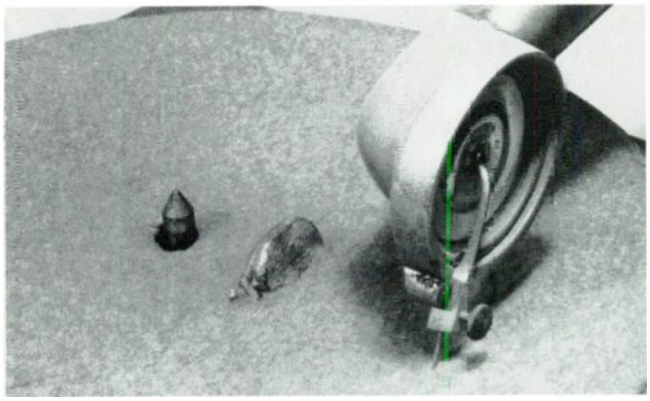
Aretino, 1906-09. The Aretino has a huge 3" hub in the center, a bit too large to be considered a spindle. The Aretino front-mount, as well as its cousin, the Busy Bee Grand, has no traveling arm. Instead, the horn is stuck into a socket on the special cast pot-metal reproducer. The motor is of very simple single-spring construction—so simple in fact, the crank turns as the record plays. The horn is a light, transparent green. (Ernie Bennett collection)

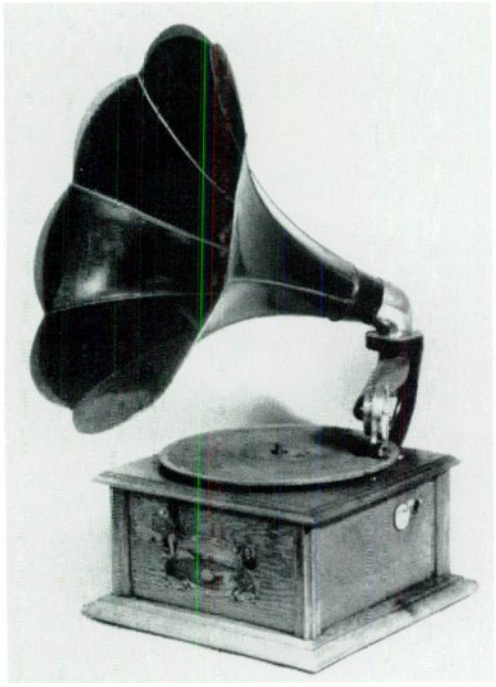
Aretino, 1908-09. This early Aretino rear-mount was constructed by Hawthorne & Sheble. Notice the unusual hinged tone-arm construction. (Ernie Bennett collection)

Aretino, 1909-14. After Columbia started to manufacture the Aretino, the machine received a characteristic Columbia motor with a combination on/off/speed control projecting through the front of the case, and a typical Columbia tone-arm. (Ernie Bennett collection)

Busy Bee "Grand", 1906-09. The Grand is essentially the same machine as the early Aretino, but with a few minor cabinet changes. The horn is iridescent red and the normal size spindle is accompanied by a projecting lug which fits into a slot on Busy Bee records. A slightly different version with a taller case also exists. (Author's collection)

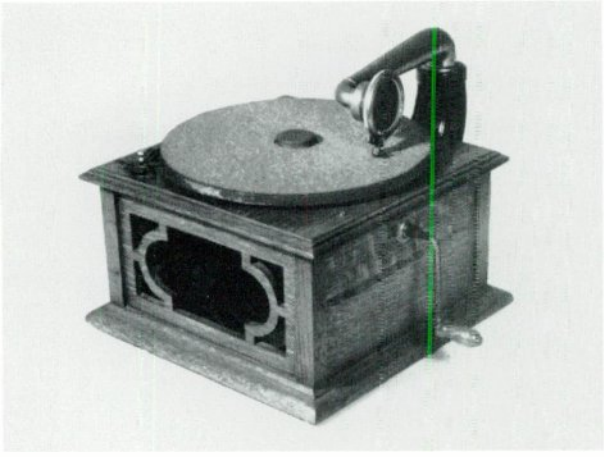
A detail of the spindle/lug arrangement on the Busy Bee Grand. Note the special cast reproducer that does away with the traveling arm seen on most other front-mount machines. The reproducer diaphragm is metal.





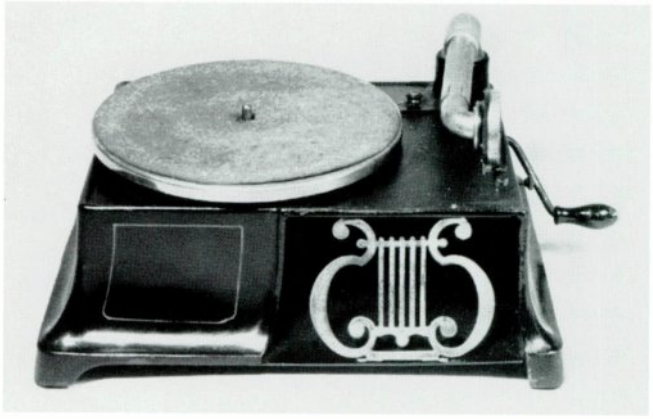
Yankee Prince, 1909-14. The Yankee Prince was the name given to the O'Neill-James rear-mounts and replaced the Busy Bee Grand. The Yankee Prince has a more typical Columbia speed control, a restyled case and a black horn. The Busy Bee turntable lug, however, was retained. (Walter Bellm collection)

Symphony, 1911-14. Built by Columbia, but sold by the United Talking Machine Co., the Symphony is a simple single-spring machine with a 1 ½" spindle. This was the only model produced by United, a subsidiary of the Standard Talking Machine Co. (Ernie Bennett collection)

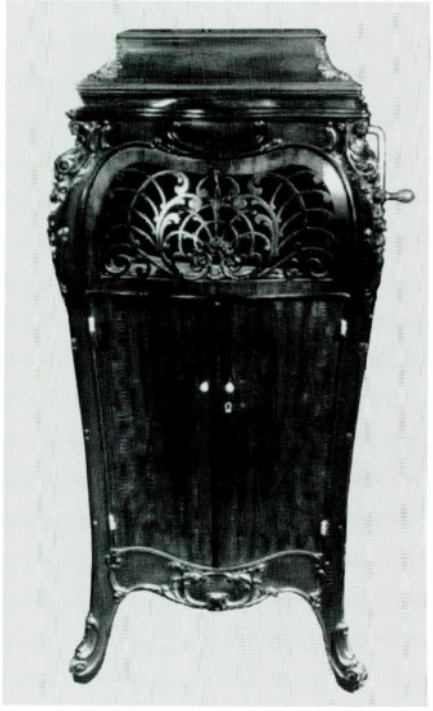


Talk-O-Phone "The Brooke," c. 1904-08. The Talk-O-Phone Co. of Toledo, Ohio produced at least fifteen distinct models between 1902 and 1909, mostly front-mounts. The simple single-spring "Brooke" was one of five machines introduced in 1904 bearing the names of famous band leaders (Herbert, Brooke, Ennis, Clark, and Sousa). The "Brooke" originally cost $18.00. (Ernie Bennett collection)

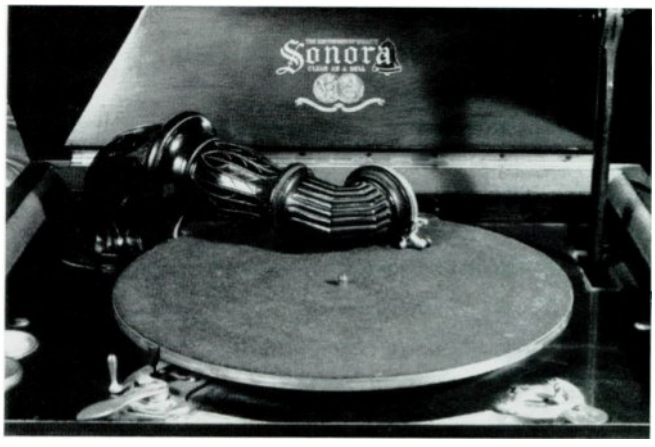
Little Wonder, 1901-12. This simple cast-iron machine, made by the Boston Talking Machine Co., is the more common of the two Little Wonder models. The other type is a miniature floor model. The 6 ½" turntable can just hold the special Little Wonder records that came with it. Although Little Wonder records are lateral-cut, the machine can also play small vertical-cut records, too. (Walter Bellm collection)



Universal, c. 1922. This interesting cast-iron machine was manufactured by the Universal Phonograph Co. of Chicago, probably during the early 20's. (Bill and Peggy Robbins collection)

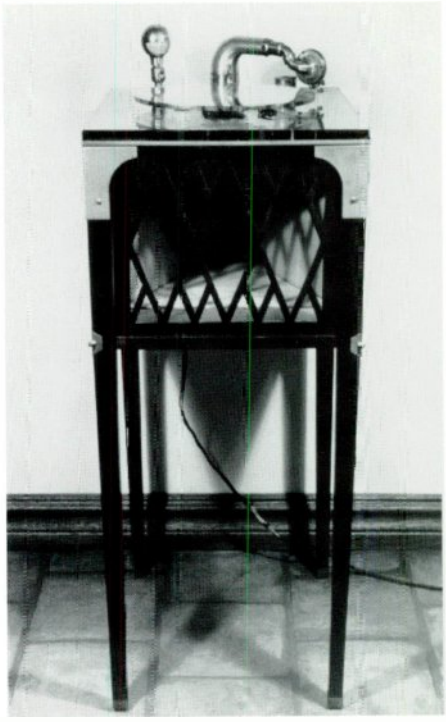


Sonora "Supreme," c. 1915-22. The "Supreme" is undoubtedly one of the most elaborate floor models ever produced in the U.S. The cabinet came in either red or brown mahogany, or Circassian walnut. All hardware, including the triple-spring motor, is gold-plated! When fully wound, Sonora claimed that the Supreme could play up to fifteen 10" records on one winding, and as a unique feature, the "Supreme" has a special meter to indicate the number of records that can be played before rewinding is necessary. (Walter Bellm collection)

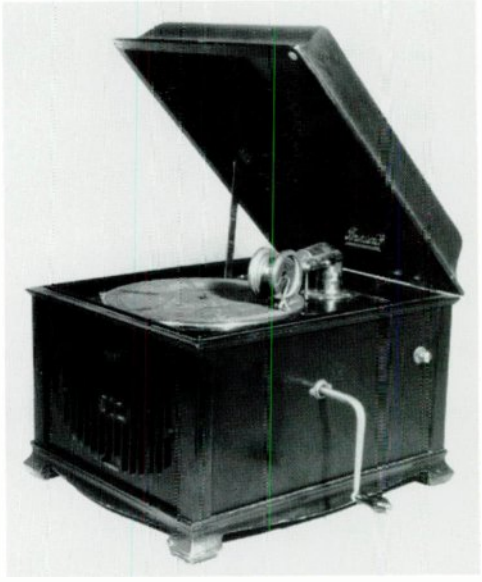


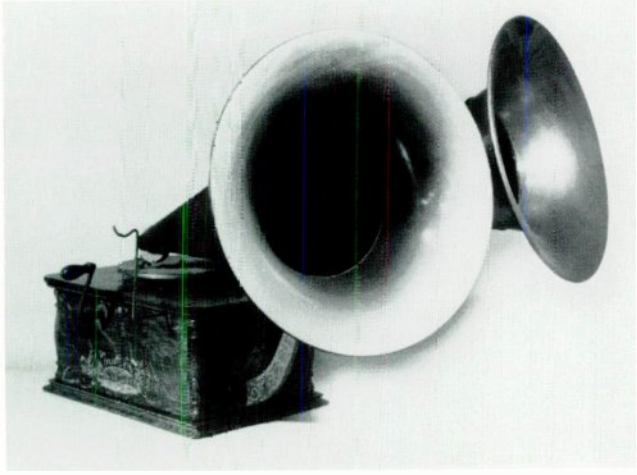
This detail shows the Sonora's carved wood tone-arm, found on the "Supreme" and a number of other Sonora models.

Kurtzmann, c. 1920. Made in Buffalo N.Y., the Kurtzmann is unique among American machines in that it's primarily made of glass! It is interesting to note that the motor, lamp, and reproducer are almost identical to those found on the Capitol phonograph lamp. All hardware is gold-plated. The reproducer can play both vertical- and lateral-cut records. The light bulb in the upper left-hand corner lights up when the electric motor is turned on. (Ernie Bennett collection)

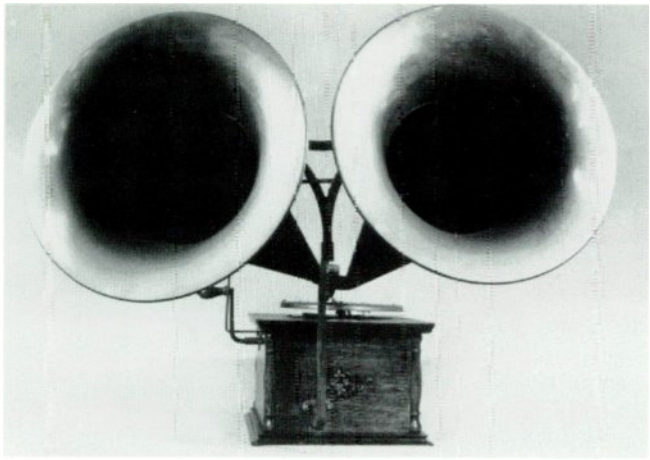


Brunswick, c. 1922-30. This machine is a fairly typical example of Brunswick's production during the 20's. Note the Ultona reproducer and the small knob projecting from the cabinet at the rear. This knob operates a tone control device which blocks off the sound passage with a sliding piece of wood. The internal horn is made of spruce. (Walter Bellm collection)

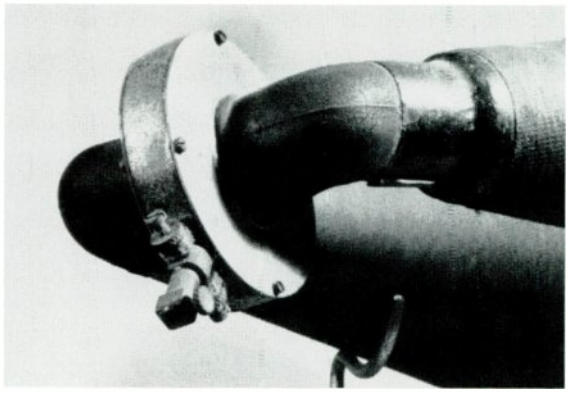




Kalamazoo Duplex, c. 1905-08. The ungainly Duplex was an interesting acoustic development. Although Columbia had experimented with sound amplification through the use of multiple reproducers, the Duplex utilized sound waves from both sides of a single diaphragm. Duplex sound reproduction is similar to hearing out-of-phase stereo speakers and the result is quite effective. The Duplex has a simple single-spring motor that fills only a small portion of the rather large oak cabinet. (Walter Bellm collection)

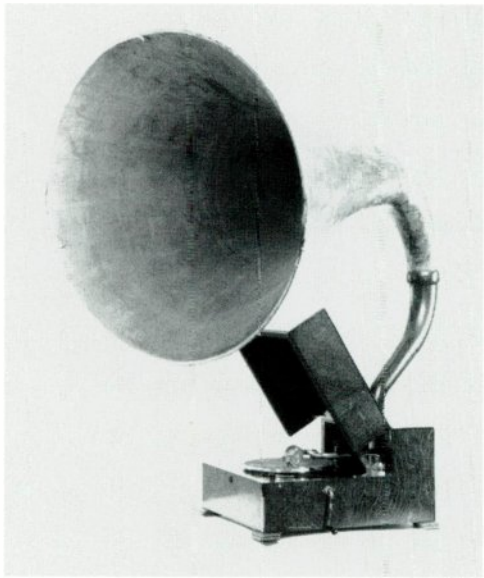


Another view of the Duplex. The Duplex Phonograph Co. also produced some very fine records to go with their machines, which inspired Victor to sue the company in 1907.



This photo shows the first of two very similar versions of the Duplex reproducer.

This photo does not do justice to the colorful Duplex decal.



E.M.G. Mark Xb Oversize, c. 1935. E.M.G. "hand-made" gramophones, with their enormous papier-maché horns reflect the ongoing English emphasis on acoustic quality rather than flashy appearance. Starting in the early 20s, E.M. Ginn and his partner H.B. Darvey started making some of the best-sounding acoustic machines ever produced. Early machines have straight horns and the Mark X series with S-shaped horns commenced in 1927. Production continued until the early 40s. The Mark Xb features a 33 ½" diameter horn, the Xa was 28", and the IX was smaller still. Ginn himself left the company in 1930 to form "Expert," which produced similar machines, though with only a single bend in the horn and a unique horseshoe-shaped soundbox. (Photo courtesy of Christie's South Kensington)

The Fairy Phonograph Lamp, c. 1918-23. The Fairy Phonograph Lamp was produced for a number of years by the Endless-Graph Co. of Chicago. Volume controls and on/off switches are hidden in the side columns. Although the lamp is made of copper and many collectors polish them up, the copper was originally painted to resemble dark green oxidation. This model has a 12" turntable, but a 10" model also exists. The lampshade is a good copy of the original, but is a few inches taller than it should be. Right view shows the machine in use. The shade has been removed for the sake of clarity.(Author's collection)

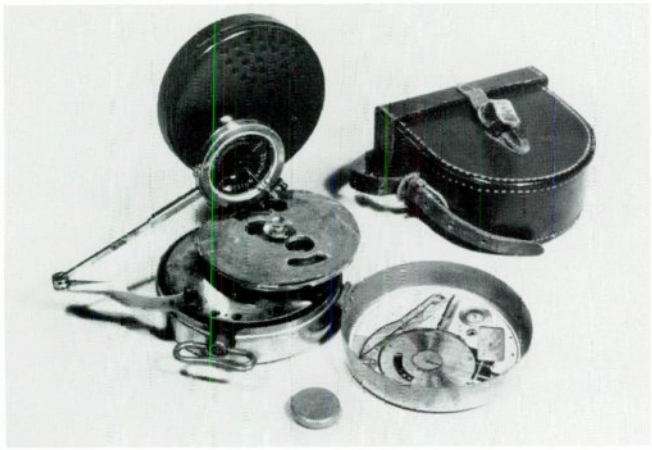
The Capitol model O, c. 1919-23. The Burns-Pollock Electrical Mfg. Co. of Indiana Harbor, Indiana was responsible for producing this extremely heavy bronze curiosity. Six different models were produced: three "Standard" models with 12" turntables in either bronze (model O), silver (model L), or gold (model E), plus three similar "Junior" models with 10" turntables. The lampshade shown here is a fair approximation of the original, built on the original hinged frame. The model O originally sold for $160.00. (Walter Bellm collection)

The Phonolamp, c. 1920-26. This particular lamp is the model L, but the designation seems only to apply to the shape of the shade and the color scheme—in this case red and gold. Other models in blue, green, and yellow can also be found. The sound comes out of the top of the shade, rather than through the base as is seen in most other phonograph lamps. The shade shown here appears to be original. (Walter Bellm collection)

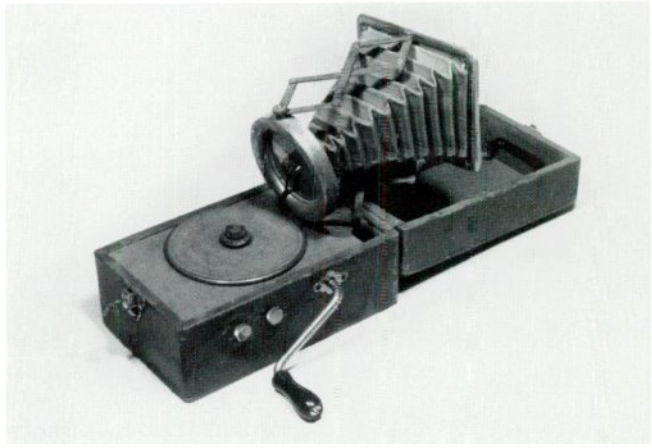
Pathéphone No. 6, c. 1906. In 1906, the French Pathé Co. abandoned cylinder machines entirely to concentrate on disc models. This one has the characteristic "viking prow" back-bracket often seen on early Pathé models. The plunger to the right of the crank operates a rack-and-pinion device that quickly gets the turntable up to the proper speed—often in excess of 90 rpm. All pre-1930 Pathé machines use vertical-cut records. The horn shown here is American and not French. (Peter Dilg collection)

Hawthorne & Sheble "Star," c. 1908. This model is fairly typical for H&S's production. The model shown here is a large, solidly-built machine, equipped with a special hinged tone-arm—one of several variants designed to circumvent Victor patents. The tube attached to the side of the case is a used needle container, a common H&S feature. The reproducer shown here is a replacement and the horn elbow is also suspicious. (Photo courtesy of Christie's South Kensington)

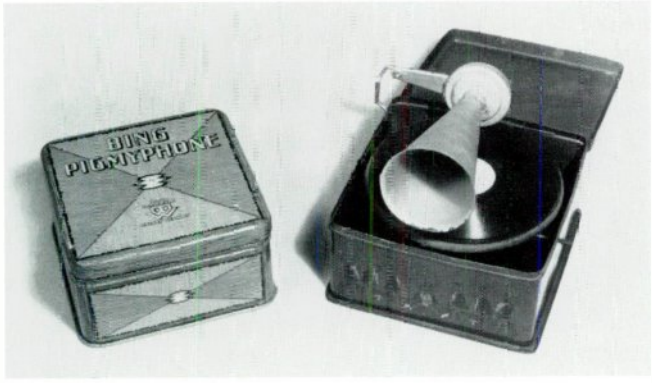
Klingsor, c. 1907-20. The Klingsor's claim to fame was its special harp. The strings were meant to vibrate sympathetically as the record played, thus enhancing the sound. The machine was invented in Germany in 1907 and produced by a number of different firms. The Klingsor sold quite well, particularly in England where it was marketed by John Murdoch. Murdoch was still selling these machines after WWI, some in British-made cabinets. Cabinet variations are numerous and precise dating is quite difficult. Exactly how one tunes the strings is something of a lost art, but there is no doubt that bringing them up in pitch produces positive results. Klingsors actually sound very good. (Ernie Bennett collection)



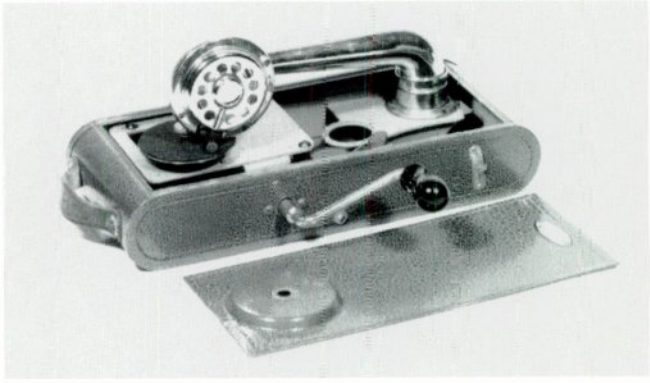
Mikiphone, c. 1925. The Swiss-made Mikiphone is probably one of the smallest machines ever made. Getting all the parts in the oversized "watch case" is rather like assembling a Chinese puzzle. An interesting feature of the Mikiphone is the on/off device, which works by moving the reproducer back and forth along the record groove. Speed is adjusted in the same way. (Dennis and Patti Valenti collection)



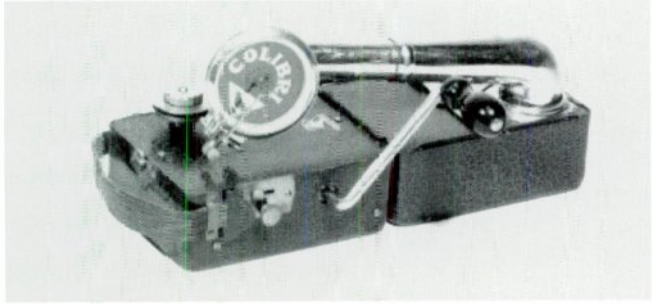
Triumphone, c. 1924. There are a fantastic number of "camera" phonographs, so named because they resemble early box cameras. I'm particularly fond of this one from Paris because of the ingenious bellows horn. The acoustic qualities are poor, as could be expected. (Bill and Peggy Robbins collection)



Bing "Pigmyphone," c. 1930. The German-made Pigmyphone is one of a number of toy tinplate phonographs produced from the mid-20's up until WWII. The photo shows two similar machines, opened and closed. (Bill and Peggy Robbins collection)



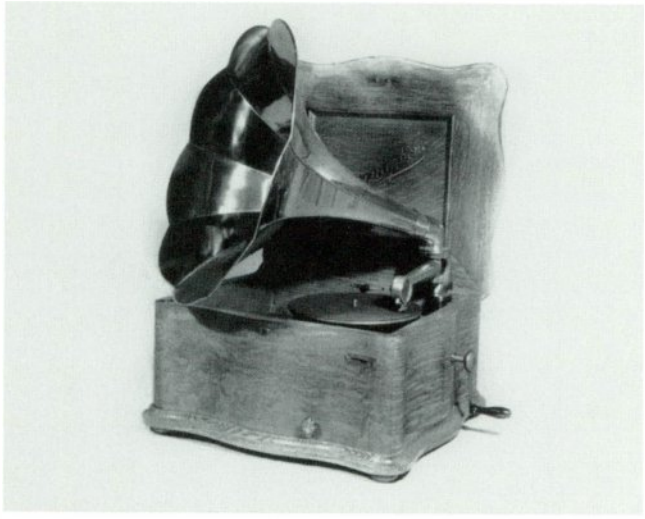
Thorens "Excelda," c. 1930. Made in Switzerland, the Excelda was designed to resemble a bellows-type camera of the era. Like so many miniature gramophones, the Excelda can only be wound when it is placed on the edge of a table and before the record has been screwed down onto the spindle. (Photo courtesy of Christie's South Kensington)



Colibri, c. 1928. Made in Belgium, this small camera-type gramophone features a special sound chamber in the lid. When the machine is unfolded and the telescoping tonearm is assembled, a spring-loaded panel raises automatically to create a baffle. (Photo courtesy of Christie's South Kensington)

Combination Talking Machine/Music Boxes

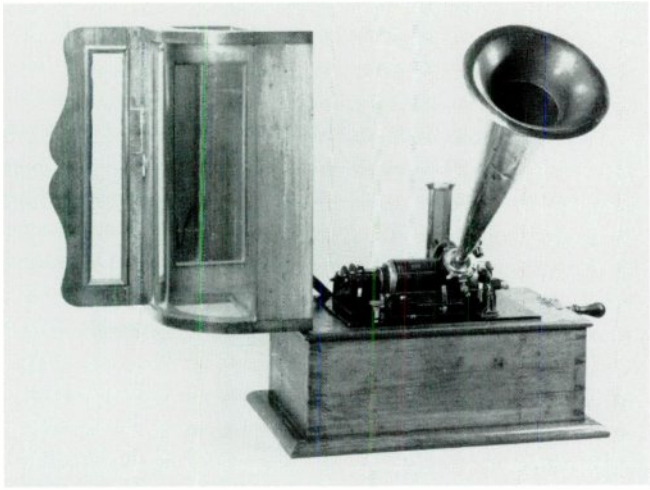
Miraphone, c. 1906-10. In addition to the superb 12" Mira music box, this machine is equipped with Columbia-made parts that allow it to play 78's. The matching mahogany horn is similar to those wooden horns made in Europe from about 1908 onwards. The Miraphone was made by Mermod Frères of St. Croix, Switzerland starting in 1903. The pre-1906 models were all of front-mount design, with parts supplied by the Gramophone Co. in England. The first machines sold for about $100.00. After 1910, the music box portion of the machine was abandoned and the Miraphone name was used on inexpensive internal horn machines until Mermod Frères went out of business around 1915. (Ernie Bennett collection)



Reginaphone style 150, 1906-15. This oak 15 ½" Reginaphone was made by the Regina Music Box Co. of Rahway, N.J., one of a large number of Reginaphone styles which utilized Columbia parts. Some later internal horn Reginaphones used the handsome cabinets of the early Grafonolas. The style 150 originally cost about $100.00. (Walter Bellm collection)

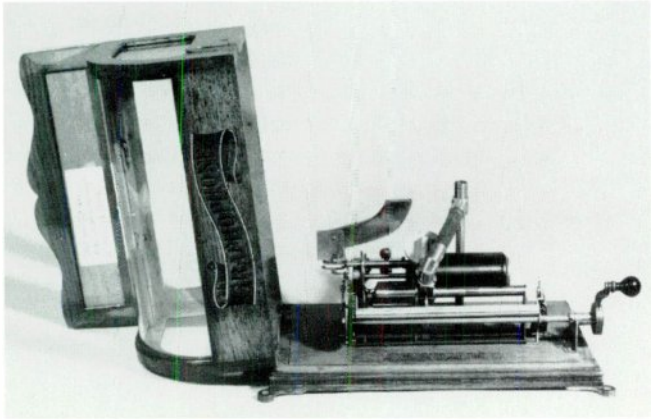
Coin-in-slot Machines

Although the following section does not contain "classic" juke boxes in the Wurlitzer-Seeburg-Rockola tradition, these early coin-operated machines paved the way for the colorful music-makers of the 30's and 40's. The first machines were primarily of the cylinder variety (though not exclusively) and very early models provided music through hearing tubes. As the novelty effect of the phonograph wore off, operators discovered that the same machine, equipped with a horn, provided acceptable background music in stores and restaurants. However, by 1908, these phonographs had been pretty much abandoned in favor or coin pianos.

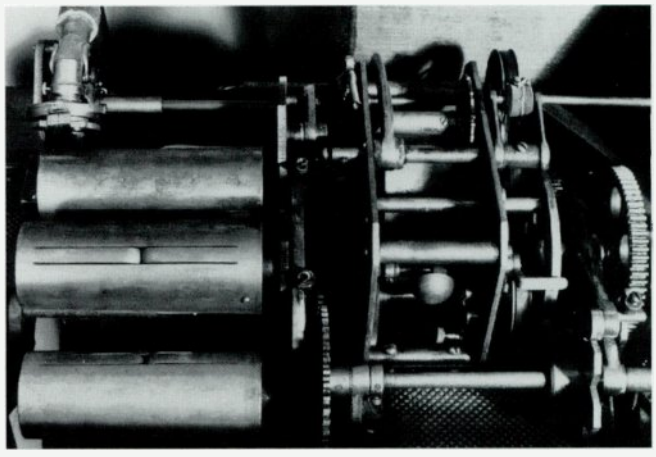


Edison "Excelsior," 1901-08. The "Excelsior," is based on the early model A "Standard." This machine was rarely equipped with hearing tubes but rather with a 14" horn of the "witch's hat" variety. Early Excelsiors used the Automatic reproducer (as shown here), but this was soon changed to the model B reproducer. A cloth-covered rubber tube, which connects the reproducer and horn tube is missing on this particular machine and in actual use, the horn protrudes from the top of the case. The crank was attached with a set-screw so that customers would not run off with it. The original price of the "Excelsior" was $50.00. (Photograph courtesy of Christie's South Kensington.

Columbia BS, c. 1898-01. The BS is a coin-operated version of the popular "Eagle." The case is equipped with metal lugs for attaching the machine to a table or other difficult-to-steal perch. The machine sold for $20.00, but owners of regular "Eagles" could have their machines converted to the BS style for an extra $10.00. The machine pictured here uses quarters, but originally the BS accepted nickels and pennies. A similar machine based on the AT was marketed in a coin-op version as the AS, as was a coin-op "Grand," called the SG for "Slot Grand." Shown below is an open view of the machine.(Walter Bellm collection)



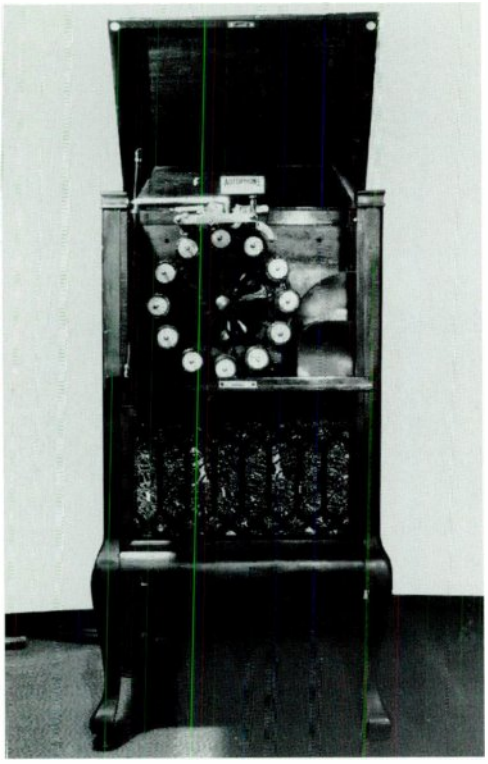
Regina Hexaphone, 1908-21. The Regina Music Box Co. made about 8000 of these machines in four very similar models: style 101, style 102, style 103, and style 104. The one shown here is a style 102, built between 1911-15. The Hexaphone can play any one of six four-minute cylinders, hence the name. Normally, the Hexaphone has a top gallery, but this is missing from the machine in the photo. (Ernie Bennett collection)



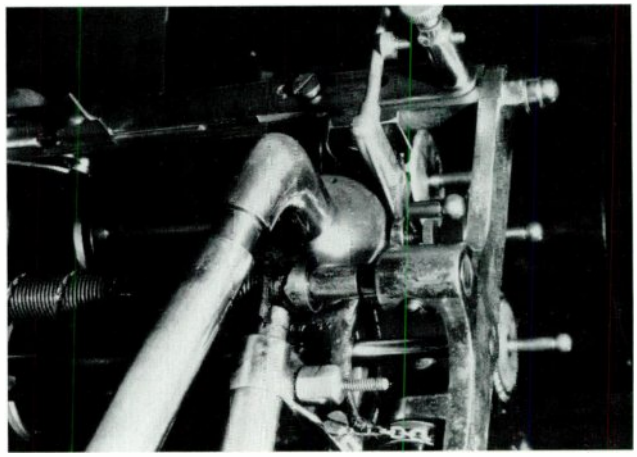
A detail of the Hexaphone mechanism. Each mandrel is equipped with its own drive gear. Later models have gears that are slightly larger than the diameter of the mandrel rather than the small ones shown in the photograph.

The Multiphone, c. 1900-13. Three different machines were produced with the name "Multiphone" during the first years of the century. The first machine was made from 1900-05 in Kalamazoo, Michigan and provided music from any one of 24 pre-selected two-minute cylinders through the large horn protruding from the top. In 1905, the company was reorganized in New York and produced a new model with a flamboyant, lyre-shaped case. Most of these machines play two-minute cylinders, but before the company went into liquidation in 1909, a few four-minute models were made. In 1913, a new Multiphone was introduced, this time in a more discreet case, which could play any of 12 four-minute cylinders. The picture here shows all three models. From left to right, they are: a 1913 model, an early Kalamazoo Model, and the lyre-shaped New York model. A Columbia BS can be seen sitting on top of the 1913 machine. (Walter Bellm collection)

Rosenfield Automatic Phonograph, c. 1906. The Rosenfield Co. of New York produced this machine based on the Columbia AZ with some reproducer modifications. It is equipped with a 110V electric motor. The oak cabinet is very similar to that of the early Edison Class M coin-ops. (Ernie Bennett collection)



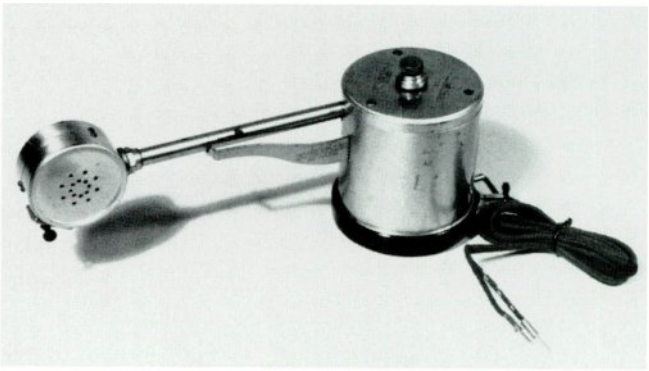
The Autophone model 200, c. 1912. Made in a limited number by the American Phonograph Co. of New York, the Autophone resembles a regular floor model phonograph when closed. Despite the fine mahogany finish, the discreet cabinet, and the ability to play any of twelve Blue Amberol cylinders, the Autophone was not a great success. The price in 1912 was $200.00. (Walter Bellm collection)



This photo shows part of the highly nickeled Autophone mechanism. Note the feedscrew at the far left, which is cut with two different threads; the deep groove returns the reproducer to the beginning of the record after the selection has been played.

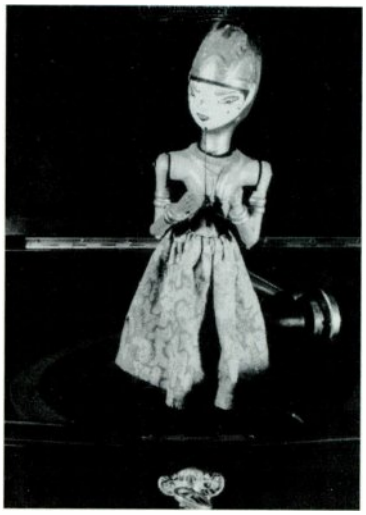
Some Interesting Accessories

Jones Motrola, c. 1925. Although the Motrola never won any prizes for appearance, it was a very practical device. At the press of a button, the machine is wound up and the motor shuts itself off. The cabinet is not marred when attaching the Motrola as one of the escutcheon screws is used to fasten the motor to the cabinet. (Dennis and Patti Valenti collection)



Bristolphon model L, c. 1925. The Bristolphon, made by the Bristol Co. of Waterbury, Conn., is an attachment for converting an acoustic machine into an electric one. The leads are meant to be plugged into a radio. The device simply sits on the motor board and does not require more permanent installation. (Peter Dilg collection)

This illustration shows a variety of dancing dolls and other novelties. Front row (left to right): Fighting Roosters, National Co., Boston, Mass., c. 1915; Magnetic Dancers, c. 1920; Dancing Sam, Dancing Sam Novelty Co., Cleveland, Ohio, c. 1915. Back row (left to right): Siam Soo, Norton E. Converse Co. Winchendon, Mass., c. 1916; Vaudette-type, c. 1915. (Dennis and Patti Valenti collection)



Siam Soo in action. Siam Soo works rather like a self-contained marionette. Her gymnastics were originally accompanied by a special record issued by Columbia. (Dennis and Patti Valenti collection)

Price Guide

Rarity and price guide

In the strictest sense, a rare machine is one that has survived in comparatively fewer numbers than other models. Although production figures exist for some marquees such as Edison, which is helpful, this doesn't always give an accurate indication of the number of machines that are still around. For example, an inexpensive machine may have been produced in great numbers, but since its useful lifetime was probably quite short, the chances are it was thrown out after just a few years and may be quite rare today. Just for the sake of comparison, consider the fact that most people throw out their old TV sets when they break down.

Determining the relative rarity of a machine today is largely a matter of educated guesswork—a "gut feeling" based on how many machines one has actually seen or seen advertised. What follows, while not particularly scientific, will hopefully be of help to those of you who stumble across something and want some indication of its historical and monetary value. Finally, let me know if you find any glaring errors so they can be corrected in future editions.

Other factors that influence rarity

Special cabinetry, unusual extra equipment, special plating—all of these will contribute to a machine's rarity. For example, original gold-plated hardware, when not standard equipment, increases a machine's rarity—and desirability.

It's easy to confuse rarity with availability. Country of origin and distribution networks always play a role. American machines are, with the exception of Edison phonographs, hard to find in Europe. The opposite is also true; German machines are common in Europe, but only occasionally cross the Atlantic. I can't recall ever seeing a Japanese machine, but I'm sure they probably exist somewhere.

Even within the United States, what's "rare" in one place may be quite common somewhere else. For example, Talk-O-Phones were distributed primarily in the midwest, so that's where you're most likely to find them—"in the rough" or in collections. Of course, once a machine gets into a private collection or in the hands of a dealer, it may end up just about anywhere.

My five-star rarity rating system

This five-star rating system is based on my own subjective evaluation of the market—with the help of some knowledgeable friends. The scale ranges from ★ for the most common models to ★★★★★ for the ultra-rare. For European machines, I've base the rarity rating on availability in the country of origin. Here's a more detailed breakdown:

★ Common machines that regularly turn up at flea markets, local antique shops, etc. Typical examples are Edison Standards and Homes.

★★ Machines that you may find in antique stores, and will often find advertised for sale in *The Antique Trader* and other collector publications. More and more machines are also advertised on the Internet.

★★★ Somewhat rarer, but nonetheless found in many private collections. The Edison Opera is one of these. Ads for machines in this category will turn up regularly in specialist newsletters such as *In The Groove* and *The Antique Phonograph Monthly*. You will probably also be able to find one through a specialist dealer.

★★★★ Fairly rare, but not by any means unique. Original coin-slot phonographs are a good example. You will usually have to purchase a machine of this type at auction, through a specialist dealer, or, if you are looking for something very specific, you may have to

advertise in a newsletter in order to coax a machine out of hiding.

★★★★★ Very rare, indeed! I've given this rating to machines that I've generally only seen a few times—usually in museums. If you find one, congratulations! Generally speaking, just about anything made before 1897 falls into this category. For example, Bell-Tainter, Berliner, early Columbia machines, and original tinfoil machines receive this rating. Most original tinfoil machines are one-offs made by enthusiasts in the late 1800's and are scarce as hen's teeth.

Rarity and prices

You might reasonably expect that the price of a particular machine was in some way related to its rarity. Well, when it comes to old gramophones and phonographs, this doesn't always hold true. True, there *are* rare machines that are also very expensive, for example the Edison Idelia. But since so few of these machines ever change hands, it's difficult to determine "the going rate." Then again, some rare machines have little collector appeal and thus are less expensive than one might think. Lastly, some expensive machines such as the Edison Opera and Victor VI are actually much more plentiful than their prices indicate. In short, it's not always easy to establish a fair or representative price, and rarity alone is a poor guide.

Factors that influence price

Although rarity will, to some extent, play a role in setting the price, the machine's *desirability* is a much more important factor. Condition is always the key issue. A well-preserved original machine will always command a higher price than a pile of rusty junk. Next is the presence of original equipment. These items include the original horn, reproducer, horn crane, etc.

The type of horn also has a lot to do with the price of a particular machine. On a cylinder model, a really good morning-glory horn with fine hand-painted decorations may double the price of a machine. Wooden horns on disc machines invariably push up the price, too.

If the original instructions still accompany the machine (I've even seen phonographs that had the original packing crates), along with oiling cans, tools, recorders, etc., up goes the price. Finally, extras such as fancy cabinetry (particularly for Victrolas, Grafonolas and Edison Diamond Discs) are always prized by collectors.

The price guide

On the following pages, you'll find a list of most of the common models sold in the United States during the heyday of the outside horn machine. I've also included some foreign models, plus a few interesting inside-horn machines. Many of these machines are illustrated elsewhere in the book, so take a look if you are in doubt as to what you have.

Setting accurate prices for almost 300 machines is a daunting task. Moreover, it's sometimes difficult to set fair prices, since all collectors want *their* machines to be more valuable than someone else's. Happily, I have had first-rate assistance from Christopher Proudfoot, head of the Gramophone and Phonograph Department at the internationally-renowned auction house, Christie's, and his colleague, George Glastris, a fellow phonograph collector and, like myself, a native of St. Louis. Christie's started gramophone and phonograph auctions almost a quarter of a century ago and in my opinion, they're probably the most experienced machine appraisers in the world.

Christopher and George have spent many hours pouring over auction catalogs—their own and those of others—and talking with collectors and dealers on both sides of the Atlantic to make these price guidelines as accurate and unbiased as possible. I cannot thank them enough. I also hasten to add that the prices indicated here are not necessarily auction prices—as far as possible, they indicate the prices you'd expect to pay in the U.S. on the open market for these machines. If you disagree with our prices—and many of you will—the only thing we can suggest is that you sell a machine and prove us wrong!

The prices indicated are for clean, complete, working machines with no reproduction parts. Some minor restoration is permitted, but no repainted horns, replating, refinishing or other major cosmetic repairs. The exceptions are cabinet models, which are generally more desirable after they have been refinished—assuming the work is well done.

Prices for cylinder machines are indicated *without horns* since these are only rarely an integral part of the machine and were often purchased separately. The exceptions here are cylinder tone-arm models, in which case the horn should be present and is included in the suggested price. Cranes, special 2/4-minute gearing and other options will generally increase the price. Those prices for machines which include horns are for *metal horns*. For machines with wooden horns, add about $400-500.

Typical prices for cylinder machine horns

If you buy a cylinder machine, it will probably come with a horn. To get a better indication of the proper price for a complete machine, here are some typical prices paid by collectors for loose original horns. Again, prices will vary according to the condition of any particular horn. All prices indicate good, solid horns with original paint and relatively few dents, scratches or other damage. Repainted horns are worth somewhat less, but prices vary tremendously based on the quality of the paintwork, pinstriping, decals, etc. Remember, though, a repainted horn will *never* be worth more than a horn in good original condition! With the exception of Cygnet horns, reproduction horns, particularly witch's hats, usually have little effect on the price of a machine.

Cylinder machine horns

Edison/Columbia 10" cone for Gem, Q, etc	$50-60
Edison-type 14" "witch's hat" (black and brass)	$95-150
Edison-type 14" "witch's hat" (all brass)	$150-250
Columbia-type 14" aluminum "witch's hat"	$125-175
Pathé-type spun aluminum horn	$50-125
Edison one-piece 21" horn for Fireside/Gem	$150-250
Edison two-piece red 21" horn for Fireside/Gem	$225-300
Edison 10-petal black morning-glory horn	$100-150
Edison 11-petal black morning-glory horn	$150-200
Edison 10-petal black Cygnet horn (metal)	$350-450
Edison 11-petal black Cygnet horn (metal)	$350-450
Edison 10-petal wood-grained Cygnet horn (metal)	$400-500
Edison 11-petal wood-grained Cygnet horn (metal)	$400-500
Edison Cygnet horn with oak bell	$800-1250
Edison Cygnet horn with mahogany bell	$1000-1,400
Large brass-belled horn (black and brass)	$150-250
Large brass-belled horn (all brass)	$175-325
Extra long (5' or 6') Columbia brass-belled horn	$175-300
Large silk-covered horns	$250-350
Large morning-glory horn (any original color)	$150-250
Large morning-glory horn with original hand-painted decorations	$200-350
Large nickel-plated morning-glory horn	$200-350
Columbia-type nickel-plated morning-glory horn (rear mount)	$200-300
Columbia-type painted morning-glory horns (rear mount)	$100-150

Model designation	Mfg. dates	Picture	Rarity	Price range
Edison cylinder machines (priced without horns)				
Class "S" "Perfected" electric models	1888-93	yes	★★★★★	7,500-12,000
Class "M" or Class "E" electric (early style)	1893-98	yes	★★★★★	5,500-7,000
Class "M" or Class "E" electric (flat front)	1898-1909	yes	★★★★★	4,500-6,000
"Gem" model A (caseless)	1899-1900	yes	★★★★	600-900
"Gem" model A (branded case)	1900-01	yes	★★★★	450-750
"Gem" model A (late style case)	1901-05	yes	★★	350-550
"Gem" model B	1905-08	yes	★	300-500
"Gem" model C	1908-09	yes	★	300-500
"Gem" model D (with red Gem horn and crane)	1909-12	yes	★★★	900-1,200
"Gem" model E (with red Gem horn and crane)	1912-13	yes	★★★★	1,000-1,500
"Standard" model A (early)	1898-1901	yes	★★	450-600
"Standard" model A (late)	1901-05	yes	★	350-500
"Standard" model B	1905-08	yes	★	350-500
"Standard" model C	1908	yes	★	350-500
"Standard" model D	1908-11	yes	★	450-600
"Standard" model E	1911	see model D	★★★	450-600
"Standard" model F	1911-12	yes	★★★	450-600
"Standard" model G	1912-14	see model F	★★★★	600-900
"Fireside" model A (with red two-piece horn)	1909-12	yes	★★	750-1000
"Fireside" model B (with Cygnet horn)	1912-15	yes	★★	900-1,400
"Home" model A (clockwork - with drawer in case)	1895-96	-	★★★★★	few survivors
"Home" model A (suitcase)	1896-1901	yes	★★	450-750
"Home" model A (long case)	1901-05	yes	★★	450-600
"Home" model B	1905-08	yes	★	350-550
"Home" model C	1908	yes	★	350-550
"Home" model D	1908-11	-	★	350-550
"Home" model E	1911-12	-	★★	450-600
"Home" model F	1912-13	-	★★★	450-600
Spring motor (early Triumph)	1895-1900	yes	★★★★	1,500-2,000
"Triumph" model A	1901-06	yes	★★★	750-1,000
"Triumph" model B	1906-08	yes	★★	600-900
"Triumph" model C	1908	see model B	★★	600-900
"Triumph" model D	1908-10	yes	★★	750-1,000
"Triumph" model E	1910-11	yes	★★	750-1,000
"Triumph" model F	1911-12	yes	★★★	900-1,200
"Triumph" model G	1912-13	see model F	★★★★	900-1,200
"Alva"(electric version of Triumph models B-F)	1907-12	see Triumphs	★★★★★	few survivors
"Idelia" model D1(with straight horn and oxidized crane)	1908-09	yes	★★★★	7,500-10,000
"Idelia" model D2(with Cygnet horn and oxidized crane)	1909-10	see model D1	★★★★	10,000-15,000
"Idelia" model E (with Cygnet horn and oxidized crane)	1910-12	see model D1	★★★★	10,000-15,000
"Concert" (early Triumph variation for 5" cylinders)	1899-1901	yes	★★★★	2,000-2,500
"Concert" (middle version)	1901-06	see Triumph A	★★★★	2,000-2,500
"Concert" (late version)	1906-08	see Triumph B	★★★★	2,000-2,500
Class "M" "Concert" ("Opera" from 1901)	1899-1906	-	★★★★★	only two known

Model designation	Mfg. dates	Picture	Rarity	Price range
Class "E" "Concert" ("Oratorio" from 1901)	1899-1906	-	★★★★	only one known
"Opera" ("Concert" from 1912) mahogany/with horn	1911-12	yes	★★★	4,000-6,000
"Opera" ("Concert" from 1912) oak/with horn	1911-13	yes	★★★	4,000-6,000
"School" phonograph (Opera variant)	1913-14	-	★★★★★	7,500-10,000
Class "M" and "E" coin-slots (several variations)	1899-1906	see Rosenfield	★★★★	5,000-10,000
Model H coin-slot (table model)	1898-1900	-	★★★★★	4,000-5,500
"Bijou" coin-slot (table model)	1901-08	-	★★★★	3,000-4,500
"Excelsior" coin-slot (table model)	1901-08	yes	★★★★★	5,000-6,500
"Climax" coin-slot (floor model)	1901-08	-	★★★★★	8,000-12,000
Edison Amberola cylinder machines				
Amberola A-1 (floor model)	1909-11	-	★★★★	1,500-3,000
Amberola B-1 (floor model)	1911-15	-	★★★★	1,500-2,250
Amberola III (floor model)	1912-15	-	★★★	1,200-1,800
Amberola IV (floor model)	1913-15	-	★★★★★	few survivors
Amberola V (table model - two variants: A and B)	1912-15	-	★★	400-800
Amberola VI (table model - four variants: A, B, C, and D)	1913-15	-	★★★	400-800
Amberola VIII (table model - two variants: A and B)	1913-14	-	★★★	400-800
Amberola X (four variants - A, B, C, and D)	1913-14	-	★★	300-500
Amberola 30 (several variants)	1915-29	yes	★	300-500
Amberola 50 (several variants)	1915-29	-	★	400-600
Amberola 75 (floor model - several variants)	1915-29	-	★★	400-600
Amberola 60 (table model)	1928-29	-	★★★★	1,200-1,800
Amberola 80 (floor model for U.K. only)	1928-29	-	★★★★★	1,500-2,250
Edison Diamond Disc machines				
Model 60 (table - three variants: A, B, and C)	1912-15	-	★★★	600-900
Model 80 (table - two variants: A and B)	1912-15	-	★★★	300-450
Model A-85 (table)	c. 1917	.	★★★★★	only one known
Model A-100 "Moderne"	1915-18	-	★★★	300-450
Model 150 (two variants: A and B)	1912-15	-	★★★★	1,000-1,500
C-150 "Sheraton" (restyled)	1915-19	-	★★	300-450
A-/B-200 "Queen Anne"	1912-15	-	★★	450-600
C-200 "Adam"	1915-19	-	★★★	450-600
A-/B-250 "Modern Renaissance"	1912-16	-	★★★★	750-1,000
C-250 "Chippendale" (C-19 from 1919)	1915-27	-	★★	400-600
W-250 "William and Mary" (W-19 from 1919)	1917-27	-	★★★	450-750
D-25 "Jacobean" (J-19 from 1919)	1918-27	-	★★★★	350-550
A-/B-275 "Sheraton" (SI-19 from 1919)	1912-27	-	★★★	450-600
A-290 "Sheraton" (more elaborate than A-275)	1912-14	-	★★★★★	1,000-1,500
A-/B-375 "Louis XV"	1912-17	-	★★★★★	1,500-2,250
A-425 "Louis XV"	1912-15	yes	★★★★★	1,500-2,250
A-400 "Louis XVI"	1912-15	-	★★★★★	1,500-2,250
A-/B-450 "Louis XVI"	1912-18	-	★★★★	1,500-2,250
C-450 "XVIII Century English" (console)	1918-27	-	★★★	1,000-1,500
"Army and Navy" (military portable)	1917-18	-	★★★★	1,000-1,500
Art models (six styles)	1916-25	-	★★★★★	few survivors

Model designation	Mfg. dates	Picture	Rarity	Price range
B-19 "Chalet" (table)	1919-23	-	★★★	350-600
H-19 "Hepplewhite"	1919-27	-	★★★	300-600
IU-19 "Italian-Umbrian" (console)	1919-27	-	★★★★	300-450
L-19 "Louis XIV"	1919-27	-	★★★★	450-600
S-19 "Sheraton - sans inlay"	1919-27	-	★★	200-300
CC-32 "Chippendale Console"	1922-27	-	★★★	450-600
WMC-33 "William and Mary Console"	1922-27	-	★★★	450-600
BC-34 "Baby Console"	1922-25	-	★★	300-450
L-35 "London No. 1" (table - primarily for export)	1922-26	-	★★	300-450
L-36 "London No. 2" (open case upright)	1922-28	-	★★★★★	none known
LU-37 "London No. 3" or "London Upright"	1922-25	-	★	200-350
LC-38 "London No. 4" or "London Console"	1922-25	-	★★	300-450
Edisonic electric models				
(two models: Beethoven, Schubert)	1927-29	-	★★★	450-600
Edison Business Phonograph (wooden case)	1905-20	-	★★	450-600
Ediphone dictation unit	c. 1935	yes	★	50-100
Columbia cylinder machines (priced without horns)				
Bell-Tainter (any model)	pre-1894	-	★★★★★	12,000-20,000
Model F	1894	see model K	★★★★★	7,500-15,000
Model G	1894	yes	★★★★★	7,500-15,000
Model K	1894	yes	★★★★★	7,500-15,000
Model I	1895	yes	★★★★★	7,500-15,000
Model C "Universal"	1897-1905	yes	★★★★	450-750
Model N "Bijou"	1895-96	yes	★★★★	750-1,200
Model AN "Bijou" (also called "Thornward")	1897	see model A	★★★★	750-1,200
Model A (Washington, D.C.)	1896-97	yes	★★★★	750-1,200
Model A (New York)	1897-98	yes	★★★	450-600
Model B "Eagle" (later called BX)	1897-1906	yes	★★	200-400
Model Q "Mignon" (early)	1898-1903	yes	★	200-350
Model Q (late)	1903-08	yes	★	200-400
Model Q (fancy Sears base)	c. 1904	yes	★★★★	450-750
Commercial Graphophone	1906-14	yes	★★★★	400-600
Model AT (early)	1898-1903	yes	★★	350-550
Model AT (late - high trunnion)	1903-06	yes	★★	450-600
Model AZ	1905-07	yes	★★	450-600
Model AG "Columbia Grand" (5" cylinders)	1899-1901	yes	★★★★	1,000-1,500
Model GG "Graphophone Grand" (5" cylinders)	1899-1901	yes	★★★★	1,500-2,000
Model HG "Home Grand" (early style - 5" cylinders)	1899-1901	yes	★★★★	750-1,000
Model HG "Home Grand" (late style - 5" cylinders)	1899-1901	yes	★★★★	1,200-1,800
Model AA (sometimes "Trump" outside U.S)	1901-02	yes	★★★	450-600
Model AB (combination standard and 5" cylinders)	1901	yes	★★★	800-1,200
Model AD "Royal" (combination standard and 5" cylinders)	1901	yes	★★★★	1,200-1,800
Model AF "Elite" (combination standard and 5" cylinders)	1901	yes	★★★★★	few survivors
Model AO	1902-04	yes	★★★	450-600
Model AW (early)	1904	yes	★★★	900-1,200

Model designation	Mfg. dates	Picture	Rarity	Price range
Model AW (late)	1904-06	yes	★★★	900-1,200
Model AP	1903-10	see model AQ	★★★★	300-450
Model AQ	1903-10	yes	★★★★	300-450
Model BC "20th Century Premier"	1905-10	yes	★★★★	750-1,500
Model BE "Leader"	1906-10	yes	★★	600-900
Model BF "Peerless"	1906-10	yes	★★	600-900
Model BG "Sovereign"	1906-10	see model BGT	★★★	750-1000
Model BCG "20th Century Grand"	1906	see model BC	★★★★★	only one known
Model BK "Jewel"	1906-09	yes	★★	300-600
Model BM "Home Premier"	1906-10	yes	★★★★	1,200-1,800
Model BO "Invincible" (rear-mount)	1908	yes	★★★	900-1,200
Model BQ "Rex"	1908-10	yes	★★★★★	1,200-1,800
Model BV "Royal"	1908-10	yes	★★★	750-1,200
Model BET "New Invincible" (rear-mount)	1908-10	see model BE	★★★★	1,000-1,500
Model BFT "New Peerless" (rear-mount)	1908-10	yes	★★★★	1,000-1,500
Model BGT "New Sovereign" (rear-mount)	1908-10	yes	★★★★	1,000-1,500
Model BKT "New Leader" (rear-mount)	1908-10	yes	★★★	1,000-1,500
Model BVT "Oxford Talking Machine" (Sears)	1908-10	see model BV	★★★★	800-1,200
Model SG "Slot Grand" (coin slot with HG chassis)	1899	-	★★★★★	only one known
Model AS (coin slot type A or AT)	1897-1901	-	★★★★	3,500-5,000
Model BS (coin slot type B "Eagle")	1898-1901	yes	★★★	1,800-3,000
Dictaphone dictation unit	c. 1915-50	yes	★	50-100
Columbia Disc Graphophones				
Model AU	1904-09	yes	★★★★	450-750
Model AK (early style case)	1903	yes	★★★	600-1000
Model AK (late style case)	1904-08	yes	★★	600-1000
Model AJ (early)	1902	yes	★★★★	600-1000
Model AJ (middle)	1903	yes	★★★	600-1000
Model AJ (late)	1904-05	yes	★★	600-1000
Model AH (early)	1902-03	yes	★★★★	750-1,200
Model AH (late)	1904-05	yes	★★★	750-1,200
Model AR (resembles BD but front-mounted)	1903-05	yes	★★★	1,200-1,800
Model AY (double-spring AR)	1903-05	see model AR	★★★★	1,200-1,800
Model BH "Champion"	1906-10	-	★★★	600-800
Model BI "Sterling" (sometimes "Regal")	1906-10	yes	★★	800-1,200
Model BJ "Imperial" (single-spring BD)	1906-10	see model BD	★★★★	1,500-2,000
Model BD "Majestic"	1906-10	yes	★★★	1,500-2,000
Model BY "New Imperial" (also "Improved Imperial")	1908-11	yes	★★★	1,500-2,000
Model BZ "Bijou"	1910-12	yes	★★★★	500-750
Model BII "Improved Sterling"	1909-11	yes	★★★	900-1,300
Model BN "Improved Champion"	1909-11	-	★★★	450-750
Model BNW "Improved Royal"	1909-13	yes	★★★	450-750
Model BNWM "Premier" (mahogany version BNW)	1909-13	see BNW	★★★	600-900
Columbia Grafonola (typical table model)	1909-30	yes	★	150-250
Columbia Grafonola (typical floor model)	1909-30	-	★	150-250
Columbia Grafonola (special case models)	1909-30	yes	★★★★	300-1,500

Model designation	Mfg. dates	Picture	Rarity	Price range
Unidentified front-mount Columbias	1906-08	-	★★	350-650
Unidentified rear-mount Columbias	1906-20	-	★★	300-600
Zon-O-Phone				
Model A No. 55 (glass-sided)	1899-1901	yes	★★★★★	1,500-2,000
Model B No. 60	1899-1901	yes	★★★★	900-1,200
Model C No. 50	1899-1901	yes	★★★	900-1,200
Model D No. 45 (very plain cabinet)	1899-1901	-	★★★★★	800-1,000
Home (early - larger version of model C)	1901-03	-	★★★★	750-1,200
Home (late)	1904-05	yes	★★★	750-1,200
Parlor (early)	1901-04	yes	★★★	750-1,200
Parlor (late)	1904-05	-	★★★	750-1,200
Grand	1901-04	yes	★★★★	1,000-1,400
Concert (early)	1901-04	yes	★★★★	1,000-1,400
Concert (middle version - front- or rear-mount)	1904-05	see earlier ver.	★★★	1,000-1,400
Concert (late - rear-mount)	1906-10	yes	★★★★	1,200-1,800
Grand Opera (front-mount)	1901-04	yes	★★★★	1,300-1,800
Grand Opera (early rear-mount)	1904-06	yes	★★★★	1,300-1,800
Grand Opera (late rear-mount)	1906-11	yes	★★★	1,400-1,800
Concert Grand (front-mount)	1901-04	yes	★★★★	1,200-1,800
Concert Grand (early rear-mount)	1904-06	yes	★★★★	1,200-1,800
Concert Grand (late rear-mount)	1906-10	-	★★★	1,200-1,800
Royal Grand (late rear-mount)	1906-11	yes	★★★★	1,800-2,250
Unidentified "Parlor-type" machine	c. 1904-06	yes	★★★	500-1,000
Berliner and Eldridge Johnson disc machines				
Kammer und Reinhardt "toy"	c. 1893	yes	★★★★★	7,500-15,000
Berliner (hand-driven)	1894-96	yes	★★★★★	4,500-7,500
Berliner (early lever-wind)	c. 1896	yes	★★★★★	few survivors
Berliner "Trademark" model	1896-98	yes	★★★★	3,000-3,750
Berliner JS	c. 1897	yes	★★★★★	3,500-4,000
Berliner A "Standard" (resembles Trademark - Canadian)	c. 1902	yes	★★★★	3,000-3,750
Berliner B "Ideal" (Canadian - resembles Victor model C)	c. 1902	-	★★★★	1,000-1,500
Berliner C "Grand" (Canadian)	c. 1902	-	★★★★	900-1,250
Berliner E "Bijou" (Canadian - resembles Victor Royal)	c. 1902	see Vic. Royal	★★★★	800-1,200
Berliner KT (Canadian tone-arm machine)	c. 1903-09	yes	★★★★	800-1,200
Johnson Toy (resembles Johnson D w. cheaper repro/horn)	c. 1900	see Johnson D	★★★★★	1,500-2,000
Johnson A (resembles Berliner JS, Victor A)	c. 1900	see Berliner JS	★★★★★	2,500-3,000
Johnson B (resembles Trademark)	c. 1900	see Trademark	★★★★	3,000-3,500
Johnson C (resembles Victor Royal but nickel plated)	c. 1900	see Vic. Royal	★★★★★	1,500-2,000
Johnson D (small hand-driven model)	c. 1900	yes	★★★★★	1,500-2,000
Victor				
"$3.00" Victor (hand-driven version of Berliner JS)	1901	-	★★★★	1,500-2,000
Model A (similar to Berliner JS)	1901	see Berliner JS	★★★★	1,000-1,500
Model B (similar to Trademark w. fleur-de-lis design)	1901	see Berliner A	★★★★	2,500-3,000
Model C (small, front-mount w. case similar to Monarch)	1903	see Monarch	★★★	900-1,200

Model designation	Mfg. dates	Picture	Rarity	Price range
Model D	1903-07	yes	★★★	1,200-1,800
Model M "Monarch" (front-mount)	1901-05	yes	★★★	900-1,200
Model M "Monarch" (rear-mount)	1903-05	see front-mount	★★★	900-1,200
Model MS "Monarch Special" (front-mount)	1902-05	yes	★★★	1,200-2,000
Model MS "Monarch Special" (rear-mount)	c. 1904-05	yes	★★★★	1,200-2,000
Deluxe Monarch (front-mount, very elaborate case)	1901	-	★★★★★	few survivors
Model E "Monarch Junior" (front-mount)	1902-05	yes	★★	750-1,200
Model E "Monarch Junior" (rear-mount)	1903-05	see front-mount	★★★	750-1,200
Model P-1 "Premium"	1902-06	yes	★★★★	600-900
Model P-2 "Premium"	c. 1909	yes	★★★★	600-900
Model R "Royal" (front-mount)	1902-04	yes	★★★	750-1,500
Model R "Royal" (rear-mount)	c. 1903-04	yes	★★★	750-1,500
Model I	1903-10	yes	★★★	750-1,200
Model II (early)	1902-09	yes	★★★★	750-1,200
Model II (late)	1909-20	yes	★★	900-1.200
Model III	1902-20	yes	★★	900-1,200
Model IV	1906-20	yes	★★	1,200-1,800
Model V	1906-20	yes	★★★	1,500-2,200
Model V (very late model)	c. 1925	yes	★★★★★	1,000-1,500
Model VI (mahogany horn was standard)	1906-15	yes	★★★	3,500-5,000
Model O (Zero)	1908-20	yes	★★★	1,000-1,500
Model Z (small front-mount w. case similar to Vic. I)	1903-08	-	★★★★	900-1,350
Victor Junior	1909-20	yes	★★★	800-1,200
School model XXV	1913-25	yes	★★★	1,500-2,200
Auxetophone (several case styles)	1906-18	yes	★★★★★	7,500-10,000
Victrola VV-VI (typical open table model)	1911-26	yes	★	100-150
Victrola VIII (typical table model)	1911-24	yes	★	150-250
Victrola XVI (typical floor model)	1907-21	-	★	150-250
Victrola XVIII (fancy floor model)	1915-16	yes	★★★	1,000-1,500
Victrola 230 (with art case)	1922-25	yes	★★★★	1,500-2,000
Victrola 230 (typical flat credenza-style)	1922-25	yes	★★	150-250
Lumière pleated diaphragm machines (typical table models)	c. 1924	-	★★★	1,200-1,800
Lumière pleated diaphragm machines (typical floor models)	c. 1924	yes	★★★	2,000-3,000
Orthophonic ("Re-entrant" in U.K.) (typical U.S. models)	c. 1925-30	-	★★★	600-1,200
Talk-O-Phone				
"Brooke"	1904-08	yes	★★★	450-750
"Clark"	1904-08	-	★★★	450-750
"Ennis"	1904-08	-	★★★★	500-800
"Herbert"	1904-08	-	★★★★	600-900
"Sousa"	1904-08	-	★★★★★	few survivors
Columbia look-alikes from Chicago				
Aretino (front-mount)	1906-09	yes	★★	300-750
Aretino (early rear-mount)	1908-09	yes	★★★	300-750
Aretino (late rear-mount)	1909-14	yes	★★★	300-750
Harmony Type D (front-mount)	1906-09	see Stand. X-2	★★	450-600

Model designation	Mfg. dates	Picture	Rarity	Price range
Harmony (rear-mount)	1909-14	yes	★★★	450-600
United Talking Machine "Symphony" (internal horn)	1911-14	yes	★★★★	200-500
Busy Bee (cylinder machine similar to Columbia Q)	1904-07	yes	★★★	300-400
Busy Bee "Queen" (cylinder machine similar to Col. BK)	1904-07	see Col. BK	★★★★	550-700
Busy Bee "Grand" (front-mount disc)	1906-09	yes	★★	450-600
Yankee Prince	1909-14	yes	★★★	600-800
Standard Talking Machine model AA (open works)	1905-09	yes	★★★★	450-600
Standard Talking Machine model X, X2 (also "Harvard")	1906-09	yes	★★★	450-600
Standard Talking Machine model A	1908-20	yes	★★	450-600
Universal Phonograph	c. 1922	yes	★★★	150-250
Other interesting cylinder machines (priced without horns)				
Original tinfoil phonograph	c. 1880	yes	★★★★★	4,500-15,000
Pathé "Coq" No. 25 (typical)	1898-06	yes	★★	200-400
Pathé No. 1 (also called "New Perfecta" and "Duplex")	1905-06	yes	★★★	250-500
Pathé "Le Gaulois"	1902-06	yes	★★	300-600
Lioret "Le Merveilleux"	c. 1898	yes	★★★★	1,200-2,500
Lioret No. 2	c. 1898	yes	★★★★★	3,500-5,000
Bettini No. 8 (one of several known models - all very rare)	c. 1900	-	★★★★★	few survivors
Excelsior (typical - many different brand-names)	c. 1903-14	yes	★	200-350
Paillard "Echophone" (typical)	c. 1903-06	yes	★★★	300-600
Thorens "Royal" (typical)	c. 1903-10	yes	★★★	300-600
Amet/Peerless (typical)	c. 1893	yes	★★★★★	4,500-7,500
Amet "Echophone" (also "Metaphone")	c. 1896	yes	★★★★★	4,500-7,500
Wizard	c. 1911	yes	★★★★	500-700
United Talking Machine "Echophone" No. 5	c. 1908	-	★★★	200-300
United Talking Machine "Echophone" No. 10	c. 1908	-	★★★★	200-300
U.S. Phonograph Co. "Banner" (also "Lakeside")	1910-13	yes	★★★	1,000-1,500
U.S. Phonograph Co. "Peerless" (floor model)	1912-13	yes	★★★★	1,500-2,500
"Puck" (many variants)	1901-14	yes	★	200-300
"La Sirena"	c. 1906-09	yes	★★★	300-500
"Harpist"	c. 1905	yes	★★★★★	1,000-1,500
"Lorelei"	c. 1906-08	yes	★★★	1,200-1,800
"Kastenpuck" (many variants)	c. 1903-14	yes	★	200-300
Polyphone cylinder reproducer (attachment)	c. 1898-1901	yes	★★★	450-600
Bettini cylinder reproducer (attachment)	c. 1898-1905	yes	★★★★	1,000-2,500
Other interesting disc machines				
Hawthorn & Sheble (typical front mount)	c. 1904-09	-	★★	1,000-1,350
Hawthorn & Sheble (typical rear-mount)	c. 1906-09	yes	★★	1,000-1,350
Kalamazoo Duplex	c. 1905-08	yes	★★★	3,000-4,500
Pathéphone Modele B (typical early front-mount)	c. 1906	-	★★★★	900-1,200
Pathéphone No. 6 (typical)	c. 1906	yes	★★	450-1,500
Palliard "Maestrophone" (typical)	c. 1906-20	-	★★	300-600
E.M.G.	1928-47	yes	★★★	1,500-3,700
E.M. Ginn "Expert"	1930-43	-	★★★★	1,500-3,700
Ultraphon (double-reproducer barrel-shaped machine)	c. 1930	-	★★★	450-750

Model designation	Mfg. dates	Picture	Rarity	Price range
Little Wonder	1909-12	yes	★★	200-300
Peter Pan	c. 1922-27	-	★★★	150-250
Thorens "Excelda"	c. 1930	yes	★★★	150-250
Colibri Cameraphone	c. 1920	yes	★★	200-300
Mikiphone	c. 1925	yes	★★	300-750
Truimphone	c. 1924	yes	★★★★	150-250
Bing "Pygmyphone" (typical)	c. 1920-40	yes	★★	150-250
Stewert	c. 1922	-	★★	100-150
Induphon	c. 1923	-	★★	100-150
Klingsor (typical - several styles)	c. 1907-20	yes	★★★	750-1,500
Kurtzmann	c. 1920	yes	★★★★★	4,500-6,000
Davis corner phonograph	c. 1923	-	★★★★	600-1,000
Brunswick table model (typical)	1916-25	yes	★	100-150
Sonora "Supreme" (typical ornate floor model)	1914-26	yes	★★★	2,000-3,000
Keen-o-phone (typical)	c. 1920	-	★★★★	800-1,200
Suitcase-type portables (typical)	1915-60	yes	★	50-200
Phonograph lamps				
Phonolamp (model refers to shape of shade)	1920-26	yes	★★★★	1,200-1,800
Modernola (floor lamp)	c. 1918	-	★★★★★	4,500-6,000
Fairy Phonograph Lamp model L (only known model)	1918-23	yes	★★★★	2,000-3,500
Capitol model O (model refers to shape of shade)	c. 1919-23	yes	★★★★	2,000-3,500
Lampagraph	c. 1920	-	★★★★★	2,000-3,500
Early acoustic multi-play coin-operated machines				
Multiphone (early)	1900-05	yes	★★★★★	7,500-12,000
Multiphone (middle)	1905-13	yes	★★★★	15,000-20,000
Multiphone (late)	1913	yes	★★★★★	10,000-15,000
Gabel "Entertainer" (several models)	1906-28	-	★★★★★	few survivors
Autophone model 200	c. 1912	yes	★★★★★	4,500-6,000
Regina Hexaphone (several variants)	1908-21	yes	★★★	6,000-9,000
Combination talking machine/music boxes				
Miraphone	c. 1906-10	yes	★★★★★	6,000-9,000
Reginaphone Style 150 (several different models exist)	c. 1906-15	yes	★★★	4,500-7,500

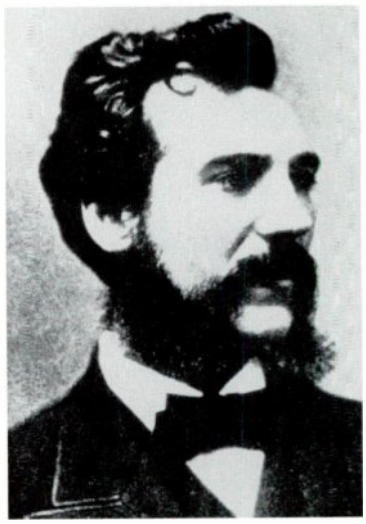
APPENDIX A

Historical names

Edward H. Amet (1860-1948)
Amet was a businessman/inventor in Waukegan, Illinois during the 1890's. Around 1892-93, he started buying dictation equipment from the North American Phonograph Co. Amet replaced the sewing machine-like treadle bases and the early electric motors with a sturdy spring motor of his own design, housed in a plain, oak case with a hinged front panel. He then resold these machines for home entertainment purposes. This was all done on a fairly small scale and few Amet machines have survived. Later on, Amet produced a machine entirely of his own design, called the "Echophone," which was given away as a premium by various illustrated newspapers, such as Frank Leslie's.

Alexander Graham Bell (1847-1922)
Bell was born in Edinburgh, Scotland and moved for health reasons to Canada in 1870. In 1872, he opened a school for the deaf in Boston, Mass. The following year, he became a professor at Boston University where he conducted experiments in sound transmission by electricity. This led to the invention of the telephone in 1876. In 1879, he opened a laboratory in Washington, later known as the Volta Laboratory, because it was financed with the Volta prize money he had received from the French Government for the invention of the telephone.

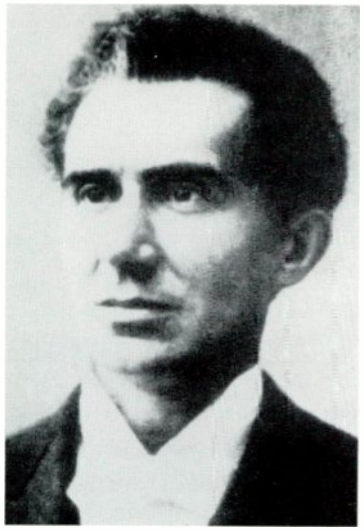
His cousin, Chichester Bell (1848-1924) worked with him from 1880 to 1886, along with Charles Sumner Tainter (1854-1940). Although initial experiments were telephone-related, the trio soon switched to phonograph development. The rival machine was demonstrated in 1888 under the name of "Graphophone." The main difference between this machine and the one Edison originally made was that Bell and Tainter utilized wax rather than tinfoil as a recording medium. By patenting a process for "engraving" the wax, which involved actual removal of recording medium, Edison lost the rights to a vital patent. Edison's own phonograph specifications refer to "embossing" the tinfoil which does not imply removal of any material. The engraving process is perhaps the key Bell-Tainter patent, and was the cause of many legal fights during the early years of the industry.



Alexander Graham Bell—from telephones to Graphophones

Emile Berliner (1851-1929)
Berliner was born in Hanover, Germany and came to the United States for the first time in 1870. In 1877, he patented a microphone, which he subsequently sold to Bell. He returned to Hanover briefly in 1880 where he set up a telephone factory, run by his brother Joseph, who later pressed records for the Gramophone Co. in Great Britain.

Inspired by the experiments of Leon Scott, Berliner patented a cylinder machine in 1887 which used lateral recording (as did Scott) as opposed to the hill-and-dale method used by Edison and Bell-Tainter. However, this cylinder machine was not meant for commercial production, but merely to stake Berliner's claim with



Emile Berliner—father of the flat disc machine

Gianni Bettini—the socialite inventor with interesting friends

regard to recording method. In 1888, he demonstrated his first disc machine, which was marketed the following year as a toy by Kammer und Reinhardt in Waltershausen, Germany. Berliner recorded on wax-coated zinc discs by scraping off a groove of wax with the recording stylus and etching the exposed zinc with acid. In 1888, the sound he could produce was much louder than that of his competitors.

Home recording was, of course, highly impractical with the Berliner method, but this didn't bother Berliner, who had high hopes for the entertainment possibilities of his device—indeed he was one of the first to recognize this need. In 1893, Berliner founded the United States Gramophone Company in Philadelphia and production of discs and machines began the following year. After some legal hocus-pocus in 1900 (see "Seaman"), Berliner was prevented from selling machines in the U.S. and moved his base of operations to Montreal, Canada, where he continued to produce machines for about ten years.

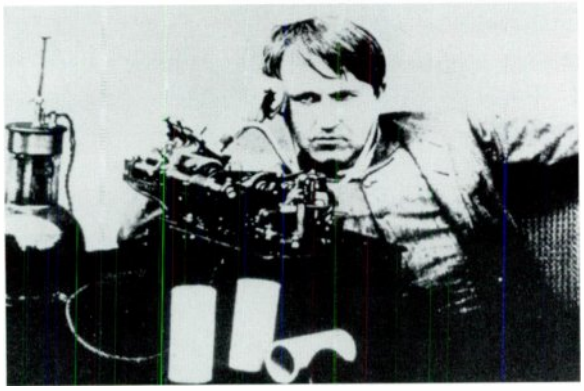
Gianni Bettini (1860-1938)
A wealthy Italian cavalry lieutenant, Bettini married an American socialite and settled in New York. There, he acquired an early Edison phonograph in 1888. Disappointed with the sound quality, Bettini set out to improve the reproducer and in 1889, he patented his "Micro-reproducer." The Micro-reproducer was essentially a large floating reproducer equipped with a spider. There is little doubt that Bettini's invention represented a genuine improvement, but his greatest contribution, far more important than the reproducer itself, are the recordings he made of his many friends in musical and theatrical circles. These included Nellie Melba, Sarah Bernhardt, Mark Twain, and a host of other luminaries. Unfortunately, only a handful of Bettini cylinders have survived—they were expensive and few were produced.

In 1902, Bettini closed his studio in New York and moved to Paris where he continued to experiment with phonographs until 1908. Bettini's own personal collection of cylinders appears to have been destroyed in Paris during WWII. Bettini also produced some cylinder and disc machines of his own design, but these, too, are quite scarce. After leaving the phonograph business, he continued to invent things, most notably a motion picture camera, produced by Bolex, and a cigarette lighter, produced by Cartier.

Charles Cros—the true inventor of sound recording

Charles Cros (1842-1888)
Cros taught chemistry, practiced medicine, wrote poetry, invented a color photography process and a number of other things, most notably the phonograph, before his death at the age of 46. Although Edison was the first person to actually record and reproduce sound, Cros was the first to describe in detail how it could be done—without actually doing it himself! Cros filed a description of his sound recording process with the French Academy of Sciences almost seven months before Edison demonstrated his first tinfoil machine.

Thomas Alva Edison (1847-1931)
The Wizard of Menlo Park was granted over 1000 U.S. patents, one of which was, in 1878, for the phonograph. Edison's first machine used tinfoil as a recording medium, and although tinfoil recording was a very impressive party trick, its commercial applications were limited at the time. Ten years later, threatened by the phonograph improvements of Bell and Tainter, Edison worked feverishly to get a similar machine on the market. He referred to this new product as the "Perfected" phonograph. He improved the "perfected" machine for the next twenty years and then concentrated on his disc machines for another twenty.



Thomas A. Edison—the wizard who made it work

Fred W. Gaisberg (1873-1951)
At the tender age of 16, Gaisberg began scouting talent and playing the piano for the first commercial recordings of the infant American Graphophone Co. In the uncertain aftermath of the Lippincott bankruptcy in 1894 (see "Lippincott), Gaisberg was contacted by Emile Berliner to scout talent for his Gramophone recordings. After three years setting up recording facilities in New York and Philadelphia, in addition to the Washington studios, Gaisberg was sent to England in 1897 to set up studios for the Gramophone Company in London. Fred Gaisberg's excellent musical taste and ability as an impresario, plus his skill as a recording engineer, led to the superb classical recordings on the Victor and HMV labels, which are still being reissued almost a century later.

Daniel Higham
Higham was a native of Bridgeport, Connecticut, the manufacturing base of the Columbia Phonograph Company. Although he later dabbled in sound recording for the movies, his main claim to fame is the friction amplifier, a device that mechanically increased the sound output of a cylinder reproducer. This device was marketed from 1905 by Columbia on two machines, the BC and BM.

Eldridge R. Johnson (1866-1945)
In 1895, Berliner was looking for a spring motor to power his Gramophone, which was hand-powered at the time. In his little machine shop in Camden, New Jersey, Johnson produced a simple, cheap motor for the Gramophone and in time came to produce the entire machine. In 1899, the Gramophone distributor, Frank Seaman, double-crossed the Berliner interests and Johnson was forced to sell machines himself in order to survive (see "Seaman"). Johnson called his company The Consolidated Talking Machine Co. and after winning court battles with Columbia regarding patent rights, Johnson renamed his company "Victor," in 1901.

Johnson's contribution to the technology of the industry is mainly that of the "tapered" tone-arm, although he also improved Berliner's original reproducer and dropped Berliner's etched zinc in favor of the

Eldridge R. Johnson—from machinist to captain of industry

superior wax disc as a recording medium. His redesigned reproducer is now known as the "Clark-Johnson" soundbox, named after the inventors. Alfred Clark was a shop owner in Philadelphia and early Berliner salesman, who later became chairman of the board of the Gramophone Co. in Great Britain.

Carl Lindström (1869-1933)
In 1892, Lindström left his native Sweden and settled in Berlin where he began constructing cylinder phonographs. In 1896, he designed, with the aid of Paul Pheiffer, the famous "Puck" machine. Lindström went on to found "Parlophon," which produced thousands of phonographs during the coming years and was perhaps Germany's leading talking machine manufacturer. Parlophon still makes records today. Lindström's factory also produced motors for many makes other than Parlophon. These motors are recognized by the symbol "£" stamped in the metal.

Henri Lioret (1848-1948)
Lioret was a watchmaker by profession, but became interested in phonographs and obtained a French patent for a process for recording on celluloid in 1893. He temporarily softened the celluloid with hot water, recorded, and let the celluloid harden again. These cylinders were considerably louder than those cut in wax, and much more durable. He was also the first to produce molded cylinders, and cylinders of four-minute duration—long before Edison accomplished either of these things.

Lioret's machines are beautifully made and resemble clocks more than phonographs in construction. Oddly enough, in light of the fact that Lioret spent much of his time working with acoustics after he left the phonograph business in 1911, his reproducer is essentially a bent nail attached to a simple celluloid disc. It is certainly not in keeping with the fine craftsmanship exhibited in his phonograph motors!

Henri Lioret—a clockmaker with a passion for phonographs

Jesse H. Lippincott (18??-1894)
Originally a glass magnate from Pittsburgh, Lippincott formed the North American Phonograph Co. in 1888, which was to be the exclusive agent for Edison phonographs in the U.S. He also managed to become the sole agent for the American Graphophone Company. Despite his virtual monopoly on machine distribution, he made a critical mistake—he established marketing territories and leased his machines, as was being done with the infant telephone industry, rather than selling his machines outright. What's more, the market was not ready for dictation equipment and early on it became clear that the market for entertainment equipment should be exploited. In 1891, Lippincott finally started to sell machines, but unfortunately these were still clumsy dictation units and were as unpopular as they were ungainly.

The bankrupt Lippincott died of a stroke in 1894 before suitable entertainment machines could be developed on a larger scale. The American Graphophone Co. was saved from financial ruin by a merger later that year with the Columbia Phonograph Co., one of Lippincott's subsidiaries.

Thomas Hood MacDonald
As manager of the Graphophone factory in Bridgeport, Connecticut, MacDonald, a Scot, saw the need for an alternative to the expensive electric motors used by Edison to power Phonographs, and the sewing machine-like treadle bases used on Graphophones. That the Graphophone used these treadle units is not hard to explain—the company's manufacturing took place in the old Elias Howe sewing machine factory! MacDonald's spring motor phonograph went on sale in late 1894. Apart from the new spring motor machines, his main contribution was the development of the 5" cylinder machines marketed by Columbia in the years 1899-1901.

William Barry Owen
Originally a legal assistant to Frank Seaman, Owen was selected by Berliner to develop the Gramophone in Europe. Owen went on to found the Gramophone Co.

in London and became its first managing director. Perhaps Owen is best remembered as the man who had the foresight to buy Francis Barraud's painting, "His Master's Voice," although it was Eldridge Johnson who first adopted it as a trademark.

Charles Parsons (1854-1931)
Sir Charles was a British engineer whose main work was in the field of steam turbines. He is remembered today by gramophone collectors for his development of the Auxetophone, an amplifying reproducer run by compressed air. This device was copied by a number of European firms, but the best known models were produced by the Gramophone Co. in Great Britain. Victor also marketed these machines in the U.S., but the reproducer and compressor were of British origin.

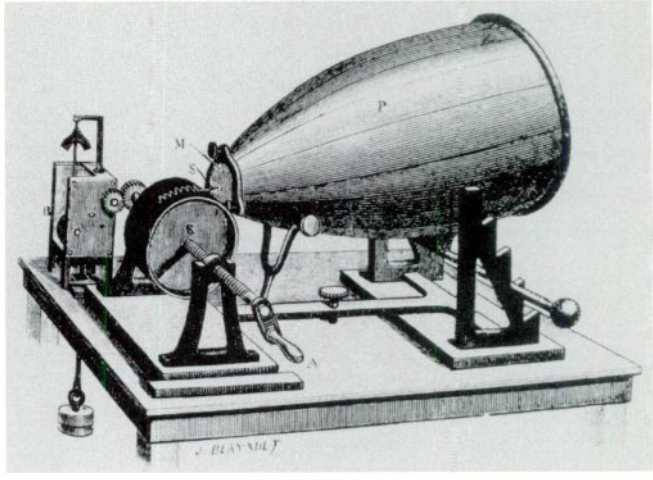
Charles Pathé (1863-1957)
Charles, and his brother Emile, purchased their first phonographs in 1893 from the London instrument maker, E.O. Kumberg. In 1896, they started selling Edison machines, but soon switched to Columbia models. In 1897, they supplemented Columbia's line with models of their own, based on Columbia's designs. The Pathé brothers (Pathé Frères, 1896) quickly realized the need for French language cylinders and discs, and set up their own studios in Paris. Pathé cylinder machines were phased out about 1906 and the Pathéphone, a hill-and-dale disc machine was marketed. Pathé discs were dubbed from pre-recorded cylinders as late as the 1920's. The company's recording technique was superb, but their machines lacked some of the technological advances of the Gramophone Co. machines, such as the tapered tone-arm, and therefore couldn't really compete with the British machines.

Pathé continued to market phonographs up until WWII, though these later machines used the more common lateral-cut records. Perhaps Pathé's greatest contribution was in the field of movie cameras and projectors, an area in which the firm is still active today.

Leon Scott de Martinville (1817-1879)
Scott constructed a device in 1855 which recorded soundwaves on paper coated with lampblack. His "Phonautographe," designed for scientific demonstrations, consisted of a horn, a diaphragm and stylus, and a rotating cylinder to which the paper was attached. Although the recording method was lateral, the machine was, for all intents and purposes, a phonograph. What Scott failed to recognize, along with the many others who saw and used his device, was that it

Leon Scott—he failed to recognize what he had invented

Charles Pathé—founder of a French media dynasty



Scott's "Phonautographe" of 1855.

was possible to take the principle one step further and reproduce the recorded sound. Today, after seeing his invention, it is almost impossible to understand how Scott could have missed such an obvious opportunity. However, it does demonstrate just how inconceivable the notion of recording was at that time—and how impressive Edison's primitive tinfoil machine must have been back in 1878.

Frank Seaman

Although there were many scoundrels during the early years of the talking machine industry, Seaman's name stands out as one of the worst. In 1896, Seaman organized the National Gramophone Co. to promote Berliner's invention. In 1898, Seaman started marketing a Gramophone look-alike under the name "Zon-O-Phone," manufactured by Seaman's own Universal Talking Machine Company. This was in direct violation of his contract with Berliner, but Seaman was discontent with the terms of the contract and sensed that he would not be included in the European exploitation of the instrument. The Zon-O-Phone was both his security and his revenge.

Meanwhile, Seaman's National Gramophone Co. was being sued by the American Graphophone Co., which claimed the Berliner machine violated Bell-Tainter patents. Since Seaman now had his own company and couldn't care less what happened to Berliner, he admitted in open court to patent infringements that were otherwise highly questionable. The result of all this was that Seaman quickly obtained a license from the Graphophone people to sell his Zon-O-Phones. Berliner was forced to stop all sales, and Eldridge Johnson started to sell the machines he had manufactured for Berliner. Johnson succeeded in fending off the Graphophone interests and eventually the two corporations reached an agreement whereby they would share the Bell-Tainter and Berliner patents.

Eventually, the financially-weakened Zon-O-Phone organization was purchased in 1903 by Victor (U.S. interests) and the Gramophone Company (European interests)—and Frank Seaman faded into well-deserved obscurity.

Werner Suess (1813-1899)

As Berliner's chief mechanic, Suess constructed the first Gramophone and also obtained a number of patents for Gramophone improvements. Perhaps his greatest contribution to the Gramophone was his use of a horn rather than hearing tubes for reproduction, and the traveling tone-arm, a radical design departure from previous machines, which relied on feedscrews.

APPENDIX B

Basic soldering techniques

Solder is an alloy, usually of tin and lead, with a melting point far below that of most metals, about 421°F. When the metal parts that are to be joined are heated, the heat from the joint melts the solder and draws it into the pores of the metal. This forms a strong mechanical bond. Think of solder as a kind of glue for metal.

Soldering is easy if you follow a few basic rules. The surfaces to be bonded must be absolutely clean and free from dirt, paint, and oxides. This can be done by grinding, sanding, or bead blasting. The main thing is that the surfaces must be clean or the solder won't stick. After the surfaces are clean, a flux is applied. Flux helps the solder penetrate the joint by reducing the surface tension. Sal ammoniac is a good flux for steel, iron, copper, and brass. Finally, the metal that is to be joined has to be hotter than the melting point of the solder. 535°F is a good working temperature.

Soldering irons

When using a soldering iron or gun, the tip of the iron is cleaned to bare copper, fluxed, and coated with a layer of solder. The clean, fluxed joint to be soldered is then touched with the hot iron. When the joint is sufficiently heated, the metal will draw the solder off the iron and into the joint. Do not move the joined pieces until they are cool and the solder has hardened.

Surface cracks and other imperfections can be filled using this technique.

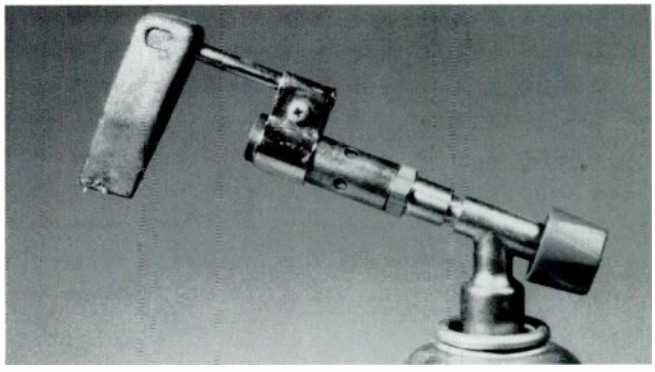
Torch soldering

Rather than touching the joint itself as in the previous method, a propane torch is used to heat the metal *around* the joint—never the joint itself. Heating the joint will only burn off the flux and oxidize the surface so that it will have to be cleaned again. When the metal is hot enough to melt the solder, the flame is removed and solder dipped in flux, or solder with a flux core, is touched to the joint where it melts and bonds to the metal.

A soldering iron like this is heated in a gas flame until it is red hot. The large head quickly heats up the parts to be joined. Small soldering guns, etc., cannot really do the job properly.

Sweat soldering

In sweat soldering, both of the surfaces to be joined are cleaned, fluxed, and coated with a thin layer of solder. This is called "tinning." Flux both pieces again and hold them together. Now, heat the metal pieces with the torch until the solder melts and they glue themselves together. This is an excellent technique for fastening small parts.



This propane torch is equipped with a handy soldering attachment. It's a little clumsy in actual use, but it works nonetheless.

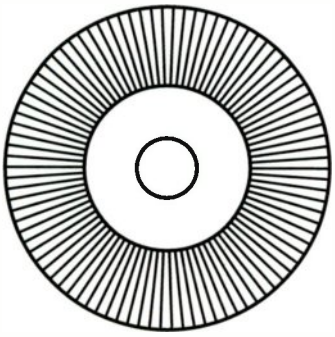
APPENDIX C

Stroboscopes

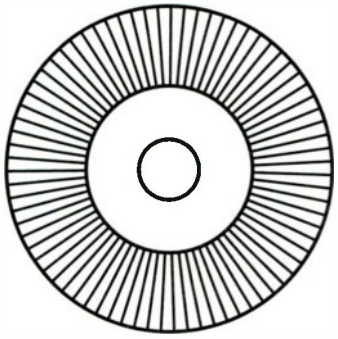
A stroboscope consists of a circle of equally-spaced lines on a contrasting background, for example, black on white. When the stroboscope is viewed under an electric light powered by alternating current, the lines appear to stand still when the turntable or mandrel is rotating at the proper speed.

What happens is, the electric light is actually blinking on and off 3600 times a minute at 60 Hz. (3000 at 50 Hz.), and each time the light goes on, the black lines on the stroboscope have rotated one space—assuming it is running at the proper speed.

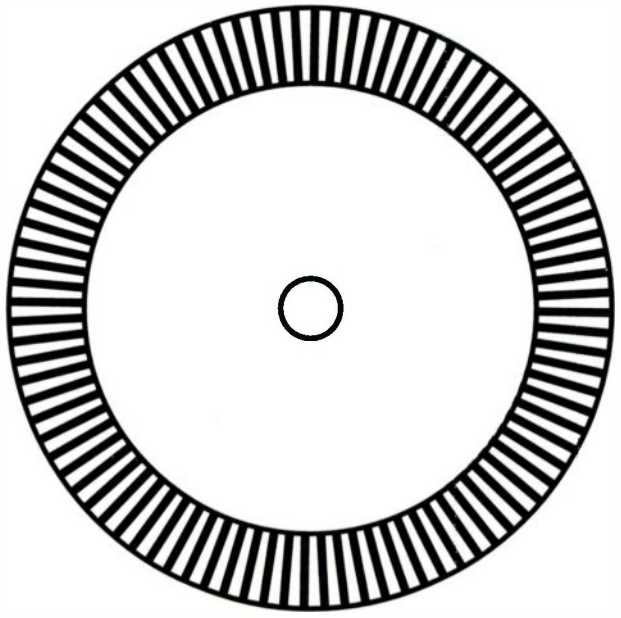
The proper speed is determined by the number of lines in the circle. If you want to make a stroboscope that indicates 78 RPM, take 7200 (which is 2 x 3600) and divide it by the speed, 78. That gives you 92.3. If



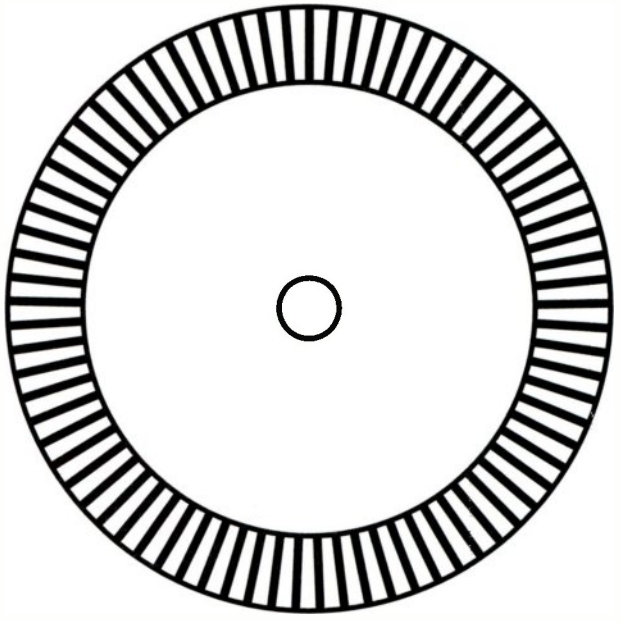
Cylinder stroboscope, 160 RPM, 60 Hz.



Cylinder stroboscope, 160 RPM, 50 Hz.



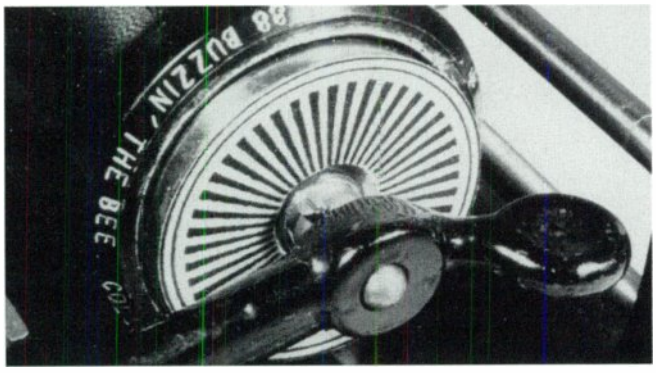
Disc stroboscope, 78 RPM, 60 Hz.



Disc stroboscope, 78 RPM, 50 Hz.

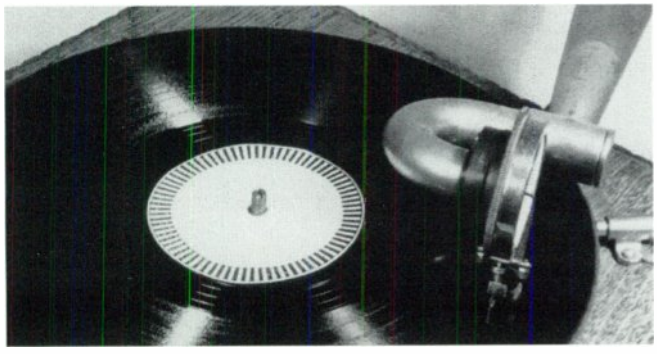
you round down to 92, and mark 92 equally-spaced lines around the circumference of a circle, you will have made a stroboscope that indicates a speed of 78.26, which is close enough for most purposes.

Instead of drawing lines around the edge of a circle, it is possible to make a long band with about 100 equally-spaced markings. When this band is rolled into a ring, held together with a paper clip, it is possible to adjust the number of lines to indicate any speed from 72 RPM on up. This ring is simply set in the center of the turntable when you want to use it. The ring method is, of course, useless on cylinder machines. Here, it is necessary to glue a stroboscope to the end of the mandrel for best results.

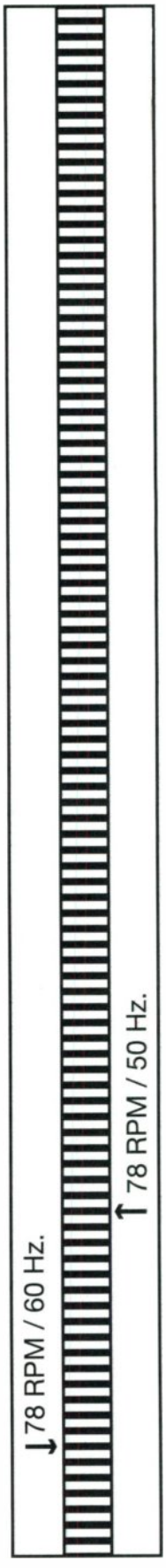


A cylinder stroboscope in use.

A variable-speed disc stroboscope.



A fixed-speed disc stroboscope.



Universal disc stroboscope.

APPENDIX D

Some useful addresses

Antique Phonograph Center (parts and repairs)
Floyd Silver
P.O. Box 2574
Highway 206
Vincentown, NJ 08088
(609) 859-8617

Antique Phonograph Supply Co. (parts and repairs)
Dennis and Patti Valenti
Route 23, Box 123
Davenport Center, NY 13751-0123
(607) 278-6218

APM Archives (books and reprints)
Allen Koenigsberg
502 East 17th St.
Brooklyn, NY 11226
(718) 941-6835

Keith Badman (cylinder reproducer parts)
East Pynes
Upton Pyne
Exter, Devon, EX5 5EG
England

Ralph and Delores Blanta (parts and repairs)
Highway 62, Route 1, Box 453
Green Forest, AR 72638
(501) 437-2855

Cecil Dancer (reproduction Victor castings and wooden horns)
P.O. Box 5456
San Jose, CA 95150
(408) 293-8211

Ron Dethlefson (books on Edison recordings)
3605 Christmas Tree Lane
Bakersfield, CA 93306-1114
(805) 872-1530

Expert Stylus Co. (styli and reproducer parts)
P.O. Box 3
Ashtead, Surrey KT21 2QD
England
(+44) 372 276604

Don Gfell (custom-made wood horns)
61 Cherry Street
Milan, OH 44846
(419) 499-4272 (office)
(419) 499-4433 (home)

Tom Hawthorn (parts and repairs)
77 Columbia Ave.
Roseville, CA 95678
(916) 773-4727

Leo Hirtz (parts and repairs)
P.O. Box 6, Route 1
Bernard, IA 52032
(319) 879-3107

Rod Lauman (parts and repairs)
19 Cliff Street
St. Johnsbury, VT 05819
(802) 748-4893

Memory Lane Music (parts and repairs)
Everett F. Clark
RFD 1, Box 1760
Morrill, ME 04952
(207) 342-5434

Wendell Moore (*Edison Phonograph Monthly* reprints)
6 East Park Street
Brazil, IN 47834
(812) 446-0252

Patent and Trademark Office
2021 Jefferson Davis Highway
Washington, D.C. 20231

Phonoservice (parts and accessories)
B.A. Williamson
157 Childwall Valley Road
Liverpool LI6 1LA
England

Promar Publishing (books and reprints)
P.O. Box 6554
Huntington Beach, CA 92615
(714)-963-2474

Mirek Stehlik (parts and accessories)
63 Forestwood Drive
Kitchener, Ontario N2N 1A9
Canada
(519) 743-4882

Ron Sitko (parts and accessories)
26 Tekakwitha Court
Clifton Park, NY 12065
(518) 371-8549

Bill Tarling (parts and accessories)
1401 Birchmount Road
Scarborough, Ontario M1P 2E2
Canada
(416) 288-8983

Terra Firma (hard-to-find and made-to-order parts)
Tim Fabrizio
P.O. Box 10307
Rochester, NY 14610
(716) 244-5546

The Vestal Press, Ltd. (books and reprints)
320 N. Jensen Road
P.O. Box 97
Vestal, NY 13850
(607) 797-4872

USS, Inc. (phonograph repair videos, documentaries)
Mark Ulano
400 West Avenue 42
Los Angeles, CA 90065
(213) 222-5400

George Vollema (parts and repairs)
1401 Maplerow NW
Grand Rapids, MI 49504
(616) 453-6567

Charlie Weatherbee (reproduction phonograph toys)
2120 The Crescent
Clermont, FL 32711
(904) 394-3971

Wonderful Windup Antiques (repro. cast parts, horns)
Norm and Janyne Smith
9096 Harvard Boulevard
Poland, OH 44514
(216) 758-5001

Don Woodrow (parts and repairs)
21 Minows Crescent
Scarborough, Ontario M1G 3P8
Canada
(416) 439-3851

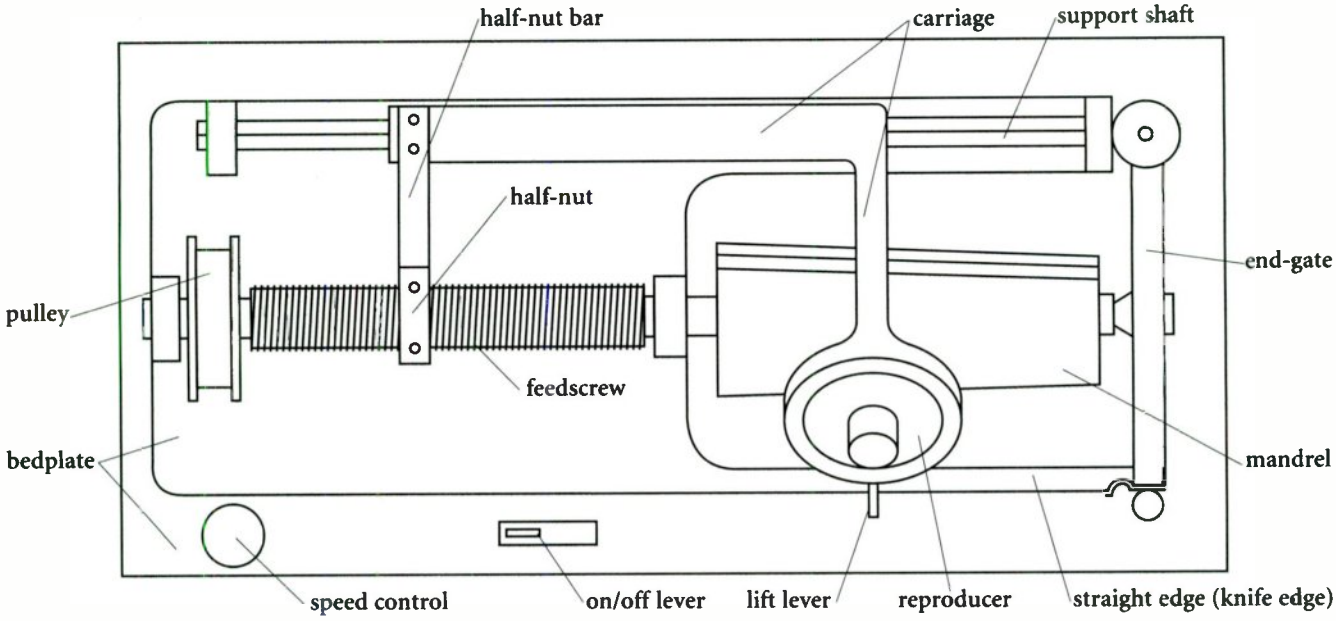
Wyatt's Musical Americana Talking Machine Co.
(parts and repairs)
Dwayne and Donna Wyatt
P.O. Box 601
Lakeport, CA 95453
(707) 263-5013

Yesterday Once Again (parts and repairs)
Neil Maken
P.O. Box 6773
Huntington Beach, CA 92615
(714) 963-2474

Internet Resources

rec.antiques.radio+phono
(newsgroup for phonograph collectors)

GLOSSARY



A schematic representation of an Edison Home. The terms, though, apply to other makes and models as well, although the layout may differ.

Glossary

acoustic tone-arm—see "tone-arm"

Amberol cylinder—Edison's first four-minute cylinder, produced from 1908-12. The cylinders are made of hard, black wax and should not be confused with the later Blue Amberol cylinders, which are celluloid.

Amberola—Edison's internal horn cylinder phonograph, produced from 1909-29.

arbor—normally refers to the shaft going through the center of the spring barrel, but can actually be any mechanical axis.

back-bracket—the cast tone-arm support on rear-mount machines.

back-mount—see "rear-mount"

barrel—the circular housing for a spring.

bearing—any fixture that serves to hold another part in correct alignment, most often a hole drilled in a casting, which accepts a pin or rod.

bedplate—the casting or plate onto which the exposed parts of a cylinder machine are attached.

black-and-brass horn—any horn that has a black, conical body and a flared, brass bell.

black wax cylinder—see "cylinder, wax"

blank—usually refers to an unrecorded cylinder, one without grooves. Blanks originally sold as blanks are softer in composition than shaved commercially-recorded cylinders in order to facilitate recording.

Blue Amberol—Edison's blue celluloid four-minute cylinder produced from 1912-29.

bushing—a precision-drilled metal lining inserted in a casting to form a more accurate bearing.

carriage—the part of the cylinder machine that contains the reproducer and half-nut, and guides them

across the recording along supporting shafts.

carrier arm—an Edison term used to describe the carriage.

casting—any part made in a mold rather than turned on a lathe, etc.

combination attachment—allowed older Edison phonographs (pre-1908) to play the new four-minute Amberol cylinders as well as the earlier two-minute ones.

Concert cylinder—Edison's 5" diameter brown wax cylinder.

crane—the common name for any horn support, usually on a cylinder machine. Needed when horns are longer than about 18".

cutter—see "recorder"

cylinder, indestructible—generally any celluloid cylinder, although contemporary vinyl cylinders can also be regarded as "indestructible."

cylinder, wax—a common term for any cylinder, generally two-minute, made from a soft, wax-like material. The earliest cylinders from 1888 were white and actually made from wax. Brown cylinders contain about 12 parts stearic acid, one part caustic soda, and one part paraffin, plus a dash of aluminum oxide. The black wax cylinders produced after 1901 were made from a metallic-soap composition and were considerably harder than the soft wax cylinders used to make the master recordings. This is frequently a problem when attempting home recording on a shaved cylinder.

decals—also known as "transfers," are designs, trademarks, logos, etc. used to decorate a cabinet or bedplate. Originally, these were printed in reverse on a sheet of tissue paper. The design was coated with a thin layer of varnish or shellac and the paper was pressed against the cabinet. When the varnish was dry, the paper could be peeled off and the design would remain glued to the case. Modern decal replicas are almost always of the water-transfer type, such as those used on model airplanes. Some modern varnish transfers have been reproduced in recent years.

Diamond Disc—Edison's vertical-cut disc record, made from 1912-29. These are about four times as thick as normal 78's in order to prevent warping.

diaphragm—the membrane which reproduces the soundwaves in a reproducer. This is usually a flat mica disc, but other materials such as glass, laminated paper, plastic, and embossed copper and aluminum were also used in their construction.

Disc Graphophone—refers to Columbia disc machines built between 1902-10. When Columbia stopped production of cylinder machines in 1910, the word "disc" became unnecessary and subsequent outside horn machines were known simply as "Graphophones."

dog—see "pawl"

dome—a small metal hemisphere which holds the stylus, found on some floating reproducers.

elbow—usually refers to the connection between the horn and the tone-arm (rear-mount) or the horn and the reproducer (front-mount). Front-mount machines usually have leather elbows, although Zon-O-Phone, Talk-O-Phone, and some others used metal elbows. Rear-mount machines almost always had metal elbows.

EMI—"Electrical and Musical Industries," the company that now owns The Gramophone Co. (HMV), British Victor.

endgate—a metal arm on cylinder phonographs, mainly Edison, which contains one of the two end bearings for the mandrel. The endgate pivots at one end so that it can be opened for insertion and removal of the cylinder.

escutcheon—a term for any decorative piece of metal designed to protect a portion of a wooden cabinet. A crank escutcheon is therefore the metal ring or plate attached to the cabinet at the point where the crank enters the case.

extension arm—the metal bracket that supports the traveling arm on front-mount machines.

feedscrew—a threaded rod that works in conjunction with a half-nut to guide the reproducer across the recording, usually on cylinder machines, but not exclusively.

fiber gear—a gear made from laminated cloth.

fiber needle—a disc stylus made from a bamboo splinter or a thorn. Fiber needles reduce record wear, but require constant resharpening and only give good results in conjunction with reproducers that weigh over 8 oz. Most reproducers weigh closer to 5-6 oz. and are too light to work well with fiber needles.

floating reproducer—see "reproducer, cylinder"

floating weight reproducer—see "reproducer, cylinder"

front-mount—any disc machine that has a horn attached directly to the reproducer without the benefit of an acoustic tone-arm.

gasket—a rubber ring, either flat or tubular, used to hold the diaphragm in place in a reproducer.

Generally, there are two gaskets in a reproducer, although some cylinder reproducers (floating) have just one gasket and a wax seal.

Gold-Molded cylinder—Edison's first molded cylinder, produced by gold "sputtering" the wax master in order to make it conductive and thus allow it to be electroplated, the first step in creating a mold. These cylinders were made from 1901-12, although they were known simply as "Standard" cylinders after 1908.

goose-neck—an Eldridge Johnson invention whereby the reproducer could be pivoted on the tone-arm for easy needle replacement. This is seen almost exclusively on Victor and HMV machines. Also called "swan-neck."

governor—a centrifugal regulator consisting of spring-mounted weights and a movable flange, used for speed regulation in virtually all talking machines.

Grafonola—an internal horn Columbia machine.

Gramophone—originally Emile Berliner's invention, but with a small "g," gramophone is used outside North America to indicate all disc machines.

half-nut—a small, grooved piece of metal which travels along the feedscrew, moving the reproducer in relation to the record grooves. Usually seen on cylinder machines.

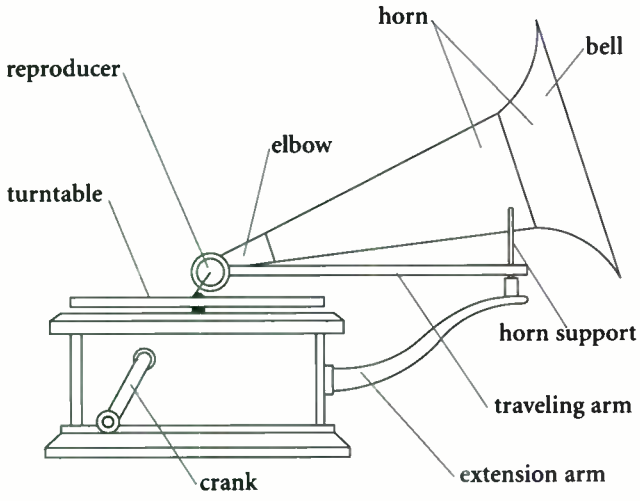
hill-and-dale—see "vertical-cut"

HMV—"His Master's Voice," the British equivalent of Victor.

indestructible cylinder—see "cylinder, indestructible"

knife edge—see "straight edge"

lateral-cut—a recording method where the depth of the groove is constant and the needle track moves from side to side. Also known as "needle-cut" and the "valley method."



A typical front-mount machine.

leadscrew—see "feedscrew"

lift lever—the device that lifts the reproducer from the cylinder. Also known as the "lift pin."

listening tubes—white rubber tubes rather like a doctor's stethoscope, in common use on cylinder machines up until the late 1890's. Some early disc machines were also equipped with listening tubes.

mandrel—the rotating metal mounting that forms the core of the cylinder when it is played on a phonograph.

mechanical feed—machines which have reproducers guided by a feedscrew rather than being propelled by the groove itself are said to have a "mechanical feed."

morning-glory horn—any petaled horn.

needle-cut—see "lateral-cut"

needle-head—see "reproducer, disc"

NOS—"new original stock," old parts that have never been installed in a machine before.

-ola—a suffix which generally indicates an internal-horn machine, e.g. Victrola, Grafonola, Amberola, etc.

pawl—the metal arm that fits into the notches in a ratchet wheel (cogwheel) and allows the wheel to rotate in one direction only. Also called a "dog."

phono-cut—see "vertical-cut"

Phonograph—with a large "P," this refers to Edison products. With a small "p," "phonograph" (in North America) refers to any talking machine. Outside North America, the term "phonograph" is generally reserved for cylinder machines, and disc machines are called "gramophones."

Pink Lambert cylinder—a bright pink celluloid cylinder made between 1901-08 by Thomas B. Lambert of Chicago.

pot metal—a zinc alloy used for inexpensive castings in many Columbia machines. Due to the presence of lead and other impurities, pot metal is subject to intergranular corrosion, which results in swelling and cracking of the metal.

pre-tone-arm—see "front-mount"

rear-mount—any machine equipped with an acoustic tone-arm where the horn is supported entirely by a cast bracket mounted on the rear of the machine.

recorder—a device similar in appearance to a reproducer that permits home recording.

reproducer, cylinder—also called the "speaker," these fall basically into two categories: the floating reproducer and the floating weight reproducer. In the

floating reproducer, the entire weight of the reproducer bears down on the stylus, which is attached directly to the diaphragm. This type of reproducer is not mounted in a carrier arm and can pivot both laterally and vertically. The floating weight reproducer's stylus is mounted in a small bar, which in turn is attached to a weight. A linkage connects the stylus bar to the diaphragm. The main body of the reproducer is held firmly by a carrier arm, while the weight and stylus are free to move in the manner of the floating reproducer.

reproducer, disc—also called the "sound-box," is the part that contains the diaphragm, stylus bar, and the needle.

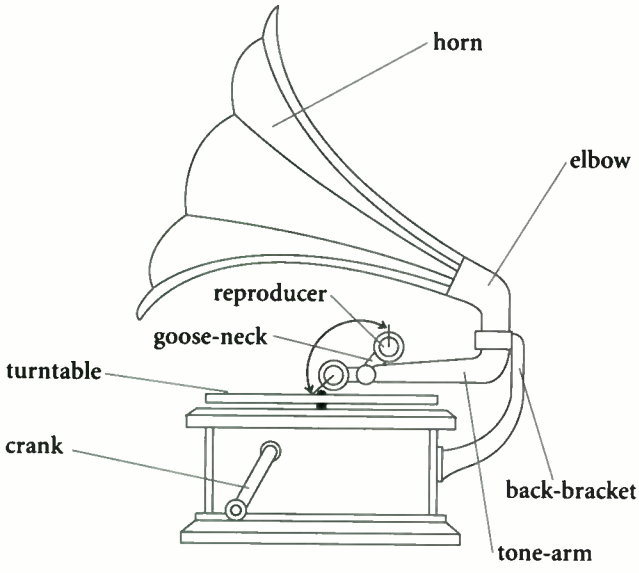
ride-the-reproducer—any horn that does not require the use of a crane is said to "ride the reproducer."

RPM—revolutions per minute.

SASE—"self-addressed, stamped envelope," commonly requested by dealers, used when replying to your questions. Even if an SASE is not asked for specifically, if you include one with a letter, you are much more likely to get an answer.

shaver—a device for paring off a layer of wax from a cylinder in order to prepare it for recording. Many early Edison phonographs are equipped with a built-in shaver, but machines built specifically for this purpose were produced and are also called "shavers."

sound magnifier—a special reproducer designed by Daniel Higham for Columbia, which amplifies the movement of the diaphragm and hence the sound by means of a friction strap or "shoe" and a rotating amber wheel.



A typical rear-mount machine.

spares—a British term for "spare parts."

speaker—see "reproducer, cylinder"

spider—a stylus holder for a floating reproducer similar in appearance to the web-spinning arachnid of the same name. The stylus is mounted in the spider's "body" and the "legs" are attached to the diaphragm.

straight edge—the support on which the front of an Edison reproducer carriage slides.

stroboscope—a paper wheel with a pattern of lines which indicate the speed of a cylinder or disc when viewed under artificial light (alternating current).

stylus—in lateral-cut disc machines, this refers to the needle. In all vertical-cut disc and cylinder machines, this is the glass, sapphire, or diamond point that "reads" the grooves in the recording.

stylus bar—a piece of metal which holds the stylus.

swan-neck—see "goose-neck"

swarf—wax shavings produced while recording.

swing arm—see "end-gate"

talking machine—a term apparently coined about 1888 to describe all types of machines that could reproduce recorded sound. Before 1888, the only machine that could do this was Edison's "Phonograph." In 1888, both the Bell-Tainter "Graphophone" and the Berliner "Gramophone" were launched and the need for a more general term arose.

tapered tone-arm—an Eldridge Johnson invention in which the hollow acoustic tone-arm is slightly conical in shape rather than having a cylindrical bore.

tinfoil phonograph—the first phonographs used tinfoil as a recording medium, hence the name "tinfoil phonograph." the tinfoil was wrapped around a grooved brass or wood cylinder and the recording stylus made a series of impressions in the foil. The grooves underneath allowed the stylus to move in and out without hitting the core.

tone-arm—usually refers to an acoustic tone-arm, a hollow tube that conducts the sound from the reproducer to the horn. In front-mount machines, the traveling arm may also be referred to as a "tone-arm."

tone-arm bracket—see "tone-arm support"

tone-arm support—can refer to either the extension arm on front-mount machines, or the back bracket on rear-mount machines.

TPI—threads per inch.

transfer—see "decal"

traveling arm—a piece of wood or metal to which the reproducer and horn are attached on front-mount disc machines. This arm pivots on the extension arm.

trunnion—the tube which guides the reproducer carriage along the feedscrew shaft on Columbia cylinder machines. Collectors commonly refer to the two Columbia AT machines as "high" and "low" trunnion models, although the part that changes the position of the reproducer and horn is not part of the actual trunnion, but merely a bracket attached to it.

turntable—the flat, circular disc that supports a disc record.

up-and-over—see "rear-mount"

valley method—see "lateral-cut"

vertical cut—a recording method where the groove varies in depth rather than modulating from side to side. This method was used in all cylinder machines, as well as a few disc models, notably those of Pathé.

Victrola—an internal horn machine made by Victor, though commonly used (incorrectly) to refer to all acoustic, spring-driven machines.

white metal—see "pot metal"

witch's hat—a short horn, usually 14" in length with a flared bell.

worm gear—a shaft with a spiral groove, commonly seen on governors.

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Books about gramophones and phonographs

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Baumbach, Robert W., *Look for the Dog*, Stationery X-Press, Woodland Hills, Calif., 1981. This is without a doubt the definitive guide to Victor machines. Practically every machine Eldridge Johnson ever produced from 1901 to 1929 is illustrated with original catalog pictures and described in detail. The book also includes many pictures from the Victor factory, a section devoted to Victor patents, and excerpts from Victor's own maintenance guides.

Bergonzi, Benet, *Old Gramophones*, Shire Publications Ltd., Princes Risborough, Buckinghamshire, UK, 1991. This is a sober, well-written introduction to talking machines, written specifically for collectors. It is very similar in scope and format to V.K. Chew's book, which is often out of print.

Contini, Marco, *Fonografi e Grammofoni*, BE-MA Editrice, Milan, Italy, 1987. Mr. Contini's personal collection is illustrated in 100 color portraits, including many rarities. Text is in both Italian and English. A lovely, little book.

Charbon, Paul, *La Machine Parlante*, Jean-Pierre Gyss, Paris, 1981. Each of the eleven richly illustrated chapters is devoted to one of the pioneers of recorded sound, from Leon Scott to Valdemar Poulsen. Emphasis is, naturally enough, placed on the French contributions, of which there are many. Even if you cannot read a word of French, the pictures make the book worthwhile.

Chew, V.K., *Talking Machines*, Her Majesty's Stationery Office, London, 1981. This little book is informative, accurate, well-illustrated, and inexpensive. Again, the emphasis is on European makes, but this should not put off American readers. An excellent value, but occasionally out of print.

Ciravegna, Nino, *Fonografi e Grammofoni*, Stella Polare Editrice, Bergamo, Italy, 1990. A fine, large-format picture book showing machines from the Galbiati di Brugherio museum in Milan. The brief text and captions are in Italian only, but the pictures are big and colorful.

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De Vries, Leonard, *Dank U, Meneer Edison*, De Gooise Uitgeverij, Bussum, Holland, 1977. A large, illus-

trated paperback about early talking machine history, prepared in commemoration of the phonograph centennial in 1977. In Dutch.

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Frow, George L., *The Edison Disc Phonographs*, George L. Frow, Sevenoaks, Kent, England, 1982. This companion volume to the earlier cylinder phonograph book completes the history of the Edison talking machine. A superb book.

Gelatt, Roland, *The Fabulous Phonograph*, MacMillan, New York, 1977. Back in the 1950's, this was one of the two books every collector had to have on his or her bookshelf. Happily, this volume has been reprinted and is again available to the public. More than a mere discussion of the various makes and models, Mr. Gelatt emphasizes sound recording, a subject much overlooked by other authors.

Gillett, W., *The Phonograph and How To Construct It*, (Original, 1892) George L. Frow, Sevenoaks, Kent, England, 1978. This booklet from the early days of the talking machine contains a complete set of instructions and drawings for making a tinfoil phonograph as well as an electric machine similar to the early Edisons. It is only fair to warn you that construction of either of these machines requires a metal lathe and a good deal of expertise.

Hazelcorn, Howard, *Collector's Guide to Columbia Cylinder Phonographs*, APM, New York. This modest 36-page booklet is filled with detailed model information for 44 different cylinder models, including serial numbers, reproducers, horns and much more. Highly recommended.

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Hoover, Cynthia A., *Music Machines American Style*, U.S. Govt. Printing Office, Washington, D.C., 1971. Mainly a picture book, this was the accompanying guide to the Smithsonian Institution exhibit of the same name. The text is not always entirely accurate, but the pictures are fun.

Jewell, Brian, *Veteran Talking Machines*, Midas Books, Tunbridge Wells, Kent, England, 1977. Having clipped all the pictures out of a number of well-known books, Mr. Jewell rearranged some of the words and glued the whole mess together. I think this book is a waste of money.

Jüttemann, Herbert, *Phonographen und Grammophone*, Klinkhardt & Biermann, Braunschweig, Germany, 1979. A sober and thorough account of the history of talking machines, liberally illustrated with pictures from old German catalogs. The book also includes a valuable guide to almost 200 German manufacturers in the years prior to 1930. In German.

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Maken, Neil, *Phonographs from the Attic*, Promar Publishing, Huntington Beach, CA., 1996. This book has been designed to help new collectors identify machines through photographs and descriptions in large type of many popular models, plus identification tips.

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My only regret is that some of the machines are shown with blatantly incorrect tone-arms, horns, etc.—a fact not mentioned in the accompanying captions and thus misleading to the novice.

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Read, Oliver and Welch, Walter L., *From Tinfoil To Stereo*, Howard Sams & Co., Indianapolis, 1976. This is the second of the two books which were required reading for collectors 30-40 years ago and has now been reprinted. Once the bible of the phonograph collector, the book is actually rather heavy reading, discussing at length the legal squabbles of the fledgling talking machine industry. Illustrated.

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Tewksbury, George E., *A Complete Manual of the Edison Phonograph*, (original, 1897) George L. Frow, 1978. With sections on phonograph batteries, recording, cylinder shaving, and loads of other hard-to-find information, this book is highly recommended to those who wish to experiment with home recording or tinker with early electric machines.

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Grotz, George, *The Antique Restorer's Handbook*, Doubleday & Co., Garden City, New York, 1976. An A to Z guide to restoring just about anything—except phonographs.

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Grotz, George, *Instant Furniture Refinishing*, Doubleday & Co., Garden City, New York, 1966. All (or almost all) the tricks of the refinishing trade are revealed in this inexpensive paperback. Even if you don't plan on refinishing as much as a chopstick, this book is

wonderfully entertaining.

Hilts, Len and Kay, *Furniture Repair and Restoration*, Creative Homeowner Press, Passaic, New Jersey, 1981. What makes this book so good is that it is filled with illustrations showing each step in the repair process, demonstrated by people who obviously know what they are doing. What's more, there is a superb list of suppliers at the end of the book, which is indispensable when you are hunting for special refinishing products or unusual veneers.

Periodicals and newsletters

The Antique Phonograph Monthly, published by Allen Koenigsberg, 502 East 17th Street, Brooklyn, New York, 11226. Although there aren't exactly 12 issues a year, the magazine contains many interesting and valuable articles about machines and recordings. It also has a terrific advertising section, which is highly recommended. Mr. Koenigsberg also publishes a wide range of high-quality reprinted literature and other books of interest.

Antique Phonograph News, newsletter of the Canadian Antique Phonograph Society. New members should apply to Mr. William Pratt, 122 Major Street, Toronto, Ontario M5S 2L2, Canada.

Hillandale News, magazine of the City of London Phonograph and Gramophone Society, 80 Boltons Lane, Pyrford Woking, Surrey, England. The six issues each year contain a wide variety of articles concerning early recordings and machines. Although quite a bit of space is devoted to the nitty-gritty of record collecting, there are also good technical and historical articles. The Society offers an outstanding selection of reprinted material, discounted to members.

International Talking Machine Review, c/o John Booth, 105 Sturdee Ave., Gillingham, Kent ME7 2HG, England. Mr. Booth continues to carry on Ernie Bayly's fine work and supplies a wide variety of reprinted catalogs, posters and books, in addition to the sober and informative newsletter.

In The Groove, newsletter of the Michigan Antique Phonograph Society, c/o John Whitacre, 2609 Devonshire, Lansing, Michigan 48910. Although collector's groups pop up and disappear regularly, MAPS has put out this newsletter unfailingly each and every month for many years. The articles are informal and fun to read. There is also a great advertising section. As an added bonus, members receive the MAPS resource directory containing the names, addresses and interests of all its members, plus those of suppliers, sound archives, museums and much more. This directory alone is worth the modest membership fee.

The New Amberola Graphic, c/o Martin Bryan, 37 Caledonia Street, St. Johnsbury, VT 05819. As could be expected, emphasis is on Edison products, but the magazine is always good value—interesting articles, good advertising.

The Reproducer, newsletter of the Vintage Radio and Phonograph Society, c/o George Potter, P.O. Box 165345, Irving, TX 75016. Emphasis here is more on radio than phonographs, but that shouldn't put anyone off. It's a nice informal newsletter that nicely serves the needs of these two hobbies.

The Sound Box, newsletter of the California Antique Phonograph Society, c/o Bob Sitter, P.O. Box 67, Duarte, CA 91010-0067. Along with the Michigan group, CAPS is one of the most active collectors organizations in the U.S. and an excellent source for parts, machines, and useful tidbits of historical information.

The Sound Record, newsletter of the Phonograph Society of New South Wales, c/o Barry Badham, 20 Ryde Road, Pymble 2073, Australia. Another good collector group, this time from "down under."