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FM

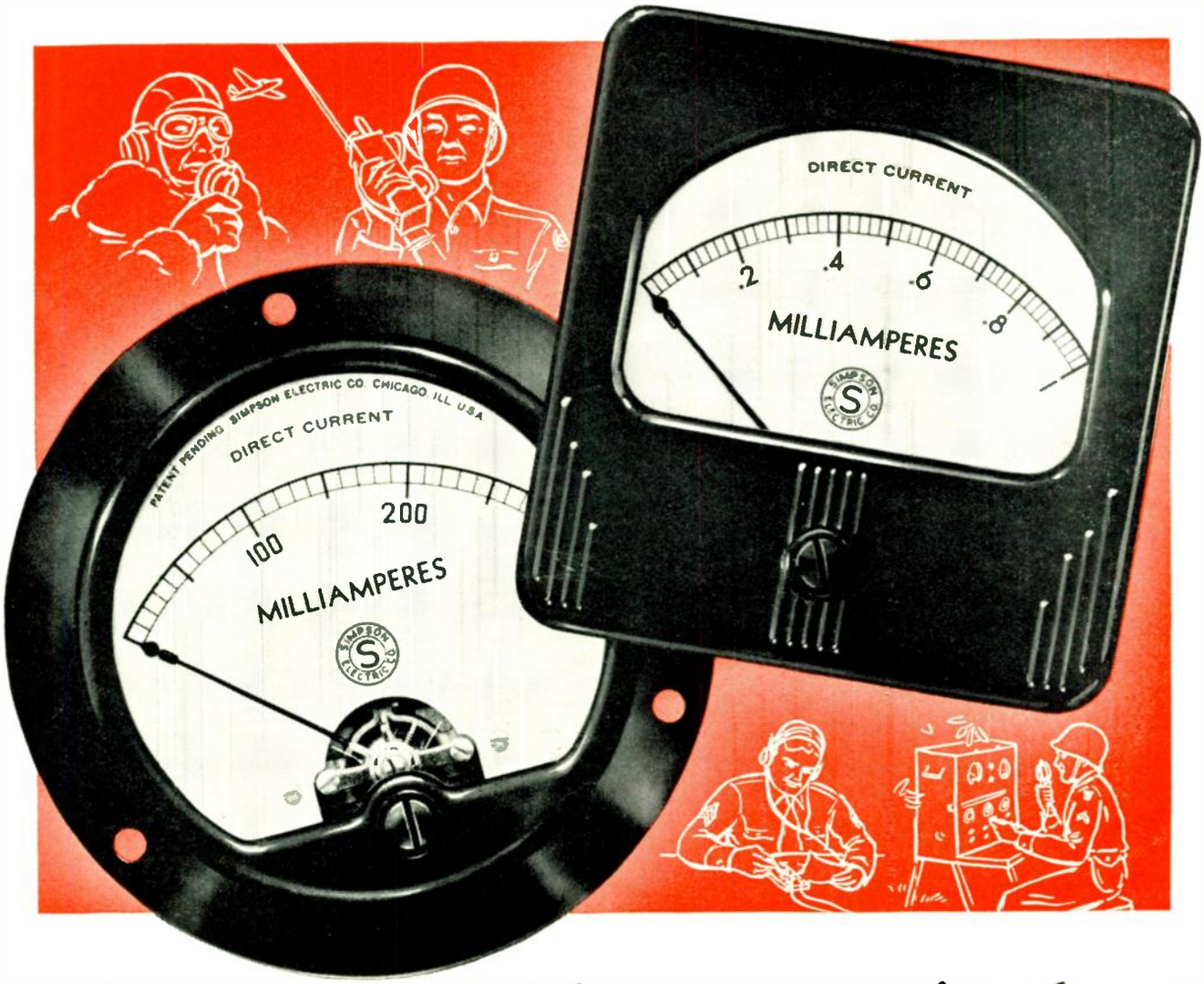
FEBRUARY 1943

RADIO-ELECTRONIC ENGINEERING & DESIGN

LOOP FOR
AUTOMATIC RADIO COMPASS

Radio-Electronic Products Directory

THE JOURNAL OF WARTIME RADIO-ELECTRONIC DEVELOPMENT, ENGINEERING & MANUFACTURING ★ *Edited by M. B. Sleeper* ★



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★ By the thousands, Simpson Instruments are going forth to assume vital responsibilities in America's march to victory—to help do the job that must be done. ★ You will find them in active service on the fighting fronts—maintaining vital communications, and keeping watch over the men and machines that carry the battle to America's enemies on land and sea and in the air. ★ On the home front they are helping importantly in the production of planes, tanks, ships and guns.

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BUY WAR BONDS AND STAMPS FOR VICTORY

FM RADIO-ELECTRONIC ENGINEERING & DESIGN

COMBINED WITH: APPLIED ELECTRONIC ENGINEERING

VOL. 3 | FEBRUARY, 1943 | NO. 3

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Although no actual figures have been published, it is certain that a large part of the millions and millions of dollars now being spent for radio equipment is going into aircraft service. It is equally certain that in the post-war period of air transport expansion, this field of radio manufacturing will assume substantial proportions. This month's cover picture shows two men who have been taking a leading part in the development of aircraft radio equipment. They are R. K. Frazier, receiver section chief and W. L. Webb, right, chief engineer of Bendix Radio.

AIRCRAFT-MARINE PRODUCTS INC

A-MP

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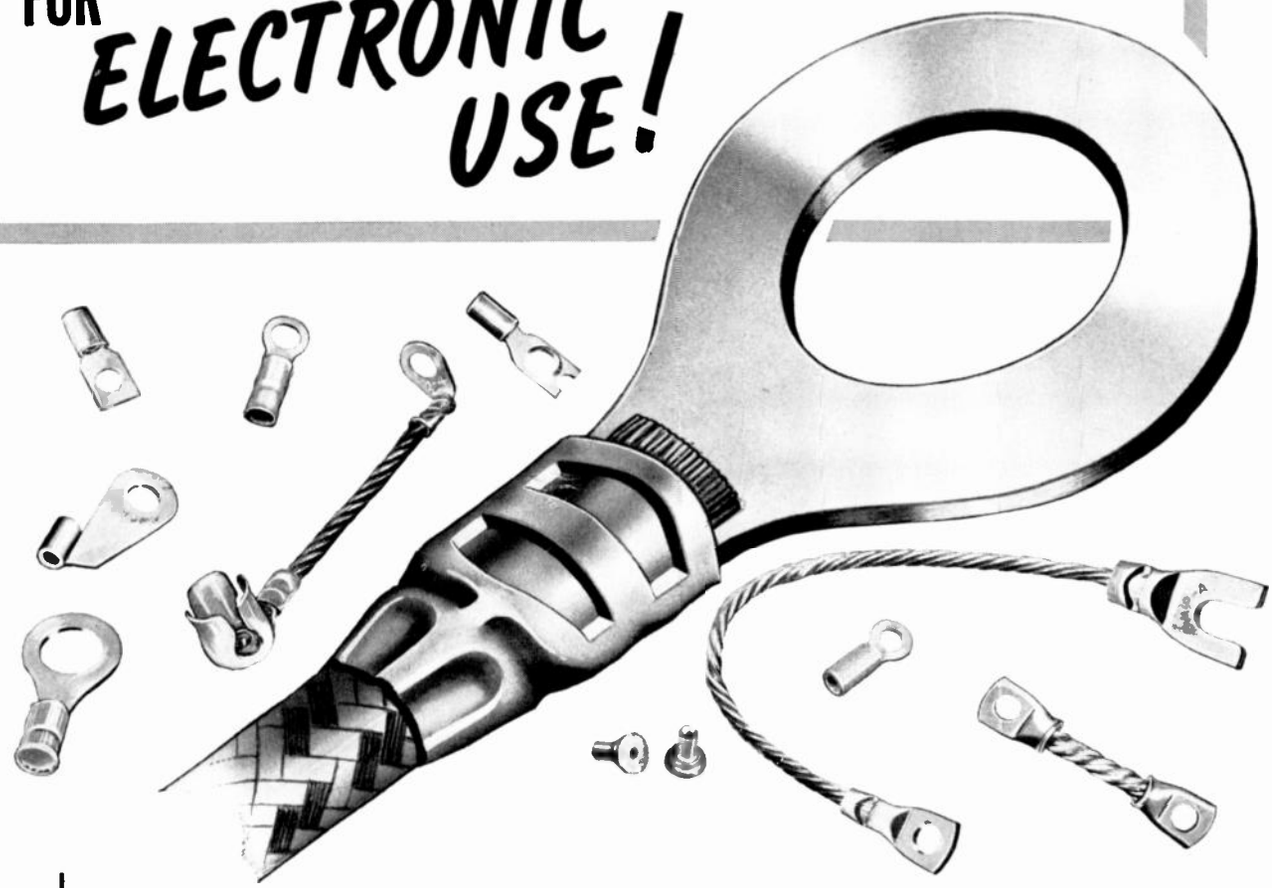
A-MP *Solderless* WIRING DEVICES FOR *ELECTRONIC USE!*



In actual service in the electronics and allied industries, the Diamond Grip Solderless Insulation Support Terminal is used and is daily maintaining the highest quality electrical connections under the severe conditions required in gun control, aircraft, communications, radio and electronics use—and especially in low voltage and high frequency requirements.

These pure copper insulation support terminals are approximately 32% lighter in weight and 1/32" shorter in length. They have been engineered to meet every operating and installation need of the electronic designer and production engineer.

Three Perfect Crimps at One Time with Production Line Speed Regardless of Quantity

The AMP Solderless Wiring System saves production time and assures uniformity of application by unskilled workers without the necessity of pre-training. The AMP self-gauging hand-die, and foot and power installation tools are so accurate and so easy to use that rejects are practically eliminated and every installed terminal is the mechanical and electrical duplicate of all others in the line.

AMP is first to put the solderless insulation support terminal on a production-line basis.

In service as on the assembly line, the AMP Diamond Grip Insulation Support Terminal gives unsurpassed efficiency at all times.

Tests made by unbiased, non-commercial laboratories show that AMP Diamond Grip Terminals show no significant change in resistance of the terminal even under the severest operating conditions. The tests included a multiplicity of circuits, variations in current, voltage, temperatures and corrosion. Detailed test data will be sent you on request.

Write today for AMP Bulletin 19 explaining the AMP System of Solderless Wiring.

"PRECISION ENGINEERING AIRCRAFT-MARINE PRODUCTS INC A-MP SOLDERLESS WIRING DEVICES APPLIED TO THE END OF A WIRE"

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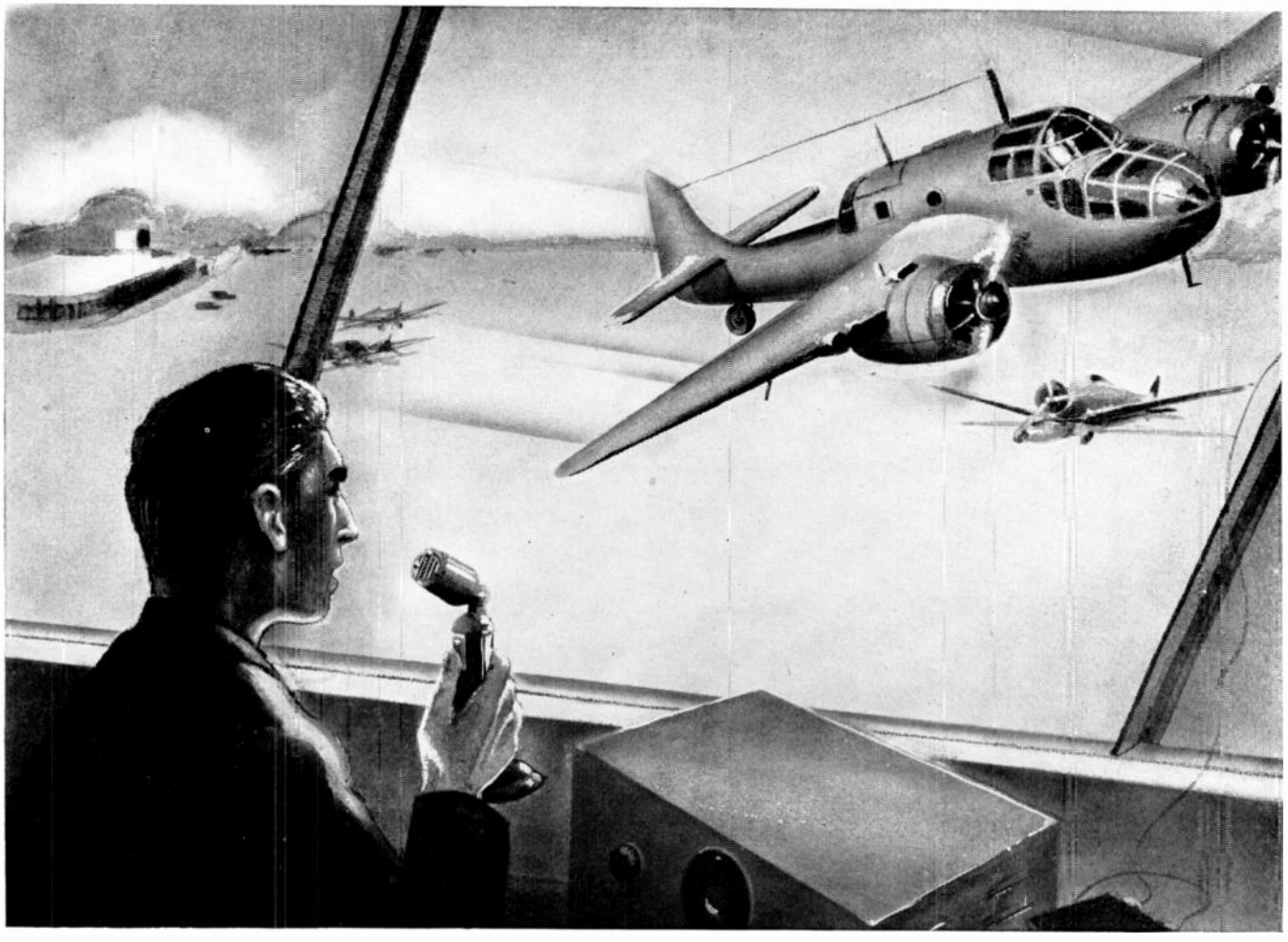


For a nation on wings

Built to Civil Aeronautics Administration specifications, CAA-515, the Electro-Voice Model 7-A microphone is widely used for airport landing control and is highly suitable for many other sound pick-up applications.

The smooth frequency curve, rising with frequency, gives extremely high intelligibility even under adverse conditions. Desk mounting incorporates easily accessible switch which can be operated by thumb of either right or left hand. Microphone may be moved without danger of pressing this switch. If you have a microphone problem, we invite you to consult our engineering department.

If, however, your limited quantity requirements can be met by any of our standard model microphones, with or without minor modifications, may we suggest that you contact your local radio parts distributor? He may be able to supply your immediate needs from remaining stocks. In all instances, his familiarity with our products and many of your problems will enable him to serve you well. Our distributors should prove to be vital links in expediting your smaller orders.

. . . Any model Electro-Voice microphone may be submitted to your local supplier for TEST and REPAIR at our factory.

Electro-Voice MICROPHONES

ELECTRO-VOICE MANUFACTURING CO., INC. 1239 SOUTH BEND AVENUE, SOUTH BEND, INDIANA

Listening Posts!

You will find Hallicrafters Communications Equipment working three shifts at our Country's "Listening Posts"... searching the airways for illegal programs and espionage messages.

Hallicrafters Communications Equipment is engineered to "take it" on this constant operating... there are no rest periods, no time out, it's constant performance!

The Hallicrafters Equipment you can buy—when communications equipment may again be sold for Civilian use—will incorporate all of the endurance and top quality performance you will ever demand.

Illustration—typical view of Hallicrafters Communications Equipment is a monitoring (listening in) station—somewhere in the U.S.A.

WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF SHORT WAVE RADIO COMMUNICATIONS EQUIPMENT

ARMY E NAVY

hallicrafters

CHICAGO, U.S.A.

FIG. 1, LEFT: THESE BARRELS AND BOXES, FILLED WITH UNSORTED MIXED HARDWARE, INDICATE THE MAGNITUDE OF PRODUCTION WASTE WHICH REPUBLIC AVIATION HAS UNDERTAKEN TO ELIMINATE. THIS IS TYPICAL OF THE CONDITIONS WHICH PREVAIL IN MANY PLANTS NOW ALL-OUT ON WAR PRODUCTION

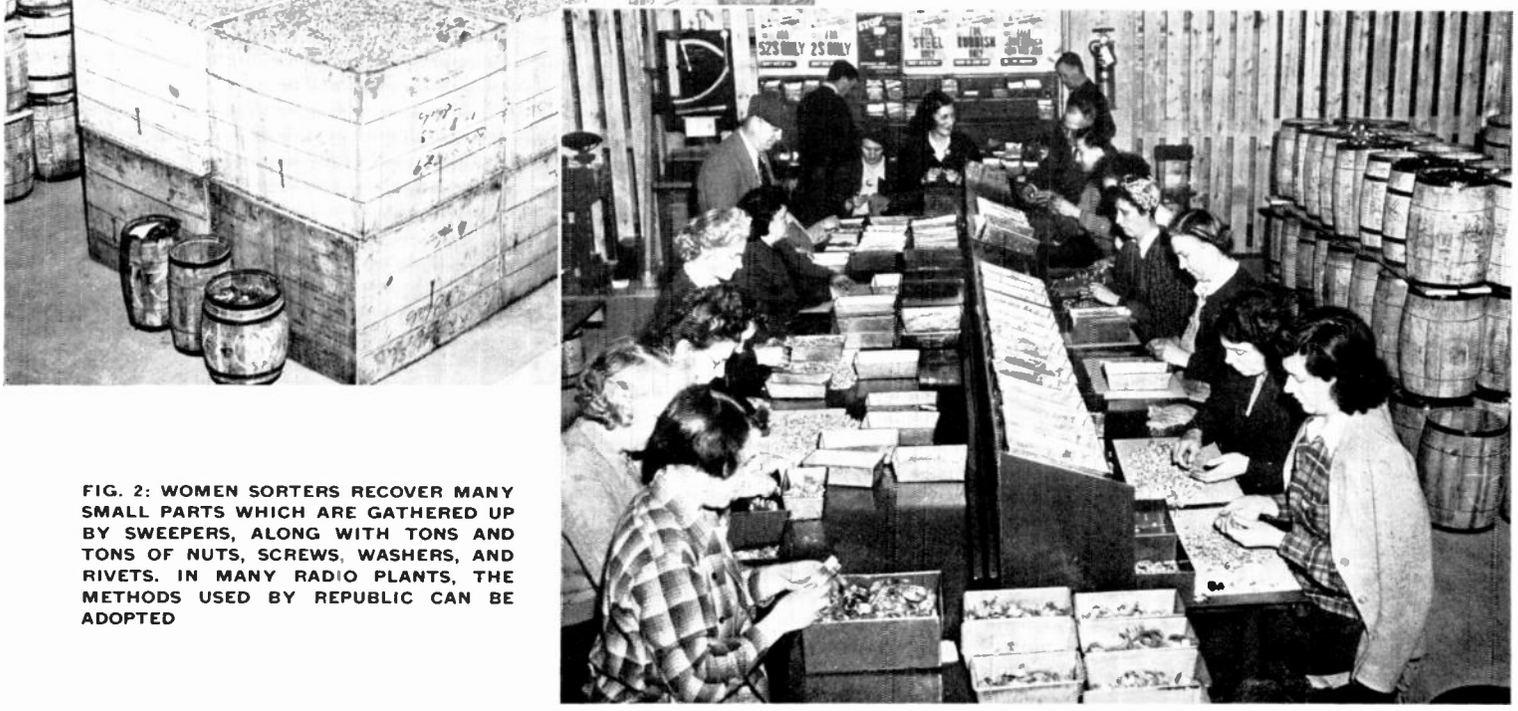


FIG. 2: WOMEN SORTERS RECOVER MANY SMALL PARTS WHICH ARE GATHERED UP BY SWEEPERS, ALONG WITH TONS AND TONS OF NUTS, SCREWS, WASHERS, AND RIVETS. IN MANY RADIO PLANTS, THE METHODS USED BY REPUBLIC CAN BE ADOPTED

THRIFT CAN BE MADE POPULAR

Methods Used at Republic Aviation Corporation Can Be Adopted by Radio Manufacturers

BY GORDON C. SLEEPER*

RECLAMATION in the great war plant of Republic Aviation Corporation at Farmingdale, Long Island, has been made more than a name for salvage or conservation activities. It is now becoming a crusade, a popular movement enrolling enthusiastic supporters in many departments, a cause focusing the thoughts and talents of many people on problems of reducing waste in materials, time, and money.

The success of our organized efforts in this direction may offer an example to radio manufacturers whose workers, like our own, handle many small parts which are valuable both because of their cost and scarcity.

Waste was no great problem in aircraft factories in peacetime. Skilled workers respected their tools, materials were issued under the watchful eyes of experienced foremen, purchasing agents bought closely, large inventories were luxuries few could afford.

Then came war and war expansion. Production became the only watchword — output the only measure of success. The hundreds of skilled workmen became the thousands of men and women pouring into aircraft plants eager to do their part, but mostly untrained in the use of precision tools, and with little comprehension of the value of materials handled. Waste and spoilage grew to great proportions, but nothing mattered except the terrible urgency for planes and more planes.

Procurement people threw caution to the winds. With 30,000 different parts in the bill of materials for just a single model, and unfilled orders climbing from millions to hundreds of millions of dollars, no wonder the best peacetime systems of material control and balanced inventories blew up with a loud bang. Moreover, as the tempo of war quickened and lessons of actual fighting were learned, engineering changes came thick and fast, making obsolete whole mountains of precious inventories just acquired.

At first, all this was taken as inevitable, as part of the cost of doing the job under War conditions. Management strained every nerve to meet production schedules, lived through all the headaches of building and equipping huge new factories, recruited and trained whole armies of new employes. No wonder they couldn't stop to reclaim scrap — to reduce spoilage — to eliminate waste. It wasn't worth the trouble. It seemed small potatoes anyway. Nothing mattered but production.

Republic Aviation was no better and no worse than other companies. The picture as drawn was true for most of the airplane

*Assistant to the President, Republic Aviation Corporation, Farmingdale, L. I., N. Y.

builders. It is probably true of many radio manufacturers whose volume of business is now climbing into stratospheric figures.

The first real beginning of reclamation work at Republic Aviation came in February of last year when the newly organized War Production Board got panicky about aluminum output, and ordered every prime contractor to organize a program of scrap metal segregation and sale.

Because the Maintenance Department already collected waste in the plant, had the necessary trucks, and had an old building available down by the incinerator, Scrap Sales started out as part of Maintenance. Barrels painted to a color code suggested by the WPB and marked for the various alloys of aluminum such as 24S, 52S, and 2S, as well as for stainless steel, rubber, brass, and copper were placed as close to the point of generation as possible.

Just about this time Republic's P-47 Thunderbolt, the Army's new six and one-half ton high-altitude fighter came into production, succeeding the P-43 Lancer. As new thousands of people were hired and every imaginable type of machine had to be fed, it was natural that scrap collection and sale grew into big business. Much had to be learned about getting real segregation at the source. It is no small trick to keep the right barrels at the right places at the right time, and to get everyone concerned to use them correctly.

Segregated aluminum solids and turnings are sold directly to the two principal producers of aluminum. Unsegregated or mixed alloys, as well as other scrap metals, are sold two or three times a week to authorized scrap dealers. Monthly tonnages of scrap metals run in excess of 300,000 pounds. Revenue is now running at the rate of $150,000 a year.

The Scrap Sales division, since November a part of the Reclamation Department organized at that time, also collects and returns to vendors many items such as pails, casks, barrels, engine boxes and other special containers. It sells used files, rawhide hammers, and plexiglass. It bales paper, cardboard, and excelsior, supplying what is needed to the Shipping or Airplane Spare Parts departments and sells the rest. It runs a small lumber yard to supply boards and boxes for shipping purposes, selling its overflow of used lumber to a nearby contractor whose entire business is built on Republic's surplus.

The Scrap Sales division is now investigating the reclaiming of used crankcase oil, cutting and engine oils, thinners, lacquers, zinc chromate sludge, and other chemicals. It will operate the new centrifuging plant now being installed for handling aluminum chips and turnings produced in huge quantity by spar milling machines and routers.

The second important division of Republic's new Reclamation department is the Hardware Sorting division. Imagine what can and does happen when thousands of new workers on day and night shifts walk up to rotobins or other dispensing outlets to help themselves to some three or four thousand different types, sizes or lengths of rivets, nuts, bolts, fittings and other hardware such as can be seen in the accompanying illustrations. If each one takes only ten percent more than he or she needs, and at the end of the shift tosses the excess into collection boxes scattered about on workbenches, the day's accumulation for the whole plant is staggering. Actually ten percent was low for many items when the Reclamation department first took over this problem.

Looking at the tons of mixed hardware already collected but not sorted and realizing that from 500 to 700 pounds more were being added every twenty-four hours, it took a bold man to believe that any sorting division, however large or efficient, could ever master such a situation.

(CONTINUED ON PAGE 39)

FIG. 3, LEFT: THESE RECLAIMED AIRCRAFT PARTS SUGGEST THE COMPONENTS WHICH ARE TO BE FOUND IN EVERY RADIO FACTORY AND LABORATORY. THESE PARTS ARE VALUABLE BECAUSE OF THEIR SCARCITY AS WELL AS FOR THEIR INTRINSIC WORTH. WASTED PARTS WHICH CAN BE RECOVERED RUN AS HIGH AS 10% OF THE MATERIAL PURCHASES

FIG. 4, RIGHT: SAMPLES ARE IDENTIFIED BY PARTS NUMBERS, AS A GUIDE FOR THE USE OF THE SORTERS IN THEIR WORK OF RECLAMATION

TIME REQUIRED FOR A RECORDING CAN BE MEASURED TO AN ACCURACY OF FIVE SECONDS BY THE USE OF THE SIMPLE SCALES SHOWN BELOW

HOW MUCH PLAYING TIME?

Simple Method for Checking Time Required for Records

BY WALTER WIDLAR *

THE problem of predetermining the playing time for a given recorded selection or commercial is one which must be solved many times a day by every studio engineer.

At WGAR and WJR we undertook to reduce this to a simple method by which the answer in every case could be found quickly and accurately. The Record-A-Rule is the result of this effort.

By applying the correct scale to 16-in. lateral or vertical-cut transcriptions, it is possible to measure the playing time to an accuracy of 5 seconds. The rule is also particularly useful in measuring the time required for partial cuts on instantaneous recording blanks, as when dubbing in portions of several recordings to a single master disc. Approximate measurements can be made of some recordings while they are revolving on the turntable.

The Record-A-Rule is a vest-pocket scale of the exact size shown below. It has four scales, for 96 lines per inch on 78 RPM recordings, and 112, 128, and 136 lines per inch for 33⅓ RPM transcriptions.

Samples of the rule were distributed by members of our staff at the NAB convention last year. Since that time, we have received many requests for a table showing the pitch and speed used by the various manufacturers of equipment and records.

Following is the data which we have gathered from these sources:

LINES PER INCH FOR 33⅓ RPM

Columbia Recording Corp., Lateral	133
Muzak Transcriptions, Inc., Lateral	112
Muzak Transcriptions, Inc., Vertical	130
Presto Instantaneous Recorder, Standard	112
RCA Instantaneous Recorder, Standard	112
NBC pressings and instantaneous cuts	136
World Broadcast System, Lateral and Vertical up to †	138

LINES PER INCH FOR 78 RPM

Columbia Recording Corp.	85 to 96
Decca Records	86 to 98
Victor Division of RCA	86 to 110

In order to make the above data accurate and up-to-date, telegraph requests were sent to the different companies in January of this year, and the information given was tabulated from the replies.

The length of the recording determines the groove pitch used in the manufacture of 78 RPM records. Decca reported that they use three pitches: 98 lines per inch for 3 minutes; 92 lines for 2¾ minutes; and 86 lines for 2½ minutes.

Examination of some 78 RPM records shows a difference in the groove pitch between the beginning and the end.

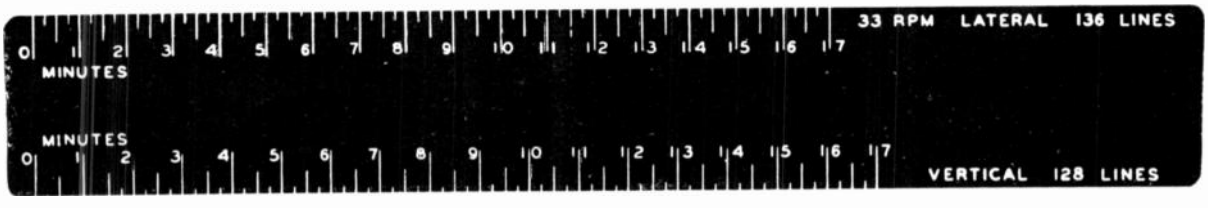
Despite these variations, and even though there are only four scales on the Record-A-Rule, we have found that, with a little practice, usefully accurate measurements can be made even when the groove pitch does not fit any one of the scales exactly.

The method is simple. To measure the playing time for a given recording, first select the proper scale on the rule. Then hold the record near the light so that the groove modulations are visible. Next, put the zero marking of the scale even with the first modulated groove, and read the scale to the last modulated groove. This will give the time in minutes and fractions.

† A large number of World vertical pressings have been measured at 128 lines per inch.

* Engineer, Station WGAR, Cleveland, Ohio.

DATA GIVEN ABOVE ON VARIOUS TYPES OF RECORDINGS SHOWS WHICH SCALE OF THE RECORD-A-RULE SHOULD BE USED



NOTES ON MODERN APPARATUS DESIGN

Do-and-Don't Suggestions to Help Designers and Engineers to Get the Right Answer the First Time

BY M. B. SLEEPER

ALTHOUGH a year has passed since the radio industry was converted to exclusive production for our Armed Forces, radio engineers have not mastered entirely the design requirements of military equipment. This situation is responsible for much delay in the transition stage from the successful experimental model to final, approved design, ready for production.

No complete textbook of standard practice has ever been issued for the guidance of designers and engineers, and the specifications which do exist, and in great volume, often hide specific requirements in pages of generalities which are rife with exceptions.

As a result, it is sometimes necessary to resubmit designs repeatedly until one feature after another has been modified to the point where, finally, the last detail has been put right and the complete equipment is given final approval.

No Bars to Improvement ★ The publication of a single volume on acceptable methods and practices would be of great help to the designers and engineers whose job it is to make experimental models into practical equipment capable of meeting service conditions. However, this might well have the effect of closing the door against the exercise of engineering ingenuity and originality at a time when it is not desirable to freeze the design of radioelectronic equipment, or to put up any bars to improvements. Moreover, requirements must be changed as dictated by experience and the needs of strategy and geography.

Tentative Standards ★ However, certain requirements and practices are now being observed to such an extent that they can be considered as tentative standards. At least, it is much safer to observe certain practices than to disregard them, and the nearer a model can come to acceptance when it is first submitted, the less time will be consumed in revising drawings and in submitting subsequent designs.

The notes which follow are entirely unofficial. They cannot be applied in all cases, since they are subject to many exceptions. To many engineers, some of these notes may seem too obvious to warrant mentioning, but they are included for the benefit of the less experienced. Some engineers may say: "That isn't what I was told to do." And they may be quite right. Still, these suggestions are safe to follow, and will help to avoid many of the mistakes which would probably call for corrections and changes.

The illustration in Fig. 1 depicts an experimental chassis shown for the purpose of indicating some of the common errors of omission and commission which must be corrected by designers and engineers before official acceptance of the models can be obtained.

1. Chassis Ground ★ It is usually necessary to provide a ground binding post on the front of the chassis. The securing nut must be staked so that the binding post cannot work loose. The panel should be engraved GND, adjacent to the post.

2. Finish and Color ★ Practically all metal cabinets for the Signal Corps are finished in black. This is also true of Navy aircraft equipment. Other Navy equipment is finished in standard gray. Fine wrinkle finish is used for outside surfaces, and smooth enamel inside. Wooden carrying cases are painted in gray for the Navy and olive drab for the Signal Corps. Nickel or other shiny finishes which reflect light should be avoided.

3. Friction on Controls ★ All controls must have enough friction to retain their adjustment under vibration. This applies particularly to tuning controls, and also to variable resistors. However, the required friction must be introduced in such a way as to permit the control to turn smoothly. This should be checked on the vibration table before submission for approval, for it will surely be noted during the acceptance test.

4. Set Screws ★ It is advisable to use cup-pointed Allen-head set screws for securing knobs and similar elements. This type of set screw has a hexagonal recess in the head end. Black oxide finish should be specified. Also it is necessary to provide a wrench for each size of set screw used. These are merely hexagonal rods bent at right angles. They, too, must be finished in black oxide. Clips must be mounted in the cabinet to hold the wrenches firmly enough that they will not shake loose.

5. Engraving ★ Metal nameplates and markers have given place to engraved laminated phenolic. More recently, specifications call for engraving directly on metal front panels. In such cases, the letters must be filled with an enamel for which there are exact specifications. For obvious reasons, white wax cannot be used.

6. Flats on Shafts ★ Wherever knobs are secured to the shafts of such components as condensers, switches, or variable resistors, the shafts must have flats milled 1/16 in. to take the set screws.

7. Lockwashers on Controls ★ A lockwasher should be provided on each control which is secured to a panel by means of a threaded collar. The washer should be located at the rear of the panel. Special care is necessary to prevent such devices from working loose in service.

8. Nomenclature ★ The word VOLUME is generally preferred to AUDIO GAIN CONTROL, and SENSITIVITY in place of R.F. GAIN CONTROL for panel indications, despite the wide use of the alternate words on broadcast equipment.

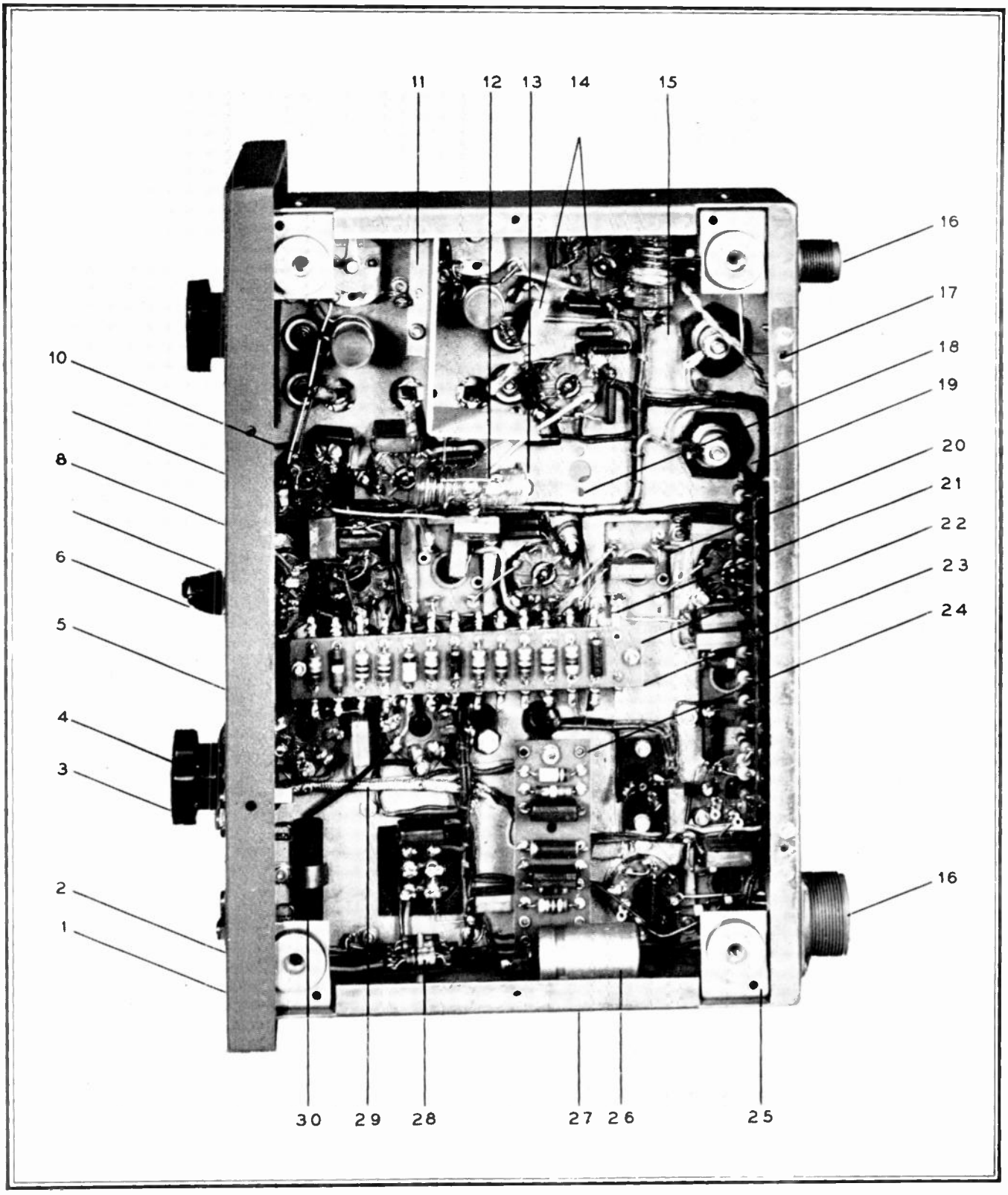
9. Screw Heads ★ Heads of bolts and screws which appear on the front panels of cases finished in black should be given a black oxide finish. Usually, nickel plating is acceptable for screws appearing on gray-finished cabinets.

10. Socket Connections ★ Solid wires should not be used for connections to socket terminals. Use flexible wire, and leave enough slack to permit the contacts to move freely. The reason for this is that if the contacts cannot align themselves freely with the pins, the pins may be bent enough to break the seals on the tubes. Care must be taken to use a minimum amount of solder on the contacts, and to prevent solder from dropping into the tube-pin holes.

11. Shield Plates ★ This shield plate should have been spot-welded to the chassis, both to keep it from working loose, and to assure a permanent, low-resistance contact. An exception, of course, is the shield plate which must be removed to permit access to components.

12. Coil Terminals ★ Terminals should be secured to all coils, to serve as anchor-points to which wiring is soldered. This is particularly important on coils wound with bare wire, to which taps are soldered, as vibration may cause the taps to break.

13. Coil Mountings ★ This coil is mounted by an angle bracket at only one end. When coils are parallel with the surface of the



NUMBERS GIVEN HERE REFER TO THE NOTES IN THE ACCOMPANYING TEXT, EXPLAINING FAVORED DESIGN METHODS AND PRACTICES

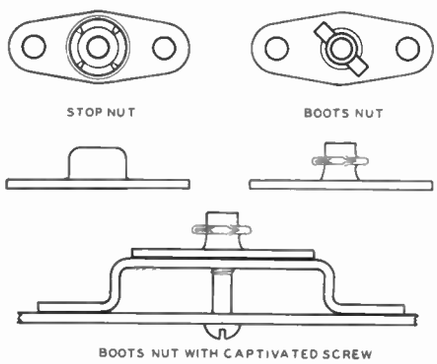
chassis, they should be supported at both ends. The only exception is in the case of coils wound on solid dielectric forms which are at right angles to the panel. It is usually permissible to mount such coils with a single screw, carrying a lockwasher under the head. In addition, where screws enter solid dielectric coil forms, locking compound should be put into the threaded holes. A tentative specification has been set for this compound.

14. Condenser and Resistor Mountings ★ Experience has shown that small condensers and resistors should not be mounted by their leads without any other support. Vibration causes the leads to break, and even loosens the terminal connections in condensers and resistors. In certain cases, this practice cannot be avoided because circuit requirements make it necessary to keep the leads down to minimum length, but unsupported units are always frowned upon. Soldered joints on the leads should be kept at least ½ in. from the body of the condenser or resistor, because excessive heat transmitted by the leads may

alter the capacity or resistance value.

15. Chassis Grounds ★ It is very dangerous to solder ground connections to the flat surface of a cadmium-plated chassis. The writer has seen a whole production run of receivers on which, two months after they were completed, soldered connections to the cadmium plating lifted right off. The reason was that the plating did not adhere to the steel where heat had been applied. Small soldering tabs, punched out of the chassis so that wires can be wound around them, are best for ground connections. Second choice, for hand-made models, is to drill holes through the chassis, through which the wires can be inserted and soldered.

16. Location of Receptacles ★ General practice is to put receptacles for separable connectors on the front panel, not at the rear. The purpose is to make it possible to connect all cables after the equipment has been secured in position, and to disconnect the cables instantly in case of emergency. There may be exceptions to this, but rear connections are being used only in unusual circumstances.



ABOVE: STOP NUT IS FOR SEMI-PERMANENT FASTENING. BOOTS NUT IS FOR SCREWS REMOVED FOR SERVICE. BELOW: BOOTS NUT USED WITH CAPTIVATED SCREW TO HOLD BOTTOM PLATE OF A CHASSIS

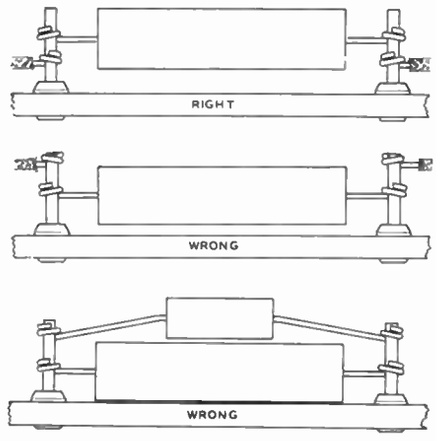
17. Special Nuts ★ Elastic stop nuts and Boots nuts have their specific applications, and must be used correctly in each case. Stop nuts are for screws which will be seldom if ever removed. They are designed for permanent fastenings. For example, they should not be used to take screws which fasten a bottom shield plate, since the plate must be removed whenever it is necessary to examine the under-chassis parts. Boots nuts are the correct choice where locking is required on screws that must be taken out from time to time. Lock washers and nuts are out of the question for this specific purpose, and the steel chassis is too thin to be threaded. As an added refinement, Boots nuts might set up from the turned-over edge of the chassis so that captivated screws could be used to hold the bottom plate in place.

18. Drilling After Finishing ★ Once a chassis has been finished, no further holes should be drilled. This is particularly important in the case of steel chassis for, if the metal is left unprotected, it will rust quickly. Upon exposure to salt water dampness, serious corrosion will set in.

19. High-value Condensers ★ Electrolytic condensers are ruled out of military equipment. The condenser indicated at 19 is an oil-filled paper condenser. When this type of mounting is used, great care must be used to tighten the mounting nut so that it cannot come loose. The engineers in charge of acceptance tests, as well as the inspectors, are very liable to grip a condenser of this type and try to turn it loose. Because of its high center of gravity and substantial weight, this type is liable to come loose under vibration.

20. IF and RF Transformers ★ Wide latitude is allowed in the design of IF and RF transformers, so that no specific recommendations can be made. There is one feature, however, that is looked upon with much favor and, in some instances, required: If possible, the component parts should be independent of the shield, and secured to a frame which is fastened to the phenolic base. The base should be secured to the chassis. Then the shield should be fastened to the chassis in such a way that it can be removed without disturbing the mounting base and the components which it carries. Generous space should be allowed between the chassis and the transformer terminals.

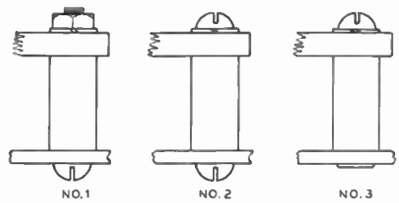
21. Mounting Board Terminals ★ Lugs and eyelets of the type shown are not favored for mounting boards which carry resistors and condensers. The preferred terminal post types are illustrated here. One has a straight shank, while the other, of larger diameter, is grooved to fix the locations of the wires soldered to it. The base, which is counterbored, is put through a hole in the mounting board and rolled over. Leads must not be soldered to the base, on the under side of the board, because heating might cause the terminal to come loose.



RIGHT AND WRONG METHODS OF CONNECTING COMPONENTS AND WIRING TO TERMINALS ON MOUNTING BOARDS

Some simple rules apply to the use of these terminal posts: 1) Put all circuit wires near the base, with the condenser or resistor leads above. Then these components can be removed without disturbing the wire connections. 2) If a shunt resistor or condenser is required to give exact values, do not attach the leads of one to the leads of the other. Run the leads of both to the terminal posts. In the former case, it is difficult to remove the upper unit without damaging the lower. 3) Arrange all condensers and resistors which are parallel so that their values can be read from the same position of inspection.

22. Covering Components ★ Mounting boards must be located in such ways that they do not prevent access to screws, fastenings, and wiring connections. If the location of a board makes it necessary to unfasten it in order to reach some other element, it is sure to be marked for alteration by the engineer making the acceptance tests. Therefore, it is wise to observe this point in the first model.



NO. 2 IS PREFERABLE TO NO. 1, BUT NO. 3 IS THE BEST WAY TO FASTEN MOUNTING BOARDS WHERE IT CAN BE APPLIED

23. Board Mountings ★ It is not good practice to use a long screw, nut, and a spacing post with a clearance hole to fasten a mounting board. If it is necessary to loosen the board, the long screw and the post are too easily lost. Neither is it advisable to use a threaded post with screws through the chassis and through the board. Loosening one screw is liable to loosen the other. The favored method is illustrated here. There is a shoulder on one end of the post, and it is counter bored so that it can be rolled over to secure it to the panel. The board is secured by a machine screw and lockwasher.

24. Edges of Laminated Phenolic ★ Although Bakelite is considered non-hygroscopic, experience at sea and in the tropics has shown that moisture is absorbed through the sawed edges of phenolic sheet. Accordingly, mounting boards and all other phenolic sheet parts must be coated with Bakelite varnish on all sawed edges, to seal them against moisture.

25. Shock Absorbers ★ Ordinary shock absorbers such as were used for civilian equipment are unsuited for military applications. They must be of the Lord type, or the equivalent. Furthermore, the shock absorbers must be carried on a single-unit frame which can be fastened down per-

manently. Then quick-detachable means must be provided for removing the cabinet from the shock absorbers.

Some designs use slide fasteners, while others have two captivated screws to hold the cabinet to the shock absorbers. Many variations of these methods are in use. There is nothing that can be described specifically as standard practice. However, the fastenings must be secure against vibration, and capable of being unfastened readily by hand, and in a matter of a few seconds. Mountings and cabinets must be interchangeable so that, if an instrument fails, it can be removed and replaced with another.

26. Oil-Filled Condensers ★ All the small round condensers secured by brackets and clamps are conspicuous by their absence in military equipment. They are replaced by oil-filled paper condensers of the bathtub type, completely sealed in flat-bottom metal cases which have tabs of ample dimensions for mounting.

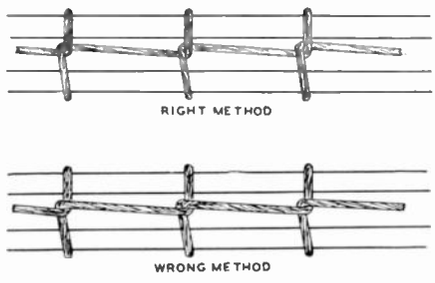
This has been a highly successful substitution. However, care and skill are required on the part of operators who solder wires to the terminals. The solder on the terminals is a part of the seal. If this is melted, it may cause the seal to leak after a time. While there have been some complaints on this score, they have been minor compared to the superior service afforded by oil-filled paper condensers.

27. Metal Cabinets ★ Three elements of cabinet design must be considered: 1) the chassis and its integral front panel, 2) the cabinet which carries the chassis and front panel and, 3) the mounting by which the cabinet is held in place.

The front panel must be fastened rigidly to the chassis, so that there is no give between the two when the unit is picked up by the top edge of the panel. The means used to hold the chassis in the cabinet must be secure, and tight enough to eliminate any chatter, yet quickly detachable by hand to permit the chassis to be removed from the cabinet in a few seconds. The fastenings must be accessible from the front. The chassis illustrated would be ruled out, for example, because the front panel is fastened to the cabinet with machine screws, on the top, bottom, and sides.

Even when shock absorbers are not required, it is usually necessary to provide a mounting to which the cabinet is secured. This applies generally to all small equipment. The purpose is to make possible the quick replacement of any unit without having to remove mounting screws or bolts.

28. Impregnating Condensers and Resistors ★ So many specifications now call for impregnating small resistors and mica or ceramic condensers in Superla wax that it is a good idea to do that without waiting to be told. The extra sealing is highly useful as added protection against dampness at sea and in the tropics.



HOW TO MAKE KNOTS FOR LACINGS

29. Wiring ★ All wires of sufficient length to be affected by vibration must be cabled with lacing twine. Further, cables of any length must be secured by clamps or other effective means. The purpose is, of course, to keep any strain from being transmitted to the soldered connections. A safe rule to follow is this: If you can wiggle a wire or a cable with your finger, it is not sufficiently secure.

It may seem unnecessary to point out the correct way to lace wires, but the fact is that many engineers do not do it correctly on their hand-made models. When lacing is done correctly, each knot tends to hold itself in place. If it is done the wrong way, the twine becomes loose as soon as the tension is released, or the twine is cut.

30. Paper-Case Condensers ★ All paper-case condensers have been ruled out completely. They do not stand up under extreme humidity, and some of the tropical bugs have found the paper so delectable that they cannot resist its flavor.

31. Toggle Switches ★ The practice of mounting toggle switches so that the movement is up-and-down is fairly standard. The ON position should be at the top.

It is advisable to specify that toggle switches shall have the laminated insulation wax-impregnated. Failures have developed in switches of this type from the absorption of moisture through the end grain of the laminations.

32. Spare Fuses ★ The relatively new practice of mounting extra extractor posts on the front panel of a receiver, to hold spare fuses of the Littelfuse type, is finding much favor. This is a very good idea because a fuse may be blown out by some temporary condition. With spares readily accessible, the burned out fuse can be replaced at once. Otherwise, the apparatus might be out of commission for an indefinite length of time.

It is considered better practice to have the fuses available on the front panel rather than mounting them somewhere inside the cabinet.

33. Black and White Screws ★ Some manufacturers are following the practice of differentiating between the screws to be removed for service and the replacement of components, and the screws which are used to hold parts of equipment together.

That is, screws which may be removed for service and replacement purposes are cadmium or nickel plated. Those which should not be removed are black-nickel plated. On more complicated instruments, this is a great help to service men.

34. Relay Mountings ★ To facilitate the servicing of small telephone-type relays, many designers are mounting them on bases fitted with banana plugs or tube bases. When this is done, a defective relay can be replaced quickly, and the faulty unit can then be repaired at some convenient time.

As a rule, such relays are protected with a cover, and auxiliary fastenings are provided to hold the unit in place, rather than depending upon the plugs or tube base pins alone.

35. Shielding on Bakelite ★ Among the very interesting new processes that are coming into use is that of depositing copper shielding on molded Bakelite parts electrically.

That is, a case or cover molded of Bakelite can be made to serve as an electrical shield. Some very elaborate molded parts are handled in this way, since the mechanical design can be simplified greatly by not having to fabricate and mount a separate metal shield.

This process handled by the Metaplast Corporation, to which the molded parts are sent for plating.

36. Color-Coded Wiring ★ Although the RMA set up standards for color-coding of radio wiring, the code was seldom used for either civilian or military equipment.

Now, however, with so many men and women doing radio service work with only the background of a few months' training, it seems likely that color-coded wiring will come into general use. It is a great help in speeding up service, and in making it easier to trace the wires, to identify socket connections, and to follow out the wiring on a set from the diagram.

Either extruded phenolic tubing in various colors or colored woven insulation and tracers are being used for this purpose.

Marking Components ★ The plan of marking the chassis and mounting boards with identifying numbers for the components is being carried out more thoroughly now than in the past. The purpose is to help identify parts on the equipment with those in the wiring diagram, and also to eliminate the mistake of putting on the wrong replacement part if the original is mislaid after it has been removed. Where space is limited, numbers are now put directly under the part.

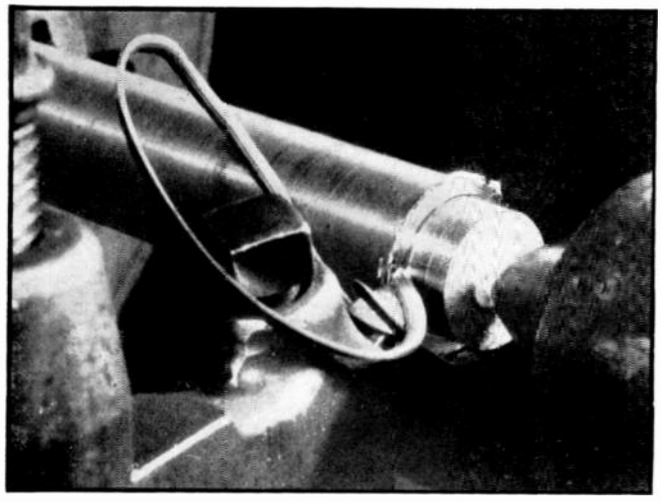


FIG. 1. NOTE BURRED EDGES ON ROUGH TURNING OPERATION PERFORMED ON A BAR OF REGULAR INVAR STEEL

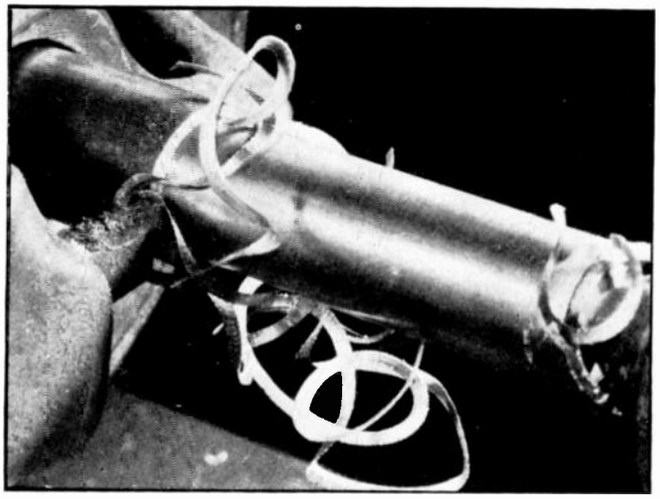


FIG. 2. SAME OPERATION ON NEW FREE-MACHINING INVAR PRODUCES CLEAN SURFACE DUE TO IMPROVED CHARACTERISTICS

NEW FREE-MACHINING INVAR

Low Coefficient of Expansion Is Retained in New Alloy Which Can Be Machined Readily

BY FRANK R. PALMER * AND G. V. LUERSSEN **

INVAR steel is a highly useful material for a variety of radio components because of its extremely low coefficient of expansion. It has particular application to aircraft radio equipment in such parts as air condensers, the capacity of which is subject to change in ambient temperatures ranging from −50° to +140° F. However, the difficulty of machining this material, due to its toughness and destructive effect on cutting tools, has been a great drawback to its wide use.

Now, with the introduction of a new alloy known as Carpenter Free-Cut Invar "36," that characteristic disadvantage has been overcome, and the advantages of Invar will probably find much wider application in the design of radio-electronic equipment.

Invar has a coefficient of expansion of .000001 per degree C., which is approximately one-tenth that of steel. This improvement comes from the use of 36% nickel alloy. Anyone familiar with the difficult machining properties of 18–8 stainless steel will have an idea of the troubles encountered with regular Invar bar stock. Actually, straight 18–8 is easier to machine than regular Invar, although the stainless work-hardens while Invar does not.

The addition of selenium to the alloy is responsible for the improved characteristics of free-machining Invar. Without affecting the metal's low coefficient of expansion, the machining time has been reduced as much as 72%.

Just what this means in a practical way is shown in the accompanying illustrations, and is summarized in the table comparing results on regular and free-machining alloys. In these tests, standard high-speed cutting tools were used, ground with standard angles such as are used in run-of-mine shop work.

Smoother, faster cutting, with greatly increased tool life on both drilling and turning operations, were obtained with the new alloy. This opens the way to the application of free-machining Invar to radio and electronic devices and components produced in large quantities, instead of limiting it, as in the past, to a few, very special instruments.

To be sure, wartime restrictions on the use of nickel may limit the use of the new Invar alloy on some of the potential applications. On the other hand, there are numerous instances where the advantages to be obtained will amply justify its use.

FIG. 5, RIGHT: THIS DRILL WAS BADLY BURNED WHEN IT HAD PENETRATED 1-$^{1}/_{16}$ IN. OF REGULAR INVAR

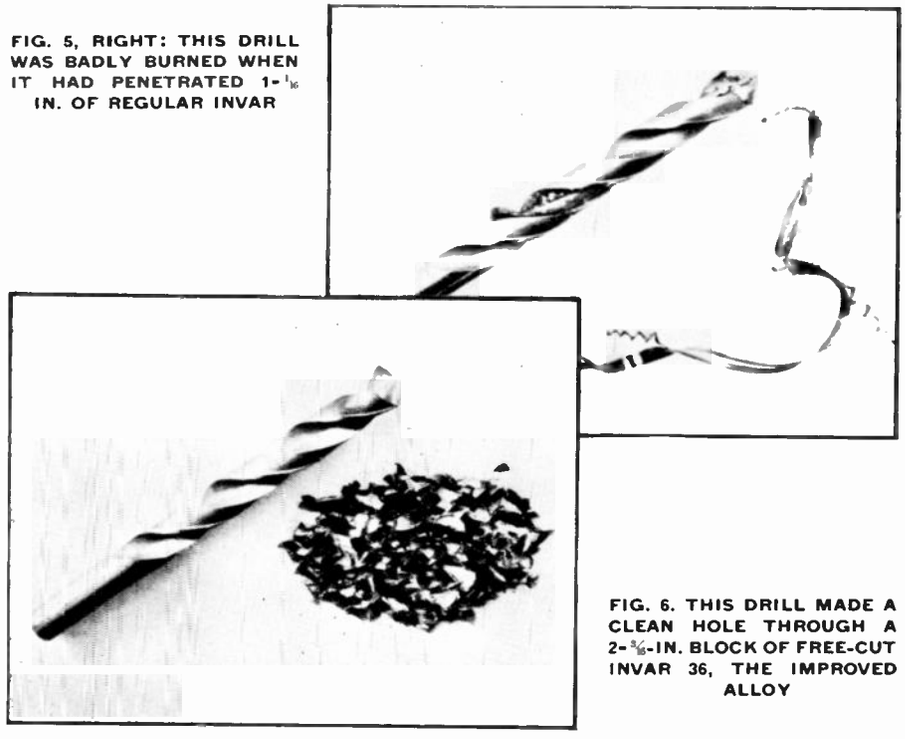


FIG. 6. THIS DRILL MADE A CLEAN HOLE THROUGH A 2-$^{3}/_{16}$-IN. BLOCK OF FREE-CUT INVAR 36, THE IMPROVED ALLOY

* Vice president, Carpenter Steel Co., Reading, Pa.
** Metallurgist, Carpenter Steel Co., Reading, Pa.

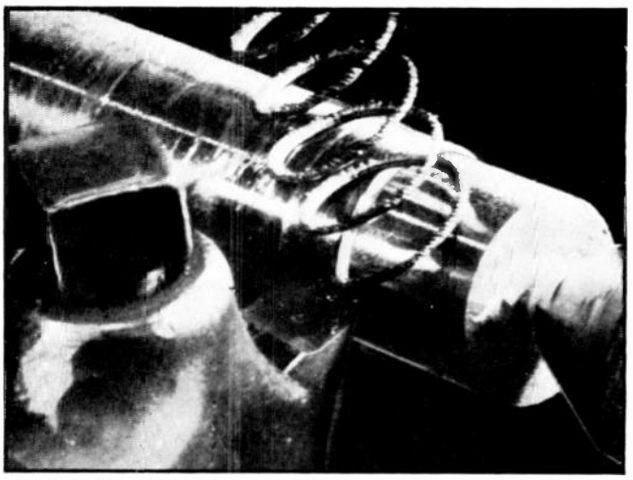


FIG. 4. NOTE THE COARSE CHIP FROM A FINISHING CUT ON THE BAR OF REGULAR INVAR. THIS IS THE SAME BAR AS IN FIG. 1

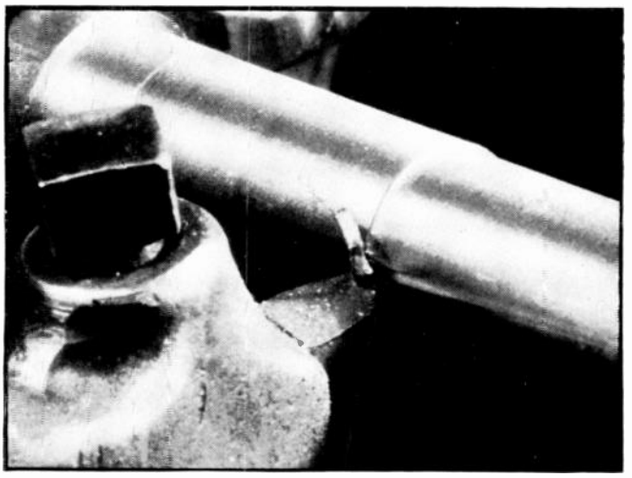


FIG. 5. SIMILARLY, THIS ILLUSTRATION SHOWS THE SMOOTHER FINISHING CUT TAKE ON THE FREE MACHINING INVAR BAR

	REGULAR INVAR		CARPENTER FREE-CUT INVAR "36"	
OPERATION	SPEED	REMARKS	SPEED	REMARKS
ROUGHING Bar 1 in. round Cut: $\frac{1}{32}$ in. Feed: .0055 in.	28.80 sur. ft. min.	Machining satisfactory.		
	49.22 sur. ft. min.	Tool failed after cutting about 1 in. along bar.		
	82.47 sur. ft. min.	Tool failed after only a few revolutions.	82.47 sur. ft. min.	Machining satisfactory. No effect on tool.
			137.45 sur. ft. min.	Top speed for the lathe used. No indication of failure. At this speed feed was increased from .0055 in. to .0125 in. with results still satisfactory.
FINISHING Cut: .050 in. Feed: .0055 in.	23.40 sur. ft. min.	Indications were that this speed provided the best possible finish.	111.67 sur. ft. min.	This speed gave a very good finish. With feed increased to .0125 in. the finish was still good.
	NOTE: This test made to determine highest speed possible for satisfactory finish.			
DRILLING $\frac{7}{16}$ in. round high speed drills. Test block 2 $\frac{3}{16}$ in. thick. Feed: .004 in. per revolution.	665 RPM	Drill failed completely when hole was only 1 $\frac{1}{16}$ in. deep.	665 RPM	Drill went through entire 2 $\frac{3}{16}$ in. test block with ease. After test, drill still in good condition.
THREADING Single point tool. Ten threads per inch. Two roughing cuts at .04 in. Two finish cuts at .004 in.	60 RPM	Two rough cuts resulted in torn threads. Two finish cuts failed to provide satisfactory threads.	188 RPM	Same number of rough and finish cuts made. Threads greatly superior to those on regular Invar sample.
	NOTE: This test made to determine highest speed for best possible threads.			

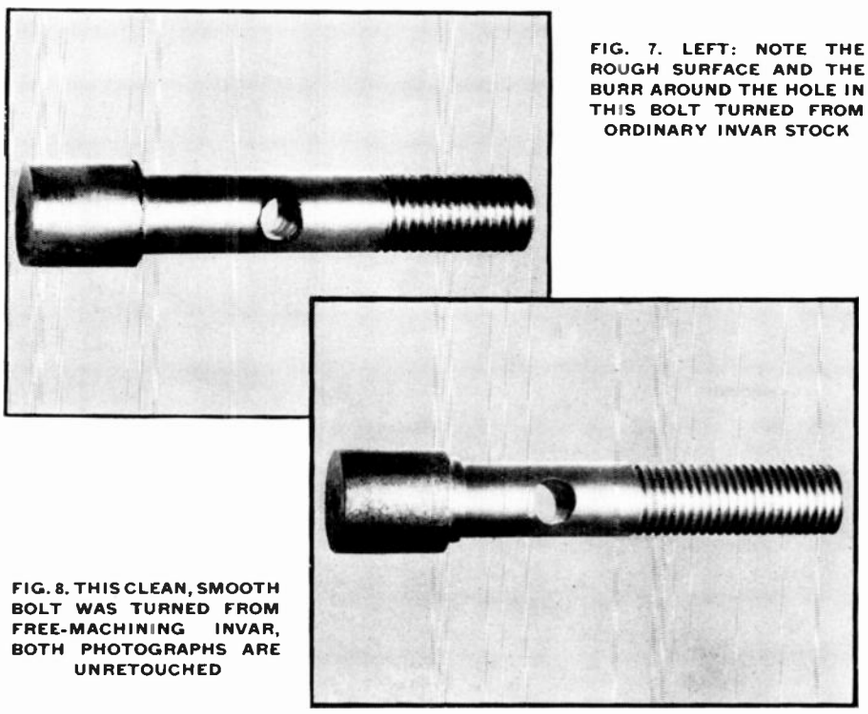


FIG. 7. LEFT: NOTE THE ROUGH SURFACE AND THE BURR AROUND THE HOLE IN THIS BOLT TURNED FROM ORDINARY INVAR STOCK

FIG. 8. THIS CLEAN, SMOOTH BOLT WAS TURNED FROM FREE-MACHINING INVAR, BOTH PHOTOGRAPHS ARE UNRETOUCHED

despite the large nickel content of Invar.

Of still greater importance at this time is the substitution of the new alloy for such parts as are now being made of regular Invar. This will result in greater man-machine-hour output, with an improvement in the pieces which will reduce the number of rejections substantially.

A bulletin just issued by the WPB shows that increased production of Steatite has cut down the delivery of ceramic parts to a very large degree. This is due to new production facilities now in operation, and also to the fact that, owing to the slow deliveries on Steatite, many parts were redesigned so that they could be molded from phenolic materials. Some ceramic parts on which deliveries were lagging by eight months are now available in a matter of a few weeks.

ance of FM equipment used by our Armed

by a bomb today. It was wrecked so badly

take every effort of our Country to win." 17

SPOT NEWS NOTES

Items and comments, personal and otherwise, about manufacturing, broadcasting, communications, and television activities

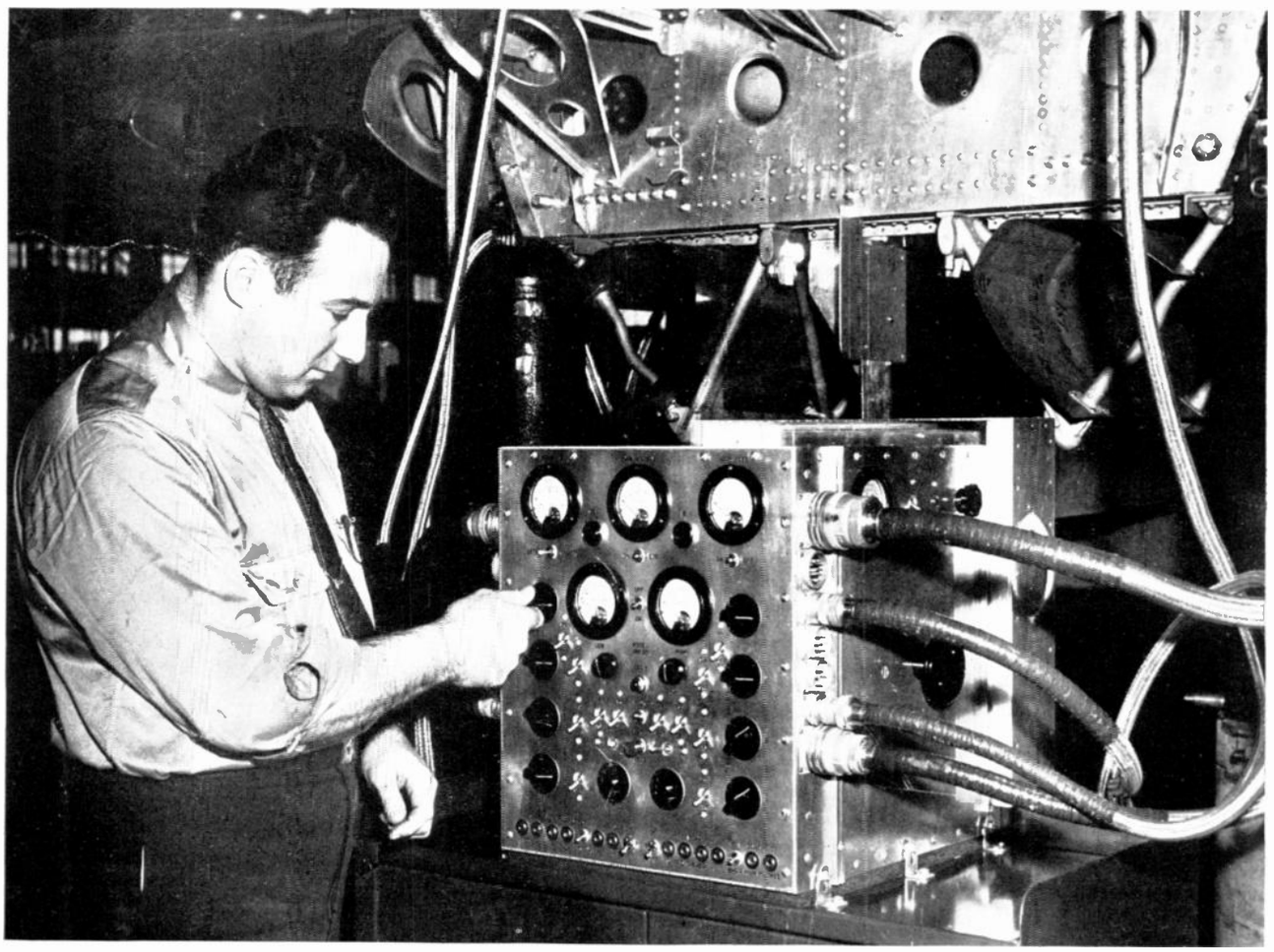


FIG. 1. THE AUTHOR WITH THE CIRCUIT ANALYZER CONNECTED TO THE CABLES OF A REPUBLIC P-47 THUNDERBOLT

ANALYZER FOR AIRCRAFT CIRCUITS

"Betsy" Makes Complete Tests in 30 Minutes, Replacing Less Accurate Point-to-Point Method Requiring 10 Hours

BY JAMES KUFFLER *

THE P-47 Thunderbolt fighter carries electrical, radio, and electronic equipment of amazing complexity. In fact, the average radio engineer might wonder how the pilot of a single-seater ship could keep track of so much apparatus and at the same time fly what is the world's fastest plane.

So much equipment calls for a very elaborate system of cables for power supplies, controls, and interconnections, and all the wires terminate in separable connectors. It is necessary, therefore, to check the electrical installation on each plane with the utmost care and thoroughness, leaving nothing to chance. Such tests must prove out the correctness of the wiring, check the insulation, and disclose open, short, or high-resistance circuits.

When the first Thunderbolts started to come off the lines at Republic Aviation Corporation, we found that 8 to 10 hours were required for this work, even though it was done by highly skilled experts. It was out of the question to put less experienced men on such a job.

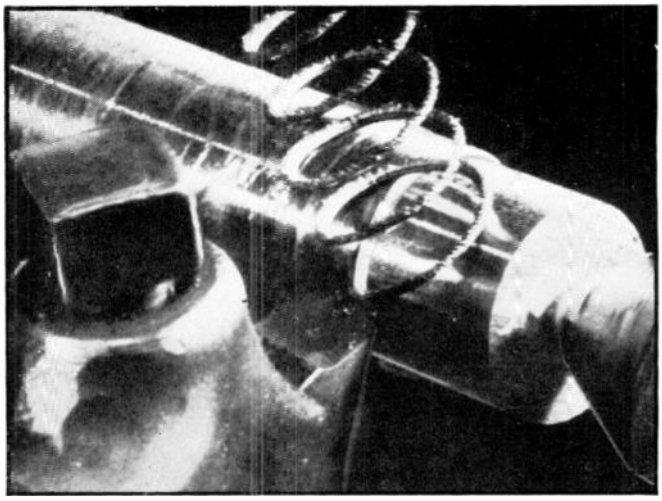
Still, using point-to-point methods, there was always a chance that the most careful and conscientious man might miss one circuit and that, as every engineer knows, would surely be the one that was defective.

Betsy ★ This was the situation which brought about the birth of "Betsy," the circuit analyzing equipment which has won such high regard at the Republic plant.

As the accompanying illustrations show, this analyzer is mounted on a steel cabinet which can be wheeled up to the plane under test. Within the cabinet are flexible extension cables which can be taken out and used to connect any cable plug on the ship to a corresponding socket on the ana-

(CONTINUED ON PAGE 22)

* Electrical Test Engineer, Republic Aviation Corp., Farmingdale, Long Island, N. Y.



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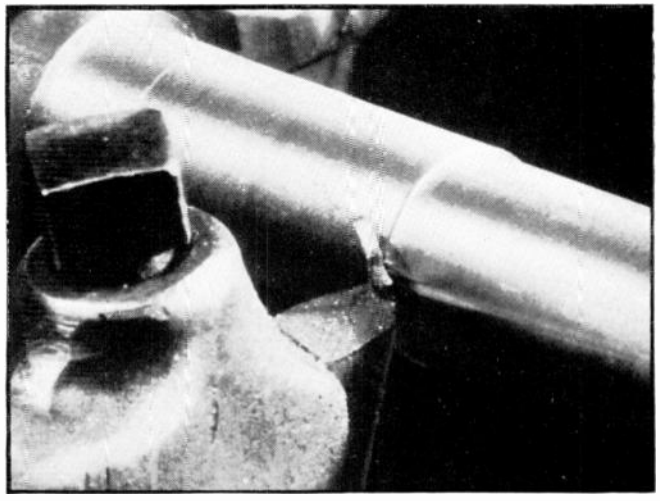

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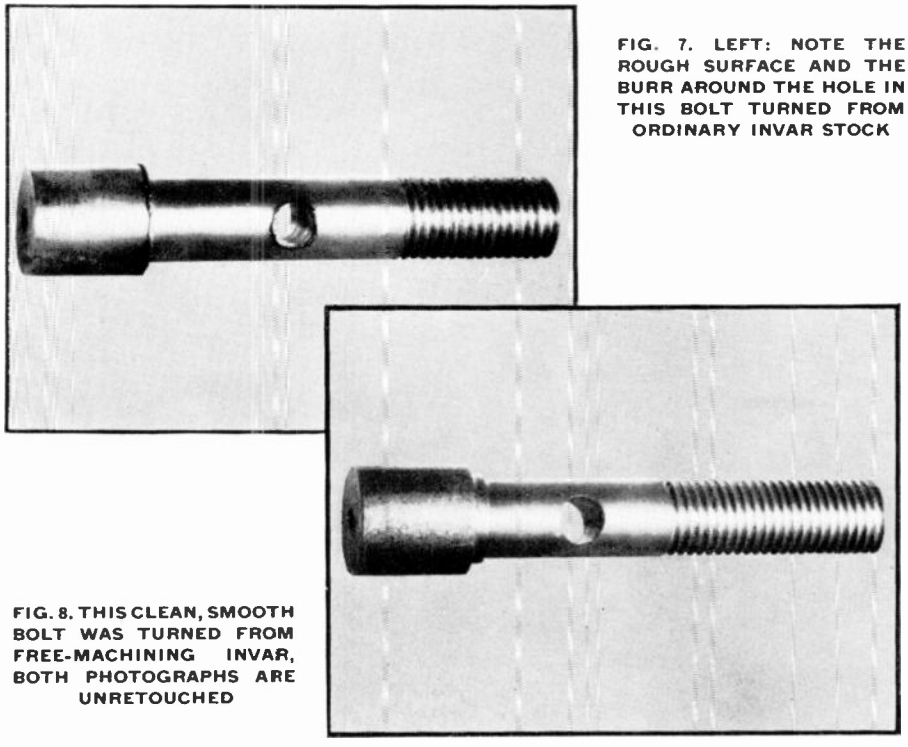

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SPOT NEWS NOTES

Items and comments, personal and otherwise, about manufacturing, broadcasting, communications, and television activities

JOAN BECKETT AT THE CONSOLE WHICH CONTROLS LIGHTS IN THE WGRB TELEVISION STUDIO AT SCHENECTADY, N. Y.

Wanted: The Technical Library of the Federal Communications Commission, at Washington, D. C., needs back copies of *FM* Magazine for November, 1940 and February, 1941, in order to complete their files. Since both single copies and the bound volumes containing those numbers are sold out completely, we hope that any reader who has duplicates of those two issues will come to the aid of the FCC's librarian.

Scrap for Ships: An idea of the importance of salvaging every bit of scrap steel in every radio manufacturing plant can be gained from the following table which shows how many tons of scrap steel are used in ships of various classes:

	Tons
31-ton Coast Guard Patrol Boat	15½
500-ton Submarine Chaser	250
530-ton Submarine	265
1,500-ton Destroyer	750
2,000-ton Gun Boat, Erie class	1,000
6,000-ton Mine Sweeper	3,000
7,500-ton Light Cruiser	3,750
10,000-ton Heavy Cruiser	5,000
20,000-ton Aircraft Carrier	10,000
35,000-ton Battleship	17,500

At the rate we are now building ships of all classes, it is easy to see why scrap salvage has become not merely important, but a vital war necessity.

Record Blank Standards: Fourteen points of standard practice for electrical transcriptions and broadcast recordings, adopted by the NAB, are set forth in a folder just released by Gould-Moody, manufacturers of recording blanks. The information is particularly useful right now when, in the interest of economy, the last inch of service must be obtained from every disc. Copies of the folder can be obtained by writing the Company at 395 Broadway, New York City.

Television: New movie "Sightseeing at Home" has been completed at General Electric's Schenectady television station WRGB. Actual transmission and reception are explained by animated diagrams, in a manner similar to that used so successfully in GE's film explanation of FM. The film is available to schools, colleges, churches, and men's service organizations through General Electric film distribution centers, or from the Visual Instruction Section at Schenectady, N. Y.

Pilot Lights: A wide variety of pilot light units of open and enclosed designs, as well as panel jewels and lamp brackets, are shown in a new catalog issued by Gothard Manufacturing Company, 1300 N. Nineteenth Street, Chicago. Plain or faceted jewels are available in red, green, amber, blue, opal, and clear glass. A 27-piece sample board can be obtained by laboratories and purchasing departments.

Army-Navy E: Presented to General Radio Company on February 16th by Capt. John J. Hyland, U. S. N., and Col. James H. Van Horn, U. S. A. Governor Leverett Saltonstall took part in the ceremony. Melville Eastham, General Radio's president and the least-photographed man among the leading figures of the industry, of whom the Editor hoped to get a picture, again eluded the camera man successfully.

Alva J. Carter: January 24th marked the passing of one of the industry's old-timers, known affectionately to his many friends as "Nick," president of Carter Motor Company, Chicago. Many of the first broadcast receivers were equipped with Carter plugs and jacks and other components. More recently, the Carter Motor Company was formed, specializing in dynamotors for mobile radio equipment and similar applications. Associated with A. J. Carter were R. W. Carter, vice president, E. J. Carter, secretary, and B. R. Carter, treasurer, by whom the affairs of the Company will be continued.

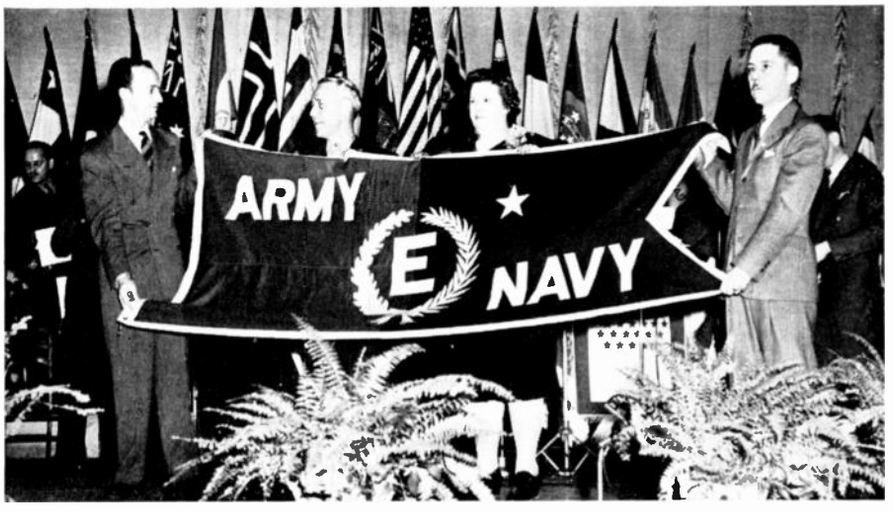
Name Changed: Emby Products Company, Inc., of Los Angeles, is now known as the Selenium Corporation of America. The change in name is to indicate the increased scope of the Company's activities. Products are instrument and relay rectifiers, photo-electric cells, and related scientific devices. Chief engineer is Eric Lidow.

New Plastics: BM-16034 is the number of a new molding plastic recently developed by Bakelite Corporation for long-flow extrusion work and transfer molding. Weight is 22.3 to 23 grams per cubic inch, power factor .05 at 1 mc., and dielectric constant is 6 at 1 mc. Molding shrinkage is .008 to .010 inch per inch. Material is for use up to 149° C.

BM-13017 has been developed for aircraft and automobile ignition parts, particularly for extrusion molding around inserts. Weight is 30.5 grams per cubic inch, molding shrinkage .002 to .0035 inch per inch, power factor .025 at 1 mc., and dielectric constant 5 at 1 mc. This material is for use up to 149° C.

New RMA Members: Recent additions to the membership of the Radio Manufacturers Association are The Benwood Linze Co., St. Louis, Mo.; Boonton Radio Corp., Boonton, N. J.; Eitel-McCullough, Inc., San Bruno, Calif.; Haydu Bros., Plainfield, N. J.; Sperti, Inc., Cincinnati, Ohio;

(CONTINUED ON PAGE 35)



W. W. GARSTANG, V. P. OF ELECTRONIC LABORATORIES, INC., AND LIEUT. COMDR. RALPH BRENGLE, WITH REPRESENTATIVES OF ELECTRONIC'S EMPLOYEES, PHOTOGRAPHED DURING "E" CEREMONIES AT INDIANAPOLIS

NEWS PICTURE

FREQUENCY modulation transmitters and receivers are playing such a vital rôle in military communications that exact information concerning the performance of FM equipment used by our Armed Forces is not being released for publication.

However, news has come from Africa that FM tank installations are operating over a distance of 200 miles.

The ability of FM equipment to take punishing treatment was confirmed in a letter from Col. G. A. Williams to Fred M. Link. He wrote: "We had a vehicle hit by a bomb today. It was wrecked so badly that it cannot be repaired, but the radio still worked."

Col. Williams' letter, written from a French farmhouse in Medjez-el-Bab, contained the comment: "The Germans are wonderfully equipped and magnificently led, and don't let anyone tell you this is not going to be a long, hard war that will take every effort of our Country to win."

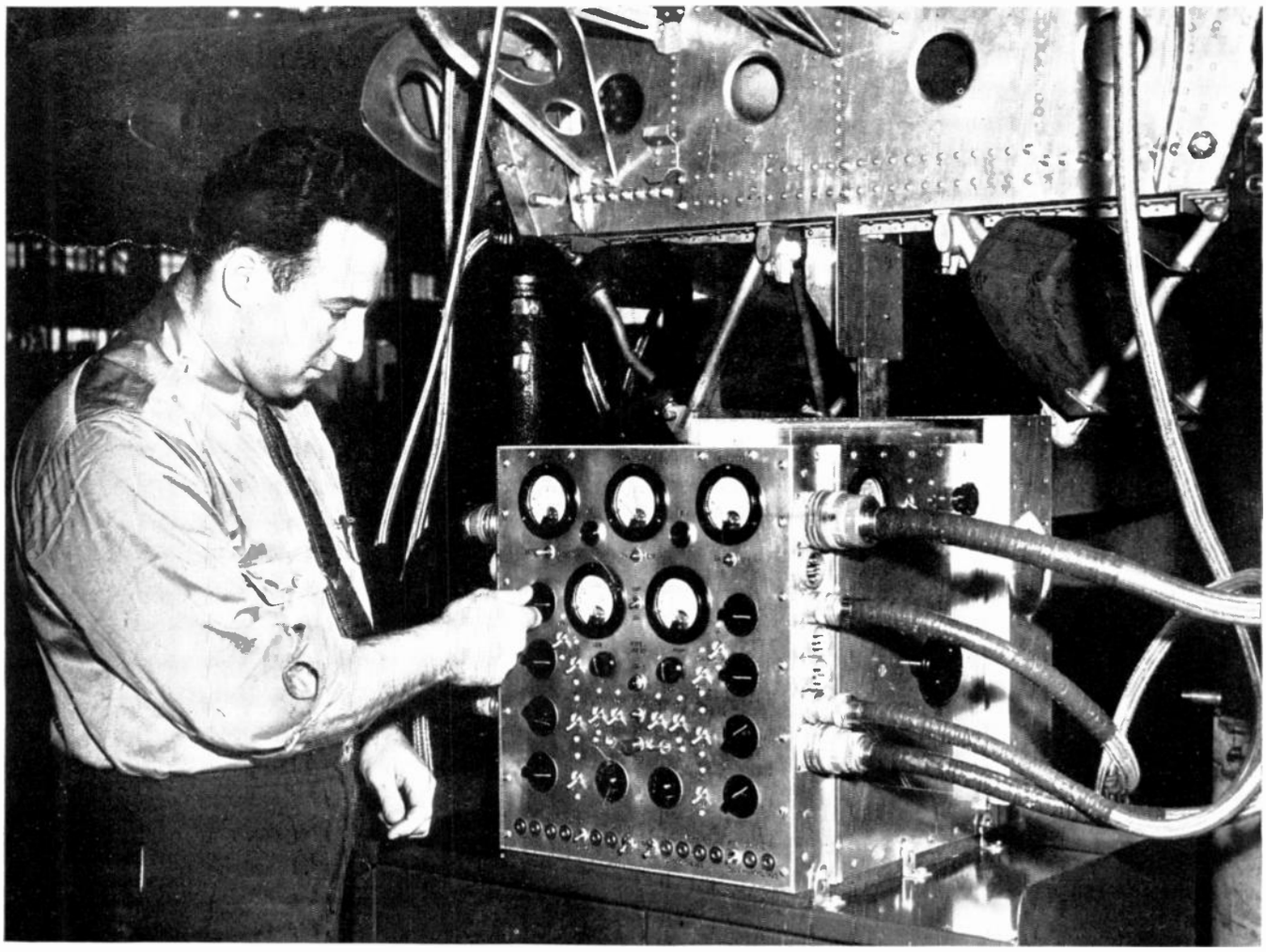


FIG. 1. THE AUTHOR WITH THE CIRCUIT ANALYZER CONNECTED TO THE CABLES OF A REPUBLIC P-47 THUNDERBOLT

ANALYZER FOR AIRCRAFT CIRCUITS

"Betsy" Makes Complete Tests in 30 Minutes, Replacing Less Accurate Point-to-Point Method Requiring 10 Hours

BY JAMES KUFFLER *

THE P-47 Thunderbolt fighter carries electrical, radio, and electronic equipment of amazing complexity. In fact, the average radio engineer might wonder how the pilot of a single-seater ship could keep track of so much apparatus and at the same time fly what is the world's fastest plane.

So much equipment calls for a very elaborate system of cables for power supplies, controls, and interconnections, and all the wires terminate in separable connectors. It is necessary, therefore, to check the electrical installation on each plane with the utmost care and thoroughness, leaving nothing to chance. Such tests must prove out the correctness of the wiring, check the insulation, and disclose open, short, or high-resistance circuits.

When the first Thunderbolts started to come off the lines at Republic Aviation Corporation, we found that 8 to 10 hours were required for this work, even though it was done by highly skilled experts. It was out of the question to put less experienced men on such a job.

Still, using point-to-point methods, there was always a chance that the most careful and conscientious man might miss one circuit and that, as every engineer knows, would surely be the one that was defective.

Betsy ★ This was the situation which brought about the birth of "Betsy," the circuit analyzing equipment which has won such high regard at the Republic plant.

As the accompanying illustrations show, this analyzer is mounted on a steel cabinet which can be wheeled up to the plane under test. Within the cabinet are flexible extension cables which can be taken out and used to connect any cable plug on the ship to a corresponding socket on the ana-

(CONTINUED ON PAGE 22)

* Electrical Test Engineer, Republic Aviation Corp., Farmingdale, Long Island, N. Y.

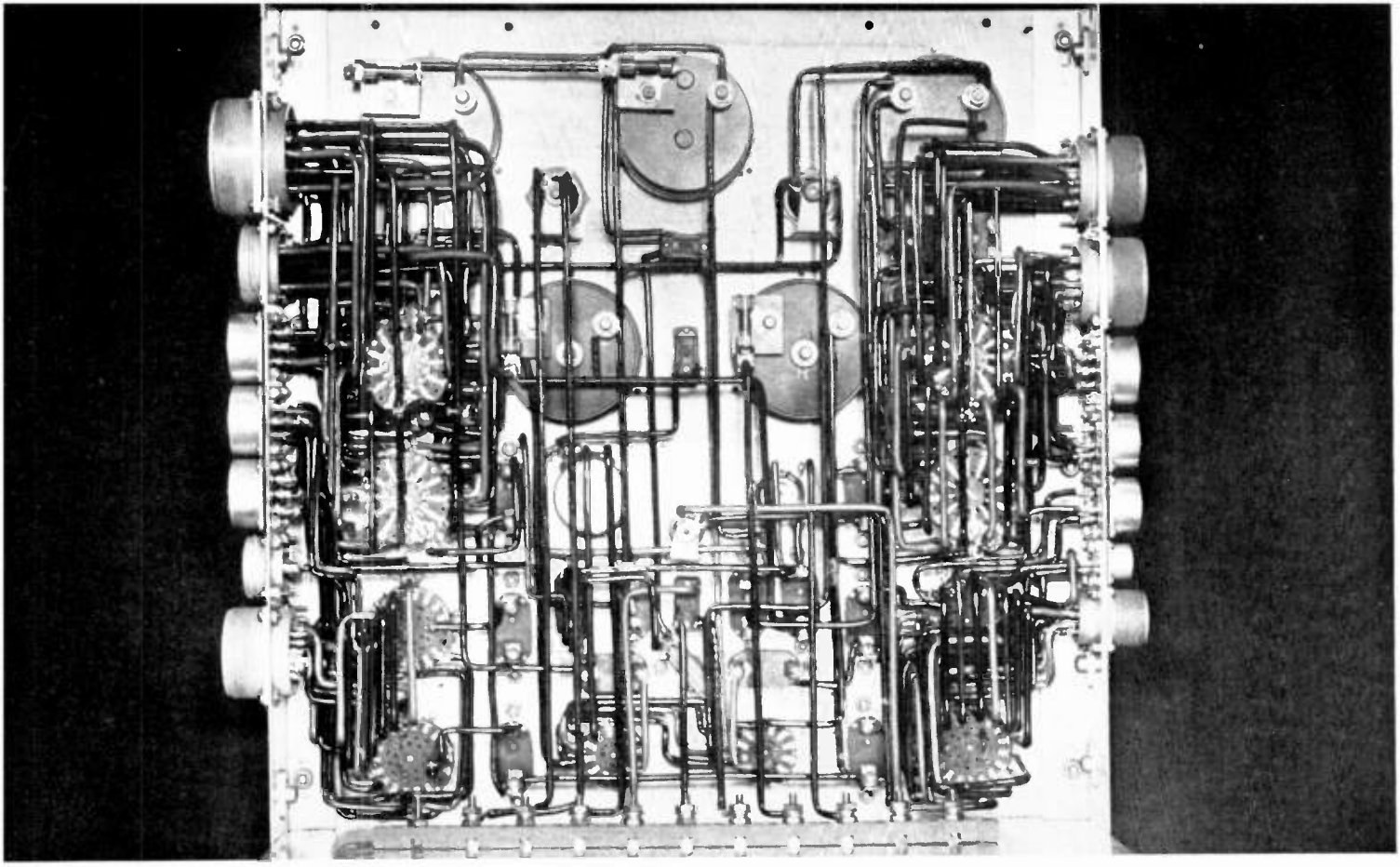
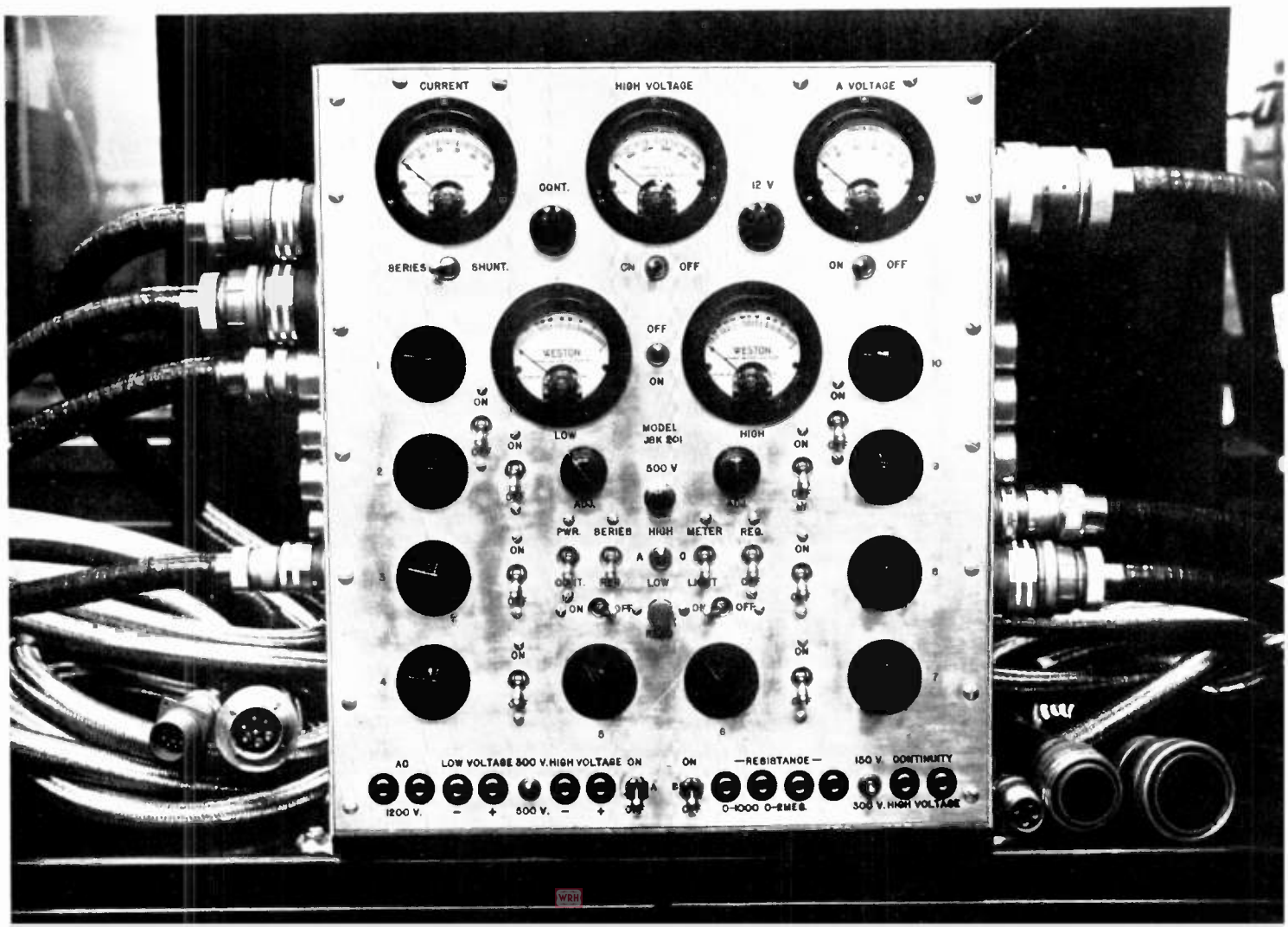


FIG. 2. THIS IS A VIEW OF THE WIRING CARRIED AT THE REAR OF THE FRONT PANELS. CONNECTIONS FROM THE SOCKETS TO THE ROTARY SWITCHES APPEAR VERY SIMPLE, CONSIDERING THE NUMBER OF CIRCUITS AND COMBINATIONS INVOLVED

FIG. 3. A CLOSE-UP OF THE FRONT PANEL, WITH THE EXTENSION CABLES PLUGGED. ROTARY SWITCHES HAVE DIALS NUMBERED FROM 1 TO 20, ALTHOUGH NUMBERS DO NOT SHOW IN THIS PHOTO. WOVEN CONDUIT PROTECTS CABLES FROM ABRASION



DO YOU KNOW? HOW THEY LIKE FM!

Independent survey shows that 91% of FM radio set owners would recommend them to their friends!

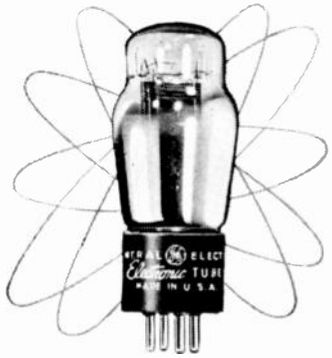
Americans want FM radio. *Facts* show that FM has what it takes to win public acceptance. An independent, doorbell-ringing consumer survey of hundreds of FM set owners proved this beyond any doubt. Overwhelmingly, FM set owners like FM's better tone quality, its virtual freedom from static, its breath-taking "background of silence"!

For example: That FM reception is better than regular broadcast reception is the conviction of 85% of FM set owners. And more than half of these classified it as a "great improvement"! Some 79% of FM owners expressed full satisfaction with their FM reception quality. And 91% would recommend it to their friends!

Today there are 600,000 FM receivers in use. A good record, considering that from the start the production of FM transmitters and receivers was handicapped by the demands of war production.

These *facts* about FM indicate a trend which EVERY BROADCASTER should watch. We believe that the growth of FM will be rapid throughout the United States after the war, replacing many of the present local, regional and possibly a few of the high-power stations. Thus a twofold benefit can be expected — *FM* plus better AM reception as a result of fewer and possibly more powerful AM stations on clearer channels.

For more detailed information on the FM survey, write for the booklet, "What the Consumer Thinks of FM," to Radio, Television, & Electronics Department, General Electric Company, Schenectady, N. Y.



FM Broadcast Apparatus • FM Broadcasting • FM Receivers • FM Military Radio • FM Police Radio

NO OTHER MANUFACTURER OFFERS SO MUCH FM EXPERIENCE

GENERAL ELECTRIC

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FM

lyzer. Then, by means of controls on the panel, each individual wire can be checked, or the load conditions can be duplicated and measurements made under simulated in-flight conditions.

Fig. 1 shows how Betsy is set up for actual operation. There are sockets at the left and right of the front panel, corresponding to the plugs on the ship's cables. The cables running to the analyzer are the extension lengths or "flexes," as we call them.

A two-way telephone system, stored in the cabinet when it is not in use, serves the important purpose of enabling the man in the cockpit to talk directly to the operator of the test equipment. This helps greatly to speed up the work because it is impossible to shout back and forth against the steady roar of factory noise.

The use of Betsy is not limited to final inspection. Since in-flight conditions can be set up on any circuits plugged in from the plane, tests and checks can be made at any stage during the installation of the radio and electrical equipment.

Cable Circuits ★ Connections to individual wires in the cables, for metering and test purposes, are made by means of the rotary switches along both sides and the bottom of the panel. The chart which is used with the analyzer shows what terminal of which connector is connected at each point of the switches. The switches operate in pairs, so that positive or negative connection can be made to any cable wire.

Meters at the top of the panel measure DC current, high voltage, and low voltage. The two meters below read low and high resistance directly in ohms and megohms, respectively. Toggle switches permit the meters to be cut in or out.

Along the bottom are connections for taking of voltages from the power supplies, and for leads through which connections can be made to the meters on the panel. The latter make it possible to take special measurements on circuits other than those brought in through the cables.

Thus, by means of the circuits which can be set up and connected selectively to the wires in the different cables, the voltage and current can be measured in any circuit, as well as the resistance of any circuit or of any wire to ground. If the meters are reversed when the desired wire is selected on one of the paired switches, the opposite polarity can be obtained by selecting the wire on the other switch.

Fig. 2 shows the wiring of the various switches and controls at the back of the panel. As the connections have been worked out, practically any test or combinations of tests can be made on the wiring of the plane.

Routine Tests ★ In practice, the wiring of the entire ship was first broken up into the individual cable circuits, so as to give a complete picture of the tests which would be required.

Then, after several proof-tests had been conducted to determine upon a standard procedure, a chart was prepared. With this chart, the operator only needs to read the settings of the controls and the corresponding values which will show on the meters if there is nothing wrong.

In case there is a change or alteration in the wiring, it is only necessary to note the difference on the analyzer, and modify the test chart accordingly. Only in the event that a cable connector is changed would it be necessary to make any revision in the analyzer itself.

Power Supplies ★ The main power supply of the analyzer operates from a 60-cycle line. A special transformer, built by United Transformer Company, provides constant output with a variation in primary voltage from 90 to 115 volts.

Direct current of 50 volts at 50 amperes is furnished from two General Electric argon gas rectifiers. These can be seen in Figs. 4 and 5. These illustrations also show the special balancing resistor used to compensate for the unequal internal resistance of the tubes. This resistor, made by Ohmite Manufacturing Company, looks like a cross section of corrugated paper wound around a tube. Voltage is fed through the regulator and filtered with a capacity of 15,000 mfd. This removes the alternating current ripple completely.

On the right hand side of the analyzer case is a hand wheel. This rotates the huge voltage regulator which can be seen at the left in Fig. 5. It is a special over-size Ohmite variable resistor, built for this equipment, to regulate the DC output from 0 to 50 volts at 50 amperes.

The power supply incorporates a most important feature. Obviously, if there is a short in any circuit, serious damage might be done to one or more wires in the cable, or to equipment on the plane. However, an arrangement is provided whereby, in case of a short, the voltage automatically drops to a point so low that no harm results. Unfortunately, details of the method cannot be disclosed at this time.

There is also a high-voltage power supply in this equipment, with selective output for making checks up to 600 volts DC at 400 milliamperes, and at 1,200 volts AC. These high voltages are used to test insulation and radio circuits after installation. Damage to insulation on the wires show up on these tests. Such faults sometimes occur on long or tight conduit pulls, but they might not cause trouble until later when the plane is in service. The high-voltage check, however, discloses them while the plane is still under construction.

Aside from the intended purpose of the analyzer, many special uses have been found for the different voltages which it makes available. In emergencies, we have used it in our experimental laboratory[1] to supply anodic and cadmium-plating tanks.

Mechanical Construction ★ Test equipment for use on the assembly floor of an airplane factory must, at best, take considerable punishment. Accordingly, we chose a heavy steel cabinet, mounted on rugged rubber-tired wheels, to hold the extension cables and to carry the analyzer. When the equipment is not in use, the panel is protected by a cover which slides down from the top on guides just behind the connectors. Thus the sockets are protected from dust and mechanical injury. During the tests, the cover is pulled up and slipped down on similar guides at the rear of the unit. Fig. 1 shows it in this position.

Checking Battle Damage ★ Another use for this type of equipment is for locating damage to the cable system which may occur in service.

It is an extremely difficult job to check the wiring if some part of a cable is shot away, and then to check the repair when it has been made, if this is done by the point-to-point method.

However, with Betsy on the job, any damage can be found in a matter of minutes and the repair can be checked just as quickly.

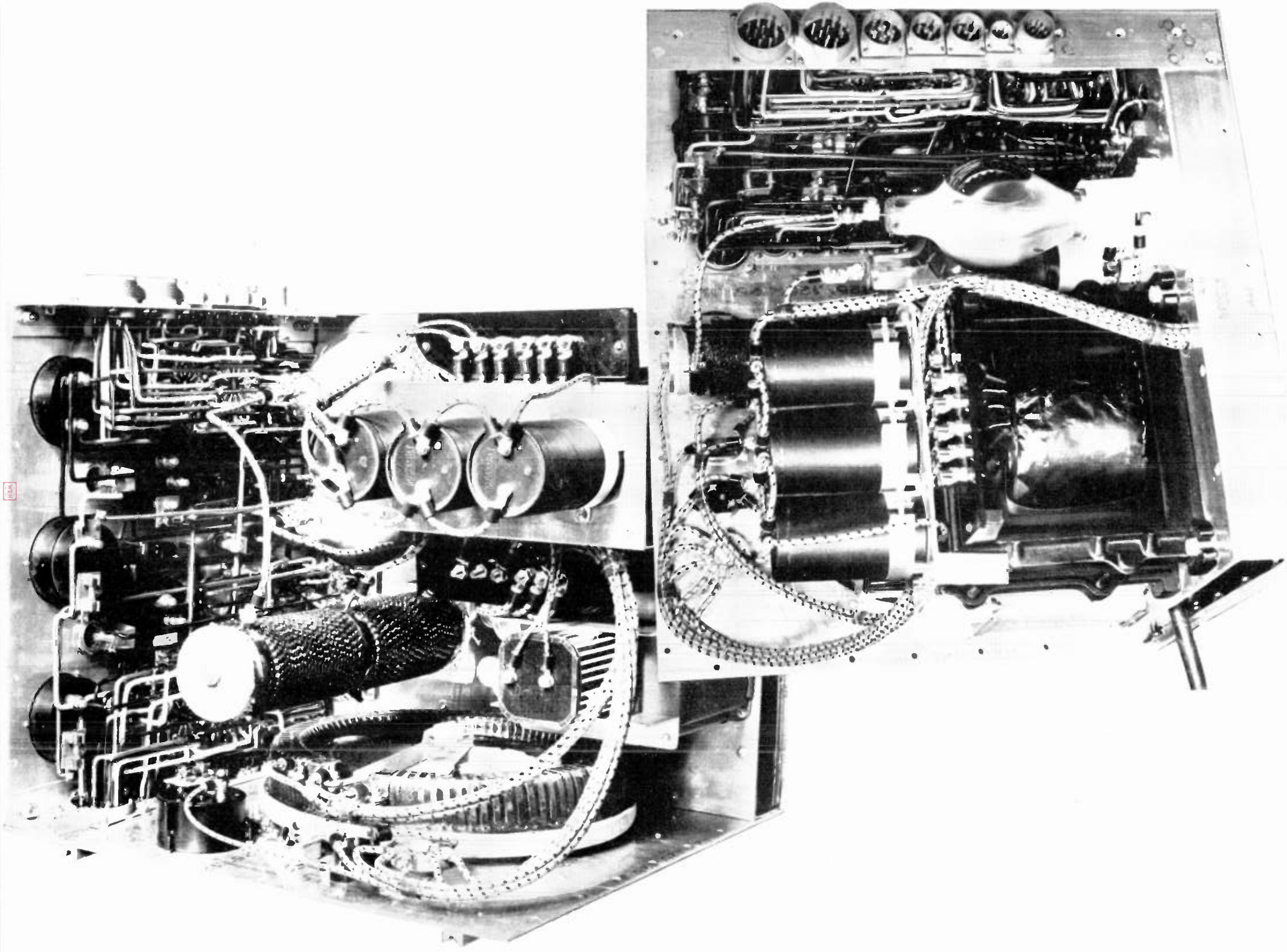
Special Note ★ Complete information on further details of this equipment will be made available by Republic Aviation Corporation to other aircraft manufacturers who may want to build similar units. However, this can only be done if arrangements are made for a company to send an engineer to the Republic plant. This will be understood in view of the prevailing conditions which make extensive engineering correspondence out of the question.

FIG. 4, OPPOSITE, ABOVE: Looking at the analyzer from the top, with the rear and side plates removed. In this view, the huge Ohmite variable resistor can be seen at the left. This is controlled by a handle on a shaft extending through the side plate. The large cylindrical resistor in the center of the base is used to compensate for unequal internal resistance of the rectifier tubes.

FIG. 5, OPPOSITE, BELOW: The argon gas rectifier can be seen in this view. Above the big power transformer are the Mallory condensers to the total capacity of 15,000 mfd. Side, rear, and top plates are made removable so that all parts of the equipment are accessible.

Radio engineers and designers will undoubtedly find a number of ideas in the design of "Betsy" which can be modified for use in testing and checking a great variety of radio equipment and installations. A modified analyzer, similarly constructed, would have many applications in factories where radio equipment is being produced.

[1] Pictures of this laboratory were published in the January, 1943 issue of Radio-Electronic Engineering.



MICA-DIELECTRIC CONDENSERS

PART 2—A.S.A. STANDARDS OF NOVEMBER 12, 1942

FULL-SIZE drawings of the various standard types of molded mica-dielectric condensers are given on these pages, together with listings of standard capacities and characteristics.

Part 1 gave the full details of standard specifications, and Part 3 will cover the different standardized types of molded and ceramic case potted condensers.

The three tables below are reprinted from Part 1 for ready reference. They show the 6-dot color code, of which the three upper dots give the three significant figures of capacity in mmf., with the decimal multiplier shown by the right hand lower dot. Capacity tolerance is indicated by the lower center dot, and the characteristic of Q, temperature coefficient, and drift, by the left hand lower dot.

SIX-DOT CONDENSER COLOR CODE

Cable No.	Color	Significant Figure	Decimal Multiplier	Tolerance	Characteristic
.....	Black	0	1		A
60113	Brown	1	10		B
60149	Red	2	100	2 per cent (G)	C
60041	Orange	3	1,000		D
60187	Yellow	4			E
60105	Green	5			F
60102	Blue	6			G
60010	Violet	7			
60034	Gray	8			
.....	White	9			
.....	Gold	..	0.1	5 per cent (J)	
.....	Silver	..	0.01	10 per cent (K)	
.....	Black	..		20 per cent (M)	

CAPACITY TOLERANCE-LOWER CENTER DOT

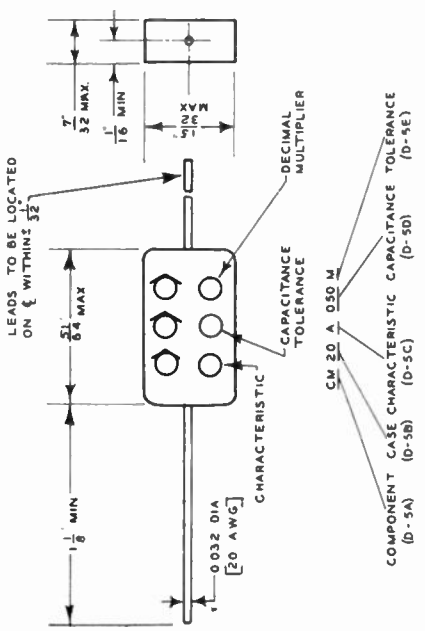
Designation letter	Tolerance
G	± 2 per cent
J	± 5 per cent
K	± 10 per cent
M	± 20 per cent

CHARACTERISTIC: LOWER LEFT HAND DOT

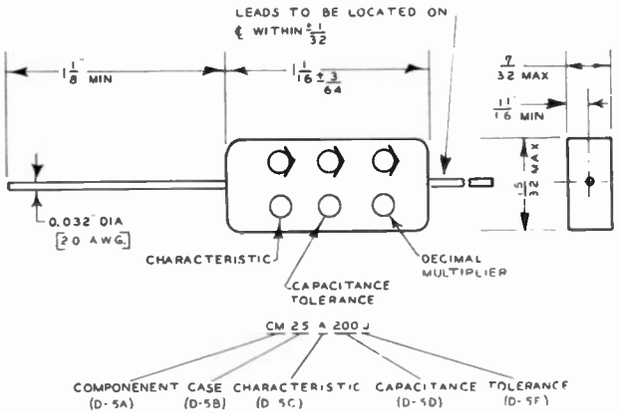
Characteristic	Q	Temperature Coefficient Parts/Million/deg. C	Maximum Capacitance Drift (F-6)
A	Not specified	Not specified	Not specified
B	[As specified	Not specified	Not specified
C	in D-5c (1)]	−200 to +200	0.5 per cent
D	"	−100 to +100	0.2 per cent
E	"	0 to +100	0.05 per cent
F	"	0 to + 50	0.025 per cent
G	"	0 to − 50	0.025 per cent

Type Designation †	Cap μμf	DC Wkg Vtge	Characteristics Available at ±2% (G)	±5% (J)	±10% (K)	±20% (M)	Capacity Color Code: Upper Left Dot	Upper Center Dot	Upper Right Dot	Lower Right Dot
CM20–330–	33	500		ABC	ABC	ABC	black	orange	orange	black
CM20–360–	36	500		ABC			black	orange	blue	black
CM20–390–	39	500		ABC	ABC		black	orange	white	black
CM20–430–	43	500		ABC			black	yellow	orange	black
CM20–470–	47	500		ABC	ABC	ABC	black	yellow	violet	black
CM20–510–	51	500	C	ABC			black	green	brown	black
CM20–560–	56	500		ABC	ABC		black	green	blue	black
CM20–620–	62	500	C	ABC			black	blue	red	black
CM20–680–	68	500	C	ABC	ABC	ABC	black	blue	gray	black
CM20–750–	75	500	C	ABC			black	violet	green	black
CM20–820–	82	500	C	ABC	ABC		black	gray	red	black
CM20–910–	91	500	C	ABC			black	white	brown	black
CM20–101–	100	500	C	ABC	ABC	ABC	black	brown	black	brown
CM20–111–	110	500	C	ABC			black	brown	brown	brown
CM20–121–	120	500	C	ABC	ABC		black	brown	red	brown
CM20–131–	130	500	C	ABC			black	brown	orange	brown
CM20–151–	150	500	C	ABC	ABC	ABC	black	brown	green	brown
CM20–161–	160	500	C	ABC			black	brown	blue	brown
CM20–181–	180	500	C	ABC	ABC		black	brown	gray	brown
CM20–201–	200	500	CD	ABCD			black	red	black	brown
CM20–221–	220	500	CD	ABCD	ABCD	ABCD	black	red	red	brown
CM20–241–	240	500	CD	ABCD			black	red	yellow	brown
CM20–271–	270	500	CD	ABCD	ABCD		black	red	violet	brown
CM20–301–	300	500	CD	ABCD			black	orange	black	brown
CM20–331–	330	500	CD	ABCD	ABCD	ABCD	black	orange	orange	brown
CM20–361–	360	500	CD	ABCD			black	orange	orange	brown
CM20–391–	390	500	CD	ABCD	ABCD		black	orange	blue	brown
CM20–431–	430	500	CD	ABCD			black	yellow	white	brown
CM20–471–	470	500	CD	ABCD	ABCD	ABCD	black	yellow	orange	brown
CM20–511–	510	500	CD	ABCD			black	green	violet	brown
							black	green	brown	brown

† Complete type designation will include additional letter symbols as shown in sketch.



Type Designation †	Cap μμf	DC Wkg Vtge	Characteristics Available at ±2% (G)	±5% (J)	±10% (K)	±20% (M)	Capacity Color Code: Upper Left Dot	Upper Center Dot	Upper Right Dot	Lower Right Dot
CM20–050–	5	500				AB	black	green	black	gold
CM20–100–	10	500			AB	AB	black	brown	black	black
CM20–120–	12	500			AB		black	brown	red	black
CM20–150–	15	500			AB	AB	black	brown	green	black
CM20–180–	18	500			AB		black	brown	gray	black
CM20–200–	20	500		ABC			black	red	black	black
CM20–220–	22	500		ABC	ABC	ABC	black	red	red	black
CM20–240–	24	500		ABC			black	red	yellow	black
CM20–270–	27	500		ABC	ABC		black	red	violet	black
CM20–300–	30	500		ABC			black	orange	black	black



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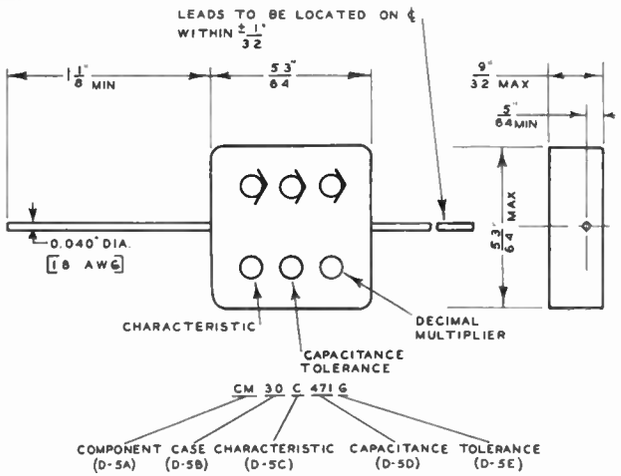
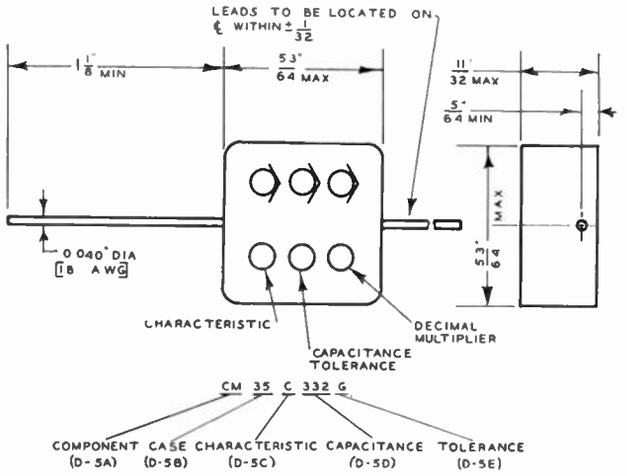
CM25–050–	5	500				AB	black	green	black	gold
CM25–100–	10	500			AB	AB	black	brown	black	black
CM25–120–	12	500			AB		black	brown	red	black
CM25–150–	15	500			AB	AB	black	brown	green	black
CM25–180–	18	500			AB		black	brown	gray	black
CM25–200–	20	500		AB			black	red	black	black
CM25–220–	22	500		AB	AB	AB	black	red	red	black
CM25–240–	24	500		AB			black	red	yellow	black
CM25–270–	27	500		AB	AB		black	red	violet	black
CM25–300–	30	500		AB			black	orange	black	black
CM25–330–	33	500		AB	AB	AB	black	orange	orange	black
CM25–360–	36	500		AB			black	orange	blue	black
CM25–390–	39	500		AB	AB		black	orange	white	black
CM25–430–	43	500		AB			black	yellow	orange	black
CM25–470–	47	500		AB	AB	AB	black	yellow	violet	black
CM25–510–	51	500	BDE	ABDE			black	green	brown	black
CM25–560–	56	500	BDE	ABDE	ABDE		black	green	blue	black
CM25–620–	62	500	BDE	ABDE			black	blue	red	black
CM25–680–	68	500	BDE	ABDE	ABDE	ABDE	black	blue	gray	black
CM25–750–	75	500	BDE	ABDE			black	violet	green	black
CM25–820–	82	500	BDE	ABDE	ABDE		black	gray	red	black
CM25–910–	91	500	BDE	ABDE			black	white	brown	black
CM25–101–	100	500	BDE	ABDE	ABDE	ABDE	black	brown	black	brown
CM25–111–	110	500	BDE	ABDE			black	brown	brown	brown
CM25–121–	120	500	BDE	ABDE	ABDE		black	brown	red	brown
CM25–131–	130	500	BDE	ABDE			black	brown	orange	brown
CM25–151–	150	500	BDE	ABDE	ABDE	ABDE	black	brown	green	brown
CM25–161–	160	500	BDE	ABDE			black	brown	blue	brown
CM25–181–	180	500	BDE	ABDE	ABDE		black	brown	gray	brown
CM25–201–	200	500	BDE	ABDE			black	red	black	brown
CM25–221–	220	500	BDE	ABDE	ABDE	ABDE	black	red	red	brown
CM25–241–	240	500	BDE	ABDE			black	red	yellow	brown
CM25–271–	270	500	BDE	ABDE	ABDE		black	red	violet	brown
CM25–301–	300	500	BDE	ABDE			black	orange	black	brown
CM25–331–	330	500	BDE	ABDE	ABDE	ABDE	black	orange	orange	brown
CM25–361–	360	500	BDE	ABDE			black	orange	blue	brown
CM25–391–	390	500	BDE	ABDE	ABDE		black	orange	white	brown
CM25–431–	430	500	BDE	ABDE			black	yellow	orange	brown
CM25–471–	470	500	BDE	ABDE	ABDE	ABDE	black	yellow	violet	brown
CM25–511–	510	500	BDE	ABDE			black	green	brown	brown
CM25–561–	560	500	BDE	ABDE	ABDE		black	green	blue	brown
CM25–621–	620	500	BDE	ABDE			black	blue	red	brown
CM25–681–	680	500	BDE	ABDE	ABDE	ABDE	black	blue	gray	brown
CM25–751–	750	500	BDE	ABDE			black	violet	green	brown
CM25–821–	820	500	BDE	ABDE	ABDE		black	gray	red	brown
CM25–911–	910	500	BDE	ABDE			black	white	brown	brown
CM25–102–	1000	500	BDE	ABDE	ABDE	ABDE	black	brown	black	red

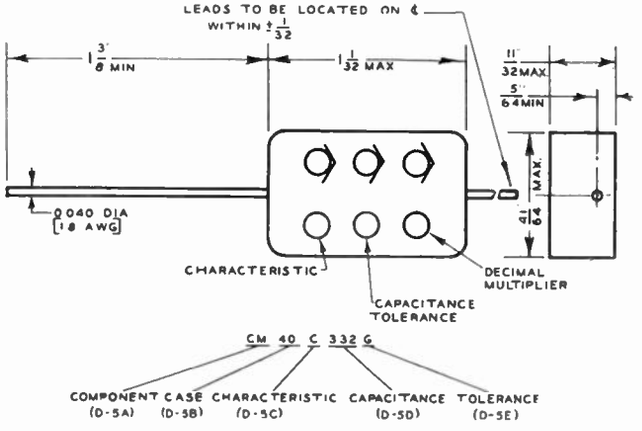


CM30–471–	470	500	CDE	ABCDE	ABCDE	ABCDE	black	yellow	violet	brown
CM30–511–	510	500	CDE	ABCDE			black	green	brown	brown
CM30–561–	560	500	CDE	ABCDE	ABCDE		black	green	blue	brown
CM30–621–	620	500	CDE	ABCDE			black	blue	red	brown
CM30–681–	680	500	CDE	ABCDE	ABCDE	ABCDE	black	blue	gray	brown
CM30–751–	750	500	CDE	ABCDE			black	violet	green	brown
CM30–821–	820	500	CDE	ABCDE	ABCDE		black	gray	red	brown
CM30–911–	910	500	CDE	ABCDE			black	white	brown	brown
CM30–102–	1000	500	CDE	ABCDE	ABCDE	ABCDE	black	brown	black	red
CM30–112–	1100	500	CDE	ABCDE			black	brown	brown	red
CM30–122–	1200	500	CDE	ABCDE	ABCDE		black	brown	red	red
CM30–132–	1300	500	CDE	ABCDE			black	brown	orange	red
CM30–152	1500	500	CDE	ABCDE	ABCDE	ABCDE	black	brown	green	red
CM30–162–	1600	500	CDE	ABCDE			black	brown	blue	red
CM30–182–	1800	500	CDE	ABCDE	ABCDE		black	brown	gray	red
CM30–202–	2000	500	CDE	ABCDE			black	red	black	red
CM30–222–	2200	500	CDE	ABCDE	ABCDE	ABCDE	black	red	red	red
CM30–242–	2400	500	CDE	ABCDE			black	red	yellow	red
CM30–272–	2700	500	CDE	ABCDE	ABCDE		black	red	violet	red
CM30–302–	3000	500	CDE	ABCDE			black	orange	black	red
CM30–332	3300	500	CDE	ABCDE	ABCDE	ABCDE	black	orange	orange	red

† Complete type designation will include additional letter symbols as shown in sketch.



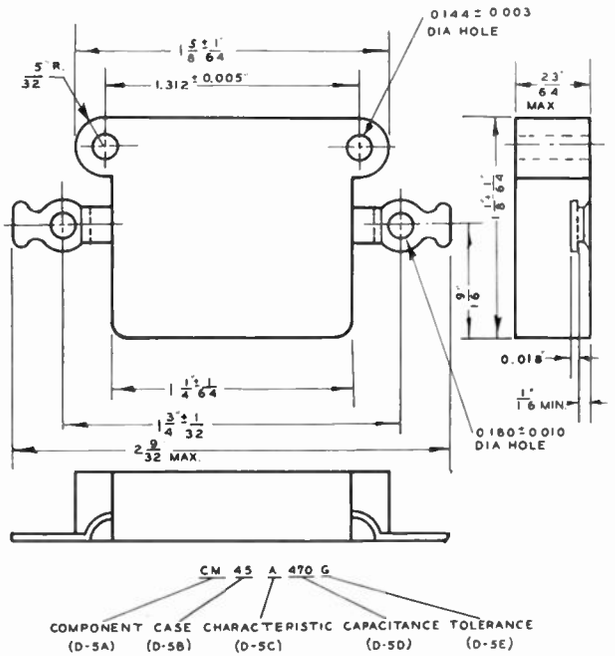
Type Designation †	Cap μμf	DC Wkg Vtge	Characteristics Available at ±2% (G)	±5% (J)	±10% (K)	±20% (M)	Capacity Color Code Upper Left Dot	Upper Center Dot	Upper Right Dot	Lower Right Dot
CM35–332–	3300	500	CDE	ABCDE	ABCDE	ABCDE	black	orange	orange	red
CM35–362–	3600	500	CDE	ABCDE			black	orange	blue	red
CM35–392–	3900	500	CDE	ABCDE	ABCDE		black	orange	white	red
CM35–432–	4300	500	CDE	ABCDE			black	yellow	red	red
CM35–472–	4700	500	CDE	ABCDE	ABCDE	ABCDE	black	yellow	violet	red
CM35–512–	5100	500	CDE	ABCDE			black	green	brown	red
CM35–562–	5600	500	CDE	ABCDE	ABCDE		black	green	blue	red
CM35–622–	6200	500	CDE	ABCDE			black	blue	red	red
CM35–682–	6800	300	CDE	ABCDE	ABCDE	ABCDE	black	blue	gray	red
CM35–752–	7500	300	CDE	ABCDE			black	violet	green	red
CM35–822–	8200	300	CDE	ABCDE	ABCDE		black	gray	red	red



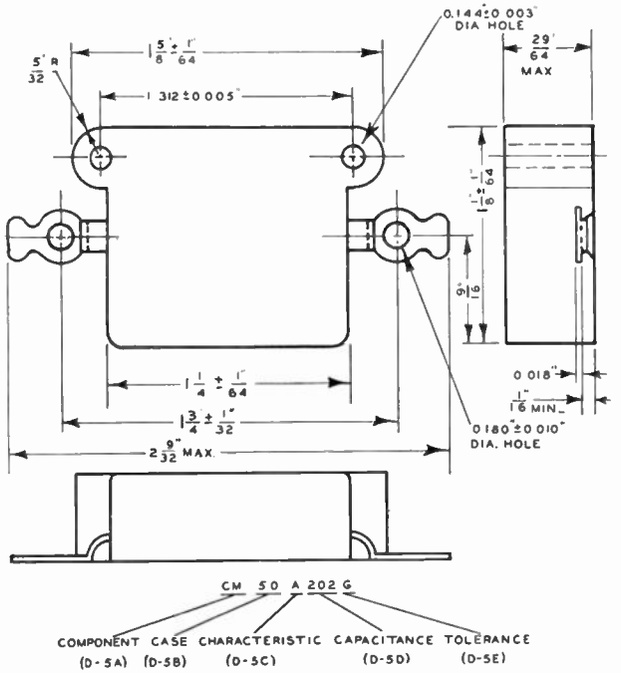
Type Designation †	Cap μμf	DC Wkg Vtge	Characteristics Available at ±2% (G)	±5% (J)	±10% (K)	±20% (M)
CM45–101–	100	2500	AB	AB	AB	AB
CM45–111–	110	2500	AB	AB		
CM45–121–	120	2500	AB	AB	AB	
CM45–131–	130	2500	AB	AB		
CM45–151–	150	2500	AB	AB	AB	AB
CM45–161–	160	2500	AB	AB		
CM45–181–	180	2500	AB	AB	AB	
CM45–201–	200	2500	AB	AB		
CM45–221–	220	2500	AB	AB	AB	AB
CM45–241–	240	2500	AB	AB		
CM45–271–	270	2500	AB	AB	AB	
CM45–301–	300	2500	AB	AB		
CM45–331–	330	2500	AB	AB	AB	AB
CM45–361–	360	2500	AB	AB		
CM45–391–	390	2500	AB	AB	AB	
CM45–431–	430	2500	AB	AB		
CM45–471–	470	2500	AB	AB	AB	AB
CM45–511–	510	2500	AB	AB		
CM45–561–	560	2500	AB	AB	AB	
CM45–621–	620	2500	AB	AB		
CM45–681–	680	2500	AB	AB	AB	AB
CM45–751–	750	2500	AB	AB		
CM45–821–	820	2500	AB	AB	AB	
CM45–911–	910	2500	AB	AB		
CM45–102–	1000	2500	AB	AB	AB	AB
CM45–112–	1100	2500	AB	AB		
CM45–122–	1200	2500	AB	AB	AB	
CM45–132–	1300	2500	AB	AB		
CM45–152–	1500	2500	AB	AB	AB	AB
CM45–162–	1600	2500	AB	AB		
CM45–182–	1800	2500	AB	AB	AB	
CM45–202–	2000	1200	AB	AB		
CM45–222–	2200	1200	AB	AB	AB	AB
CM45–242–	2400	1200	AB	AB		
CM45–272–	2700	1200	AB	AB	AB	
CM45–302–	3000	1200	AB	AB		
CM45–332–	3300	1200	AB	AB	AB	AB
CM45–362–	3600	1200	AB	AB		
CM45–392–	3900	600	AB	AB	AB	
CM45–432–	4300	600	AB	AB		
CM45–472–	4700	600	AB	AB	AB	AB
CM45–512–	5100	600	AB	AB		
CM45–562–	5600	600	AB	AB	AB	
CM45–622–	6200	600	AB	AB		
CM45–682–	6800	600	AB	AB	AB	AB
CM45–752–	7500	600	AB	AB		
CM45–822–	8200	600	AB	AB	AB	
CM45–912–	9100	600	AB	AB		
CM45–103–	10000	600	AB	AB	AB	AB

† Complete type designation will include additional letter symbols as shown in sketch.

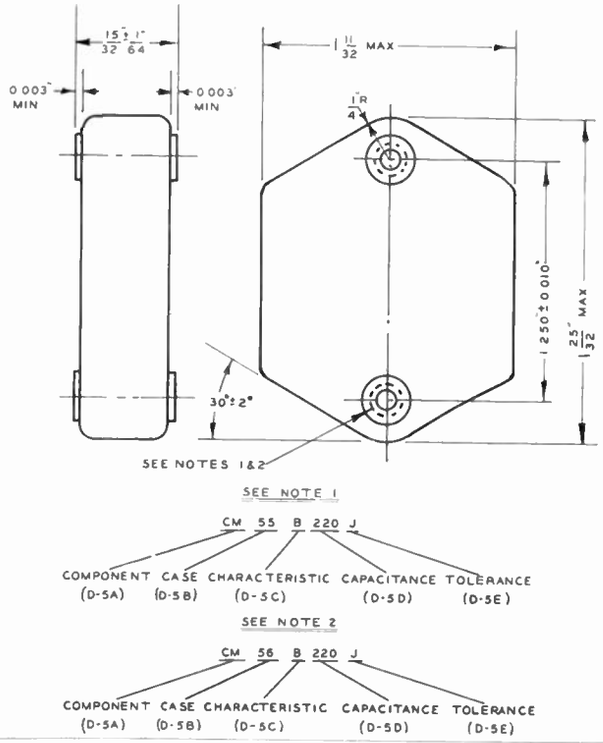
CM40-332-	3300	500	CDE	ABCDE	ABCDE	ABCDE	black	orange	orange	red
CM40-362-	3600	500	CDE	ABCDE			black	orange	blue	red
CM40-392-	3900	500	CDE	ABCDE	ABCDE		black	orange	white	red
CM40-432-	4300	500	CDE	ABCDE			black	yellow	orange	red
CM40-472-	4700	500	CDE	ABCDE	ABCDE	ABCDE	black	yellow	violet	red
CM40-512-	5100	500	CDE	ABCDE			black	green	brown	red
CM40-562-	5600	500	CDE	ABCDE	ABCDE		black	green	blue	red
CM40-622-	6200	500	CDE	ABCDE			black	blue	red	red
CM40-682-	6800	500	CDE	ABCDE	ABCDE	ABCDE	black	blue	gray	red
CM40-752-	7500	500	CDE	ABCDE			black	violet	green	red
CM40-822-	8200	500	CDE	ABCDE	ABCDE		black	gray	red	red
CM40-912-	9100	300	CDE	ABCDE			black	white	brown	red
CM40-103-	10000	300	CDE	ABCDE	ABCDE	ABCDE	black	brown	black	orange



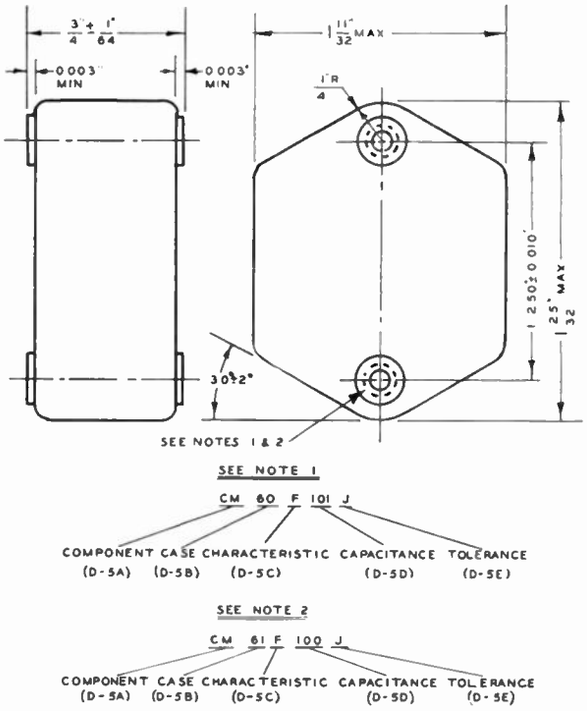
Type Designation†	Cap μμf	DC Wkg Vtge	Characteristics Available at ±2% (G)	±5% (J)	±10% (K)	±20% (M)
CM45-470-	47	2500	AB	AB	AB	AB
CM45-510-	51	2500	AB	AB		
CM45-560-	56	2500	AB	AB	AB	
CM45-620-	62	2500	AB	AB		
CM45-680-	68	2500	AB	AB	AB	AB
CM56-750-	75	2500	AB	AB		
CM45-820-	82	2500	AB	AB	AB	
CM45-910-	91	2500	AB	AB		



CM50-202-	2000	2500	AB	AB		
CM50-222-	2200	2500	AB	AB	AB	AB
CM50-242-	2400	2500	AB	AB		
CM50-272-	2700	2500	AB	AB	AB	
CM50-302-	3000	2500	AB	AB		
CM50-332-	3300	2500	AB	AB	AB	AB
CM50-362-	3600	2500	AB	AB		
CM50-392-	3900	2500	AB	AB	AB	
CM50-432-	4300	2500	AB	AB		
CM50-472-	4700	2500	AB	AB	AB	AB
CM50-512-	5100	2500	AB	AB		
CM50-562-	5600	1200	AB	AB	AB	
CM50-622-	6200	1200	AB	AB		
CM50-682-	6800	1200	AB	AB	AB	AB
CM50-752-	7500	1200	AB	AB		
CM50-822-	8200	1200	AB	AB	AB	
CM50-912-	9100	1200	AB	AB		
CM50-103-	10000	1200	AB	AB	AB	AB
CM50-113-	11000	1200	AB	AB		
CM50-123-	12000	600	AB	AB	AB	
CM50-133-	13000	600	AB	AB		
CM50-153-	15000	600	AB	AB	AB	AB
CM50-163-	16000	600	AB	AB		
CM50-183-	18000	600	AB	AB	AB	
CM50-203-	20000	600	AB	AB		
CM50-223-	22000	600	AB	AB	AB	AB
CM50-243-	24000	600	AB	AB		
CM50-273-	27000	600	AB	AB	AB	



Type Designation † (Note 1)	Type Designation † (Note 2)	Cap μμf	DC Wkg Vtge	Characteristics Available at ± 2% (G)	± 5% (J)	± 10% (K)	± 20% (M)
CM55–220–	CM56–220–	22	2500		B	B	B
CM55–240–	CM56–240–	24	2500		B		
CM55–270–	CM56–270–	27	2500		B	B	
CM55–300–	CM56–300–	30	2500		B		
CM55–330–	CM56–330–	33	2500		B	B	B
CM55–360–	CM56–360–	36	2500		B		
CM55–390–	CM56–390–	39	2500		B	B	
CM55–430–	CM56–430–	43	2500		B		
CM55–470–	CM56–470–	47	2500		B	B	B
CM55–510–	CM56–510–	51	2500	B	B		
CM55–560–	CM56–560–	56	2500	B	B	B	
CM55–620–	CM56–620–	62	2500	B	B		
CM55–680–	CM56–680–	68	2500	B	B	B	B
CM55–750–	CM56–750–	75	2500	B	B		
CM55–820–	CM56–820–	82	2500	B	B	B	
CM55–910–	CM56–910–	91	2500	B	B		
CM55–101–	CM56–101–	100	2500	BCD	BCD	BCD	BCD
CM55–111–	CM56–111–	110	2500	BCD	BCD		
CM55–121–	CM56–121–	120	2500	BCD	BCD	BCD	
CM55–131–	CM56–131–	130	2500	BCD	BCD		



Note 1: Types CM55 and CM60 have brass terminal inserts threaded 6–32

Note 2: Types CM56 and CM61 have brass terminal inserts drilled .144 in.

Type Designation † (Note 1)	Type Designation † (Note 2)	Cap μμf	DC Wkg Vtge	Characteristics Available at ± 2% (G)	± 5% (J)	± 10% (K)	± 20% (M)
CM60–101–	CM61–101–	100	2500	F	F	F	F
CM60–111–	CM61–111–	110	2500	F	F		
CM60–121–	CM61–121–	120	2500	F	F	F	
CM60–131–	CM61–131–	130	2500	F	F		
CM60–151–	CM61–151–	150	2500	F	F	F	F
CM60–161–	CM61–161–	160	2500	F	F		
CM60–181–	CM61–181–	180	2500	F	F	F	
CM60–201–	CM61–201–	200	2500	F	F		
CM60 221–	CM61–221–	220	2500	F	F	F	F
CM60–241–	CM61–241–	240	2500	F	F		

CM55-151-	CM56-151-	150	2500	BCD	BCD	BCD	BCD
CM55-161-	CM56-161-	160	2500	BCD	BCD		
CM55-181-	CM56-181-	180	2500	BCD	BCD	BCD	
CM55-201-	CM56-201-	200	2500	BCD	BCD		
CM55-221-	CM56-221-	220	2500	BCD	BCD	BCD	BCD
CM55-241-	CM56-241-	240	2500	BCD	BCD		
CM55-271-	CM56-271-	270	2500	BCD	BCD	BCD	
CM55-301-	CM56-301-	300	2500	BCD	BCD		
CM55-331-	CM56-331-	330	2500	BCDE	BCDE	BCDE	BCDE
CM55-361-	CM56-361-	360	2500	BCDE	BCDE		
CM55-391-	CM56-391-	390	2500	BCDE	BCDE	BCDE	
CM55-431-	CM56-431-	430	2500	BCDE	BCDE		
CM55-471-	CM56-471-	470	2500	BCDE	BCDE	BCDE	BCDE
CM55-511-	CM56-511-	510	2500	BCDE	BCDE		
CM55-561-	CM56-561-	560	2500	BCDE	BCDE	BCDE	
CM55-621-	CM56-621-	620	2500	BCDE	BCDE		
CM55-681-	CM56-681-	680	2500	BCDE	BCDE	BCDE	BCDE
CM75-751-	CM56-751-	750	2500	BCDE	BCDE		
CM55-821-	CM56-821-	820	2500	BCDE	BCDE	BCDE	
CM55-911-	CM56-911-	910	2500	BCDE	BCDE		
CM55-102-	CM56-102-	1000	2500	BCDE	BCDE	BCDE	BCDE
CM55-112-	CM56-112-	1100	2500	BCDE	BCDE		
CM55-122-	CM56-122-	1200	2500	BCDE	BCDE	BCDE	
CM55-132-	CM56-132-	1300	2500	BCDE	BCDE		
CM55-152-	CM56-152-	1500	2500	BCDE	BCDE	BCDE	BCDE
CM55-162-	CM56-162-	1600	2500	BCDE	BCDE		
CM55-182-	CM56-182-	1800	2500	BCDE	BCDE	BCDE	
CM55-202-	CM56-202-	2000	2500	BCDE	BCDE		
CM55-222-	CM56-222-	2200	2500	BCDE	BCDE	BCDE	BCDE
CM55-242-	CM56-242-	2400	2500	BCDE	BCDE		
CM55-272-	CM56-272-	2700	2500	BCDE	BCDE	BCDE	
CM55-302-	CM56-302-	3000	2500	BCDE	BCDE		
CM55-332-	CM56-332-	3300	2500	BCDE	BCDE	BCDE	BCDE
CM55-362-	CM56-362-	3600	2500	BCDE	BCDE		
CM55-392-	CM56-392-	3900	2500	BCDE	BCDE	BCDE	
CM55-432-	CM56-432-	4300	2500	BCDE	BCDE		
CM55-472-	CM56-472-	4700	1200	BCDE	BCDE	BCDE	BCDE
CM55-512-	CM56-512-	5100	1200	BCDE	BCDE		
CM55-562-	CM56-562-	5600	1200	BCDE	BCDE	BCDE	
CM55-622-	CM56-622-	6200	1200	BCDE	BCDE		
CM55-682-	CM56-682-	6800	1200	BCDE	BCDE	BCDE	BCDE
CM55-752-	CM56-752-	7500	1200	BCDE	BCDE		
CM55-822-	CM56-822-	8200	1200	BCDE	BCDE	BCDE	
CM55-912-	CM56-912-	9100	1200	BCDE	BCDE		
CM55-103-	CM56-103-	10000	1200	BCDE	BCDE	BCDE	BCDE
CM55-113-	CM56-113-	11000	1200	BCDE	BCDE		
CM55-123-	CM56-123-	12000	1200	BCDE	BCDE	BCDE	
CM55-133-	CM56-133-	13000	1200	BCDE	BCDE		
CM55-153-	CM56-153-	15000	600	BCDE	BCDE	BCDE	BCDE
CM55-163-	CM56-163-	16000	600	BCDE	BCDE		
CM55-183-	CM56-183-	18000	600	BCDE	BCDE	BCDE	
CM55-203-	CM56-203-	20000	600	BCDE	BCDE		
CM55-223-	CM56-223-	22000	600	BCDE	BCDE	BCDE	BCDE
CM55-243-	CM56-243-	24000	600	BCDE	BCDE		
CM55-273-	CM56-273-	27000	600	BCDE	BCDE	BCDE	
CM55-303-	CM56-303-	30000	600	BCDE	BCDE		
CM55-333-	CM56-333-	33000	600	BCDE	BCDE	BCDE	BCDE

CM60-271-	CM61-271-	270	2500	F	F	F	
CM60-301-	CM61-301-	300	2500	F	F		
CM60-331-	CM61-331-	330	2500	F	F	F	F
CM60-361-	CM61-361-	360	2500	F	F		
CM60-391-	CM61-391-	390	2500	F	F	F	
CM60-431-	CM61-431-	430	2500	F	F		
CM60-471-	CM61-471-	470	2500	F	F	F	F
CM60-511-	CM61-511-	510	2500	F	F		
CM60-561-	CM61-561-	560	2500	F	F	F	
CM60-621-	CM61-621-	620	2500	F	F		
CM60-681-	CM61-681-	680	2500	F	F	F	F
CM60-751-	CM61-751-	750	2500	F	F		
CM60-821-	CM61-821-	820	2500	F	F	F	
CM60-911-	CM61-911-	910	2500	F	F		
CM60-102-	CM61-102-	1000	2500	F	F	F	F
CM60-112-	CM61-112-	1100	2500	F	F		
CM60-122-	CM61-122-	1200	2500	F	F	F	
CM60-132-	CM61-132-	1300	2500	F	F		
CM60-152-	CM61-152-	1500	2500	F	F	F	F
CM60-162-	CM61-162-	1600	2500	F	F		
CM60-182-	CM61-182-	1800	2500	F	F	F	
CM60-202-	CM61-202-	2000	2500	F	F		
CM60-222-	CM61-222-	2200	2500	F	F	F	F
CM60-242-	CM61-242-	2400	2500	F	F		
CM60-272-	CM61-272-	2700	2500	F	F	F	
CM60-302-	CM61-302-	3000	2500	F	F		
CM60-332-	CM61-332-	3300	2500	F	F	F	F
CM60-362-	CM61-362-	3600	2500	F	F		
CM60-392-	CM61-392-	3900	2500	F	F	F	
CM60-432-	CM61-432-	4300	2500	F	F		
CM60-472-	CM61-472-	4700	2500	BCDEF	BCDEF	BCDEF	BCDEF
CM60-512-	CM61-512-	5100	2500	BCDEF	BCDEF		
CM60-562-	CM61-562-	5600	2500	BCDEF	BCDEF	BCDEF	
CM60-622-	CM61-622-	6200	2500	BCDEF	BCDEF		
CM60-682-	CM61-682-	6800	2500	BCDEF	BCDEF	BCDEF	BCDEF
CM60-752-	CM61-752-	7500	2500	BCDEF	BCDEF		
CM60-822-	CM61-822-	8200	2500	BCDEF	BCDEF	BCDEF	
CM60-912-	CM61-912-	9100	2500	BCDEF	BCDEF		
CM60-103-	CM61-103-	10000	2500	BCDEF	BCDEF	BCDEF	BCDEF
CM60-113-	CM61-113-	11000	2500	BCDEF	BCDEF		
CM60-123-	CM61-123-	12000	2500	BCDEF	BCDEF	BCDEF	
CM60-133-	CM61-133-	13000	2500	BCDEF	BCDEF		
CM60-153-	CM61-153-	15000	2500	BCDEF	BCDEF	BCDEF	BCDEF
CM60-163-	CM61-163-	16000	2500	BCDEF	BCDEF		
CM60-183-	CM61-183-	18000	1200	BCDEF	BCDEF	BCDEF	
CM60-203-	CM61-203-	20000	1200	BCDEF	BCDEF		
CM60-223-	CM61-223-	22000	1200	BCDEF	BCDEF	BCDEF	BCDEF
CM60-243-	CM61-243-	24000	1200	BCDE	BCDE		
CM60-273-	CM61-273-	27000	1200	BCDE	BCDE	BCDE	
CM60-303-	CM61-303-	30000	1200	BCDE	BCDE		
CM60-333-	CM61-333-	33000	1200	BCDE	BCDE	BCDE	BCDE
CM60-363-	CM61-363-	36000	600	BCDE	BCDE		
CM60-393-	CM61-393-	39000	600	BCDE	BCDE	BCDE	
CM60-433-	CM61-433-	43000	600	BCDE	BCDE		
CM60-473-	CM61-473-	47000	600	BCDE	BCDE	BCDE	BCDE

† Complete type designation will include additional letter symbols as shown in sketch.

RADIO-ELECTRONIC PRODUCTS DIRECTORY

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★ Link, F. M., 125 W. 17th St., N. Y. C.
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★ Radio Eng. Labs., Inc., L. I. City, N. Y.
★ Snyder Mfg. Co., Noble & Darien Sts., Phila.
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Chandler Prods. Corp., Cleveland, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Federal Screw Prod. Co., 224 W. Huron St., Chicago
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Lamson & Sessions Co., Cleveland, O.
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Parker-Kalon Corp., 198 Varick, N. Y. C.
Pawtucket Screw Co., Pawtucket, R. I.
Progressive Mfg. Co., Torrington, Conn.
Republic Steel Corp., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Shakeproof, Inc., 2501 N. Keeler, Chicago
Southington Hardware Mfg. Co., The, Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

BOOKS on Radio & Electronics

MacMillan Co., 60 Fifth Ave., N. Y. C.
McGraw-Hill Book Co., 330 W. 42 St., N. Y. C.
Radio Technical Pub. Co., 45 Astor Pl., N. Y. C.
Rider, John F., 404 Fourth Ave., N. Y. C.
Ronald Press Co., 15 E. 26 St., N. Y. C.
Van Nostrand Co., D., 250 Fourth Ave., N. Y. C.
Wiley & Sons, John, 440 Fourth Ave., N. Y. C.

CABLE, Coaxial

American Phenolic Corp., 1830 S. 54 Av., Chicago
Anaconda Wire & Cable Co., 25 B'way, N. Y. C.
Andrew Co., Victor J., 363 E. 75 St., Chicago
Belden Mfg. Co., 4673 W. Van Buren, Chicago
Boston Insulated Wire & Cable Co., Boston
Communications Prods. Co., Jersey City, N. J.
Cornish Wire Co., 15 Park Row, N. Y. C.
Doolittle Radio, Inc., 7521 S. Loomis Blvd., Chicago
General Cable Corp., 420 Lexington, N. Y. C.
General Insulated Wire Corp., 53 Park Pl., N. Y. C.
Johnson Co., E. F., Waseca, Minn.
Simplex Wire & Cable Corp., Cambridge, Mass.

CABLE, Coaxial, Solid Dielectric

American Phenolic Corp., 1830 S. 54 Ave., Chicago
Federal Tel. & Radio Corp., E. Newark, N. J.
Simplex Wire & Cable Corp., Cambridge, Mass.

CABLE, Microphone, Speaker & Battery

Alden Prods. Co., Brockton, Mass.
Anaconda Wire & Cable Co., 25 Broadway, N. Y. C.
Belden Mfg. Co., 4633 W. Van Buren, Chicago
Boston Insulated Wire & Cable Co., Dorchester, Mass.
Gavett Mfg. Co., Brookfield, Mass.
Holyoke Wire & Cable Corp., Holyoke, Mass.

CASTINGS, Die

Aluminum Co. of America, Pittsburgh, Pa.
American Brass Co., Waterbury, Conn.
Dow Chemical Co., Dow metal Div., Midland, Mich.

CERAMICS, Bushings, Washers, Special Shapes

Akron Porcelain Co., Akron, O.
American Lava Corp., Chattanooga, Tenn.
Centralab, Div. of Globe-Union Inc., Milwaukee, Wis.
Electronic Mechanics, Inc., Paterson, N. J.
Gen'l Ceramics & Steatite Corp., Keasbey, N. J.
Isolantite, Inc., Belleville, N. J.
Lapp Insulator Co., Leroy, N. Y.
Louthan Mfg. Co., E. Liverpool, O.
Star Porcelain Co., Trenton, N. J.
Steward Mfg. Co., Chattanooga, Tenn.
Victor Insulator Co., Victor, N. Y.

CHOKES, RF

Aladdin Radio Industries, 501 W. 35th, Chicago
Alden Prods. Co., Brockton, Mass.
American Communications Corp., 306 B'way, N. Y. C.
Barker & Williamson, Upper Darby, Pa.
Coto-Coil Co., Providence, R. I.
D-X Radio Prods. Co., 1575 Milwaukee, Chicago
General Winding Co., 420 W. 45 St., N. Y. C.
Guthman & Co., Edwin, 400 S. Peoria, Chicago
Hammarlund Mfg. Co., 424 W. 33 St., N. Y. C.
Johnson Co., E. F., Waseca, Minn.
Leetrohm, Inc., Cicero, Ill.
★ Meissner Mfg. Co., Mt. Carmel, Ill.
Miller Co., J. W., Los Angeles, Cal.
Muter Co., 1255 S. Michigan, Chicago
★ National Co., Malden, Mass.
Ohmite Mfg. Co., 4835 W. Flournoy St., Chicago
Radex Corp., 1328 Elston Av., Chicago
Sickles Co., F. W., Chicopee, Mass.
Teleradio Eng. Corp., 484 Broome St., N. Y. C.
Triumph Mfg. Co., 4017 W. Lake St., Chicago

CLIPS, Connector

Mueller Electric Co., Cleveland, O.

CLIPS & MOUNTINGS, Fuse

Alden Prods. Co., Brockton, Mass.
Dante Elec. Mfg. Co., Bantam, Conn.
Ilsco Copper Tube & Prods., Inc., Station M., Cincinnati
Jefferson Elec. Co., Bellwood, Ill.
Jones, Howard B., 2300 Wabansia, Chicago
Littlefuse, Inc., 4753 Ravenswood, Chicago
Patton MacGuyer Co., Providence, R.I.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Stewart Stamping Co., 621 E. 216 St., Bronx, N. Y.
Zierick Mfg. Co., 385 Girard Ave., Bronx, N. Y. C.

CLOTH, Insulating

Acme Wire Co., New Haven, Conn.
Brand & Co., Wm., 276-4th Av., N. Y. C.
Endurette Corp. of Amer., Cliffwood, N. J.
Insulation Mfgrs. Corp., 565 W. Wash. Blvd., Chicago
Irvington Varnish & Insulating Co., Irvington, N. J.
Mica Insulator Co., 196 Varick, N. Y. C.

CONDENSERS, Fixed

Aerovox Corp., New Bedford, Mass.
American Condenser Corp., 2508 S. Michigan, Chicago
Art Radio Corp., 115 Liberty, N. Y. C.
Atlas Condenser Prods. Co., 548 Westchester Av., N. Y. C.
Automatic Winding Co., East Newark, N. J.
Bud Radio, Inc., Cleveland, O.
Cardwell Mfg. Corp., Allen D., Brooklyn, N. Y.
Centralab, Milwaukee, Wis.
Condenser Corp. of America, South Plainfield, N. J.
Condenser Prods. Co., 1375 N. Branch, Chicago
Cornell-Dubilier Elec. Corp., S. Plainfield, N. J.
Cosmic Radio Co., 699 E. 135th St., N. Y. C.
Crowley & Co., Henry L., W. Orange, N. J.
Deutschmann Corp., Tobe, Canton, Mass.
Dumont Elec. Co., 34 Hubert St., N. Y. C.
Electro-Motive Mfg. Co., Willimantic, Conn.
Erie Resistor Corp., Erie, Pa.
Fast & Co., John E., 3123 N. Crawford, Chicago
General Radio Co., Cambridge, Mass.
Girard-Hopkins, Oakland, Calif.
H. R. S. Prods., 5707 W. Lake St., Chicago
Illinois Cond. Co., 3252 W. North Av., Chicago
Industrial Cond. Corp., 1725 W. North Av., Chicago
Insuline Corp. of America, Long Island City, N. Y.
Johnson Co., E. F., Waseca, Minn.
Kellogg Switchb'd & Supply Co., 6650 Cicero, Chicago
Mallory & Co., P. R., Indianapolis, Ind.
Micamold Radio Corp., Brooklyn, N. Y.
Muter Co., 1255 S. Michigan, Chicago
Potter Co., 1950 Sheridan Rd., N. Chicago
RCA Mfg. Co., Camden, N. J.
Sangamo Elec. Co., Springfield, Ill.
Solar Mfg. Corp., Bayonne, N. J.
Sprague Specialties Co., N. Adams, Mass.
Teleradio Engineering Corp., 484 Broome St., N. Y. C.

CONDENSERS, Gas-filled

Lapp Insulator Co., Inc., Leroy, N. Y.

CONDENSERS, High-Voltage Vacuum

Centralab, Milwaukee, Wis.
Erie Resistor Corp., Erie, Pa.
★ General Electric Co., Schenectady, N. Y.

CONDENSERS, Small Ceramic Tubular

Centralab, Div. of Globe-Union, Inc., Milwaukee, Wis.
Erie Resistor Corp., Erie, Pa.

CONDENSERS, Tubular Ceramic Transmitting

Cornell-Dubilier, S. Plainfield, N. J.
RCA Mfg. Co., Inc., Camden, N. J.
Sangamo Electric Co., Springfield, Ill.
Solar Mfg. Corp., Bayonne, N. J.

CONDENSERS, Variable Receiver Tuning

Alden Prods. Co., Brockton, Mass.
American Steel Package Co., Defiance Ohio
Barker & Williamson, Ardmore, Pa.
Bud Radio, Inc., Cleveland, O.
Cardwell Mfg. Corp., Allen D., Brooklyn, N. Y.
General Instrument Corp., Elizabeth, N. J.
Hammarlund Mfg. Co., 424 W. 33d St., N. Y. C.
Insuline Corp. of Amer., L. I. City, N. Y.
Meissner Mfg. Co., Mt. Carmel, Ill.
Millen Mfg. Co., Malden, Mass.
National Co., Malden, Mass.
Oak Mfg. Co., 1267 Clybowon Ave., Chicago
Radio Condenser Co., Camden, N. J.
Rauland Corp., Chicago, Ill.

CONDENSERS, Variable Transmitter Tuning

Barker & Williamson, Upper Darby, Pa.
Bud Radio, Cleveland, O.
Cardwell Mfg. Corp., Allen D., Brooklyn, N. Y.
Hammarlund Mfg. Co., 424 W. 33 St., N. Y. C.
Insuline Corp. of Amer., L. I. City, N. Y.
Johnson, E. F., Waseca, Minn.
Millen Mfg. Co., James, Malden, Mass.
★ National Co., Malden, Mass.
Radio Condenser Co., Camden, N. J.

CONDENSERS, Variable Trimmer

Aerovox Corp., New Bedford, Mass.
Alden Prods Co., Brockton, Mass.
American Steel Package Co., Defiance, O.
Bud Radio, Inc., Cleveland, O.
Cardwell Mfg. Corp., Allen, Brooklyn, N. Y.
Centralab, Milwaukee, Wis.
Fade Radio & Elec. Corp., Long Island City, N. Y.
General Radio Co., Cambridge, Mass.
Guthman, Inc., E. I., 400 S. Peoria, Chicago
Hammarlund Mfg. Co., 424 W. 33 St., N. Y. C.
Insuline Corp. of America, Long Island City, N. Y.
Johnson Co., E. F., Waseca, Minn.
Mallory & Co., Inc., P. R., Indianapolis, Ind.
★ Meissner Mfg. Co., Mt. Carmel, Ill.
Millen Mfg. Co., James, Malden, Mass.
Miller Co., J. W., Los Angeles, Cal.
Muter Co., 1255 S. Michigan Av., Chicago
★ National Co., Malden, Mass.
Potter Co., 1950 Sheridan Rd., N. Chicago
Sickles Co., F. W., Chicopee, Mass.
Solar Mfg. Corp., Bayonne, N. J.
Teleradio Eng. Corp., 484 Broome, N. Y. C.

CONNECTORS, Cable

Aero Electric Corp., Los Angeles, Calif.
Alden Prods., Brockton, Mass.
Amer. Microphone Co., 1915 S. Western Av., Los Angeles
Amer. Phenolic Corp., 1830 S. 54th St., Chicago
American Radio Hardware Co., 476 B'way., N. Y. C.
Andrew, Victor J., 6429 S. Lavergne Av., Chicago
Astatic Corp., Youngstown, O.
Atlas Sound Corp., 1442 39th St., Brooklyn, N. Y.
Birnbach Radio, 145 Hudson St., N. Y. C.
Breeze Mfg. Corp., Newark, N. J.
Brush Development Co., Cleveland, O.
Bud Radio, Cleveland, Ohio
Cannon Elec. Development, 3209 Humboldt, Los Angeles
Eby, Inc., Hugh H., Philadelphia
Electro Voice Mfg. Co., South Bend, Indiana
Franklin Mfg. Corp., 175 Varick St., N. Y. C.
General Radio Co., Cambridge, Mass.
Harwood Co., 747 N. Highland Ave., Los Angeles
Insuline Corp. of Amer., L. I. City, N. Y.
Jones, Howard B., 2300 Wabansia, Chicago
Mallory & Co., P. R., Indianapolis, Ind.
★ Radio City Products Co., 127 W. 26 St., N. Y. C.
Selectar Mfg. Co., Long Island City, N. Y.

CONTACT POINTS

Callite Tungsten Corp., Union City, N. J.
Mallory & Co., Inc., P. R., Indianapolis, Ind.

COUPLINGS, flexible

Cardwell Mfg. Corp., Allen D., Brooklyn, N. Y.
Johnson Co., E. F., Waseca, Minn.
Millen Mfg. Co., James, Malden, Mass.
★ National Co., Inc., Malden, Mass.

CRYSTAL GRINDING EQUIPMENT

Felker Mfg. Co., Torrance, Calif.

Additions This Month

34 NEW MANUFACTURERS' NAMES

This Directory is revised every month, so as to assure engineers and purchasing agents of up-to-date information. We shall be pleased to receive suggestions as to company names which should be added, and hard-to-find items which should be listed in this Directory.

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It doesn't actually win the battle, but hobnobbing with a foreign buddy is a form of wartime communication that builds international morale. In the picture two Americans and a French soldier tell it with gestures to an English Tommy.

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EITEL-McCULLOUGH, INC., SAN BRUNO, CALIF.

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ARMY NAVY

CRYSTALS, Quartz

Bausch & Lomb Optical Co., Rochester, N. Y.
Bellefonte Eng. Labs., Bellefonte, Penna.
Billey Elec. Co., Erie, Penna.
Burnett, Wm. W. L., San Diego, Cal.
Collins Radio Co., Cedar Rapids, Iowa
Crystal Research Labs., Hartford, Conn.
Electronic Research Corp., 800 W. Washington Blvd., Chicago
General Electric Co., Schenectady, N. Y.
General Radio Co., Cambridge, Mass.
Harvey-Wells Communications, Southbridge, Mass.
Hipower Crystal Co., 2035 W. Charleston, Chicago
Hollister Crystal Co., Merriam, Kan.
Hunt & Sons, G. C., Carlisle, Pa.
Jefferson, Inc., Ray, Westport, L. I., N. Y.
Kaar Engineering Co., Palo Alto, Cal.
Meck Industries, John, Plymouth, Ind.
Miller, August E., North Bergen, N. J.
Peterson Radio, Council Bluffs, Iowa
Precision Crystal Labs., Springfield, Mass.
Precision Piezo Service, Baton Rouge, La.
Premier Crystal Labs., 63 Park Row, N. Y. C.
RCA Mfg. Co., Camden, N. J.
Scientific Radio Service, Hyattsville, Md.
Standard Piezo Co., Carlisle, Pa.
Valpey Crystals, Holliston, Mass.
Zeiss, Inc., Carl, 485 Fifth Av., N. Y. C.

DIALS, Instrument

Crowe Nameplate Co., 3701 Ravenswood Ave., Chicago
General Radio Co., Cambridge, Mass.
Gits Molding Corp., 1600 Huron St., Chicago
★ National Co., Inc., Malden, Mass.
Rogan Bros., 2003 S. Michigan Ave., Chicago

DISCS, Recording

Advance Recording Products Co., Long Island City, N. Y.
Allied Recording Products Co., Long Island City, N. Y.
Audio Devices, Inc., 1600 B'way, N. Y. C.
Federal Recorder Co., Elkhart, Ind.
Gould-Moody Co., 395 B'way, N. Y. C.
Presto Recording Corp., 242 W. 55 St., N. Y. C.
RCA Mfg. Co., Camden, N. J.

FASTENERS, Separable

Camloc Fastener Co., 420 Lexington Ave., N. Y. C.
Shakeproof, Inc., 2501 N. Keeler Ave., Chicago

FELT

American Felt Co., Inc., Glenville, Conn.
Western Felt Works, 4031 Ogden Ave., Chicago

FIBRE, Vulcanized

Brandywine Fibre Prods. Co., Wilmington, Del.
Continental-Diamond Fibre Co., Newark, Del.
Insulation Mfgrs. Corp., 565 W. Wash. Blvd., Chicago
Mica Insulator Co., 196 Varick, N. Y. C.
Nat'l Vulcanized Fibre Co., Wilmington, Del.
Taylor Fibre Co., Norristown, Pa.
Wilmington Fibre Specialty Co., Wilmington, Del.

FILTERS, Electrical Noise

Aviu Products Co., 737 N. Highland Ave., Los Angeles
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Tobe Deutschmann Corp., Canton, Mass.

FINISHES, Metal

Alrose Chemical Co., Providence, R. I.
Aluminum Co. of America, Pittsburgh, Pa.
Ault & Wiborg Corp., 75 Varick, N. Y. C.
Hilo Varnish Corp., Brooklyn, N. Y.
Maas & Waldstein Co., Newark, N. J.
New Wrinkle, Inc., Dayton, O.

FREQUENCY METERS

★ Browning Labs., Inc., Winchester, Mass.
General Radio Co., Cambridge, Mass.
Lavoie Laboratories, Long Branch, N. J.
★ Link, F. M., 125 W. 17 St., N. Y. C.
Measurements Corporation, Boonton, N. J.

FREQUENCY STANDARDS, Primary

General Radio Co., Cambridge, Mass.

FREQUENCY STANDARDS, Quartz Secondary

Millen Mfg. Co., Inc., Malden, Mass.

FUSES, Enclosed

Dante Elec. Mfg. Co., Bantam, Conn.
Jefferson Elec. Co., Bellwood, Ill.
Littlefuse, Inc., 4753 Ravenswood Av., Chicago

GEARS & PINIONS, Metal

Continental-Diamond Fibre Co., Newark, Del.
Gear Specialties, Inc., 2650 W. Medill, Chicago
Perkins Machine & Gear Co., Springfield, Mass.
Thompson Clock Co., H. C., Bristol, Conn.

GEARS & PINIONS, Non-Metallic

Brandywine Fibre Prods. Co., Wilmington, Del.
Formica Insulation Co., Cincinnati, O.
Gear Specialties, Inc., 2650 W. Medill, Chicago
★ General Electric Co., Pittsfield, Mass.
Mica Insulator Co., 196 Varick St., N. Y. C.
National Vulcanized Fibre Co., Wilmington, Del.
Perkins Machine & Gear Co., Springfield, Mass.
Richardson Co., Melrose Park, Chicago
Synthane Corp., Oaks, Pa.
Taylor Fibre Co., Norristown, Pa.
Wilmington Fibre Specialty Co., Wilmington, Del.

GENERATORS, Gas Engine Driven

Kato Engineering Co., Mankato, Minn.

GENERATORS, Hand Driven

Carter Motor Co., 1608 Milwaukee, Chicago

GENERATORS, Standard Signal

Boonton Radio Corp., Boonton, N. J.
Ferris Instrument Co., Boonton, N. J.
General Radio Co., Cambridge, Mass.
Measurements Corp., Boonton, N. J.

GENERATORS, Wind-Driven, Aircraft

General Armature Corp., Lock Haven, Pa.

HEADPHONES

Brush Development Co., Cleveland, O.
Conn. Tel. & Electric Co., Meriden, Conn.
Carrier Microphone Co., Inglewood, Cal.
Cannon Co., C. F., Springwater, N. Y.
Carron Mfg. Co., 415 S. Aberdeen, Chicago
Chicago Tel. Supply Co., Elkhart, Ind.
Connecticut Tel. & Elec. Co., Meriden, Conn.
Elec. Industries Mfg. Co., Red Bank, N. J.
Kellogg Switchboard & Supply Co., 6650 S. Cicero Av., Chicago
Murdock Mfg. Co., Chelsea, Mass.
Telephonics Corp., 350 W. 31 St., N. Y. C.
Trimm Radio Mfg. Co., 1770 W. Berteau, Chicago
Universal Microphone Co., Inglewood, Cal.

HORNS, Outdoor

Graybar Elect. Co., Lexington Ave. at 43 St., N. Y. C.
Jensen Radio Mfg. Co., 6601 S. Laramie Ave., Chicago
Operadio Mfg. Co., St. Charles, Ill.
Oxford Tartak Radio Corp., 915 W. Van Buren St., Chicago
Racon Electric Co., 52 E. 19 St., N. Y. C.
RCA Mfg. Co., Camden, N. J.
University Laboratories, 225 Varick St., N. Y. C.

INSTRUMENTS, Radio Laboratory

Ballantine Laboratories, Inc., Boonton, N. J.
General Radio Co., Cambridge, Mass.
Hewlett Packard Co., Palo Alto, Calif.
Measurements Corporation, Boonton, N. J.

INSULATORS: Ceramic Stand-off, Lead-in, Rod Types

American Lava Corp., Chattanooga, Tenn.
Corning Glass Works, Corning, N. Y.
Electronic Mechanics, Inc., Clifton, N. J.
Isolantite, Inc., Belleville, N. S.
Johnson Co., E. F., Waseca, Minn.
Lapp Insulator Co., Inc., Leroy, N. Y.
Locke Insulator Co., Baltimore, Md.
Millen Mfg. Co., Malden, Mass.
National Co., Inc., Malden, Mass.

IRON CORES, Powdered

Crowley & Co., Henry L., West Orange, N. J.
Gibson Elec. Co., Pittsburgh, Pa.
Mallory & Co., P. R., Indianapolis, Ind.
Stackpole Carbon Co., St. Marys, Pa.
Western Electric Co., 195 Broadway, N. Y. C.
Wilson Co., H. A., Newark, N. J.

IRONS, Soldering

Acme Electric Heating Co., 1217 Washington St., Boston
Amer. Electrical Heater Co., 6110 Cass Ave., Detroit
Electric Soldering Iron Co., Deep River, Conn.
General Electric Co., Schenectady, N. Y.
Hexacon Electric Co., Roselle Park, N. J.
Vasco Electrical Mfg. Co., 1116 Avalon Blvd., Los Angeles
Vulcan Electric Co., Lynn, Mass.

JACKS, Telephone

Alden Prods. Co., Brockton, Mass.
Amer. Molded Prods. Co., 1753 N. Honore St., Chicago
Chicago Tel. Supply Co., Elkhart, Ind.
Guardian Elec. Mfg. Co., 1627 W. Walnut St., Chicago
Insuline Corp. of Amer., Long Island City, N. Y.
Johnson, E. F., Waseca, Minn.
Jones, Howard B., 2300 Wabansia Ave., Chicago
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Mangold Radio Pts. & Stamping Co., 6300 Shelbourne St., Philadelphia
Molded Insulation Co., Germantown, Pa.

KEYS, Telegraph

Amer. Radio Hardware Co., Inc., 476 Broadway, N. Y. C.
Bunnell & Co., J. H., 215 Fulton St., N. Y. C.
Mossman, Inc., Donald P., 6133 N. Northwest Hy., Chicago
Signal Electric Mfg. Co., Menominee, Mich.
Telephonics Corp., 350 W. 31 St., N. Y. C.

KNOBS, Radio & Instrument

Alden Prods. Co., Brockton, Mass.
American Insulator Corp., New Freedom, Pa.
Chicago Molded Prods. Corp., 1025 N. Kolmar, Chicago
General Radio Co., Cambridge, Mass.
Gits Molding Corp., 4600 Huron St., Chicago
Imperial Molded Prods. Corp., 2921 W. Harrison, Chicago
Kurtz Kasch, Inc., Dayton, O.
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Millen Mfg. Co., James, Malden, Mass.
★ Nat'l Co., Inc., Malden, Mass.
Radio City Products Co., 127 W. 26 St., N. Y. C.
Rogan Bros., 2001 S. Michigan, Chicago

LABELS, Removable

Avery Adhesives, 451 3rd St., Los Angeles

LABELS, Stick-to-Metal

Ever Ready Label Corp., E. 25th St., N. Y. C.

LABORATORIES, Electronic Research

★ Browning Labs., Inc., Winchester, Mass.

LUGS, Soldering

Burndy Engineering Co., 459 E. 133rd St., N. Y. C.
Cinch Mfg. Corp., W. Van Buren St., Chicago
Dante Elec. Mfg. Co., Bantam, Conn.
Ideal Commutator Dresser Co., Sycamore, Ill.
Isco Copper Tube & Prods., Inc., Station M, Cincinnati
Krueger & Hudepohl, Third & Vine, Cincinnati, O.
Patton-MacGuyer Co., 17 Virginia Av., Providence, R. I.
Sherman Mfg. Co., Battle Creek, Mich.
Thomas & Betts Co., Elizabeth, N. J.
Zierick Mfg. Co., 385 Girard Ave., Bronx, N. Y. C.

LUGS, Solderless

Aircraft Marine Prod., Inc., Elizabeth, N. J.

MACHINES, Impregnating

Stokes Machine Co., F. J., Phila., Pa.

MACHINES, Numbering

Altair Machinery Corp., 55 VanDam, N. Y. C.
Numberall Stamp & Tool Co., Huguenot Park, Staten Island, N. Y.

MACHINES, Riveting

Chicago Rivet & Machine Co., Bellwood, Illinois
★ Wiedeman Machine Co., Phila., Pa.

MACHINES, Screwdriving

Detroit Power Screwdriver Co., Detroit, Mich.
Stanley Tool Div. of the Stanley Works, New Britain, Conn.

MAGNETS, Permanent

★ General Elec. Co., Schenectady, N. Y.
Thomas & Skinner Steel Prod. Co., Indianapolis, Ind.

MARKERS, Wire Identification

Brand & Co., Wm., 276 4th Ave., N. Y. C.

METAL, Thermostatic

Baker & Co., 113 Astor, Newark, N. J.
C. S. Bralnin Co., 20 VanDam, N. Y. C.
Callite Tungsten Corp., Union City, N. J.
Chace Co., W. M., Detroit, Mich.
Metals & Controls Corp., Attleboro, Mass.
Wilson Co., H. A., 105 Chestnut, Newark, N. J.

METERS, Ammeters, Voltmeters, Small Panel

Cambridge Inst. Co., Grand Central Terminal, N. Y. C.
De Jur-Amsco Corp., Shelton, Conn.
★ General Electric Co., Bridgeport, Conn.
Hickok Elec. Inst. Co., Cleveland, O.
Hoyt Elec. Inst. Works, Boston, Mass.
Readrite Meter Works, Bluffton, O.
Roller-Smith Co., Bethlehem, Pa.
★ Simpson Elec. Co., 5218 W. Kinzie, Chicago
Triplett Elec. Inst. Co., Bluffton, O.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Weston Elec. Inst. Corp., Newark, N. J.
Wheelco Inst. Co., 847 W. Harrison St., Chicago

METERS, Q

Boonton Radio Corp., Boonton, N. J.

METERS, Vacuum Tube Volt

Ballantine Laboratories, Inc., Boonton, N. J.
Ferris Instrument Corp., Boonton, N. J.
General Radio Co., Cambridge, Mass.
Hewlett-Packard Co., Palo Alto, Calif.
Measurements Corp., Boonton, N. J.
★ Radio City Products Co., 127 W. 26 St., N. Y. C.

METERS, Vibrating Reed

Biddle, James G., 1211 Arch St., Philadelphia
Triplett Elec. Inst. Co., Bluffton, O.

MICA

Brand & Co., Wm., 276 Fourth Av., N. Y. C.
Insulation Mfgrs. Corp., 565 W. Wash. Blvd., Chicago
Macallen Co., Boston, Mass.
Mica Insulator Corp., 196 Varick, N. Y. C.
New England Mica Co., Waltham, Mass.
Richardson Co., Melrose Park, Chicago

MICROPHONES

Amer. Microphone Co., 1015 Western Av., Los Angeles
Amperite Co., 561 B'way, N. Y. C.
Astatic Corp., Youngstown, O.
Brush Development Co., Cleveland, O.
Carrier Microphone Co., Inglewood, Cal.
Elect. Industries Mfg. Co., Red Bank, N. J.
Electro Voice Mfg. Co., South Bend, Ind.
Kellogg Switchboard & Supply Co., 6650 S. Cicero, Chicago
Radio Speakers, Inc., 221 E. Cullerton, Chicago
Philmore Mfg. Co., 113 University Pl., N. Y. C.
Permoflux Corp., 4916 W. Grand Av., Chicago
Rowe Industries, Inc., Toledo, O.
Shure Bros., 225 W. Huron St., Chicago
Telephonics Corp., 350 W. 31 St., N. Y. C.
Turner Co., Cedar Rapids, Ia.
Universal Microphone Co., Inglewood, Cal.

MONITORS, Frequency

★ General Electric Co., Schenectady, N. Y.
General Radio Co., Cambridge, Mass.
RCA Mfg. Co., Camden, N. J.

MOTOR-GENERATORS, Dynamotors, Rotary Converters

Alliance Mfg. Co., Alliance, O.
Air-Way Mfg. Co., Toledo, O.
Bendix, Red Bank, N. J.
Black & Decker Mfg. Co., Towson, Md.
Bodine Elec. Co., 2262 W. Ohio, Chicago
★ Carter Motor Co., 1608 Milwaukee, Chicago
Clements Mfg. Co., Chicago, Ill.
Continental Electric Co., Newark, N. J.
Delco Appliance, Rochester, N. Y.
Diehl Mfg. Co., Elizabethport, N. J.
Dormeyer Co., Chicago, Ill.
Eclipse Aviation, Bendix, N. J.
Elcor, Inc., 1060 W. Adams, Chicago
Electric Motors Corp., Racine, Wis.
Electric Specialty Co., Stamford, Conn.
Electrolux Corp., Old Greenwich, Conn.
Eureka Vacuum Cleaner, Detroit, Mich.
General Armature Corp., Lock Haven, Pa.
★ General Electric Co., Schenectady, N. Y.
Jannette Mfg. Co., 558 W. Monroe, Chicago
Knapp-Monarch, St. Louis, Mo.
Leland Electric Co., Dayton, O.
Ohio Electric Co., 74 Trinity Pl., N. Y. C.
Pioneer Gen-E-Motor, 5841 W. Dickens Av., Chicago
Redmond Co., A. G., Owosso, Mich.
Russell Co., Chicago, Ill.
Webster Co., Chicago, Ill.
Westinghouse Elect. Mfg. Co., Lima, O.
Wincharger Corp., Sioux City, Iowa

MOUNTINGS, Shock Absorbing

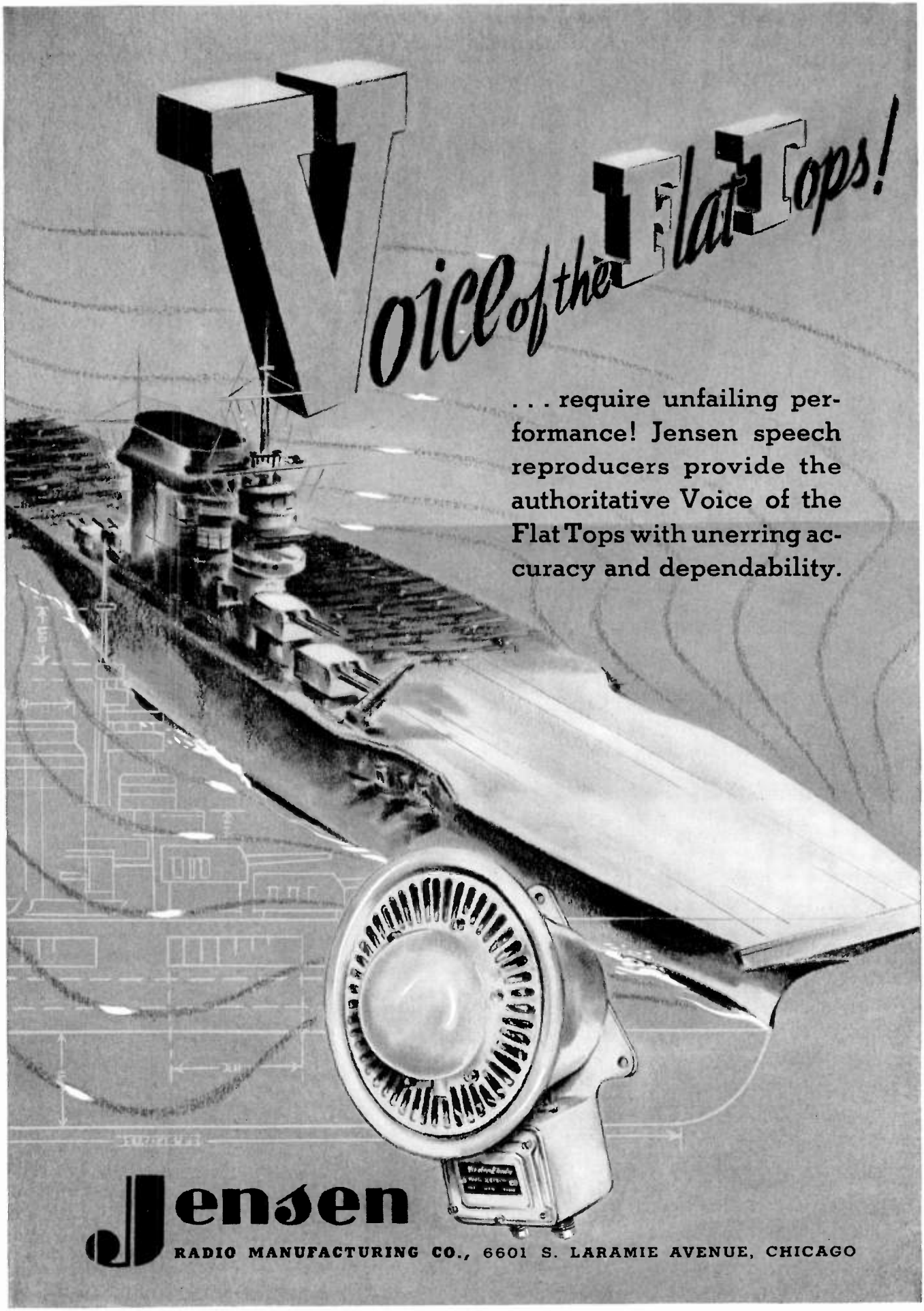
Lord Mfg. Co., Erie, Pa.
Pierce-Roberts Co., Trenton, N. J.
U. S. Rubber Co., 1230 6th Ave., N. Y. C.

MYCALEX

★ General Electric Co., Schenectady, N. Y.
Mycalex Corp. of Amer., Clifton, N. J.

NICKEL, Sheet, Rod, Tubes

Eagle Metals Co., Seattle, Wash.
Pacific Metals Co., Ltd., San Francisco, Calif.
Steel Sales Corp., 129 S. Jefferson St., Chicago
Tull Metal & Supply Co., J. M., Atlanta, Ga.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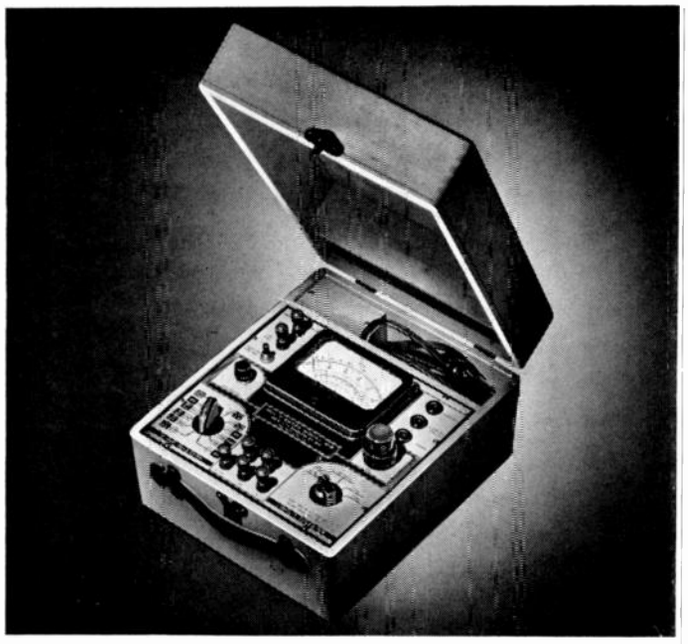


UNIVERSAL DE LUXE MULTITESTER

The original, advanced design features of the Model 419 Universal Multitester make it ideally suited for a wide range of applications in both the laboratory and factory.

The R.C.P. system of A.C. measurements eliminates troublesome copper oxide rectifier. Rectifier used is more rugged, sensitive, easier to replace and more economical. It is not subject to the frequency, wave form and temperature errors found with copper oxide rectifiers.

- ★ A.C. Meter scales are linear and coincide with D.C. scales.
- ★ Meter sensitivity is 2000 ohms per volt.
- ★ Direct reading, capacity meter with wide spread scales.
- ★ Ohmmeter has self contained power supply.
- ★ Ultra sensitive low ohm ohmmeter range ideal for detecting shorted turns, contact resistance, voice coils resistance, etc.
- ★ Inductances can be computed with graph supplied.
- ★ Meter completely fused.
- ★ Supply line is double fused.
- ★ Special position for checking output voltages.
- ★ New improved terminals replace conventional jacks.

Ranges:—

D.C. voltmeter:—0-5-50-250-2,500-5,000 volts.
A.C. voltmeter:—0-10-100-500-1,000-5,000 volts.
D.C. milliammeter:—0-1-10-50-250-1,000 ma.
D.C. ammeter:—0-1-5-25 amps.
Capacitymeter:—0-.03-.30-3.-30-300 mfd.
Low ohmmeter:—0-100 ohms.
Ohmmeter:—15,000-150,000 ohms.
Megohmmeter:—0-1.5-15 megohms.
Inductance measurements—chart reference:—0-.25 1000 millihenries.
Inductance measurements—chart reference:—0-.25-100-1000-10,000 henries.

Model 419P illustrated above in hand rubbed, natural finish maple case complete, ready to operate..... **$36.50**

Model 419C, open face bench type with 4½" meter, in hard wood case **$34.50**

Model 419V-7 with large 7¼" bakelite meter in upright black crackle steel case, 10½" x 19" x 5¼"..... **$44.50**

Other instruments in the complete line of R.C.P. electronic and electrical test instruments described in catalog No. 127. If you have an unusual test problems — either for production line or laboratory work — consult our engineering department.

RADIO CITY PRODUCTS COMPANY, INC.

127 WEST 26th ST. — NEW YORK CITY

MANUFACTURERS OF PRECISION ELECTRONIC LIMIT BRIDGES — VACUUM TUBE VOLTMETERS — VOLT-OHM-MILLIAMMETERS — SIGNAL GENERATORS — ANALYZER UNITS — TUBE TESTERS — MULTI-TESTERS — OSCILLOSCOPES — AND SPECIAL INSTRUMENTS BUILT TO SPECIFICATIONS.

Whitehead Metal Prod. Co., 303 W. 10th St., N. Y. C.
Williams and Co., Inc., Pittsburgh, Pa.

NUTS, Self-locking

Boots Aircraft Nut Corp., New Canaan, Conn.
Elastic Stop Nut Corp., Union, N. J.
Palnut Co., Inc., Irvington, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

OSCILLOSCOPES, Cathode Ray

Du Mont Laboratories, Inc., Allen B Passaic, N. J.
General Electric Co., Schenectady, N. Y.
General Radio Co., Cambridge, Mass.
Millen Mfg. Co., Malden, Mass.
RCA Mfg. Co., Inc., Camden, N. J.

OVENS, Industrial & Laboratory

★ General Elec. Co., Schenectady, N. Y.
Trent Co., Harold E., Philadelphia

PILOT LIGHTS

Alden Prods. Co., Brockton, Mass.
Amer. Radio Hardware Co., Inc., 467 B'way, N. Y. C.
Dial Light Co. of America, 90 West, N. Y. C.
Drake Mfg. Co., 1713 W. Hubbard, Chicago
General Control Co., Cambridge, Mass.
★ General Elec. Co., Lamp Dept., Nela Specialty Div., Hoboken, N. J.
Gothard Mfg. Co., Springfield, Ill.
Herzog Miniature Lamp Works, 12-19 Jackson Av., Long Island City, N. Y.
Kirkland Co., H. R., Morristown, N. J.
Mallory & Co., P. R., Indianapolis, Ind.
Rothard Mfg. Co., N. 9th Ave., Springfield, Ill.
Signal Indicator Corp., 140 Cedar St., N. Y. C.
Sylvania Elec. Prod. Co., Emporium, Pa.

PHOSPHOR BRONZE

American Brass Co., Waterbury, Conn.
Bunting Brass & Bronze Co., Toledo, O.
Driver-Harris Co., Harrison, N. J.
Phosphor Bronze Smelting Co., Philadelphia
Revere Copper & Brass, 230 Park Av., N. Y. C.
Seymour Mfg. Co., Seymour, Conn.

PLASTICS, Extruded

Blum & Co., Inc., Julius, 532 W. 22 St., N. Y. C.
Brand & Co., Wm., 276 Fourth Ave., N. Y. C.
Extruded Plastics, Inc., Norwalk, Conn.
Irvington Varnish & Insulator Co., Irvington, N. J.

PLASTIC, Sheet for Name Plates

Mica Insulator Co., 200 Varick St., N. Y. C.

PLASTICS, Injection Molded

Tech-Art Plastics, 41-01 36th Ave., Long Island City, N. Y.

PLASTICS, Laminated or Molded

Acadia Synthetic Prods., 4031 Ogden Av., Chicago
Alden Prods. Co., Brockton, Mass.
American Cyanamid Co., 30 Rockefeller Plaza, N. Y. C.
American Insulator Corp., New Freedom, Pa.
American Molded Prods. Co., 1753 N. Honore, Chicago
Auburn Button Works, Auburn, N. Y.
Barber-Colman Co., Rockford, Ill.
Brandywine Fibre Prods. Co., Wilmington, Del.
Catalin Corp., 1 Park Av., N. Y. C.
Celanese Celluloid Corp., 180 Madison Av., N. Y. C.
Chicago Molded Prods. Corp., 1024 N. Kolmar, Chicago
Continental-Diamond Fibre Co., Newark, Del.
Dow Chemical Co., Midland, Mich.
Durez Plastics & Chemicals, Inc., N. Tonawanda, N. Y.
Extruded Plastics, Inc., Norwalk, Conn.
Formica Insulation Co., Cincinnati, O.
★ General Electric Co., Plastics Dept., Pittsfield, Mass.
General Industries Co., Elyria, O.
Gits Molding Corp., 4600 Huron St., Chicago
Imperial Molded Prods. Co., 2921 W. Harrison, Chicago
Industrial Molded Prods. Co., 2035 Charleston, Chicago
Kurz-Kasch, Inc., Dayton, O.
Macallen Co., Boston, Mass.
Mica Insulator Co., 196 Varick, N. Y. C.
Monsanto Chemical Co., Springfield, Mass.
National Vulcanized Fibre Co., Wilmington, Del.
Northern Industrial Chemical Co., Boston, Mass.
Printloid Corp., 93 Mercer St., N. Y. C.
★ Radio City Products Co., 127 W. 26 St., N. Y. C.
Richardson Co., Melrose Park, Chicago
Rogan Bros., 180 N. Wacker Dr., Chicago
Rohm & Haas Co., Philadelphia
Stokes Rubber Co., Joseph, Trenton, N. J.
Surprenant Elec. Ins. Co., Boston
Synthane Corp., Oaks, Pa.
Taylor Fibre Co., Norristown, Pa.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Wilmington Fibre Specialty Co., Wilmington, Del.

PLASTICS, Transparent

Celanese Celluloid Corp., 180 Madison Ave., N. Y. C.
du Pont de Nemours & Co., E. I., Arlington, N. J.
Printloid Corp., 93 Mercer St., N. Y. C.
Rohm & Haas Co., Washington Sq., Philadelphia

PLATING, Metal on Molded Parts

Metaplast Corp., 205 W. 19 St., N. Y. C.

PLUGS (Banana), Spring Type

Birnbach Radio Co., 145 Hudson St., N. Y. C.
Eastman Kodak Co., Rochester, N. Y.

PLUGS & JACKS, Spring Type

Eby, Inc., Hugh H., Philadelphia, Pa.
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Ucinite Co., Newtonville, Mass.

PLUGS, Telephone Type

Alden Prods. Co., Brockton, Mass.
American Molded Prods. Co., 1753 N. Honore, Chicago
Chicago Tel. Supply Co., Elkhart, Ind.
Guardian Elec. Mfg. Co., 1627 W. Walnut, Chicago
Insuline Corp. of Amer., Long Island City, N. Y.
Johnson Co., E. F., Waseca, Minn.
Jones, Howard B., 2300 Wabansia Av., Chicago
Mallory & Co., Inc., P. R., Indianapolis, Ind.

PLYWOOD, Metal Faced

Haskelite Mfg. Corp., 208 W. Washington St., Chicago

PRESSES, PLASTIC MOLDING

Kux Machine Co., 3930 W. Harrison, Chicago

PRESSES, Stamping

Stokes Machine Co., F. J., Philadelphia
Watson-Stillman Corp., The, Roselle Park, N. J.
★ Wiedeman Machine Co., Phila., Pa.

RECTIFIERS, Current

Benwood Linze Co., St. Louis, Mo.
Continental Elec. Co., 903 Merchandise Mart, Chicago
Electronics Labs., Indianapolis, Ind.
Fansteel Metallurgical Corp., N. Chicago, Ill.
★ General Electric Co., Bridgeport, Conn.
International Tel. & Radio Mfg. Corp., E. Newark, N. J.
Mallory & Co., P. R., Indianapolis, Ind.
Nothelfer Winding Labs., Trenton, N. J.
United Cinephone Corp., Torrington, Conn.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

RECTIFIERS Instrument & Relay

Selenium Corp. of Amer., 1800 W. Pico Blvd., Los Angeles

REGULATORS, Temperature

Allen-Bradley Co., Milwaukee, Wis.
Dunn, Inc., Struthers, 1321 Cherry, Philadelphia
Fenwal Inc., Ashland, Mass.
★ General Electric Co., Schenectady, N. Y.
Mercoid Corp., 4217 Belmont, Chicago
Minneapolis-Honeywell Regulator, Minneapolis, Minn.
Spencer Thermostat Co., Attleboro, Mass.

REGULATORS, Voltage

Acme Elec. & Mfg. Co., Cuba, N. Y.
Amperite Co., 561 Broadway, N. Y. C.
Ferranti Elec., Inc., 30 Rockefeller Plaza, N. Y. C.
★ General Elec. Co., Schenectady, N. Y.
H-B Elec. Co., Philadelphia
Sola Electric Co., 2525 Clybourn Av., Chicago
★ United Transformer Corp., 150 Varick St., N. Y. C.

RELAYS, Small Switching

Allied Control Co., Inc., 223 Fulton St., N. Y. C.
Amperite Co., 561 Broadway, N. Y. C.
G-M Laboratories, Inc., 4313 N. Knox Ave., Chicago
Guardian Electric, W. Walnut St., Chicago
Potter & Brumfield Co., Princeton, Ind.
Sigma Instruments, Inc., 76 Freeport St., Boston, Mass.
Struthers Dunn, Inc., 1326 Cherry St., Philadelphia
Ward Leonard Elec. Co., Mt. Vernon, N. Y.

RELAYS, Small Telephone Type

Amer. Automatic Elect. Sales Co., 1033 W. Van Buren St., Chicago
Clare & Co., C. P., 4719 W. Sunnyside Ave., Chicago
Guardian Electric Co., 1625 W. Walnut St., Chicago
Wick Organ Co., Highland, Ill.

RELAYS, Time Delay

Amperite Co., 561 Broadway, N. Y. C.
Haydon Mfg. Co., Inc., Forestville, Conn.
Industrial Timer Corp., Newark, N. J.
Sangamo Elect. Co., Springfield, Ill.

RELAY TESTERS, Vibration

Kurman Electric Co., Inc., 3030 Northern Blvd., L. I. City, N. Y.

SPOT NEWS

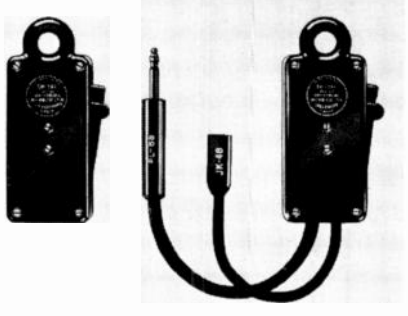
(CONTINUED FROM PAGE 16)

and Templetone Radio Co., Mystic, Conn.

Electronics Department: GE has thus abbreviated the name of its Radio, Television, and Electronics Department, according to an announcement from vice president W. R. G. Baker.

$150,000,000 V Loan: One of the largest bank loans ever obtained by an American industrial company has been granted to the Bendix Aviation Corporation, according to E. R. Breech, president. The purpose is to permit substantial increase in the Company's War Production, now at the rate of more than $700,000,000 annually. It is interesting to note that the interest on amounts borrowed against this credit will be at the rate of $2\frac{3}{4}\%$, with an commitment fee of $\frac{1}{4}\%$ on the unused portion of the credit. Such portions of the loan that may apply to cancelled contracts will not become due and payable until final settlement of the contracts.

Microphone Cord Assembly: Signal Corps has approved the microphone cord assemblies which Universal Microphone Company, Inglewood, Calif., is furnishing to Govern-



ment contractors. Although designed primarily for aircraft and parachute use, these assemblies are suitable for tank and other mobile equipment, and can stand extremes of heat and cold. Molded parts are of high-impact phenolic.

The parts illustrated above comprise the SW-141 switch, PL-68 plug, and JK-48 jack. The assemblies carry the numbers CD-318 and CD-508. The SW-141 switch is used ordinarily as a press-to-talk microphone, but the button can be locked for continuous operation. Connecting cordage is rubber covered, providing complete protection for use under exposed conditions.

Dimensions of the switch are $4\frac{15}{32}$ ins. long, $1\frac{3}{4}$ ins. wide, and $\frac{3}{4}$ in. thick. Universal is said to be tooled up for high-quantity production on these parts.

RESISTORS, Fixed

Acme Elec. Heating Co., Boston, Mass.
★ Aerovox Corp., New Bedford, Mass.
Allen-Bradley Co., Milwaukee, Wis.
Atlas Resistor Co., 423 Broome St., N. Y. C.
Centralab, Milwaukee, Wisconsin
Clarostat Mfg. Co., Brooklyn, N. Y.
Cont'l Carbon, Inc., Cleveland, O.
Daven Co., 158 Summit St., Newark, N. J.
Dixon Crucible Co., Jersey City, N. J.
Erie Resistor Corp., Erie, Pa.
Globar Div. Carborundum Co., Niagara Falls, N. Y.
Hardwick, Hindle, Inc., Newark, N. J.
Instrument Resistors Co., Little Falls, N. J.
Intern'l Resistance Co., Philadelphia
Lectrohm, Inc., Cicero, Ill.
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Ohmite Mfg. Co., 4835 W. Flournoy, Chicago
Precision Resistor Co., Newark, N. J.
Sensitive Research Inst. Corp., 4545 Bronx Blvd., N. Y. C.
Shalleross Mfg. Co., Collingdale, Pa.
Sprague Specialties Co., N. Adams, Mass.
Stackpole Carbon Co., St. Marys, Pa.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
White Dental Mfg. Co., 10 E. 40th St., N. Y. C.
Wirt Co., Germantown, Pa.

RESISTORS, Fixed Precision

Instrument Resistors, Inc., Little Falls, N. J.
Intern'l Resistance Co., Philadelphia
Ohmite Mfg. Co., 4835 Flournoy St., Chicago

RESISTORS, Flexible

Clarostat Mfg. Co., Inc., Brooklyn, N. Y.

RESISTORS, Variable

★ Aerovox Corp., New Bedford, Mass.
Allen-Bradley Co., Milwaukee, Wis.
Amer. Instrument Co., Silver Spring, Md.
Atlas Resistor Co., N. Y. C.
Centralab, Milwaukee, Wis.
Chicago Tel. Supply Co., Elkhart, Ind.
Cinema Eng. Co., Burbank, Cal.
Clarostat Mfg. Co., Brooklyn, N. Y.
Cutler-Hammer, Inc., Milwaukee, Wis.
DeJur Amsco Corp., Shelton, Conn.
Electro Motive Mfg. Co., Willimantic, Conn.
General Radio Co., Cambridge, Mass.
G-M Labs., Inc., Chicago, Ill.
Hardwick, Hindle, Inc., Newark, N. J.
Instrument Resistors, Inc., Little Falls, N. J.
Intern'l Resistance Co., Philadelphia
Lectrohm, Inc., 5125 W. 25 St., Cicero, Ill.
Mallory & Co., P. R., Indianapolis, Ind.
Ohio Carbon Co., Cleveland, Ohio
Ohmite Mfg. Co., 4835 W. Flournoy St., Chicago
Precision Resistor Co., Newark, N. J.
Shalleross Mfg. Co., Collingdale, Pa.
Stackpole Carbon Co., St. Marys, Pa.
Utah Radio Prods. Co., 820 Orleans St., Chicago
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
Wirt Co., Germantown, Pa.

RESISTORS, Variable, Ceramic Base

Hardwick, Hindle, Inc., Newark, N. J.
Lectrohm, Inc., 5125 W. 25 St., Cicero, Ill.
Ohmite Mfg. Co., 4835 Flournoy St., Chicago

RIVETS, Plain

Central Screw Co., 3519 Shields Av., Chicago
Progressive Mfg. Co., Torrington, Conn.
Republic Steel Corp., Cleveland, O.

SCREW MACHINE Parts, Non-Metallic

Continental-Diamond Fibre Co., Newark, Del.

SCREWS, Recessed Head

American Screw Co., Providence, R. I.
Bristol Co., The, Waterbury, Conn.
Chandler Prods. Co., Cleveland, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Federal Screw Prod. Co., 224 W. Huron St., Chicago
International Screw Co., Detroit, Mich.
Lamson & Sessions, Cleveland, O.
National Screw & Mfg. Co., Cleveland, O.
New England Screw Co., Keene, N. H.
Parker Co., Charles, The, Meriden, Conn.
Parker-Kalon Corp., 198 Varick, N. Y. C.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., Chicago
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Shakeproof, Inc., 2501 N. Keeler Av., Chicago
Southington Hardw. Mfg. Co., Southington, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
Whitney Screw Corp., Nashua, N. H.

SCREWS, Self-Tapping

American Screw Co., Providence, R. I.
Central Screw Co., 3519 Shields Av., Chicago
Continental Screw Co., New Bedford, Mass.
Federal Screw Prod. Co., 224 W. Huron St., Chicago
Parker-Kalon Corp., 198 Varick, N. Y. C.
Shakeproof, Inc., 2501 N. Keeler, Chicago

SCREWS, Set and Cap

Allen Mfg. Co., Hartford, Conn.
Federal Screw Prod. Co., 224 W. Huron St., Chicago
Parker-Kalon Corp., 198 Varick, N. Y. C.
Republic Steel Corp., Cleveland, O.
Shakeproof, Inc., 2501 N. Keeler Av., Chicago

SCREWS, Hollow & Socket Head

Allen Mfg. Co., Hartford, Conn.
Central Screw Co., 3519 Shields, Chicago
Federal Screw Prod. Co., 224 W. Huron St., Chicago
Parker-Kalon, 198 Varick, N. Y. C.
Standard Pressed Steel Co., Jenkintown, Pa.

SELENIUM

Federal Tel. & Radio Corp., S. Newark, N. J.
Benwood Linze Co., St. Louis, Mo.
Selenium Corp. of Amer., 1800 W. Pico Blvd., Los Angeles

SHAFTING, Flexible

Breeze Corps., Inc., Newark, N. J.
Mall Tool Co., 7708 S. Chicago Ave., Chicago
Steward Mfg. Corp., 4311 Ravenswood Ave., Chicago
Walker-Turner Co., Inc., Plainfield, N. J.
White Dental Mfg. Co., 10 E. 48 St., N. Y. C.

SHEETS, Electrical

American Rolling Mill Co., Middletown, O.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Follansbee Steel Corp., Pittsburgh, Pa.
Granite City Steel Co., Granite City, Ill.
Newport Rolling Mill Co., Newport, Ky.
Republic Steel Corp., Cleveland, O.
Ryerson & Son, Inc., Jos. T., Chicago

SHIELDS, Tube

★ Goat Metal Stampings, Inc., 314 Dean St., Brooklyn, N. Y.

SOCKETS, Tube

Aladdin Radio Industries, 501 W. 35th St., Chicago
Alden Prods. Co., Brockton, Mass.
Amer. Phenolic Corp., 1830 S. 54th Av., Chicago
Amer. Radio Hardware Co., 476 B'way, N. Y. C.
Birnbach Radio Co., 145 Hudson, N. Y. C.
Bud Radio, Inc., Cleveland, O.
Cinch Mfg. Co., 2335 W. Van Buren St., Chicago
Cont'l-Diamond Fibre Co., Newark, Del.
Eagle Elec. Mfg. Co., Brooklyn, N. Y.
Eby, Inc., H. H., Philadelphia
Federal Screw Prods. Co., 26 S. Jefferson, Chicago
Franklin Mfg. Corp., 175 Varick, N. Y. C.
Hammarlund Mfg. Co., 424 W. 33 St., N. Y. C.
Johnson Co., E. F., Waseca, Minn.
Jones, Howard B., 2300 Wabansia, Chicago
Micarta Fabricators, Inc., 4619 Ravenswood, Chicago
Millen Mfg. Co., James, Malden, Mass.
Miller Co., J. W., Los Angeles, Cal.
★ Nat'l Co., Malden, Mass.
Remler Co., San Francisco, Cal.
Smith Co., Maxwell, Hollywood, Cal.

SOCKETS, Tube, Ceramic Base

Johnson Co., E. F., Waseca, Minn.
★ National Co., Inc., Malden, Mass.

SOLDER, Self-fluxing

Garden City Laboratory, 2744 W. 37th Pl., Chicago
★ General Elec. Co., Bridgeport, Conn.
Kester Solder Co., 4209 Wrightwood Av., Chicago
Ruby Chemical Co., Columbus, O.

SOLDER POTS

Lectrohm, Inc., Cicero, Ill.

SPEAKERS, Cabinet Mounting

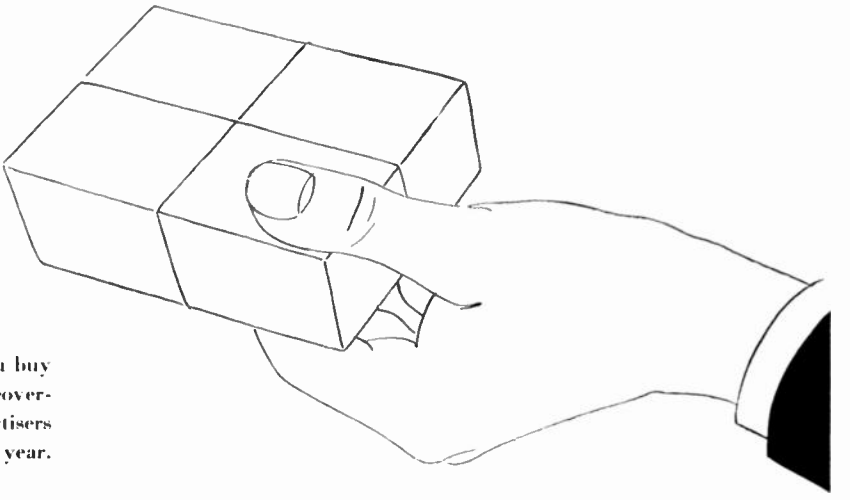
Chanadagraph Speakers, Inc., 3911 S. Michigan Ave., Chicago
Jensen Radio Mfg. Co., 6601 S. Laramie St., Chicago

SPEAKERS, Outdoor Type

Jensen Radio Mfg. Co., 6601 S. Laramie St., Chicago
University Labs., 225 Varick St., N. Y. C.

SPRINGS

Accurate Spring Mfg. Co., 3817 W. Lake, Chicago
American Spring & Mfg. Corp., Holly, Mich.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Barnes Co., Wallace, Bristol, Conn.
Cuyahoga Spring Co., Cleveland, O.
Gibson Co., Wm. D., 1800 Clybourn Av., Chicago
Hubbard Spring Co., M. D. Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.



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To advertisers who are planning to use space in Radio-Electronic Engineering: If you want those please-send-me-your-catalog replies, you'll be disappointed. . . . Our readership is made up almost entirely of radio-electronic designers, engineers, engineering executives, and purchasing agents, both civilian and military. These men have no time for idle curiosity about your products. When they write letters, they mean business. . . . If you want such replies, put Radio-Electronic Engineering at the top of your list. It ranks No. 1 in attention value for reaching this group. . . . This statement is borne out by the experience of concerns now using Radio-Electronic Engineering for the third consecutive year.

February, 1943

Instrument Specialties Co., Little Falls, N. Y.
Muehlhausen Spring Corp., Logansport, Ind.
Peck Spring Co., Plainville, Conn.
Raymond Mfg. Co., Corry, Pa.

STAMPINGS, Metal

★ Goat Metal Stampings, Inc., 314 Dean St., Brooklyn, N. Y.
Insuline Corp. of Amer., Long Island City, N. Y.

SUPPRESSORS, Parasitic

Ohmite Mfg. Co., 4835 Flournoy St., Chicago

SWITCHES, Aircraft Push

Square D Co., Kollsman Inst. Div., Elmhurst, N. Y.

SWITCHES, Key

Chicago Tel. Supply Co., Elkhart, Ind.
General Control Co., Cambridge, Mass.
Mossman, Inc., Donald P., 6133 N. Northwest Hy., Chicago

SWITCHES, Micro

Micro Switch Corp., Freeport, Ill.

SWITCHES, Rotary Gang, Bakelite Wafer

Mallory & Co., Inc., P. R., Indianapolis, Ind.
Stackpole Carbon Co., St. Marys, Pa.

SWITCHES, Rotary Gang, Ceramic Wafer

Oak Mfg. Co., 1267 Clybourn Ave., Chicago
Ohmite Mfg. Co., 4835 Flournoy St., Chicago
Shallcross Mfg. Co., Collingsdale, Pa.

SWITCHES, Time Delay

Haydon Mfg. Co., Inc., Forestville, Conn.
Industrial Timer Corp., Newark, N. J.
Sangamo Elect. Co., Springfield, Ill.

TERMINAL STRIPS

Cinch Mfg. Corp., W. Van Buren St., Chicago
Curtis Devel. & Mfg. Co., N. Crawford Ave., Chicago
Franklin Mfg. Corp., 175 Varick St., N. Y. C.
Jones, Howard B., 2300 Wabansia Ave., Chicago

TEST CHAMBERS, Temperature, Humidity, Altitude

Kold-Hold Mfg. Co., 446 N. Grand Ave., Lansing, Mich.
Mobile Refrigeration, Inc., 630 5th Ave., N. Y. C.
Tenney Engineering, Inc., Montclair, N. J.

TRACING PAPERS

Keuffel & Esser, Hoboken, N. J.

TRANSFORMERS, Constant-Voltage Power

Dongan Elec. Co., 74 Trinity Pl., N. Y. C.
Raytheon Mfg. Co., Waltham, Mass.
Sola Electric Co., 2525 Clybourn Ave., Chicago

TRANSFORMERS, IF, RF

Aladdin Radio Industries, 501 W. 35th St., Chicago
Amer. Transformer Co., Newark, N. J.
Automatic Windings Co., E. Passaic, N. J.
Caron Mfg. Co., 415 S. Aberdeen, Chicago
D-X Radio Prods. Co., 1575 Milwaukee, Chicago
Gen'l Winding Co., 420 W. 45 St., N. Y. C.
Greyhound Equip. Co., 1720 Church Ave., Brooklyn, N. Y.
Guthman & Co., 400 S. Peoria St., Chicago
Hammarlund Mfg. Co., 424 W. 33 St., N. Y. C.
★ Meissner Mfg. Co., Mt. Carmel, Ill.
Millen Mfg. Co., James, Malden, Mass
Miller Co., J. W., Los Angeles, Cal.
★ Nat'l Co., Malden, Mass.
Sickles Co., F. W., Springfield, Mass.
Super Elect. Prod. Corp., Jersey City, N. J.
Teleradio Eng. Corp., 484 Broome St., N. Y. C.
Triumph Mfg. Co., 4017 W. Lake, Chicago

TRANSFORMERS, Receiver Audio & Power

Acme Elec. & Mfg. Co., Cuba, N. Y.
Amer. Transformer Co., Newark, N. J.
Amplifier Co. of Amer., 17 W. 20th St., N. Y. C.
Audio Devel. Co., N. Minneapolis, Minn.
Chicago Transformer Corp., 3501 Addison St., Chicago
Cinaudagraph Speakers, Inc., 3929 S. Michigan, Chicago
Dongan Elec. Co., 74 Trinity Pl., N. Y. C.
Electronic Trans. Co., 515 W. 29 St., N. Y. C.
Ferranti Elec., Inc., 30 Rockefeller Plaza, N. Y. C.
Freed Trans. Co., 72 Spring St., N. Y. C.
Gen'l Radio Co., Cambridge, Mass.
General Trans. Corp., 1250 W. Van Buren, Chicago
Halldorson Co., 4500 Ravenswood, Chicago
Jefferson Elec. Co., Bellwood, Ill.
Kenyon Transformer Co., 840 Barry St., N. Y. C.
Magnetic Windings Co., Easton, Pa.
Newark Transformer Co., Newark, N. J.
New York Transformer Co., 51 W. 3rd, N. Y. C.
Norwalk Transformer Corp., S. Norwalk, Conn.
Raytheon Mfg. Co., Waltham, Mass.
Skaggs Transformer Co., Los Angeles, Cal.
Standard Transformer Corp., 1500 N. Halsted, Chicago
Super Elect. Prod. Co., Jersey City, N. J.
Superior Elec. Co., Bristol, Conn.
Thermador Elect. & Mfg. Co., Riverside Dr., Los Angeles
Thordarson Elec. Mfg. Co., 500 W. Huron, Chicago
Utah Radio Prods. Co., 820 Orleans St., Chicago
★ United Transformer Co., 150 Varick St., N. Y. C.

TUBE MANUFACTURING MACHINES

Hilton Eng. Labs., Redwood City, Calif.
Elsler Eng. Co., 7518 13th St., Newark, N. J.

TUBES, Cathode Ray

★ Dumont Labs., Allen B., Passaic, N. J.
Farnsworth Tele. & Radio Corp., Ft. Wayne, Ind.
★ General Elec. Co., Schenectady, N. Y.
Nat'l Union Radio Corp., Newark, N. J.
RCA Mfg. Co., Camden, N. J.

TUBES, Current Regulating

Amperite Co., 561 Broadway, N. Y. C.
Champion Radio Works, Danvers, Mass.
Hytron Corp. & Hytronic Labs., Salem, Mass.
RCA Mfg. Co., Camden, N. J.
Sylvania Elec. Prod., Inc., Emporium, Pa.

TUBES, Photo-Electric

Bradley Labs., New Haven, Conn.
Cont'l Elec. Co., Geneva, Ill.
De Jur-Amsco Corp., Shelton, Conn.
De Vry, Herman A., 1111 W. Center, Chicago
Electronic Laboratory, Los Angeles, Cal.
Emby Prods. Co., Los Angeles, Cal.
★ General Elec. Co., Schenectady, N. Y.
General Scientific Corp., 4829 S. Kedzie Av., Chicago
G-M Labs., 4313 N. Knox Av., Chicago
Leeds & Northrup Co., Philadelphia
Nat'l Union Radio Corp., Newark, N. J.
Photobell Corp., 123 Liberty St., N. Y. C.
RCA Mfg. Co., Camden, N. J.
Rehtron Corp., 2159 Magnolia Av., Chicago
Rhamstine, J., Detroit, Mich.
Westinghouse Lamp Div., Bloomfield, N. J.
Weston Elec. Inst. Corp., Newark, N. J.

TUBES, Receiving

★ General Electric Co., Schenectady, N. Y.
Hytron Corp., Salem, Mass.
Ken-Rad Tube & Lamp Corp., Owensboro, Ky.
Nat'l Union Radio Corp., Newark, N. J.
Raytheon Prod. Corp., 420 Lexington Av., N. Y. C.
RCA Mfg. Co., Camden, N. J.
Sylvania Elect. Prod., Inc., Emporium, Pa.
Tung-Sol Lamp Works, Newark, N. J.

TUBES, Transmitting

Amperex Electronic Prods., Brooklyn, N. Y.
Eitel-McCullough, Inc., San Bruno, Cal.
Federal Telegraph Co., Newark, N. J.
★ General Elec. Co., Schenectady, N. Y.
Heintz & Kaufman, S. San Francisco, Cal.
Hytron Corp., Salem, Mass.
Nat'l Union Radio Corp., Newark, N. J.
Raytheon Prod. Corp., 420 Lexington Av., N. Y. C.
RCA Mfg. Co., Camden, N. J.
Taylor Tubes, Inc., 2341 Wabansia, Chicago
United Electronics Co., Newark, N. J.
Westinghouse Lamp Div., Bloomfield, N. J.

TUBES, Voltage-Regulating

Amperite Co., 561 Broadway, N. Y. C.
Hygrade Sylvania Corp., Salem, Mass.
Hytron Corp., Salem, Mass.
RCA Mfg. Co., Camden, N. J.

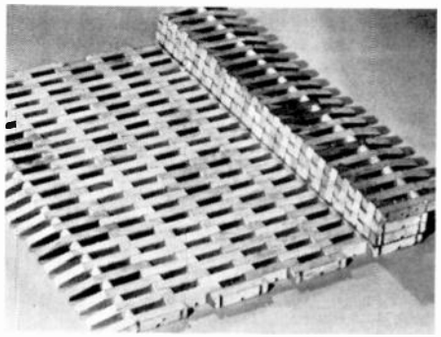
TUBING, Laminated Phenolic

Brandywine Fibre Prods. Co., Wilmington, Del.
Formica Insulation Co., Cincinnati, O.
★ General Electric Co., Pittsfield, Mass.
Insulation Mfgrs. Corp., 565 W. Washington Blvd., Chicago

SPOT NEWS NOTES

New Relay Designs: Very handsome line of relays, departing from conventional types, has been brought out by Allied Control Company, 233 Fulton Street, New York City. Suitable for aircraft applications, they are small, light, hold position at 12G., and operate at + 70° C. to − 50° C.

Foot Ease: To provide comfort to factory workers who must stand on concrete floors, American Mat Company, Toledo, O., has brought out flexible wood-link matting, illustrated above. Long wear, light weight, safety, and sanitary construction are added features. Can be



rolled up when the floor is cleaned. Available in stock sizes, and in widths up to 36 ins. of any length.

THRIFT CAN BE MADE POPULAR

(CONTINUED FROM PAGE 8)

Fig. 1 indicates the magnitude of this task.

There were clearly two problems: one to organize to sort, identify, inspect and return to production the material on hand and still coming; the other to stop or reduce the flood at its source.

Many minds have contributed to the solutions partially arrived at for both these problems but the big front-page story of interest to every manufacturer in the same boat as Republic Aviation is that the habits and thinking of an entire organization were definitely changed in a period of ninety days.

It was one thing to buy magnetic separators, to install rotary screens, to plan for conveyor belts, and to hope to find or build successful rivet sorting machines. It was not too hard to recruit and train girls with nimble fingers nor to satisfy Company and Army inspectors that resorted material was as good as new, but how could the Voice of Reclamation reach the ears and minds of men and women who had no goal or thought but increased output?

It was done by personal missionary work started at the top with an invitation to president Ralph Damon, vice-president Alfred Marchev, factory manager H. E. Lasker, and all the other important executives to come over to see what the Material Sorting division was receiving.

For days the exhibition was continued. Department heads sent over their supervisors; they sent their foremen and leadmen. Production Control sent their expeditors. All were appalled at what they saw. The real turn of the tide, however, came when Reclamation was invited to join the staff of department heads who appeared as guest speakers before the Leadmen's Training Classes.

Week after week the writer took keymen, especially chosen as leaders, from the day and night shifts behind the scenes to discuss every problem of the Reclamation department, and asked their help in meeting this situation.

The entire character of mixed hardware sent to the Sorting division began to change. Parker fittings stopped coming, so did skin fasteners and dozens of other items having real scarcity value. Ideas for better methods began to come from all over the plant.

The new thinking spread to many fields. A better method for using random sizes of sheet aluminum was suggested; revisions of certain blueprints were suggested to reduce waste of metal. Engineers on their own time began working on new machines to help sort hardware. Army inspectors became interested and gave splendid assistance. Today there is hardly a nook or corner of Republic Aviation where Reclamation has not made real friends. In our plant it is again becoming popular to be thrifty.

IMPORTANT BOOKS

A Guide to Cathode Ray Patterns: By Merwyn Bly. 40 pages, 183 illustrations, 8½ by 11 ins. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York City. Price $1.50.

One of the most useful and perhaps the most interesting tools of the radio-electronic engineer is the cathode ray oscilloscope. Improved designs with flat response up to very high frequencies, less expensive models, and long-life tubes have brought this device into wide use, and have opened new applications.

However, there are many mysteries about the meaning of the fascinating patterns which appear on the screen. The author of this Guide has undertaken to make clear their significance for the benefit of those who now, when time is precious, must come quickly to an understanding of what they see.

This has been done very successfully in a series of nearly 200 illustrations of typical cathode ray patterns, each with a brief description. The illustrations are arranged in related groups.

These groups cover phase determination, frequency determination, modulation patterns, sine-wave testing, square-wave testing, resonance curves, vacuum tube characteristics, and miscellaneous patterns.

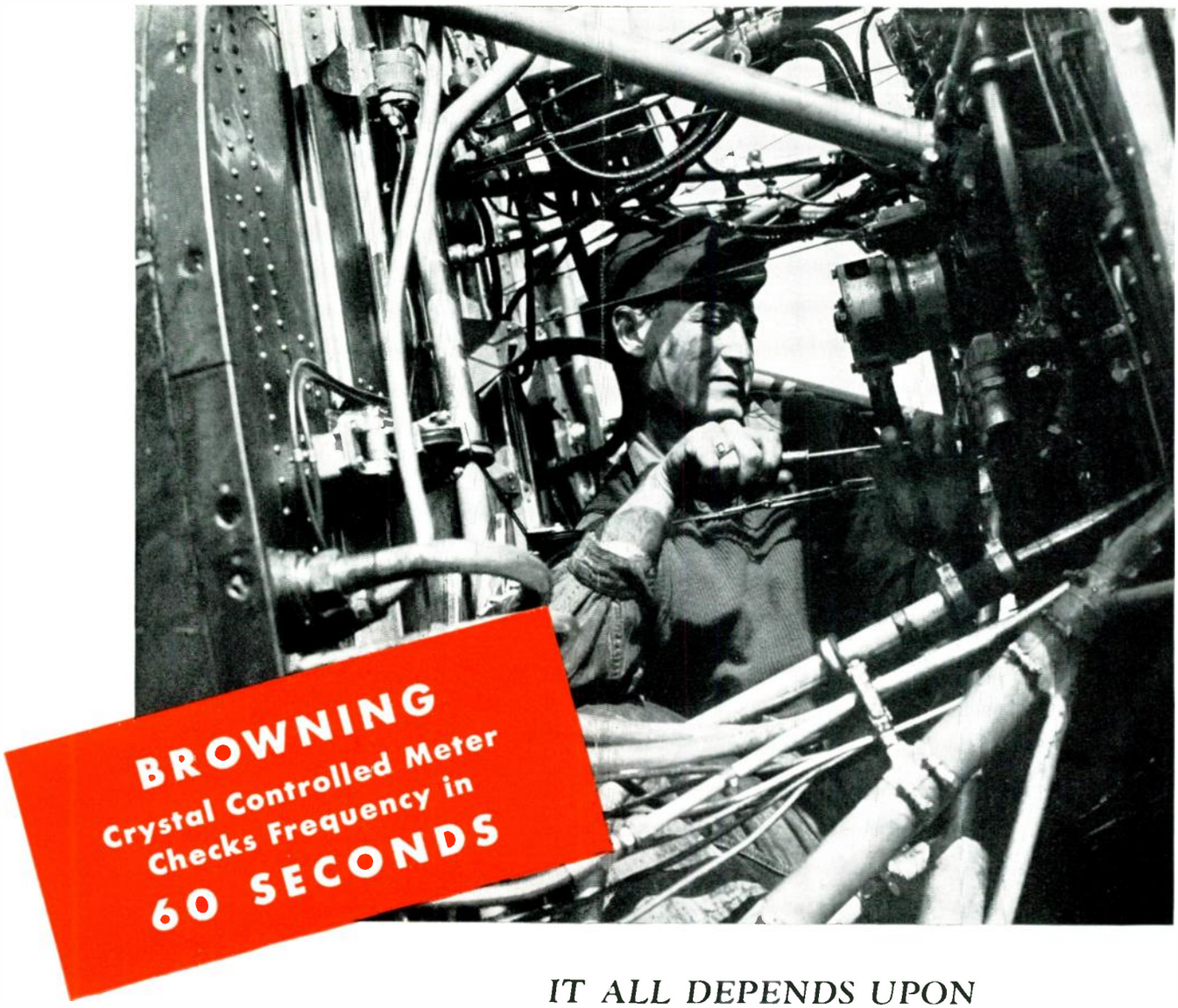
With the assistance of the illustrations, any type of pattern which appears on the cathode ray screen can be first classified, and then interpreted as to its significance.

Bluebook of Projection: By F. H. Richardson. 700 pages, 218 illustrations, 6¼ by 9 ins., cloth binding. Published by Quigley Publishing Company, Inc., New York City. Price $7.25.

This 7th edition of F. H. Richardson's Bluebook of Projection is a substantially new textbook and operating guide of motion picture projection equipment, methods, and technique. Both the general scheme of presentation and the revisions made necessary by recent technical developments distinguish this volume from the 6th edition, which was published in 1935.

Sound is treated as an integral part of image projection in a unified system of motion picture reproduction. Both theoretical and applied electricity are covered in the first five chapters, instead of being dealt with in their relation to specific classes of equipment. Thus, when the reader comes to the study of the components of the projection system, he is prepared to understand their functions whether they concern sound or image. This arrangement is a decided improvement over that of the previous edition.

Particularly interesting are the new chapters on control-tract and stereophonic sound, as practical developments of the future. Twenty highly useful charts form a guide to the location and correction of faults in sound systems.



IT ALL DEPENDS UPON

FREQUENCY STABILITY

WHEN the last adjustment has been made to tune this fighter plane to top efficiency, one more vital check will remain. The radio transmitter must be tuned precisely to its assigned frequency. Extreme accuracy is required because off-frequency transmission may result in failure to reach headquarters, or interference with other planes on adjacent channels.

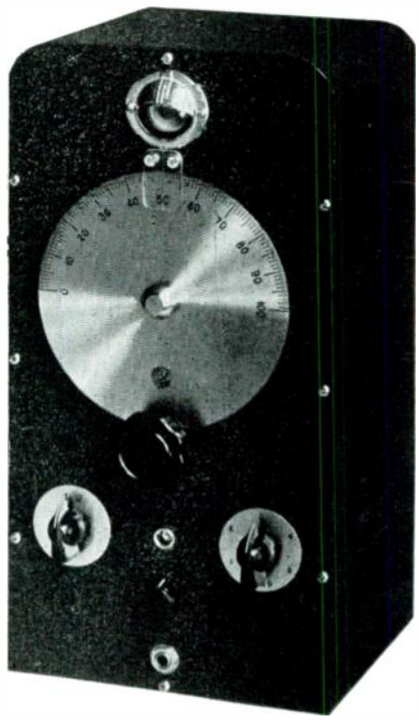
There is the same need for exact adjustment of mobile transmitters for police and other emergency services. The Browning Frequency Meter illustrated here has become standard for this purpose because it combines extreme accuracy with time-saving ease of operation.

A weekly check of every transmitter is not only protection for your own communications, but an obligation to others with whom you share your frequency.

The Browning Frequency Meter, illustrated here, is used as standard equipment for police and public utility emergency radio systems throughout the USA. It provides the greater precision now required by the FCC for all emergency transmitters.

Suitable for both FM and AM, the Browning Meter is built with one to four bands, for any frequencies between 1.5 and 60 mc. Prices:

1 Band	$125	3 Bands	$165
2 Bands	145	4 Bands	185



BROWNING LABORATORIES, INC.

WINCHESTER • MASSACHUSETTS

By Way of Contrast!

FIVE of the young ladies in this picture are employed at the REL factory, building military radio and electronic equipment for the United States and our Allies. It is truly amazing equipment, too — beautifully made and marvelously efficient, yet tough enough to withstand the punishment of service in a global war.

We don't know the sixth young lady in this picture. The reason she is there is that this is the best way we knew to bring out the contrast between today and yesterday — the difference, for example, between the pre-war broadcast stations now in use, and the equipment we shall be prepared to deliver after the War.

When you see it, you'll go back to your old transmitter and say: "Well, you were pretty good in your day, but now you make me think of the sixth girl I saw in one of REL's advertisements!"

Then you will understand why we are saying today — *Look to REL for peacetime leadership!*

REL

RADIO ENGINEERING LABS., Inc.
Long Island City New York

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5334 Hollywood Blvd., Hollywood, California
2040 Grand River Ave. W., Detroit, Michigan
310 Fifteenth St., Denver, Colorado

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