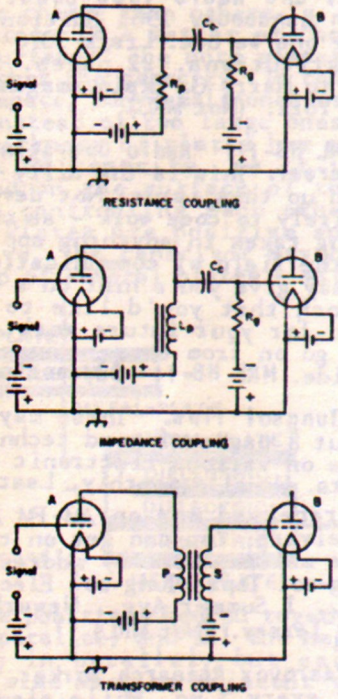
No. 2 25¢

The Capacitor in Action. Page 3

EXPERIMENTERS'

ELECTRONICS and SCIENCE

THREE BASIC FORMS OF COUPLING BETWEEN VACUUM TUBE AMPLIFIERS



The high point of yesterday's achievement should be your starting point for today.

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MRL "EXPERIMENTERS' ELECTRONICS and SCIENCE."

A random publication of

Modern Radio Laboratories.
P. O. Box 14902
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Specialists in Small Set Development since 1932.

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A note to our friends...

MRL wants to thank the many subscribers for signing up with E-S. Many of our old RB&H readers are getting back into the swim again. It seems lots of them just keep "absorbing" our literature!

E-S #2 was delayed this trip. We ran into more work than expected, in getting out MRL HB-11 "Radio Operating as a Career." Next issue should go out a lot sooner.

You can be sure we are always busy here at MRL. The minute we get all orders out - our efforts are directed back to more plans, literature, etc. We always have something new coming up. "Never a dull monent..."

You will note we cut out the Stamp page. Not that many of you aren't collectors- but the Radio gang hollered for more circuits. Occasional changes in E-S will be made as we go along. Keep us informed of your wishes.

Keep going with your experiments - there is never-ending enjoyment in all of them.

In the meantime, our best New Year wishes for 1962.

Elmer G. Osterhoudt (HQ)
Mabel E. Osterhoudt (XYL)

FOR GOOD READING.

"Short Course for the Novice License." 4 pages of good data to help you get your license. No examination is required, but you are given a form to fill out. The booklet is free, from Eico Electrical Instrument Co., Inc., 3300 Northern Blvd., Long Island City 1, New York. (Not MRL)

Transistor Substitution Handbook. You never saw as many TRX listed in one place- 6500 direct substitutes; 668 subs. for Japanese types and 530 diodes. 92 pages; stiff cover. Buy it from Howard W. Sams Co., 2202 E. 46th St., Indianapolis 6, Indiana, for $1.50. (Not MRL)

TV and Radio Tube Substitution Handbook. 1961 Edition. We have one we use. Lists 3370 tube substitutions. 22 pages. Send 50¢ to Harry G. Gisin, Amagansett New York. (Not MRL)

MRL HB-11. "Radio Operating as a Career." This is the dilly that held up this issue. Not devoted entirely to code work - as operating takes in anything applied to the field of communications. It may give you a hint on a good branch that you'd like to get into for your future work. You can go on from there - once you decide. MRL HB-11- 53¢ postpaid.

"Tungsol Tips." These may run about 8 pages of good technical data on various Electronic subjects. Usually monthly. Last one we received was on AM-FM Auto receivers. You can get on their free mailing list by addressing Tung-sol Tips, Tung-sol Electric Inc., 1 Summer Ave., Newark 4, New Jersey. (Not MRL)

"Aerovox Research Worker." Put out every 3 mo. While slanting on Condensers - it may be on any Electronic subject. Sent free if you address Aerovox Corpn., New Bedford, Mass. (Not MRL)

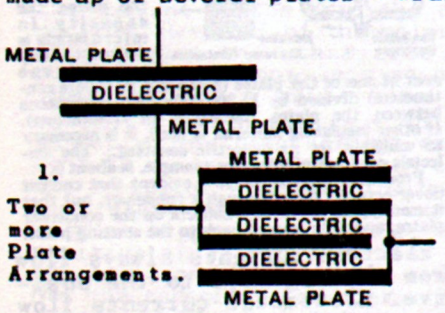
THE CAPACITOR in ACTION.

ACTION OF A CAPACITOR.

Now that we know something of the movement of electrons - we can go on with our capacitor. Any capacitor consists of three parts, e.g., one or more each of positive and negative plates and separated by a dielectric.

The amount of charge depends on (1) the higher the voltage, the higher the charge; (2) the larger the area and number of plates, the more electricity it will hold; (3) the closer the positive and negative plates, the greater the charge, or tendency to jump across the dielectric; (4) and some dielectrics allow the capacitor to hold a greater charge than others.

Capacity is a matter of "how much surface?" The more plates, the higher the capacity. To conserve space, many small ones are used instead of two large ones. The thickness of plates has no effect on capacity, as it is charged on the surface of the plates confronting each other only. Plates are positive and negative. The capacitor may be made up of several plates - with



1. Two or more Plate Arrangements.

all the positives hooked together in parallel, and all the negatives in parallel, but each poled side must be adjacent to the other.

A capacitor will receive only so much charge, depending on its size. If the source of electricity is then disconnected, the capacitor holds its charge, as many of you have found out! If you hold a wire between positive and negative plates, of a charged capacitor, there is a surge, or spark, from positive to negative - or thru your hand!

Certain materials are said to be good insulators. For instance - a wire surrounded by a covering of cotton or enamel insulation is said to be insulated from another wire similarly insulated. This is true for DC but not for AC, due to stray induction. The magnetic waves, around the wire, when the current is reversed, tend to interfere with the opposite wire. This is not as noticeable with low-frequency 110 v. 60 cycle as with RF high-frequencies. Likewise, with a capacitor, DC does nothing but charge up each side to positive and negative. However, with AC, due to the reversing of the cycle - and its consequent discharge - allows the current literally to "pass thru" the capacitor - altho this is not actually the case. With DC - we have no flow thru a capacitor at all.

The dielectric is in between the plates and may be air, glass etc. as per chart, but it must be an insulator.

The commonest dielectric used in variable condensers is air, and its dielectric constant, or specific inductive capacity, is unity. For fixed condensers, one of the best dielectrics is mica, and it is used on practically all small fixed condensers for radio use, because of its low losses. When a voltage is impressed across a condenser, a certain amount of energy is consumed in the dielectric, and the smaller this energy loss, the better is the condenser. For the larger condensers, of one or two microfarads capacity, oiled paper is generally used. Its use helps to reduce the cost and the break-down voltage of such a condenser will be greater than if plain paper is used.

Solid dielectrics have the disadvantage that if they are once broken down and punctured, due to excessive voltage, they are rendered useless. However, if a liquid dielectric is used, this disadvantage cannot exist, and for this reason laboratory condensers of fairly large capacity quite frequently use castor oil as the dielectric. In this way it is not only possible to obtain variable condensers with a fairly large capacity (the capacity of any given condenser by the use of castor oil is made five times as great as it would be if air were used), but it is also possible to apply greater voltages without sparking between plates. The capacity of any given condenser is proportional to the constant of the dielectric that is used.

Some of the most common materials used as dielectrics are listed in the table given herewith.

Material	Dielectric Constant	Puncture Voltage*
Air	1.0	19.8-22.8
Alsimag A196	5.7	240
Bakelite (paper-base)	3.8-5.5	650-750
Bakelite (mica-filled)	5-6	475-600
Celluloid	4-16	
Cellulose acetate	6-8	300-1000
Fiber	5-7.5	150-180
Formica	4.6-4.9	450
Glass (window)	7.6-8	200-250
Glass (photographic)	7.5	
Glass (Pyrex)	4.2-4.9	335
Lucite	2.5-3	480-500
Mica	2.5-8	
Mica (clear India)	6.4-7.5	600-1500
Mycalex	7.4	250
Paper	2.0-2.6	1250
Polyethylene	2.3-2.4	1000
Polystyrene	2.4-2.9	500-2500
Porcelain	6.2-7.5	40-100
Rubber (hard)	2-3.5	450
Steatite (low-loss)	4.4	150-315
Wood (dry oak)	2.5-6.8	

*In volts per mil (0.001 inch)

To the above list we will add:

Aluminum oxide	10	10.
Castor oil	5	
Ebonite	3	
Hard rubber	3-5	.006
Isolantite	6	.0018
Mylar	3	.5
Olive oil	3	
Paper (Kraft)	4	3.
Paraffin wax	2.5	
Petroleum oil	2	
Quartz	4.5	
Resin	2.5	
Shellac	3.5	
Tantalum oxide	11	11.
Vacuum	1	.0
Vaseline	2	

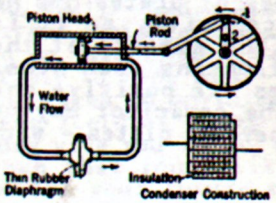
2. Dielectric Constants and Breakdown Voltages.

Mica dielectric was used as far back as 1907 - according to our data. Mica will hold twice the charge of paper.

From an early "Radio Broadcast Lab. Sheet"- we have the following, which explains the pump-like action of a capacitor.

A SIMPLE EXPLANATION OF CONDENSER ACTION

THE accompanying diagram shows the construction of a condenser, and also a simple analogy for its action. The crank and piston arrangement, when rotating, produces an alternating current of water which fills the system. A thin rubber diaphragm prevents any direct circulation, but, by bending back and forth, allows alternating motion of the water. The greater the area of the diaphragm, the thinner it is, and the more flexible it is, the easier it will be to turn the crank to operate the piston. If (refer to the diagram) the piston connecting rod is hitched to point No. 2 on the drive wheel instead of No. 1, only half the force will be required to turn the crank, as the diaphragm will only be stretched half as much. Also, the current will be only half as great. But if, then, the crank be turned twice as fast, the speed of the water will be doubled so that the current is the same as before. This establishes a relation that holds good in the electrical case, namely, that if the frequency be doubled, or trebled, etc., the electromotive force required to produce the same current will be only one half, or one third, etc., as great. In the electrical case, corresponding to the diaphragm we have a sheet of some insulating material (dielectric) separating the two sheets, or sets of sheets, of the condenser. By increasing the area of the metal plates, thinning the insulating material (this corresponds to decreasing the spacing between the plates), or employing dielectric with a high "constant" (see chart) — , the value of the applied voltage to produce a given current is proportionally decreased. Fixed condensers usually consist of metal foil cut up into small pieces which are connected together, and separated with mica or some other dielectric. There are two distinct sets of plates, corresponding to the rotor and stator plates of a variable condenser. The "capacity" of condensers used in radio circuits is usually expressed in microfarads, and if air is used as the insulating substance between the plates, the capacity in microfarads is approximately equal to the area of one of the plates (measured in square centimeters) divided by 11,300,000 times the distance between the plates (measured in centimeters). If other insulating material is used, it is necessary to multiply by its dielectric constant. The dielectric constant of mica, for example, is about 6.



From this explanation it is evident that current never actually flows through a condenser, but that it merely, we might say, collects on the condenser plates, and then returns back to the starting point.

Electron currents always flow from the negative to the positive. Electrical currents flow from positive to negative.

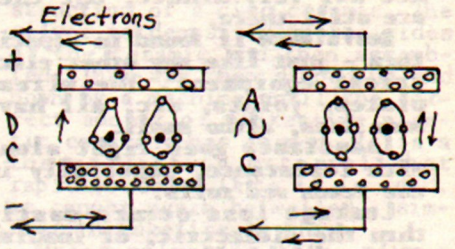
The application of a voltage across a piece of insulating material produces a certain interesting effect. When a source of positive electrical pressure is hooked to a plate- it is charged positively. Negative one is negative. Now the capacitor is said

to be charged. Positive electrons will flow into the positive plate, while there will be a flow of negative electrons away from the negative plates. That is, the positive side attracts the negative electrons within the structure of the dielectric. This makes the positive plates at a higher potential build-up than the negatives.

At the same time, there is a repulsion of negative electrons that helps the pressure along. No great migration of electrons takes place, but their eccentrical orbin is pulled over toward the positive plate. This strain, or electrostatic build-up is what holds the charge. During this strain, the dielectric will store up energy between the two sets of plates. This strain is similar to a piece of rubber connected to the two plates. The rubber retains its mechanical energy, inasmuch as it tends to pull the plates back together, until there is no longer any strain or voltage difference between them.

With an AC input - the positive retains the positive charge but on reversal of the cycle, it will be discharged to the negative side. By this reversal - the current passes thru the capacitor. Reversal of the polarities causes the other side to pull the electrons, and so on. There may be a brief flow of current between plates - which is called the displacement current. If the current is taken off the capacitor - some of the unusual state remains, that is, a surplus of positive ions at the positive plate and a surplus of electrons on the negative side. Now the capacitor is under a position of strain - and is said to be charged. On shorting the terminals - it returns to its original condition of discharge.

Ghirardi, in his Radio Physics Course, cleverly explains theory of charge thru the dielectric. The first shows the theory when capacitor is charged with DC, and



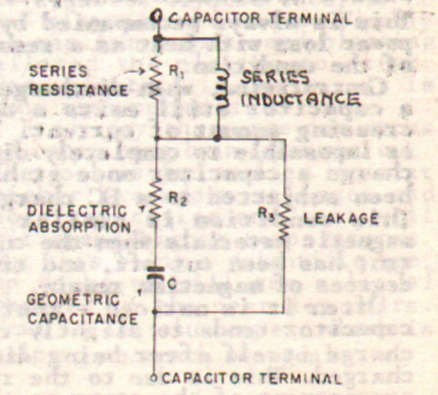
3. DC & AC Capacitor Action.

the orbits of the electrons are drawn toward the positive side. But, due to the current lag, the orbit is made oval in shape due to the pulling in first one direction and then the other. On removing the current supply, the electrons return to their approximate previous position.

LOSSES IN CAPACITORS.

As it is impossible to build anything perfectly, it is likewise impossible to build a capacitor that works perfectly. Any insulator can work as a dielectric, but certain ones are a lot better. A perfect capacitor would be one that does not leak; has no resistance in its leads; has no losses in its dielectric; and gives back all its charge once it has been discharged.

The diagram shows sources of most losses in capacitors. They



4. Loss in a Capacitor.

are all very minute, but they are still there.

Resistance if found in capacitors - just like any other electrical equipment. The wires, plates, joints, etc. all have some loss, altho small.

Inductance goes right along with resistance, especially in the leads and rolls.

Leakage loss occurs mostly thru the dielectric, or insulation, which allows current to leak across gradually. A theoretical capacitor would hold its charge indefinitely, but we know that most capacitors discharge within a short time of minutes or days. For instance, in paper capacitors, the paper dielectric may have impurities that offer less resistance to the leaking of current across dielectric.

Dielectric absorption is a loss that occurs in the dielectric material. It is the physical manifestation of the polarization of a dielectric in an electrical field. It is a natural characteristic - but is a loss source. Dielectric absorption is also a function of frequency. Dielectric properties control the amount of charge and the length of time the capacitor will remain charged. A decreasing current continues to flow into a capacitor after it is charged and this is absorbed by the dielectric field, therefore, is called dielectric absorption. This is always accompanied by a power loss with heat as a result of the condition.

Contrarivise, when discharged, a capacitor still emits a decreasing amount of current. It is impossible to completely discharge a capacitor once it has been subjected to a DC charge. This condition is similar to magnetic materials when the current has been cut off, and tiny degrees of magnetism remain.

Often it is noticed - that a capacitor tends to slightly recharge itself after being discharged. This is due to the rearrangement of the atoms on the plus and minus plates. High voltage capacitors often are shorted when not in use.

Paper condensers have more dielectric absorption than mica. Mica has more than air dielectric capacitors.

Dielectric hysteresis is a form of current lag in the dielectric. This is more noticeable in larger than smaller capacitors. This is one reason smaller ones are used for High frequency work. In capacitors, the current leads the voltage. As an example - a boy pushing a wheelbarrow down a hill - until the barrow runs away with him by its own weight.

MICA CAPACITORS.

It has been a long jump from the Leyden jar and the bulky glass plates to the tiny ceramic capacitors of today. When it was discovered that a mica dielectric was 7 times as good as air - this started cutting them down in size and up in efficiency.

Micas are used extensively, especially in tuning and other hi-frequency circuits. In many cases they are being replaced by ceramic and glass types.

Micas are made in brass foil and silver deposit types. Because mica can be sliced very thinly, you get lots of capacity with little chance of breakdown. The foil and mica sheets are stacked up - with half of the foil going one way and half the other, and each soldered to a pigtail lead. Micas are now molded in Bakelite cases, or may be dipped, to keep out moisture. In the older types the foil, mica and outside Bakelite covers were clamped in metal - in case you remember the old Cornell-Dubiliers (CD).

Micas run from almost nothing up to 1 mfd., and are marked by the dot system of coding. Tolerances in coding may run 5-20% on the regular micas. Now the drift is usually limited to about .1 mmfd. in the regular micas, at 150 C. to -55 C. Voltages may run up to 35,000 DC.

Silver micas are used for test standards, etc. The silver is deposited directly onto the mica sheet. Because it is deposited - there is no space between foil and mica - which gives increased stability and capacity. With the silver micas some moisture may leak thru the mica, but otherwise they are very stable. They have closer tolerances for Hi-Q circuits and measuring equipment.

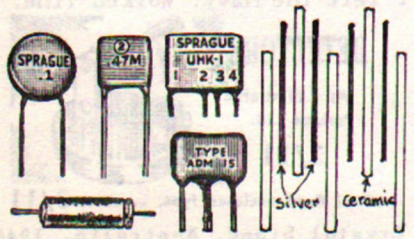
Heavy-duty micas are used in Amateur and commercial transmitters. They may run up to 12,500 v. DC., and may be up to several inches in size each way. They are used in buffer and other Hi-voltage circuits.

CERAMIC CAPACITORS.

Ceramics are made in various forms, as discs, tubulars, rolls and variables. Discs have lower inductance values than micas, but may be used where a mica is called for in most cases. They can usually be made much smaller than micas - from 1/4 to 7/8" in diameter.

They may range from approximately .5 mmfd. up to .1 mfd., with voltages up to 30,000 and surges to 40,000 DC. The temperature-compensating types can withstand temperatures from -40 to 85 C. while other types of capacitors would very as much as 15%. A disadvantage, however, is they are more fragile than micas and excessive heat may ruin them and leads may be easily broken if care is not taken.

The drawings show the various types of ceramics. Also the construction of a disc ceramic. The silver is deposited on the sides of the ceramic and then assembled. They are then dipped up and down by a machine until the correct amount of protective plastic covering has formed. It is a thermo-setting material that rapidly cools. Once it is cold, it cannot again be melted - similar to Bakelite in this.



5. Ceramics & Disc Construction.

Mylar polyester film, plus a high-grade paper is used in many of the ceramic rolled types.

Due to such high temperature demands of our space age, which may reach 1000 F. - materials must be more rugged. Glass loses its shape at 1100 F. A ceramic, developed by GE, is called Forsterite, a compound of Magnesium silicate. It is stable chemically, a good insulator and is very strong. It has operated successfully at 1500 F.

Tubular ceramics are made similar to Leyden jars - with the silver deposited on the inside and outside of the ceramic tube. They have more inductance than the disc types.

The variables are tube types but one tube slides inside the other. There is also a variable type that works in a circle like our regular tuning variables.

A problem they worked out during the War, where I worked at Electrical Products Corp., was trying to get a plating to stick to a quartz crystal face, so no end plates need be used. Finally it was found that sand-blasting allowed the plating to stick. Possibly this is the way it is done with ceramics.

Every day there are new types of capacitors being brought out. The goal is for smaller types at higher breakdown voltages and more capacities and that will withstand higher temperatures. But this being a scientific age, no doubt we will see a lot of changes in the next few years. Next is Tantalum types. which is helping to reach our goal.

To be continued.

CRYSTAL SETS and DIODES.

NOTES ON MRL #2 and 2-A SETS.

Lamp Shade Speaker on #2-A:

John Warnica, Canada, comes up with a good report: "Here is a FB way to make a real good magnetic speaker. Take an old lamp shade and fit a wooden block in small end. Drill a 1" hole in the block and clamp an earphone behind it. (2 phones may be set side by side for more volume.) Don't use lamp shades from the living room as women don't appreciate progress. The parchment shade will give you lots of amplification as well as a good tone. Suggest using soft wood, as cedar, sugar pine, etc. for the block. Here are some stations I got on the 2-A set: KMOX (700); WBZ, WBAZ Boston, Richmond (500); WCKY, WLWO Cincinnati (400); Wheeling, Pittsburgh (280); WGAR Cleveland (250); WKBW, WGR Buffalo (110); plus many SW Hams, etc."

500 Miles on 2-A:

Jim Rogers, Calif.: "Am well pleased with my 2-A and Trimm phones. I get Salt Lake (500); 3 S.F. stations (450) and many Shortwavers. I use 1N34 Diode."

50-in-1 Tuner on #2:

Brian Murphy, Ill.: "I made up your 50-in-1 Tuner (DP-61). It's perfect; couldn't be better. I use it on my #2 set. I get the signals louder and even get SW stations daytimes, loud. I got about 300 miles one day."

RECLAIMING DIODES & TRANSISTORS.

Richard Arnold, Kansas gets Montreal and New York on his #2, besides "assorted Hams." If he gets a bum Germanium diode - he cracks it open with pliers and uses it with a catwhisker. As Transistors are 2-contact Germaniums - and one side goes out, you can still use it as a Diode on the other side. What destroys a Transistor is getting voltage reversed so atoms are disturbed, thereby ruining it as Transistor use in the future.

Ernest R. Blanchard, Conn. reports getting Spanish stations on MRL Steel galenas. He says MRL cannot be beaten for crystal set parts and accessories.

MOLYBDENITE CHECKS STARLIGHT.

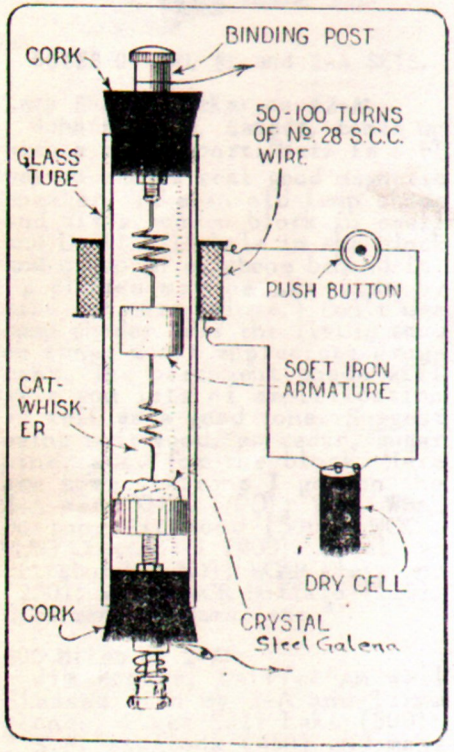
Les Hulet, N.J., some time ago wrote that his Molybdenite (often called Molly) - has worked out in the U.S.Naval Observatory for evaluating the light from distant stars. It converts light waves into electricity and actuates a galvanometer. No further information at this time.

MRL #10 DRIVES A 6" PM SPEAKER.

John P. Skubick, K8ANG, Warren Ohio. writes: "After 3 yrs. your #10 is still driving a 6" PM, 24 hrs. a day at good volume. Visitors (mostly Hams) are amazed and start to look for hidden TRX amplifiers. I use one TRX with a 25K impedance output primary into a 4 ohm VC circuit. The Aerial is an inverted-L about 50 feet long. I also had a "homebrew" #2 that worked OK on shortwaves, but got into an accident before I left the Navy. Worked fine."

MAGNETIC CRYSTAL DETECTOR

Here is an early arrangement for a push-button adjustment of a crystal detector. We prefer a Steel galena crystal for this. We have added another adjustment on the bottom so the Xtal may be turned around for a new spot. It is possible some of you may like to tinker along this line.

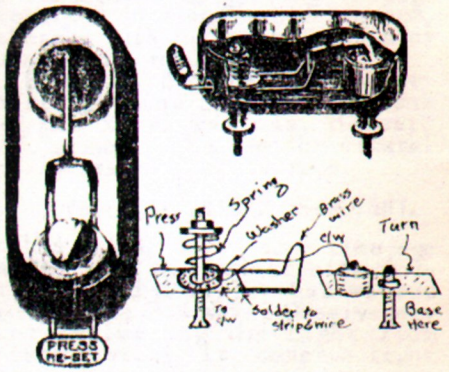


A very interesting crystal detector which gives excellent results in all types of receiving sets may be constructed as shown above. The detector itself is enclosed in a piece of glass tubing with corks at each end. Binding posts are mounted on the corks as illustrated, one of them connecting to the crystal cup and the other to the cat whisker, which is made with two spirals and between these is located a small iron armature. A solenoid is then wound around the tube as shown and connected to a battery and push button. To readjust the detector, press the button and release it. —Arthur Blumenfeld.

LOSSEV OSCILLATING CRYSTAL. In next #3 E-S. Watch for it....

PURETONE ADJUSTABLE XTL DETECTOR

In answer to many requests, we dug into our files and found the layout of this once famous stand as used in the 20's. By pressing a little lever, the catwhisker was slightly moved to one side for a new adjustment. As far as we know, it is no longer made. Below is a description of it, as given by the manufacturers:



Incorporates a sensitive, synthetic crystal, special catwhisker spring, and an ingenious Universal joint mounting - all mounted in a compact, Bakelite case, with protective glass window. The unique mounting arrangement of the catwhisker permits resetting in a fraction of a second by the touch of a finger. The synthetic crystal, employed in this detector, is extremely more sensitive than the natural Galena type, and it will pass current without burning up.

Here is an ideal unit for constructing "personal" crystal receivers which, in tone and quality, are not surpassed by even the latest 10-11 tube Electric receivers.

Above are 3 versions of it. We have shown the best in detail. Also, how one can swing the Xtal around for even more adjustments if desired. Steel galena used.

No doubt some of you young inventors can rig up something practical from these sketches.

TRANSISTORS (TRX)

TWO TRANSISTOR TESTERS.

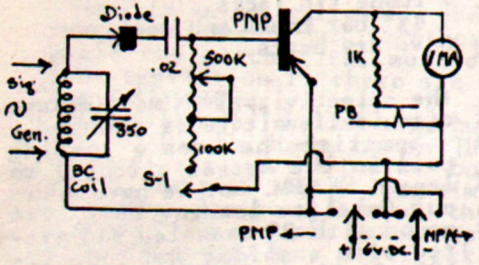
By Floyd Fitzgerald, Hawaii.

I am one of your newest customers, and have gotten a number of your Handbooks, DS, etc., and subscribed to E-S. I enjoy them very much.

I am a guided missile man, and seeing that we have the best of technical training given to anyone, anywhere, and access to the best in Lab. equipment, manuals, etc. - some people wonder why I am interested in Xtals and TRX. I can't give a definite reason, other than they are inexpensive to experiment with and also as a "labor of love!"

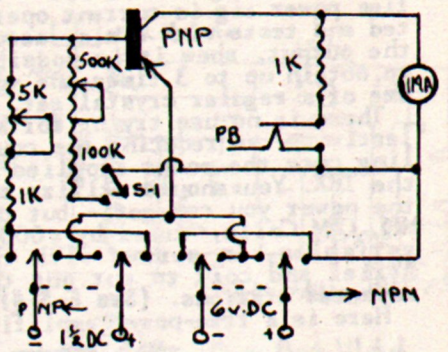
In your DS Vol. 3, page 3, is a "Simple TRX Leakage Tester" by Ed. Peil. I studied this and devised two more complicated circuits that you may like to pass on to your E-S readers. I constructed both of them in my Lab. and they work like charms.

In the first circuit, the basic



difference is in the use of a meter indicator, instead of the phones. Also the possibility of a regulated input signal at A-B, instead of RF from the Aerial. The circuit shows use for testing NPN or PNP TRX, by use of the DPDT switches. The push-button (pushed to read) can be a shunt to protect the meter from a strong signal. The output of this first circuit is pulsating DC - which operates the meter.

The circuit below is a further transition from the original - and it is for DC input. Output on this is pure DC. Meters are



just for noting the amount of deflection - and not a reading of m.a. entirely.

In operation, the signal is tuned in to maximum and then the switch (S-1) is thrown in. If too large a deflection of the meter- then the TRX shows a loss in efficiency. (See DS #3, p. 3)

SOME NOTES ON FLEA POWER RIG.

(E-S No. 1, page 10)

By Milton M. Schuman, Maryland.

Received copy of E-S #1 - and it's a beaut. The boys ought to eat it up. Congrats, and wishing you continued success with E-S.

From reports, I am getting from my members - there appears a renewed interest in "flea power" rigs. After all, who can resist "something for nothing?"

You mentioned about observing polarities - there is no reason to do this as it works with NPN or PNP. If a Diode detector is used ahead - then the Xtal polarity must be corrected.

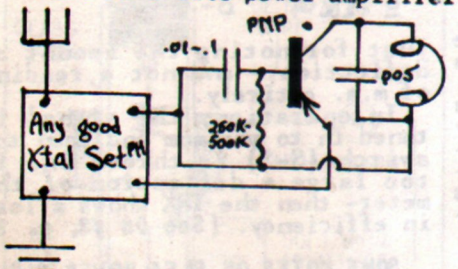
Further experiments have shown that "fuzzy reception" that you mentioned, is not caused so much by overloading - as by the use of the series-tuned Antenna condenser, especially on the H-F stations. When the variable condenser is open - the Aerial system is electrically shortened, and the power needed to actuate the TRX is proportionately diminished. When a Diode is used

for a detector ahead, this condition is minimized.

As for being a Xtal set - the flea power rig is current operated and tests with a m.a. across the output, show it is possible to obtain up to 3 times the volume of a regular crystal set.

There is no use trying for selectivity- as reducing the coupling cuts the power supplied to the TRX. You should utilize all the power you can get - but use MRL QRM Coils, tuned by .00035 variables, in series with the Aerial and coil to cut out the unwanted stations. (See E-S #1)

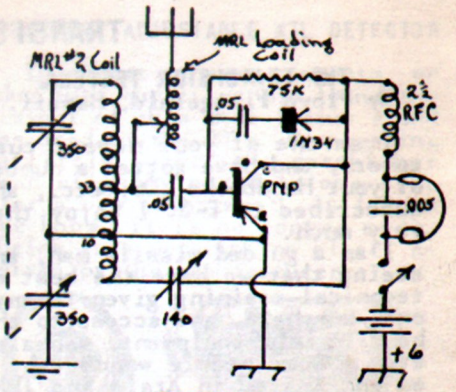
Here is a free-power amplifier



that boosts any Xtal set considerably. Naturally, any batt. added in series with phones and emitter will increase the power. Polarity of Diode, in Xtal set, is important, as said before. If you don't care to reverse the direction of the Xtal - just reverse the input leads to the TRX amplifier - and you accomplish the same thing. In some Xtal sets and TRX layout - the Xtal may be shorted out. Try both ways.

MURRAY'S REGENERATIVE TRX SET.

Walter V. Murray, Ind., says he "cooked up" this circuit. He says it does as good as any 1-tube set, and better than most, for volume. He uses a CK-768, but he says to try several of them as impedances may vary and, therefore, the selectivity of the set. Any good RF type of TRX could be tried and possibly work OK - as they are better in regenerative circuits. (Ed. One may try a Steel galena and c/w instead of the 1N34 and improve



PARTS LIST.

1 2-gang .00035 var. cond.
1 .00014 " "
1 #2 Coil; 1 loading coil. (text)
1 Slider rod 4" and slider.
1 2½ mhy. RF choke.
1 75K resistor.
2 .05 bypass condensers.
1 .005 mica or ceramic cond.
1 PNP, or NPN transistor.
1 1N34, or other diode.
1 5½x7 compo. panel.
2 Phone tip jacks.
2 1¼" bar knobs and scales.
6 v. dry batts.

the selectivity.) NPN may improve circuit if voltage is reversed.

Sometimes he uses a loading coil in the Aerial circuit, to lessen SW QRM. So, we have added our Bakelite loading coil, 2x4 wound with 22 enameled and fitted with a slider and rod. (7-106. $1.50 at MRL, less slider & rod.)

The other coil is our standard #2 Xtal set coil, of 90 Ts no.22 DCC on 2XM cello. form 2x4½". (At MRL for $1.00. 7-101). Use the 10 and 23rd tum taps.

The circuit is self-explanatory. May be mounted on 5½x7 compo. panel very easily.

An oscillator is but an amplifier with regenerative feedback. Ironically, it seems the more hi priced TRX work best as regenerative and hi-freq. stages. This is one way to tell them apart. Reverse the voltage for NPN.

2N3906 SMALL SIGNAL PNP GENERAL PURPOSE AMP
TRY BAT 85 DIODES

1-TUBE SETS

SOME GOOD DX ON MRL 1-TUBER.

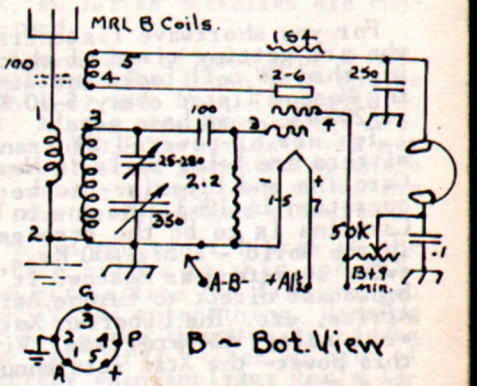
E. D. Tressler, Nebraska, reports some real good ones on the one-tuber (HB-4). He has a wall map and can figure distances good. Some of his best ones are Buenos Aires (5618); Madrid (4712); London (4350); Juneau (1812); Montreal (1359); Los Angeles (1178); Cincinnati (1086) and a big list of others. The night before the letter - he could almost hear Madrid with phones on the table. He uses mostly 20 m. band coil for most DX stations. He expected to do much better with a new Aerial. Like most of us - the 1-tuber was the only way he could get a "trip around the World!" He had complications when he wanted to put up a whip Aerial on a wooden pole - down thru a lady's cucumber bed. Draw your own conclusions on this deal! Hi

AN AUSTRALIAN ONE-TUBER.

Here is an Australian rig that you might like to put together. While the circuit is, more or less conventional, there are a few differences.

You will note the set uses but 9 v. of B - which may be any TRX battery, etc. as the B draws but .5 ma. and will last a long time this way. The more B used, the stronger the signal. Detectors, with regeneration, never take much current- it is the addition of an audio stage that eats it up. Note the most power is given to the screen grid- and you control the plate current. The original circuit called for a 250K regeneration control - but we feel that a 50K at 9 v. is OK.

The circuit uses our type B coils- which are the same as the A except a primary is used. Also a slight difference is the grid leak connection, which runs from grid to chassis. You may try it across grid cond. if you wish. If you get too much regeneration with our coils - cut the .00025 regeneration condenser to .0001.



PARTS LIST.

1 Set MRL Type B Coils.
1 .00014 cond. (or .00035 and a 25-280 trimmer in series).
2 .0001 micas; 1 .00025 mica.
1 50K vol. control and switch.
1 5 prong wafer socket.
1 7-pr. min. or other socket.
1 2.2 meg. carbon resistor.
1 .1 x 600 v. bypass condenser.
1 4½ x 6 alum. or Compo. panel.
1 Tin shield (if Compo.)
1 Compo. 4 x 5½ base.
1 1¼ bar knob and scale.
1 Small pointer knob.
2 ½ x ½ panel brackets.
1 ply. back strip 3/4 x 5½.
2 Phone tip jacks, Hardware.

If you run into interference problems on BC, in a congested area, or the Aerial is too long, slip a .0001 mica in primary.

While the circuit is drawn for a 1S4 miniature tube, the following may be substituted by checking socket connections and battery voltages: 1C5, 1F4, 1F5, 1G5, 1J5, 1LA4, 1LB4, 1Q5, 1T5, 3Q4, 3Q5, 3S4, 3V4, etc. Ordinarily these tubes draw around 1/3rd the current of a flashlite lamp - so easy on the batteries.

The set may be built on an Aluminum panel, or a Compo. panel with a metal shield behind it, which is grounded to keep down body capacities.

The above rig may be built on the regular 1-tube HB-4 chassis.

MULTI-TUBE SETS & TV.

VOA - VOICE of AMERICA - 400 Kw.

For you shortwave listeners - who are getting tired of checking thru SW call books and finding Moscow listed every 5-10 Kc. at 200 Kw. - we have news!

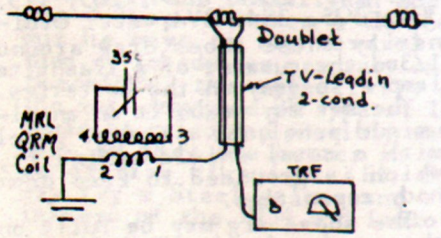
Two new hi-powered SW transmitters are being built in North Carolina and Liberia - to be in operation in 1963. The one in N. Carolina is to be the strongest in the World - a big 400 Kw., or twice as strong as Moscow. It'll broadcast direct to Europe, Asia, Africa, etc. The Liberian Xmtr. will relay VOA programs. With this power- the Xtal sets should do a good job!

These hi-powers are due to the Machlett Lab. tubes #7482- which have outputs to 400 Kw., and will be used in continuous amplifiers and oscillators. This is the first increase in VOA power since 1953.

VOA have 50 Xmtrs. in the U.S. and 57 overseas, which together use over 650 Machlett tubes at $600-$5000 each. Sizes range from 8-53" and weigh from 20-190 lbs. Use of these tubes allows a VOA station to reach up to 6000 mi. (No doubt, MRL 1-tuber has come along to pick up many of them!) 16 million people daily listen to VOA in English and 35 other languages. The Cold War is on!

AN ODD WAVE TRAP.

During some recent experiments with MRL QRM Coils - I stumbled onto a very peculiar condition. We have a shop Radio set, which is an old mantel TRF 4-tube AC job, that we use to listen to news broadcasts, etc. It is placed over the shop bench on a test shelf. The TRF uses no ground.



During the course of the experiments, I got the QRM Coil and condenser hooked to the other side of the doublet and the ground. To my surprise, it cut the station out that was on the TRF set. One would expect a signal put in parallel to the TRF would boost it - and not trap it out, as this one did.

But, grounding the TRF changed it to its regular operation - of boosting the signal. So, we got to figuring, and came up with a solution that the two ends of the doublet are out of phase and buck each other, because the peculiarity is due to the doublet. No doubt Engineers can readily figure this out.

If any of you have a solution for this - just sing out!

FAMILY WATCHES TV - 4¢ per HOUR.

Following is a survey furnished by Sylvania. It shows how little it costs for TV entertainment. Average TV set costs $269, with an average life of 9 yrs., or $29.89 per year; average repairs $40 per yr. (most of them much less); 325 Kw. hours of juice per yr., at .025¢ per Kw. (costs .042¢ here); moving every 2 yrs., or $2 per year and insurance at 73 cents per year.

This averages up to 4¢ per hr. per family, to watch TV. The average movie now runs about 40¢ per hour for one adult. No wonder they quit going to movies! So - the next time someone tells you to turn off the TV "it runs up the electric bill" - you can show them this survey.

MRL 2-TUBER (DP-31) is SHARP.

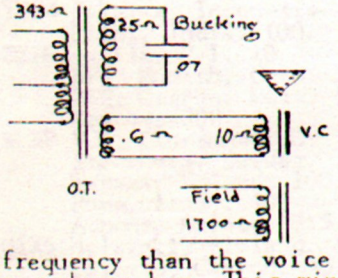
I have one of these alongside my bed. It is the first detector-to-aerial set I ever used where band spread is needed on BC. It is natural for a superhet. to be sharp, but not such a small set.

QUESTIONS & ANSWERS.

What is radiation and re-radiation? **ANS.** A regenerative set, or transmitter may radiate signals that may be picked up by a receiver. But, if guy wires, towers, etc., in the vicinity, pick up signals or squeals, they in turn re-radiate this received energy. Occasional guy insulators will break up stray radiation on transmitters - as well as help in receiving. Note the number of guy insulators around a broadcast or shortwave transmitter.

Is Litz wire better for the BC band coils? **ANS.** It may be better for BC, but no good for SW. However, if every one of the 36 to 40 turns of fine enameled wire are not individually soldered down - it introduces loss. Enamel may be removed with Wood alcohol, or grain alcohol (if U can spare some!) Hi. Rather than have this loss- we prefer to use cotton or enameled covered wire.

In the RCA 15-tube superhet., what is the purpose of the extra speaker winding? **ANS.** This is the hum-bucking coil. You can see that it tunes to a much lower frequency than the voice coil - so reduces hum. This winding may be different for different speakers - due to varying impedances, layout, etc.



I have a couple of 2½ volt wet batts. Can I use them instead of the 6 v. dry batts. on your #26 Diode-transistor set? **ANS.** Any DC voltage is OK. You won't get as much volume, due to the lower voltage - but operation will be OK, as far as batteries are concerned.

I have one of your type D Ant. couplers. Can I use this on the #26 set? **ANS.** Yes, it should do OK. As the type D tunes the Ant. by a .00035 in series - you may expect better selectivity and a boost in volume, due to tuning of the Aerial-ground circuit.

Heard you can't listen to the Police calls. Is this so? **ANS.** The air is free (so far) and you can listen to anything. Passing it on to the third party breaks the law. An Op. takes an oath of secrecy when applying for a license. Listening to Police has been in the courts, but out-ruled by them. More info. in Popular Electronics, July, 1959, p. 143.

What is the difference between fluorescent lamps and mercury vapor tubes? **ANS.** They are the same - basically. Fluorescent lamps cause much of the invisible ultraviolet radiation generated in mercury vapor tubes to be converted into visible light. This is effected by coating the insides of the glass tubes, for fluorescent lamps with chemical compounds called "phosphors," which become "excited" under electromagnetic influence and transform the SW ultraviolet into visible illumination for the longer wavelengths.

By proper choice and blending of the phosphors, used for coating fluorescent tubes, light approaching daylight in spectral quality can be generated and maintained. This type of illumination is quite suitable for both monochrome and color photography, besides being useful for many other applications in plate making and graphic arts.

ONLY 1 out of 300,000 letters are lost, according to P.O. Its a pretty safe bet your orders will get here OK. Example: how could P.O. give you $10 worth of insurance for only a dime????

WORLD SHORT WAVE B.C. STATIONS.

Most complete listing obtainable; from many sources. Freqs. often change. Max. power shown.

Continued from E-S #1.

17.835 mc. - 16 meters.

835 RFE, Lisbon. 100 Kw.
Copenhagen, Den. 50.
830 Moscow. 200.
WLWO VOA, New York. 50.
VOA, Tangier. 100.
Delhi, India. 100.
Paris. 100.
Peking, China. 120.
825 Moscow. 200.
TAV Ankara, Turkey. 100.
LLN Oslo, Norway. 100.
JOA17 Tokyo, Japan. 100.
820 ZL14 Wellington, N.Z. 7.5.
Colombo, Ceylon. 7.5.
CKNC Montreal, Canada. 50.
815 Moscow. 200.
KCBR VOA, Los Angeles. 200.
Delhi, India. 100.
DMQ17 Cologne, Germany. 100.
Paris. 100.
Prague, Czecho. 100.
BED63 Taipei, China. 20.
Sao Paulo, Brazil. 10.
810 Moscow. 200.
London. 100.
Hilversum, Neth. 100.
YDF4 Jakarta, Indonesia. 50.
Delhi, India. 100.
805 DZ16 Manila, P.I. 10.
RFE, Munich, Germ. 50.
RFE, Lisbon, Port. 100.
800 Moscow. 200.
WLWP VOA, Cincinnati,O. 150.
Stockholm, Sweden. 100.
Warsaw, Poland. 100.
Rome, Italy. 100
Athens, Greece. 7.5.
01X5 Helsinki, Finland. 10.
Colombo, Ceylon. 35.
Melbourne, Aust. 100.
797 Prague, Czecho. 100.
795 Moscow. 200.
KGEI San Francisco. 50.
WLWO VOA, Cincinnati,O. 150.
HE18 Berne, Switz. 100.
JOA17 Tokyo, Japan. 100.
Delhi, India. 100.
OE137 Vienna, Austra .03.
CR6SF Luanda, Angola. 10.
790 London. 100.
Moscow. 200.
Melbourne, Austr. 100.
785 Vila Verde, Macao. .3.
JOA17, JOB17 Tokyo. 100.
Delhi, India. 100.
Taipei, China. 20.
784 HER7 Berne, Switz. 100.
780 Moscow. 200.
WBOU VOA, New York. 50.
VOA, San Fernando, PI. 100
Paris. 100.
Peking, China. 120.
778 Athens, Greece. 7.5.
775 HEU8 Berne, Switz. 100.
Hilversum, Neth. 100.
Teheran, Iran. 20.
770 Moscow. 200.
KCBR VOA, Los Angeles. 200.
London. 100.
HED8 Berne, Switz. 100.
Stockholm, Sweden. 100.
ZL5 Wellington, N.Z. 7.5.
Rome, Italy. 100.
Delhi, India. 100.
RFE, Lisbon, Port. 100.
Prague, Czecho. 100.
767 Peking, China. 120.
765 Moscow. 200.
RFE, Munich, Germ. 50.
Paris. 100.
760 Moscow. 200.
WGEO VOA, Schenectady. 50.
Rome. 100.
755 WRUL Scituate, Mass. 50.
Singapore, Malay. 100.
LKW Oslo, Norway. 100.
JOA17 Tokyo, Japan. 100.
Taipei, China. 50.
Prague, Czecho. 100.
Rio de Janeiro, Br. 10.
750 Moscow. 200.
WRUL Scituate, Mass. 50.
VOA, Manila, PI. 50.
VOA, Tangier, Mor. 100.
745 London. 100.
Karachi, Pakistan. 50.
HLK9 Seoul, Korea. 50.
Athens, Greece. 7.5.
Peking, China. 120.
740 Moscow. 200.
WBOU VOA, Bound Brook. 50.
WLWO VOA, Cincinnati. 150.
London. 100.
CSA43 Lisbon, Port. 100.
Rome, Italy. 100.
Paris. 100.
735 Vatican, Italy. 100.

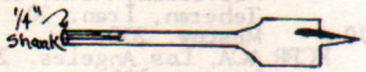
RFE - Radio Free Europe.
VOA - Voice of America.

Continued next issue.

FROM THE WORKBENCH.

A QUICK GROUND:
All switch boxes are now supposed to be properly grounded, but some of the older ones are not. Hook a 110 v. lamp between each wall receptacle prong and the plate. If properly grounded, one side to plate will light up. Now you can use this plate for a ground for your Radio OK.

IRWIN SPEEDBOR BITS FOR WOOD:

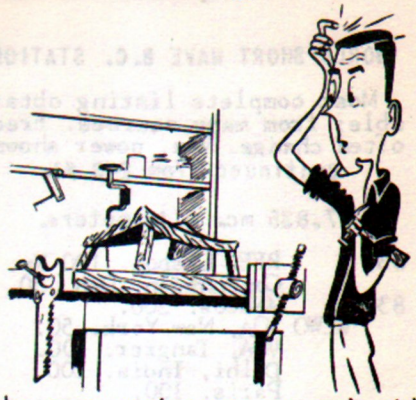


The best bit for Compo. or wood drilling is this type of bit. We previously used expansive bits but they are hard to use in a brace as each layer of Compo. must be taken out bit by bit. We now put panels under our drill press and get a straight hole. Sizes run from ¼-1½" hole. Entire bit is 6" long. Prices in our local hardware are from ¼ to 1" is 75¢; to 1½" is $1.25. A good investment for you. (Do not order from MRL.)

OPEN UP THE CABINETS:
Backs of cabinets, with built-in speakers, should be open, or at least, a fair-sized hole left in them, Otherwise, you may get microphonic noises. Always use a fibre or cellotex baffle between panel and speaker rim.

BETTER TONE ON PENTODES:
Often a .001 mica condenser is better for coupling into a pentode tube than a .01 or .02 bypass cond. Does not overload.

CHECKING AUDIO TRANSFORMERS:
Usually the side with the less resistance is the primary. Often it is a good idea to reverse one side if you get "howl," or feedback. If trans. is noisy, hook a 50 w. lamp in series with it and 110 for primary; then secondary. If windings bad - this will blow it out - and it can then be replaced, and get away from this trouble. Some transformers have



the same resistance on each side - and most input P-P transformers have less res. on secondary.

TAGS FOR SET LEADS:
Wrap lead with a strip of paper. Over this, a piece of Cellophane tape. Then mark it with India ink. This will not interfere like tags that stick out.

RENEWING OLD DIAL ENGRAVINGS:
Mash up some white chalk and mix with MRL Light Coil cement. Rub this in the cracks and wipe off. Makes them real neat.

CLEANING TUBE PRONGS:
An ink eraser is good 4 cleaning tube prongs. We use a scratch wheel on our coil bases. It removes all rosin, dirt, etc. Be sure to get the hi-freq. coils clean or they won't work.

MARKING YOUR DRILLS & WRENCHES:
We paint the upper grooves in our drill shanks with different color lacquer, especially those we use a lot. Also the handles of various spinner wrenches.

LOOSENING RUSTED NUTS, ETC.:
Hydrogen peroxide, or penetrating oil put on nuts over night should loosen most of the hard ones. Often a slight tap may also do it.

A CUSTOMER SEZ---
"I wrecked my Radio. Going to save the cabinet for a coffin 4 my cat but will send U the c/w!"

"I thought you said this drink would knock my hat off."

FUN WITH FIGURES. THERMOMETERS.

You'd be surprised how many types of thermometers have been invented. (See ur Encyclopedia)

Fahrenheit is most commonly used for household, clinical and engineering. He invented it in the 1700's. Fahrenheit also discovered the boiling point of a liquid varies with the atmospheric pressure. By varying the size of the glass tube in length and the hole diameter - thermometers may be concentrated on certain ranges. For instance, the ordinary "souvenir" type may run from 120 down to -10 F. Our oral, or fever thermo. registers 94-106 F. Our candy thermometer runs from 20-400 F. Refrigerators, blast furnaces, etc. all have their own ranges.

The Centigrade was invented in the early 1700's and used for most scientific measuring.

Kelvin invented his in the 1800's, and deals with absolute scales. He was a wizard, who entered Glasgow college at 10. He made lots of contributions to science. Some of his inventions were the modern compass, electric bridge, a form of balance and the mirror galvanometer. Does "Kelvinator" ring a bell?

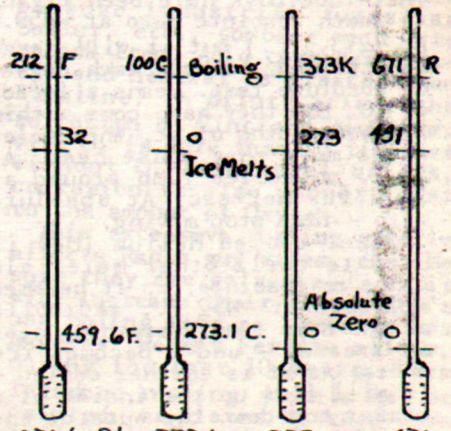
Rankine invented his scale in the late 1800's, and was based on the Fahrenheit scale. Reaumur (R) is another scale, similar to Centigrade, except the boiling point is 80 degrees. Used mostly in medicine. Made in 1730.

Experimenters along scientific lines often have occasion to compare scales. The chart may help clear up some of the differences in readings.

Converting one scale to another may seem difficult, but by using proportions, and adjusting for F. of 32 degrees, etc. it can easily be done. 1 degree C. is equal to 1.8 deg. F., or .8 R., etc. The easiest way to convert C. to F. is (C. x 1.8) plus 32 gives F. Converting F. to C. is (F. - 32) divided by 1.8 is Centigrade reading.

It is claimed the first Mercury thermometer was made in 1659, by Ismail Boullian. Galileo rigged up the first gas thermometer in early 1600's. In Fahrenheit's time - ice and salt were supposed to give the lowest temperature, so his scale was made from his observations. However, after experiencing some real cold winters, he realized soon that temperatures can get a lot below freezing.

Cheaper thermometers have air above the boiled Mercury. The air eventually oxidizes the Mercury and changes the scale. On more expensive ones, the air is replaced by Nitrogen or a vacuum. Also paper scales are no good.



THE PHYSICS REPORTER.

ABSOLUTE ZERO -459.6 F.

In December, people, pigs, oxen, dogs and reindeer all go inside and stay, at Verkhojansk, Siberia. Lowest ever recorded there was -108 F. Here the men start hitting Sapoi, a drink made from moss, paper and potato Alcohol, while sober wives wait on them. -81 was hit once at Snag, Alaska.

Dry cold of -56 F. in Minnesota can be much more comforting than twice the temperature of a wet cold region. If one's body reaches 30 deg. below normal - your veins freeze up and you may die. Freezing shows a livid and white skin and you get sleepy. Never treat frozen toes with snow or they may break off - but gently warm them.

Definition: "Absolute Zero is the unattainable stage of complete abscence of heat." The Test-tube Boys have been trying to reach absolute zero at -459.6 F. (273.1 C.) but it will never be attained, because each degree of absolute temp. means a factor of 10. But they have come within 1⅓/thousandths of it. When molecules move they cause heat. At 32 F. molecules jump around at 1470 ft. per sec. At absolute zero - they stop moving.

Super-cooled Helium (He) is used to chill other materials close to absolute, as it becomes a liquid at -452 F., and boils at the same temp. Everything near it freezes - and H becomes ice cubes. As it is further cooled - it will flow up the inside of a beaker and down the outside and against gravity. Put a tube of emery powder in liquid He and shine a 150 w. lamp on the tube, and the little added heat will cause the He to spurt up a foot high- just some of the mysteries of absolute zero. He is colorless and odorless - so plastic floats are used on its surface for experiments under bell jars. As heat does not affect it- it will not burn or explode - so is used for balloons. It is now being made in Cryostats almost as easily as dry ice, so it can be used to study low temperatures.

Metals change at low temperatures. Solder becomes a spring. Steel manufacturers dip molten stainless steel in liquid N at -320 F. and the metal can withstand very low temperatures and can be used for outer space.

Super-conductivity is realized down there. Electrical resistance ends at a certain point. Electricity will flow indefinitely around a ring of tin or lead without adding any more current. Low temperatures will extremely magnify amplification. As the molecular motion (heat) destroys the TV picture - the lower temp. are better. Radar reaches twice as far at low temp. Many experiments may be conducted at low temp. if you care to go into it further.

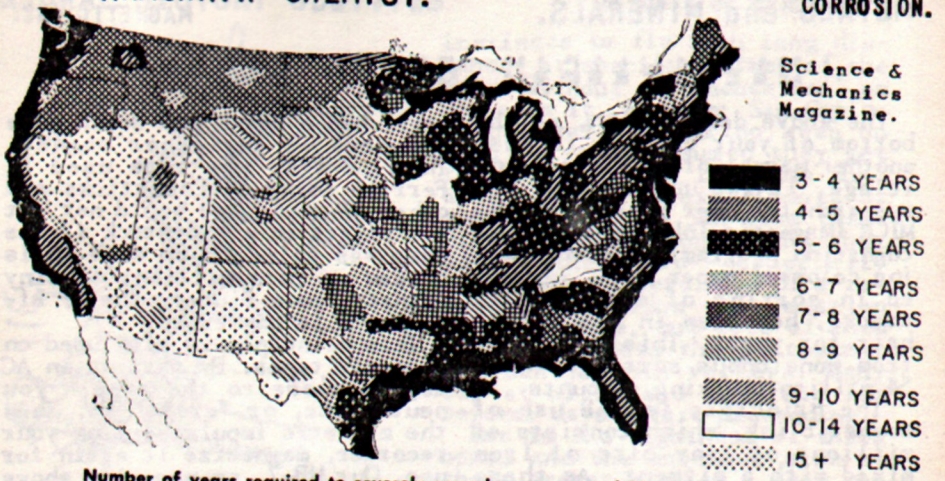
Some other peculiarities of He are that it will go thru tiny holes that are impervious to any other liquid. All low temperature work is done under vacuum. We used to bring water to a freezing point very easily in the Laboratory.

Liquid N may be obtained for about $1.50 per qt. for experiments if you like.

Another interesting subject is water. Water contracts some down to 39.2 F., which is its maximum density. But, below that, it expands, as it becomes less dense. If water did not expand, and it froze slowly downward, all marine life would die. Your car radiators freeze, ice expands and it breaks your radiator - OUCH??

THE ARMCHAIR CHEMIST.

CORROSION.



Number of years required to severely corrode an uncoated 28-gage steel test panel exposed to outside weather conditions.

The Rust-Oleum people exposed 28 guage (.0156") uncoated steel sheets to the weather for 25 yrs. This map shows results, and how long they will last. This rusting costs Americans 7 billions a year. Mufflers - 60.

See how rusting occurs in different areas. At Fort Bragg, Cal. a 100-year-old railroad shows rails as streaks of rust. But in India, the Pillar of Delhi is barely pitted at 1600 years. In Khartoum, Egypt, an ingot will corrode 28/millionths of an inch in a year; 68 times in England.

An earlier theory was that rust was caused by electrolysis, even between different points on a metal. However, Westinghouse scientists claim it has little to do with it - it is chemical.

Rust (Iron oxide, Fe_2O_3) can occur on Iron only when water and O are present. Corrosion is proportional to the amount of O reaching the surface - and removing the film of H. Rusting is the oxidation of Iron molecules to form this new compound. In the presence of dry O, the Iron forms a tiny protective oxide coating of oxide whiskers, less than 30/millionths inch long. Wind also speeds up corrosion by bringing in fresh O to surface.

Little rusting occurs in arid regions where humidity is below 60% normally. When we lived in Reno, Nev., we found metals corroded very slowly. But rusting proceeds rapidly near the salty, damp coasts and Great Lakes. See how it varies [illegible]astern U.S.

Rural areas are less troubled because industrial fumes, as Sulfur, etc., combine with O to attack Iron. Acid corrodes fastest and neutral is greater than alkaline. In dilute acids, the corrosion of Zinc and Aluminum, with O, is more than 10 times as without O. In natural waters, corrosion is also proportional to the amount of Oxygen.

This excessive rusting greatly affects Radio guy wires, etc. Be sure they are galvanized, as it will increase their lives. Don't use baling wire as I did in Los Angeles! Recent Ferrite alloys, during the last 10 years, have lessened rusting. Metals may be painted, or plated to keep down action, by keeping O and water away. On steel Tankers, I used to ride, they no sooner got one end painted, then started over.

METALS and MINERALS. MAGNETIC INK.

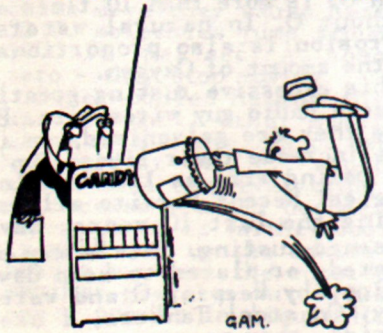
⑆1211⑈1161⑆ 8939⑈ 6403⑈

The above designation, at the bottom of your checks, is just another marvel of this electronic age. It was under study and research for over 6 years by the MICR (Magnetic Ink Character Recognition program). The increasing colossal paper work, involved in sorting of millions of checks, has been in the banks' hair for years. This gets away from monotonous sorting of the 54 million checking accounts.

The principle is the use of magnetic ink, which consists of millions of tiny bits of Iron mixed with a pigment. As these checks pass thru the machine, the Iron particles are magnetized. Next they pass under an electronic "eye" where this magnetism is picked up and formed into numbers, or characters. The machine then automatically sorts them into hoppers, like the IBM machines do their punch-cards. Clerks then feed the piles into automatic bookkeeping machines.

This coding gives the banks, among other things, information on the name and location of the bank where the check is to be routed and the account number of the writer.

You may read, on page 7 of MRL HB-7 "Magnetism ---" that if any magnetized particle is broken up - no matter how small - that it still has a north and south pole and acts as any other magnet. This is also the idea used in Ferrite cores of Loopsticks and other RF coils. You would not get the effect in a Loopstick if the core was solid. But, when it is broken up into millions of tiny magnets, in a binder, the RF efficiency is increased.



"We're just getting into magnetic inks."

This principle is also used on magnetic tapes. By passing an AC magnet close to the tape - you neutralize, or "erase" it. Then the magnetic impulses, from your recorder, magnetize it again for use. Our HB-7, on page 11, shows results of experiments with moving fields that produce electricity. This is the principle of the magnetic tape when it actuates the reproducer.

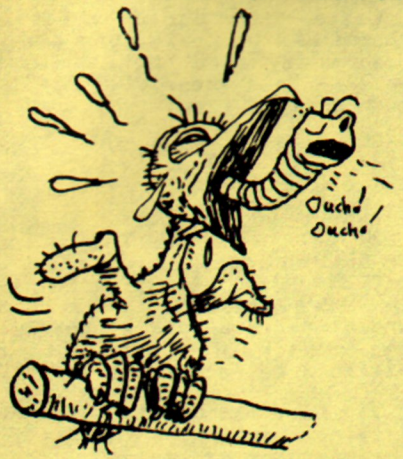
There is no limit to the use of this magnetic ink and tape. Whole TV channels are taped, as you TV operators already know.

Magnetic "labels" are magnetically recorded on the bottom of cans of fruit. After cooking, they are sorted electronically, just like the checks.

Magnetic material does not have to be Iron. Powerful plastic magnets (Bismanol) are now made from Manganese and Bismuth under hi-temperatures. When formed in a plastic binder - it keeps its magnetism 10 times longer and is one of the most powerful. Magnadurs, of little brittle black ceramics are used to sharpen TV pictures.

Eraser-sized Cobalt-Platinum magnets are now made, but more efficient in smaller sizes. Can lift a bar 16 times longer and 24 times heavier than lifted by Alnico-5 magnets. It also resists de-magnetization. Also is ductile and may be formed easy. Alnico magnets are hard to work. Production is limited by the supply of Cobalt. They will not replace Alnico in most cases.

NATURAL HISTORY ODDITIES FLIGHTS OF BIRDS.



A Hummingbird, probably the fastest takeoff - can do it in .07 second. Ducks can hover and fly straight up, backward and upside down - as established by slow-motion cameras. The fastest flying is the Duck Hawk at 165 mph. A species of Swift is the next fastest flyer.

Nobody knows how high birds can fly. Sir Edmund Hillary, on the top of Mt. Everest, saw an unidentified bird flying at his elevation of 27,000 ft. A flock of Geese was photographed near Dehra Dun, India, at 29,000 ft. Birds may fly low before storms, but it is due to low clouds that obscure their view when looking for a landing place. Swallows are said to fly high during good weather, but this is due to the insects, on which they feed, that move up with warmer air during good weather.

Oddly colored birds, arriving in Britain, have had all their feathers colored by flying thru Radioactive clouds, because their feathers have tested Radioactive on counters. Since then, Scientists have changed colors of the feathers by exposing them to degrees of Radiation.

Very little is known about the bird migrations. It is amazing how such little things possess instincts to fly such long distances at specified times of the year, without any 'education' as Man sees it. Example; San Capistrano Swallows. Altho keen on sight - it is assumed they get their directions from the Sun, as evidenced by experiments of shutting off the Sun from them. Birds migrate along paths that afford them food - especially along big valleys. In this respect, we seldom see Geese on the Peninsula, but lots of them fly up and down the Sacramento and San Joaquin valleys. Many fly at night and may feed for several days before proceeding.

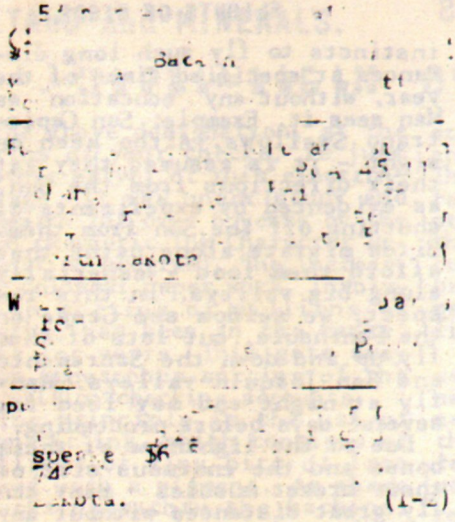
Due to the lightness of their bones and the enormous size of their breast muscles - many can fly great distances without any rest. About the greatest distance is for some shore birds that fly from Hawaii to Alaska, a distance of 3000 miles. The Golden Plover, from Labrador to S.A. (2400); Homing Pigeons may go 800. The Blackpoll Warbler averages 200 mi. per day thru Canada. The Gray-cheeked Thrush has been known to fly 130 mi. per day. Many may only travel 25-30 miles per day in migrations north and south. Many birds prefer to stay in one location, like Sparrows, Linnets, Pigeons, etc. which may become known as pests.

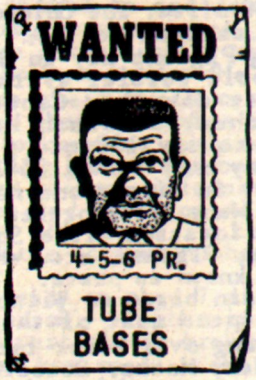
Certain birds as Wilson's Petrels spend most of their time pattering over water far out to Sea. Many Hawks, Buzzards, Eagles, etc. spend long periods in the air. The actual number of miles covered is hard to figure.

In Melbourne, tourists go 50 mi. away to see father Penguins bringing home their caches of fish they caught at Sea.

During the nesting season, the Wild Ducks moult and unable to fly for 6-7 weeks while throwing off their old feathers and growing new ones.

Birds, being an interesting subject - are studied by Audubon Societies, Biological Survey and many others to get more info.





See CAT. E-2 about sending us used tube bases. We can use 4-5-6 prong of 1-3/8" dia. only. We allow 2¢ credit on each base and postage paid at 3rd or 4th class rates. Just break off the glass, and snip off the wires. Do not clean out the glass or hit the base with hammer. While we seem to have a good supply - we can always use more. Most Radio shops have them in the junk box FREE!

MODERN RADIO LABS.

KINKS & QUIPS

CLEANING UP:
Clean rusty parts by leaving them in Kerosene for few days. - Boil vinegar in those scorched pots. - Rain water will not corrode a steam iron.

What is a sucker? ANS. an honest person who trusts everyone.

TV LEADIN RIBBONS:
Be careful when using staples on 2-conductor leadins or you may short your leads. Take piece of cardboard, fold over leadin and drive in a tack at one side. This won't interfere with the distance between wires.

The busy man has time for everything; the lazy man hasn't time for anything or anyone.

STRAINING PAINT:
Use the ladies' nylon stockings if no cheesecloth handy

Laundromat sign: "Don't wash-n-wear out your wife - let us do it for you."

CAR KINKS:
A blowtorch, filled with one part light oil and one part turpentine, can be sprayed on your springs. - A little wood alcohol added to your gas now and then will absorb water and prevent freezing of gas lines. - Put some grease in catsup container and squeeze around moving parts.

Sign in Antique store: "You think it's junk - some in and price it and see!"

ADS ON PENS & PENCILS:
Put a little lacquer thinner on printing. Leave 15 seconds and wipe off. As thinner attacks plastic pens - paint some on and wipe off at once to make smooth.

I have loose dandruff and been up all night tightening it up. Yesterday I had a short circuit, but the Radio man lengthened it out for me.