MODERN RADIO

EDITED BY ROBERT S. KRUSE

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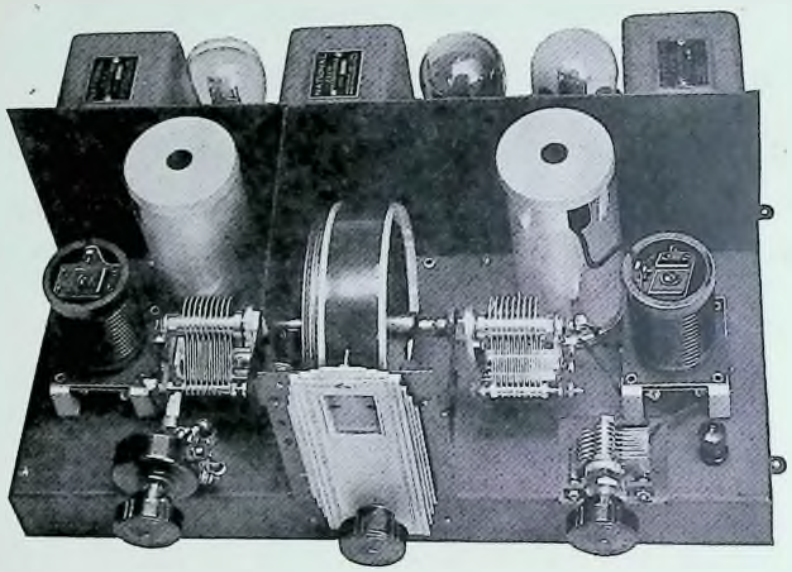
Number 3 September 20 cents

What a Kick
Foreign Stations so



"Tuning is simplicity itself, it is selective and sensitive and what more does a fan need?" says another THRILL-BOX admirer.

Others say, "Didn't know what Short-Wave reception was until I had my SW-5."

"Truly a masterpiece in the short-wave field."

"Works perfectly and surely brings in the D. X." (Names on request.)

HIGHLIGHTS ON THE SW-5

Range 9-850 meters.

True single-knob tuning. Set and forget the antenna trimmer.

Easy to Log with NATIONAL projector Dial, type H, no parallax.

Special 270° Type S. E. Tuning Condenser with insulated main-bearing and Constant-impedance pigtail makes gang-tuning possible on the short waves.

Equipped with standard set of 4 pairs of R. F. Transformers wound on forms of genuine NATIONAL R-39.

Uses the new UX-235 Variable-Mu Tubes giving improved sensitivity (see below).

Humless A. C. Power Supply with special filter section, R. F. Filter on Rectifier Tube and Electrostatic Shield.

WHY R-39 MAKES BETTER COIL-FORMS

Maximum efficiency of coil-form material depends to a large extent on freedom from moisture. Ordinary moulded materials are made with a filler of ground wood-pulp, which tends to take up water from the air. They, therefore, cause appreciable losses in short-wave work. The Radio Frequency Laboratories developed R-39 for use by NATIONAL COMPANY in its short-wave equipment, making it of ground mica, instead of pulp, for filler—and a minimum of pure uncolored Bakelite for the binder. This renders R-39 practically moisture-free and although it is necessarily more expensive to make than the usual form-materials, its tremendous advantages in short-wave work fully justify the extra cost—and are apparent at once to any THRILL-BOX user.

this set has!
loud you can hear

announcements three rooms away

So writes one enthusiastic user of the new

NATIONAL THRILL-BOX SW-5

WHY UX-235 VARIABLE-MU TUBES IMPROVE THE SW-5 THRILL-BOX

By employing a formerly unknown and unused principle of the new UX-235 Variable-Mu Tube in conjunction with the NATIONAL SW-5 THRILL-BOX circuit, the point of greatest sensitivity is approached along an inverse Logarithmic curve. This makes possible the same smoothness of control and extreme sensitivity on ALL signals, regardless of frequency or the mechanical setting of the control elements. The operator can always secure stable operation at a much higher level of sensitivity and controls are easy and non-critical to handle.

BATTERY MODEL

Made also in low-drain battery model for localities without electric current or those who prefer this type. Uses new Air-Cell Battery and 2-volt Tubes.

SPECIAL BROADCAST MODEL

We have a special Broadcast-Receiving Model of the SW-5, with 245's in push-pull, giving very large volume.

SEND IN COUPON FOR FULL INFORMATION AND PRICES

NATIONAL CO., Inc.
61 Sherman St., Malden, Mass.

Gentlemen:

(Check which)

( ) Please send me complete information and prices on your new Improved THRILL-BOX, with 227 Push-Pull Output

( ) Please send me complete information about new Special Broadcast Receiving Model of THRILL-BOX, with 245 Push-Pull Output.

( ) I enclose 50c (stamps or coin) for your 64-page Handbook of Short-Wave Radio, describing in full the latest and best short-wave receiving circuits, adapters, meters, etc.

Name.....

Address.....

MR-9

Saving $ $ in Meters and Tubes

By E. V. Sundt *

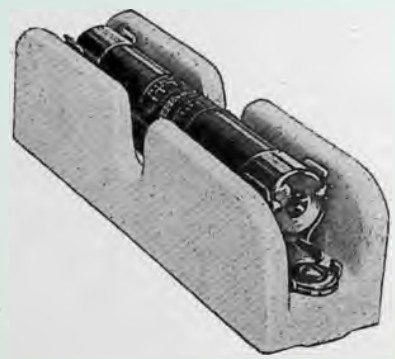
Few things are born into the world without trouble, and trouble was the very mother of Littlefuses. In 1925 the writer was a radio "bug", spending all spare dollars on radio apparatus, magazines and tubes. A good many of those dollars were wasted on "blown" meters and tubes. It seemed that there should be a field for an effective, inexpensive device to protect delicate electrical equipment.

A 3-range meter protected by fuses in clips.

A market survey of this and foreign countries revealed that nothing then existing was quick enough to protect such equipment as a 0-1 milliammeter, or the filament of a '99 tube. The desired device must evidently be accurate, more delicate electrically than anything else, very fast, and yet inexpensive and physically rugged! The cost is important. Something good and expensive is a mediocre achievement; something good and cheap is good engineering.

About this time the writer met Mr. Bernard Kollath, an excellent mechanician and production-equipment designer, formerly a model maker for the "electrical wizard" Steinmetz. We rented a little laboratory in May of 1927 and started work. During the next year five nights a week and Sunday mornings were spent in experiments. We tried magnetic circuit-breakers, electrolytic valve action and low temperature alloys —and of course we tried fuses—all sorts of fuses. We tried every kind of wire and alloy available in sizes down to 10/1,000,000 of an inch (Wollaston wire core), and metal foil as thin as .000,004". Nothing of reasonable cost acted as quickly as a thin wire, burned asunder by the current it carried. The secret of quick action lay, as expected, in keeping the diameter of the wire as small as possible. A year later we felt that we had a product which filled the bill and started advertising on a small scale. The biggest thrill of our lives came with our first order—for $1.10! Since then the users of Littlefuses have increased steadily. The quantity is, of course, not great but we fill a niche in the electrical industry and endeavor to do it well.

The standard Littlefuse is glass enclosed, measures 1 inch by ¼ inch and is made in ratings of 1/100, 1/32, 1/16, 1/8, 1/4, 3/8, 1/2, 1 and 2 amperes. In addition there are small-current high-voltage types for 1,000, 5,000 and 10,000 volt use. In these the fuse element is



A transmitter plate-supply fuse in a fuseholder with porcelain base and guard.

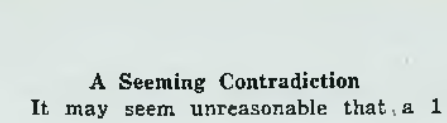
made in small sections so that they will open separately as it is easier to suppress several small arcs than one large one. Arc suppression is further aided by threading the fuse filament through baffles inside the fibre casing. The principle applications for these fuses are in radio transmitters, high-voltage rectifiers, high-voltage generators, amplifier and filter systems. The very large short-circuit currents possible with the mercury-containing rectifier tubes makes fuse protection almost imperative.

* Manager, Littlefuse Laboratories, 1772 Wilson Avenue, Chicago.

A Seeming Contradiction

It may seem unreasonable that a 1 milliampere meter can be protected by a 1/32 ampere fuse—which is to say a fuse rated at 31 times the full-scale current of the instrument. None the less the protection is real. Meters are not usually burned out by 2 or 3 times their rated current—that merely puts them off the scale, which is noticed and corrected before the relatively slow heating has done any damage. Burnouts come when the B and A supply are interchanged or the meter is in some other way overloaded so badly that one cannot get the circuit open in time when the needle makes a lightning leap to the right. Under these conditions the current is not 2 or 3 times normal but far more—and a fuse is a real protection, since its action is **much faster than the meter burnout.**

To illustrate this action, and to obtain some visible information on it, a number of meters and Littlefuses were "blown" by being connected directly across a 110 volt D.C. line. An oscillograph record was made in each case and some of these are shown herewith. In these photo-



1 milliampere D.C. meter on 110 volts D.C. Burnout time .173 seconds. Time of needle-throw about .003 second.

115 Ma. thermo-galvanometer .003 second.

199 filament, .038 second. Can be protected by ⅛ amp. fuse, as can the T.G. above.

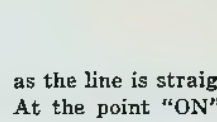
graphs the lower line may be ignored. The zig-zag center line is a 1000 cycle "timing wave" and each zig-zag represents 1/1000 of a second. The upper line shows the current through the device which is being "blown". As long as the line is straight there is no current. At the point "ON" the circuit has been closed; the current rises, the burnout occurs at "END", and the line drops back to zero. By counting the number of timing-wave zig-zags between the "ON" and "END" points the burnout time in thousandths of a second is found.

As will be seen the blowing-time of the 1/32 ampere (31 milliampere) fuse was rather less than .001 second while that of a .01 meter was .173 seconds or 173 times as long. Thus the fuse was "Quicker than a Short Circuit".

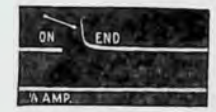
110 v. Burnout Speeds

Filament of a '99 tube.....038 sec.
(.0006 inch tungsten in vacuum)
115 milliampere thermogalvanometer .0035 sec.
0-1 milliampere d.c. meter.....173 sec.
1 ampere Littlefuse.....013 sec.
1/4 ampere Littlefuse.....003 sec.
1/32 ampere Littlefuse.....001 sec.
1/100 ampere Littlefuse—Too fast to record at all.

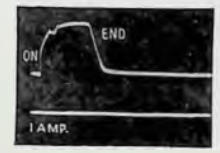
It will be seen that under the conditions mentioned (and in most practical cases as well) the thermo-galvanometer and the '99 tube filament would be saved



.001 second! 110 volt burnout 1/32 amp. fuse for 1 Ma. meter.



110 volt burnout of ¼ amp. fuse in .003 second.



110 volt burnout of 1 amp. fuse in .013 second.

by a 1/8 ampere Littlefuse, the 1 milliampere meter by the 1/32 fuse.

The speeds are somewhat hard to imagine. 1/1000 of a second is a very short time. If the length of this page represents one second, it is about the size of the period at the end of this sentence.

Erasing Transmitting Antenna Worries

By Robert S. Kruse

The sending antenna has been made mysterious by much discussion of non-essential detail, until the simple fundamentals have been lost and many of us worry and labor over things that are of no importance at all. Let us go back and make a fresh start.

Originally the situation was simple. Heinrich Hertz used an antenna like that of Fig. 1.

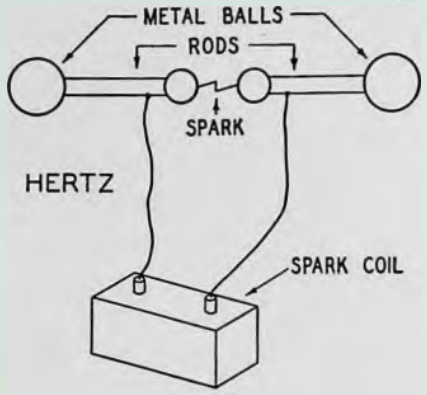


Fig. 1

Nothing could be simpler, except possibly the correct pronounciation of Hertz's name which does NOT rhyme with "hurts" in spite of all the second-rate puns along that line.

Marconi discarded one-half of the Hertz antenna and replaced it by a ground connection, as in Fig. 2.

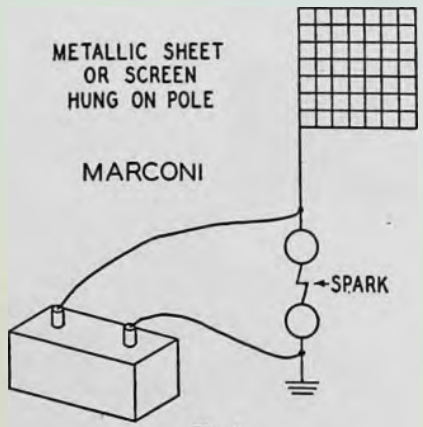


Fig. 2

If we conventionalize the two types as at A and B (Fig. 3) we find the only difference between them to be:

1—The Hertz antenna is half a wavelength long, having voltage at both ends but none in the middle.

2—The Marconi antenna is only a quarter wavelength long, having voltage at the end but none at the ground.

The dashed lines are intended to show how the voltage is distributed along the two antennas, an increase in voltage being suggested by moving the line further from the antenna wire.

The simplest way of feeding power to the two systems was of course the spark coil and spark gap. Since these have gone out of use the simplest thing is to put a small coil into the antenna at a low voltage point and to couple it to another which is fed from a transmitter. These schemes are shown in C and D, where the transmitter is a simple oscillator.

At this point—let us get it straight once for all that a Hertz antenna is NOT NECESSARILY HORIZONTAL. It may exactly as well be vertical or slanting. Similarly the Marconi antenna is NOT NECESSARILY VERTICAL, as a quick look at a few broadcasting and commercial stations will show.

Hertz and Marconi?

It is appropriate to ask why broadcasting stations stick to the grounded (Marconi) antenna while other stations frequently use ungrounded (Hertz) antennas.

There is a good reason. The broadcasting station wishes to make strong signals of a steady sort at nearby places, which means that it is not particularly interested in shooting up into the air and bouncing signals from the unsteady Heaviside layer. The station wishes to use "low angle fire" or "ground wave" transmission instead of "sky waves". For such work a Marconi antenna, PROVIDED it is working almost like the one of Fig. 3B and 3D is very good, and very simple.

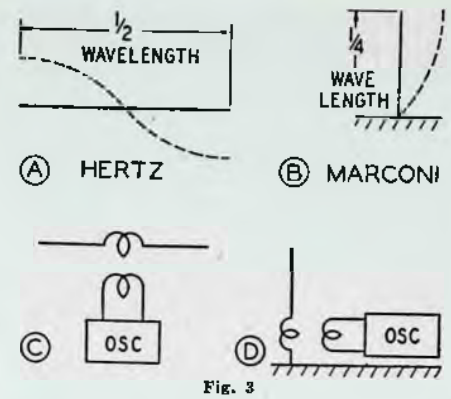


Fig. 3

Other commercial stations wish to jump over the neighbors and send to distant points. They accordingly use one of the several hundred varieties of Hertz antenna, including those that have elaborate reflectors and directors—concerning which not one word more will be said here.

As to the amateur—he has followed the fashion. Since commercial stations, for their special work to particular distances, find some new sort of antenna convenient he puts up similar antennas. The advantage for random distance potting-about is dubious. Later in this paper a simple change from this practice is suggested.

The Practical Hertz Antenna

No antenna today falls exactly into the simple classes we have named but all of them—without a single exception—are of either Hertz or Marconi type and the present messy confusion of names is needless.

For instance there is the perfectly useless and troublesome distinction between "voltage feed" and "current feed"—which the writer helped to popularize. As a matter of fact there is no such thing as a pure "current feed" or a pure "voltage feed". Any feed system whatever must supply POWER, not merely voltage or current. This means that **both voltage and current are fed in every case.** Of course those systems that connect to the antenna at a high-voltage point (for instance at one end) feed but a small current. Similarly those systems which connect to the antenna at a low-voltage point feed only a low voltage—but what do we call the system when it connects to the antenna 1/7 of the way out from a low-voltage point? Clearly all this "current-feed" and "voltage-feed" business is only a source of confusion. Let us forget it altogether.

When one starts to build an actual station the simple feed method of D is alright for a Marconi antenna, except where the power is high enough so that the strong field under the antenna tends to raise the dickens in the station house, besides wasting a good deal of high-priced antenna power. When one tries to use system C there is trouble. Shall we hang the station from the middle of the antenna? The practical ways out are all—without exception—based on one of two ideas:

1—Bending the antenna in some way and pulling a low-voltage or non-radiating part into the station as in the forms of Fig. 4.

2—Separating the station and the antenna altogether and running a transmission line from one to the other as in Fig. 5.

There is nothing mysterious about either of these schemes, but there is a very important difference between them.

(Continued on page 8)

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Published Monthly by
MODERN RADIO CO.
101 Allyn Street
Hartford, Connecticut

Business and Advertising Manager
N. T. YOUNG
Tel. 5-2733

Entered as second class matter at the post office at Hartford, Conn. (permit pending), June 20, 1931, under the act of March 3, 1879. Yearly subscription $2.00 in U. S. and Canada, $3.00 in foreign countries. Single Copies, 20c.

Contributions not returned unless accompanied by stamped, self-addressed envelope.

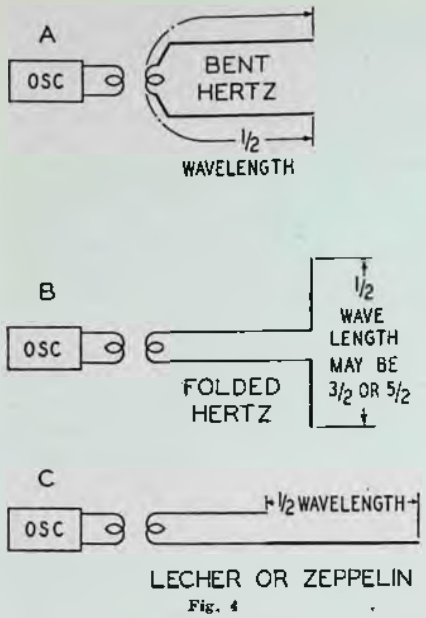


Fig. 4

Scheme 1—The Bent Hertz Antenna

The arrangement of Fig. 4A was very common a few years ago and is exactly as good as it ever was. Because the two free ends are parallel instead of being in line the radiation efficiency is a shade lower, and the currents in the system are a bit higher than in a "straight" Hertz antenna. These things are amply compensated for by the ease with which a system of this sort can be hung in a reasonable space and by the VERY IMPORTANT fact that the system can be tuned from inside the station by variable condensers in series with the coupling coils, or by changing a clip on that coil. The system received most attention at comparatively long waves (oh, very well, —at low frequencies if you prefer it so) but it can with perfect ease work at high frequencies without a single change outside the building. If the antenna was meant to work at 160 meters what is simpler than to put in a series variable condenser or two (without going out into the weather), tune the thing down to 120 meters and couple it to the 40 meter transmitter? How does the 120 meter antenna work at 40 meters? Very beautifully — any Hertz-type antenna works quite smoothly and effectively at 1/3 or 1/5 of the wavelength to which you have it tuned. If you had rather talk frequencies we will say that it works easily at 3, 5, 7 (and so on) times the frequency to which it is tuned. More of that later.

If one is worried by the possible power loss occasioned by fetching a part of the antenna into the station house then it is simple to cut down the field from that portion by merely pushing the two wires closer together as in Fig. 4B. For no good reason this is called a "Folded" antenna. Of course the advantage is not without its disadvantages, the main one of which is that the wires which are nearer together have a greater tendency to vary their performance when vibrated by the wind. They should therefore be rigid, or else be made to swing together by using heavy "dead" wire and light spreaders.

An unimportant variation on the folded-antenna idea is that at Fig. 4C. Instead of extending both wires, only one is extended.

A Bit of Debunking

Please do not take the dimensions in Fig. 4 too seriously. There is no law of either nature or Congress which compels us to make the radiating arrangements of just the lengths shown. If arrangement A is only 2/3 as big as the figure calls for, make it up with a good coil in the station and don't worry—the losses are not half as important as the losses in the earth, buildings, trees and wires all about the station. Similarly, I beg of you not to worry over the exact length of EITHER the extended or folded parts in C and B; it isn't even very vital if the two extensions in B are unequal. As long as the system as a whole takes power from the transmitter at the proper frequency—you have a good start. Let us reason over this a little. If the final tube of the transmitter is taking normal input and getting red in the face about it, something is wrong—is it not? Clearly the power is staying in the tube instead of going to the antenna. It does not matter how the antenna was measured off from the rules and tables—the thing isn't working. On the other hand if the tube stays cool at normal input the power MUST be going to the antenna,

even if the antenna meter happens to be in a part of the system where it calmly stays at "0" or drearily climbs to .03 and stops. It does not really matter if the meter has an ampere scale at all —we KNOW the power is going into the antenna. Once we have it in the antenna a reasonable portion of the power will get away if the heavy parts of the various systems of Fig. 4 are somewhere near the stated dimensions (meaning within 25% or so) and the whole thing isn't in the trees or down between two houses. The plate milliammeter and the plate's complexion tell us much more than the antenna meter. Similarly we can find out more about the radiation efficiency of the antenna by **walking outside and looking at the surroundings** than by much study of tables, dimensions and rules.

In keeping with this, never mind what particular system of tuning is used at another station, just place at the station end of your antenna such equipment as will cause the plate milliammeter and the plate temperature to stay where they belong. If in the process you work up twice the current in one leadout wire as in another, do not be too much troubled. The line may radiate a bit, some rearrangement of lengths may be advisable later—but for the present it is a good arrangement.

Vertical or Horizontal

In Fig. 4 the radiating parts for the various arrangements are shown in different positions, but again there isn't any law about it that applies to amateurs. Of course a horizontal radiating part like that of C, (or the system of B turned into a horizontal position) tends to be rather directional toward two opposite points of the compass and weak toward two, halfway between—if the thing is high enough off the earth—and if there are not too many things around the neighborhood to muss up the nice figure 8 pattern one sees in the books. In any case, the directionality is dull and the chances are that one has no choice as to the antenna position—why worry?

Similarly, if one desires to have "high angle fire" for extreme distance work only, the antenna might better have its radiation (dark) part vertical and at certain theoretically correct heights above the earth. However, since these heights are pretty uniformly impossible and the field is wound around everything within a hundred yards this, too, is not too important from an amateur standpoint. It is at least as practical, and much more convenient to adopt the suggestion at the close of this story.

COMING—PART 2

Simplified Transmission lines.

Band changing from *inside* the station.

High-angle radiation simplified.

A Short-wave Converter Powerizer

By L. W. Hatry, Associate Editor

How the manufacturer feels about recommendations frequently made for short-wave converter use I cannot guess; but they annoy me. This business of loading up the power-pack of a broadcast receiver with 2 or 3 more tubes is bad dope. In many cases the S-W converter builder or user is told to add a two tube filament or heater load and also a 10 to 20 ma. "B" load to a receiver intended to supply only its own power requirements and no more. By so doing he adds to the total drain on the receiver's power supply from 9 to 11 watts. This represents 20% overload in the midget receiver of 50 watts normal input which probably already was running at too high a temperature. The larger receivers of 100 watts or so input will be overloaded 10%. Overloads of 10% may mean nothing and again the overload may represent something the engineer did not expect; and yet again plenty of the modern outfits, judging by their running temperatures, are themselves exceeding their engineers' expectations.

That paragraph gets one objection to bad practice off my chest. I have another left. Converters built by most of us, when they do contain a power-supply, are too good and more expensive than necessary.

All of which simmers to this: If you make a converter build in its B and A supply. Small power transformers are cheap, one with a reputable name selling as low as $3. When you build up the power-supply don't make it more complicated than necessary.

A suitable transformer is one rated to supply 250 volts to one 245 and from four to six 224's. This transformer will supply enough filament "juice" for a 280 rectifier, and more than enough for the drain of three 2.5 volt heaters. If the 280 is followed with any standard filter system this same transformer will deliver far more B voltage than necessary. The answer is; don't use it with a standard filter system because (1) the converter won't need that much filtering and (2) the converter won't need that much B power. A resistance and capacity filter is entirely adequate. It is also the type in which the rectifier tube feeds into a relatively high A.C. impedance which is easier on the rectifier tube than the more usual arrangement where the rectifier tube feeds into a condenser or relatively lower A.C. impedance. The filter system is shown in Fig. 1.

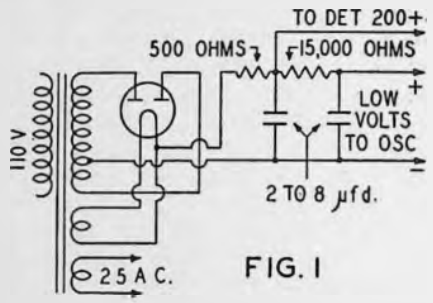


FIG. 1

A pair of electrolytic condensers can be picked up for prices between a dollar and a dollar fifty each and give lots of capacity. A pair of 2 Mfd. paper condensers (which would be sufficient) can be used instead at about the same price. Paper condensers should be rated at 400 volts at least for long life in this arrangement. The 280 rectifier (getting 300 v. R.M.S. A.C. on each plate) will deliver through this filter system about 200 volts at 15 ma. and the converter will produce no hum. A condenser input to this filter will raise the output capabilities to about 250 v. at 40 ma., which is needless.

In brief, it is possible, at mail-order prices, to build this entire AB supply for $6. The chap who is not particular can do even better.

As a final word, use a 280 for the rectifier; it is extremely long lived, rugged and the price is now too low to justify any other. Besides the use of a 227 or other half-wave-tube makes a more complicated filter system necessary.

Note—Through a drafting error the high-voltage center tap in Fig. 1 is shown off-center. —Ed.

Keeping Out of the Red—Part 2

I hope, in these plain-language stories, to pass on to the readers what I regard as vital precautions in a business which is overcrowded and highly competitive.

N. T. Young.

PROFITABLE SET SALES

In Part 1 of this story* we began to plan a retail radio business, encountered a number of questions, and answered the first three. Let us continue with the rest.

4—The Set Department

Make a small allowance for "trimming up" the set department. The acoustics of the room may be improved by rugs on the floor and tapestries on the wall. There should be chairs for the prospect's comfort. A table with an ash tray is also appreciated. It is a good idea to have several outlets for the a. c. line, the antenna and the ground.

5—How Set Sales Will be Financed

It is essential to become a member of some local credit bureau so that cus-

tomer's credit standing can readily be verified before a time payment agreement is made. A proper "conditional bill of sale" should be used so that the store has legal protection. Contact with an accredited finance company is necessary anyway and the proper blanks can be obtained from them.

In making a time payment sale a carrying charge must be added to the cash selling price. Typical charges are as follows:

Number of Months	Charges
4	3%
6	4%
8	5%
10	6%
12	7%

These charges are based on collection by the dealer himself. Customers prefer to pay at the store instead of dealing with a third party. Secure a down payment of at least 20% on contracts that are otherwise satisfactory; the larger the down payment the less chance that the set will come back.

Relations with Finance Company

When the dealer has accumulated $500 of these "conditional bills of sale" he sends them to a finance company which gives him 90% of the money which the papers represent, minus their service charges. As the dealer collects (we hope) he then pays the finance company monthly. The final 10% belong to the dealer and is kept by him.

Since the finance company makes a charge it is obviously important for the dealer to "hold as much paper" as he can, that is, to carry his own time payment accounts as much as possible. At least 25% should be carried by the dealer. If he does have to repossess any of the sets "covered by paper" which was sold to the finance company he can replace that paper with an equal amount out of his 25% reserve without having to turn cash back to the finance company.

Trade-In Allowances

It is a good rule never to allow more than 10% of the retail price of the new set as trade-in value for the old set—and to allow NOTHING for battery sets. If that will not make the sale—let someone else make it and lose money on it.

* July issue. Copies at regular price.

Used Sets

Having taken in a used set, the next problem is to get as much cash for it as possible. Do not allow the "trade-in" to occupy much space. It is better to write them off the books and put them in the cellar where they will not detract from the appearance of the new sets.

Occasionally make a window display of used sets, priced at about the trade-in value. At other times some of the used sets may be displayed in the parts department with price tags attached. In any case, don't let them stay and get older. At the end of 30 days the price should be reduced, and at the end of 60 days reduced again. If they reach the $1.50 level without selling either throw them out—after putting them well out of possibility of repair—give them away, or take them apart and make a temporary display of used parts with 5 and 10c prices. This display must not be kept around too long; what does not move reasonably soon had best be junked.

The most important thing about the used-set business is a 5c notebook in which every set is listed with date of taking in, price allowed, date of sale and price at which it finally sells. At inventory time look through this book and find out if you are losing money on the tradeins. If the tradein has been in the shop for a year it will never sell and should be regarded as junk, and the allowance for it put down as an expense.

Demonstrations

Another excellent way to lose money is to make free home demonstrations,

A big leak.

failing to understand that every demonstration costs real money in time, transportation and wear of the set and cabinet. Where a home "demo" is asked for, a $10-$25 deposit should be requested, with the understanding that if a set is bought this deposit can be applied against the price of the set.

You will probably have competitors—especially department stores—who will not ask for such a deposit. To them you will lose some sales. If possible convince the customer of the fact—and it should be a fact—that your followup and service are superior to that of a store to which radio is just another department.

Free Service with the Set

Another fine leak is the "free service" idea. With standard-price sets ($100 and up) it is safe to give a 3 month's replacement guarantee on tubes and a 6 month's repair guarantee on the set itself. There seems to be a very general failure to understand that this

Some light where needed.

CANNOT BE DONE on the miniature sets, though anyone can see that the profit on such a set is much smaller, the cost of handling it almost as great and the net profit therefore very small—so small that from 3 to 4 must be sold to clear the same net profit as from one standard set. All that can reasonably be given with such a set is a 3 month's repair guarantee and a 3 month's tube guarantee. Many stores and radio departments have already taken bad losses from overlooking this.

Antennas

An antenna charge is fair and proper. If your competitor chooses to lose his profit by making none, the only protection is to "sell" the idea that a $5 antenna is worth more than a free one. If it isn't, there is something badly wrong with the man erecting the $5 one!

Frequent Inventory for Catching Errors

Most of the dealers who have gone bankrupt in the past two years did not take inventory, keep proper books or have any idea whether they were operating at a profit or a loss.

For the first year an inventory every 60 days is none too many. This inventory should list everything and give its cost price. It should at least be classified into:

New Sets,
Used Sets,
New Parts,
Fixtures and Equipment.

Other classes may be added. The fixtures and equipment may, after the first year, be charged at decreasing value allowing anything from 10 to 33% depreciation per year, depending on condition and use. The remaining value of new sets which have become dead stock will be evident from the market price of such sets. The depreciation allowances should be added together and should appear in the inventory.

7—Bookkeeping

Bookkeeping for the average set and service establishment is not complicated. In a later article there will be shown a very simple system with illustrations.

8—Figuring Margin of Profit

Many dealers are confused as to the method of figuring their percentage of profit on a sale. The margin of profit should always be figured on the selling price, never the cost price. A "mark-up" which looks ample when compared to the cost is frequently too low to develop a profit above expenses. Recollect that a "mark-up" of 100% of the cost is only 50% of the selling price!

A particularly vicious practice is that of figuring margin (mark-up) from the cost price—and then turning around and figuring expenses on the selling price. This is complicated—and it is terribly misleading, frequently showing an apparent profit on something which is actually losing money.

A whole menagerie of additional reasons can be given for figuring everything from the selling price: here are a few:

a. Practically all other figures in retail business are based on sales and sale prices—including taxes, discounts, allowances and commissions.
b. Sales figures are always available quickly—including sales totals.
c. It is senseless to talk of margins and profits until there is a sale—for these things never existed until the sale was made—they depend on the sale to the customer and not on the purchase from the jobber.

9—Business Terms

Net profit is the money left over when all costs and expenses have been paid. It is not what the owner gets out, but what the business earns. It would be foolhardy to imagine that all of the net profit can be taken out as it develops; there should be a cash reserve in the bank, at least equal to half of the outstanding bills.

Margin, or gross profit, is the "spread" (difference) between cost and selling price. Out of it must come the operating expenses. When they are paid the net profit is left.

Operating Expenses, or overhead, are the expenses of the business, excepting only the cost of the merchandise. Too frequently some of them are overlooked in the preliminary figuring.

It may be helpful in clearing up this matter to show how a cost-price mark-up is related to a selling-price margin. The table is self-explanatory.

Mark-Up Table

Margin Desired in Per Cent. of Selling Price	Mark-Up (in % of Cost-Price) Necessary to Produce Margins in Left Column
9	10
11	12.4
13	15
15	17.7
20	25
25	33.3
30	42.9
33.3	50
35	53.9
40	66.7
50	100

PART 3 WILL DISCUSS

PARTNERSHIPS AND CORPORATIONS.

SERVICE AND SALESMEN.

CHARGE ACCOUNTS.

ADVERTISING.

The Radio Octopus—A Timely Review

The Radio Corporation of America has been bawled out with back-fence courtesy and in alley vernacular just about monthly. This statement is made to avoid giving the impression that we ballyhoo a revaluation of this "Benevolent Trust" as news. But we do regard Dane Yorke's article, "The Radio Octopus", in the August issue of *The American Mercury* with that respect which a well-reasoned, well-wrought, devastating but unimpassioned judgment deserves. It is decidedly worth a reading by everyone in the game.

"The American Mercury Authors" says of Dane Yorke that he was formerly in business in New York. We suspect he was not in the radio business, otherwise the radio history he reflects with such mirror accuracy would have breathed more hotly — and perhaps fogged the mirror. However, this history, taking up slightly less than 4 of the article's 16 pages, shows none of the grievous errors that have been the indignity of radio matter in practically all of the lay press.

In his 12 pages devoted to the RCA's activity from its birth to date, Mr. Yorke misses little that RCA has done. Those of us who have been intimate with RCA's former brutal arrogance, indifference and lordly lack of manners can feel that he pats where he might have smitten and smiles where he might have let loose a disgusted guffaw at their sudden new humanity. None of us who have participated in radio commerce, design, or merely radio repairing will be in the least surprised to learn from the *Mercury* that those manifestations of the RCA which each of us encountered were but characteristic. This thing Dane Yorke makes clear with margin to spare.

The wonder is that he does so well without convincing one of an intimacy with this game, only to be got by being a participant. He points out the prostitution of trademark sanctity in the case of the RCA — G. E. — Graybar — Westinghouse sets, differing only in nameplate and cabinet; yet does not point out how RCA has actually seemed to put unremitting effort into an attempt to diminish the tremendous prestige of its *own trademark*—and how this incredible procedure has apparently been successful in one direction—yet in another has strangely failed, "RCA" on a tube having undiminished value! Missing this Mr. Yorke naturally fails to point out that independent receiver manufacturers have been far more competent, or else (to be charitable) far less hampered by patent restrictions, than have the independent tube manufacturers.

Three-fourths of Mr. Yorke's words are aimed most specifically at RCA, otherwise a reader would be justified in assuming that much of his criticism was directed broadly—and well—at the entire industry, which has been amply stupid, nickle-chasing and self-castigating outside of, as well as within, the now numerous arms of RCA.

Let the discussion stop here. To the non-radio man the story must be fascinating of itself, as well as because of Mr. Yorke's good writing and the imprimatur of the *Mercury*. To you, as an insider, the story will not merely be fascinating, but will also give many reasons for rejoicing.

L. W. H.

A NEW HAND MICROPHONE

The "Star" style H carbon-diaphragm hand microphone shown herewith is intended for speech transmission under the conditions of an amateur radiophone station. It is accordingly designed to operate at from 4 to 8 volts and to work into a microphone-to-tube transformer with a primary impedance of 100 ohms. The current drain is from 7 to 20 ma. foot. The case is of die-cast aluminum for lightness, but finished in black lacquer to prevent finger-mark corrosion. A 7 foot moisture-proof cord is furnished. The device is made by The Gavitt Manufacturing Co., Brookfield, Mass., and the list price is $6.00.

These "highly selective" 1931 receivers are the bunk; they let the advertisements come right thru with the music.

Degenerative Feedback

How to Avoid it When Using Power Pentodes.

Due to the sensitivity of the power pentode*, and the fact that it is frequently used "single sided" certain circuit precautions are more important than in the case of the ordinary push-pull output stage using a pair of '45 triodes, or other low-mu tubes. This applies particularly to the means used for avoiding "degenerative" audio feedback.

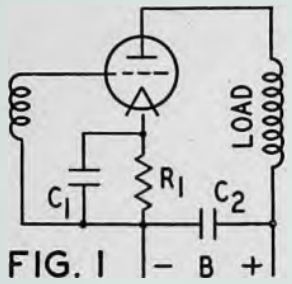


FIG. 1

The cause of degenerative feedback in a single-sided audio amplifier can be seen in Fig. 1. The diagram shows an ordinary amplifier stage in which the bias voltage is provided by returning the d.c. plate current (from filament to B minus) through the resistor R1. Any attempt of the d.c. plate current to rise will immediately increase the grid bias and thus put on the brakes. Unfortunately a similar action occurs with regard to the audio currents in the plate circuit. An audio voltage is set up across R1 and, as one might suspect from the above, it is in the right direction to *oppose* the grid voltage which is fed to the tube. Thus the feedback reduces amplification and we may properly call it degenerative. The purpose of C1 is, of course, to bypass the audio currents around R1 so that this effect will not take place. Even for the '45 the condenser C1 is not effective at low notes, as will now be shown. In the case of a single '45 the resistor R1 will be of about 1,500 ohms and the condenser C1 of about 1 microfarad. At 60 cycles this alleged bypass will accordingly have a reactance of 2,600 ohms—higher than the resistor it is supposerd to bypass, and therefore useless for bass notes. If 8 mufds. are used the drop through R1 C1 is still about 1/5 of the input-voltage to the tube, so that its 60 cycle amplification is reduced 20%. This is not too bad but the condenser is bulky and costly.

For the pentode the effect is about 3.3 times as bad since it takes but 16.5 volts grid swing for full excitation, as against the 45 volts of the '45. Putting it differently; a certain degenerative feedback is more serious in a high-mu. tube.

Dodging the Issue

The simplest way out of such an effect is to use a push-pull stage as this is balanced and no audio gets into the bias resistor. *However, the original idea of using the pentode output tube is to get rid of a tube*—and besides a single pentode is approximately equal to two '45 tubes.

The alternative is to use a filter-system to compel the d.c. and the audio current to travel independent routes. One arrangement of this sort is shown in Fig. 2, which will first be considered

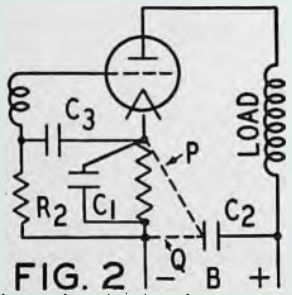


FIG. 2

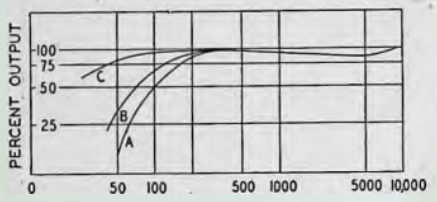
A filter system to stop degeneration. High-quality performance is possible with about 3 microfarads total if the plate supply is very free from ripple and one does not mind somewhat reduced amplification.

when using connection Q. If the tube is a '45 C3 can be 1 microfarad. This may seem insufficient in view of what has just been said, but we are now in position to *force* the audio grid currents to pass through C3 by inserting R2 in the other (d.c.) path, exactly as we ordinarily make r.f. bypasses effective by placing a choke in the d.c. path. If R2

* See remarks on grid swing in paragraph three.

is made 50,000 ohms the a.f. will certainly prefer to go through the 2,600 ohm C3 and only about 1/20th of the degenerative feedback voltage will reach the grid.

However effective the Fig. 2 circuit may be in protecting the grid circuit, it is less satisfactory in another way. Condensers C1 and C2 are in series in the plate circuit. Therefore they must *both* be of large capacity unless much of the output voltage is to be wasted across them. As before the effect is greatest at low frequencies and we lose bass. We may get around this partly by omitting C1 and connecting C2 directly to the filament centertap as suggested by the dotted line P, obtaining the same anti-de-



Degeneration in a '27 first audio stage. Curve A is taken with the circuit of Fig. 1 and with C1 of 1 microfarad. For curve B it is increased to 4 mufds. C2 was 10 mufds. both times. The curve C resulted when C2 was 25 mufds.

generative effect with a single 8 mufd. condenser (C2) instead of two 16 mufd. condensers (C2 and C3). As soon as this is done another difficulty crops up—for the circuit change has removed the bypass from R1 and the B-sub hum (which continues to pass through R1) immediately becomes louder! Now we must go into the B supply filter and put in more microfarads or henrys there. With the pentode the thing is 3.3 times as bad! This is not the way to beat the degenerative feedback.

Facing It

What is really needed is a huge bypass capacity around R1; then *no other protection at all will be required.*

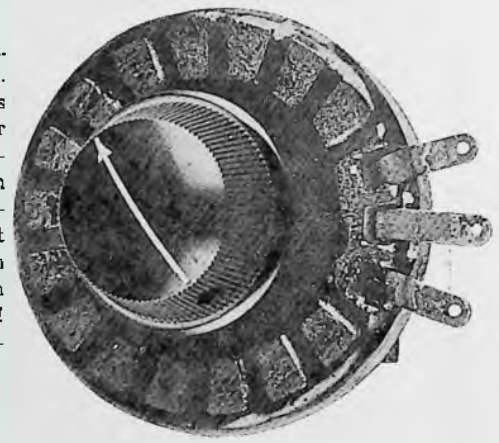
Thus we welcome as a solution of all these problems, the Aerovox 100 microfarad dry-electrolytic condenser. These may be had in 25 and 100 volt ratings, the former being suitable for pentode bias resistor bypassing, and the latter for the

A dry-electrolytic 100 microfarad bias-bypass.

'45 and '50 tubes. With so large a bypass one may return to the simple circuit of Fig. 1. The condenser C1 is the 100 microfarad bypass and C2 is any suitable paper or electrolytic condenser of perhaps 4 to 8 microfarads capacity. In most cases it is simply the last filter condenser, which is needed anyway.

A HIGH-RESISTANCE RHEOSTAT AND POTENTIOMETER

The 3", 75,000 Ward Leonard rheostat shown below has been found very convenient for adjusting the "background brightness" of the neon tube in a television receiver. Contact with the wind-



ing is through a switcharm traveling across 15 substantial copper contacts. The resistance wire is imbedded in the usual "vitrohm" manner with both ends brought out to permit potentiometer or rheostat connection. Several thousand hours of use at 3 watts dissipation have left the device unchanged in appearance and resistance.

A 1-METER LABORATORY

The Jewell Pattern 155 "Universal Laboratory Instrument" shown herewith provides nearly everything the economical experimenter needs in the way of d.c. measuring equipment. A little study of the photograph and the diagram will show that Pattern 155 offers the following:

(a) A zero-center galvanometer giving a deflection of 1 division for 20 microamperes (1 volt through 50,000 ohms), or full-scale deflection for 500 microamperes.

(b) A zero-center microammeter, range 0-500 microamperes.

(c) With button 2 depressed, a 0-100 millivoltmeter. (See also e below.)

(d) With button 1 depressed a 0-5 voltmeter. (See also f below.)

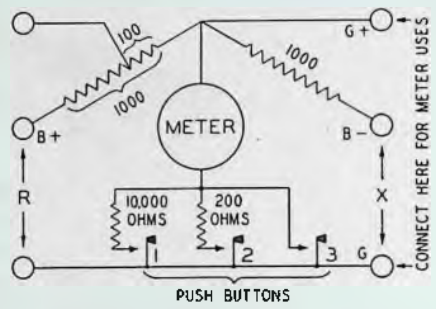
(e) With button 2 depressed the 0-100 millivoltmeter becomes an ammeter when the proper shunt is slipped over binding posts G and G plus. One shunt is shown in the picture.

(f) An extra-high resistance voltmeter, 2000 ohms per volt, can be made available by simply connecting a 100,000 ohm resistor in series. The voltage scale is then direct-reading. With 1 megohm in series the scale is multiplied by 10, that is one has a 500 volt meter. Since the instrument has a zero center one need not reverse connections.

(g) An ohm-meter is available by use of 2 or 3 dry cells, buttons 1, 2 and 3 and a simple formula accompanying the meter.

(h) A polarity indicator—when using more than 5 volts, put in series resistance, and in any case leave buttons 2 and 3 alone!

(i) A Wheatstone Bridge. 2 or 3 dry cells are connected to the B posts, the unknown resistance to the X posts and a known resistance of some adjustable type to the two R posts. Balance is obtained in the usual manner, buttons 1, 2 and 3 being used to obtain improved sensitivity as balance is approached.



The diagram will show that ratios of 1000/1000, 100/1000 and (by exchanging X and R) 1000/100 are available.

(j) By using the 4 rear posts the resistors of the ratio arm are available as standard resistors. The values provided are 100, 900, 1000, 1100 and 2000 ohms.

When the instrument is to be used as an ammeter any shunt adjusted to 100 millivolt drop may be used. Proper shunts are provided at $2.50 each for ranges of .05 amp. (50 milliamperes), .5 ampere and 1, 6, 10 and 25 amperes. Voltmeter "multipliers" for the 50 volt range are furnished at $4, a combined 50 and 250 volt multiplier at $15. The instrument itself sells at $22.

In the photograph is also shown a thermo-couple used in school work to show thermo-electric action. The construction is such as to permit a flame to be placed under the thermo-junction.

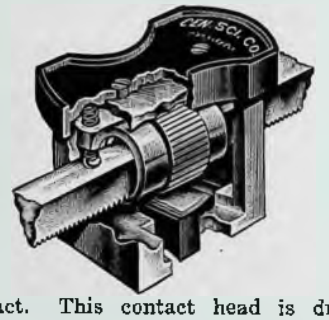
Further information on Pattern 155 may be had from Jewell Electrical Instrument Co., Chicago.

Poor selectivity against local signals is frequently caused by exposed leads to the grid (top cap) connection of screen-grid tubes.

NEW NON-INDUCTIVE CENCO RHEOSTATS

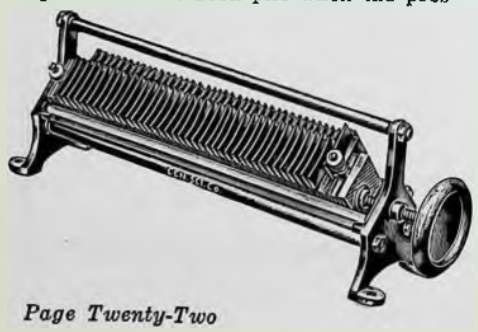
The Central Scientific Company of 460 East Ohio Street, Chicago, has announced several new types of rheostats of particular interest to radio laboratories. The slide-wire type, which is capable of dissipating about 400 watts, is essentially non-inductive, by reason of an Ayrton-Perry winding (two windings in opposite directions and connected in parallel). The winding form is of non-magnetic metal covered with a porcelain enamel. The magnetic field is so small that the 1000 cycle resistance is stated to be identical with the d.c. resistance, and when the rheostat is carrying full rated current a sensitive magnetometer discovers no stray field. Ten types are available, from 2.8 to 1435 ohms. The price is $10 to $11, the type number 5000.

The foregoing, and other (inductive) slide rheostats of Cenco make can be had with a quick-release fine-adjustment



contact. This contact head is driven slowly by a knurled sleeve working on the threaded slider-rod, or rapidly by depressing the head and releasing the screw adjustment so that ordinary slider action is possible.

Cenco also offers a new carbon-compression rheostat with metal fins for air cooling. These fins lie between the carbon squares and also act as springs to open out the carbon pile when the pressure is released, giving improved range and smoothness. About 400 watts can be dissipated as against 200 for the plain rheostat of the same sort. The resistance range is .01 ohm to 50 ohms with dependable action.



The foregoing items are described in the maker's bulletin 173.

The International Resistance Company's MR-4 resistor has been re-rated at 1½ watts, a new resistor called the MR-5 now taking the 2 watt rating. A 3 watt resistor called MR-6 has been added.

SHALLCROSS "MEGOHM" RESISTANCE BOXES

The Shallcross Mfg. Co. of Collingsdale, Pa., offers precision 2-dial decade resistance boxes, usable from D.C., through ordinary A.C. and on up through the entire audio range. This is made possible by sectionalized coils so wound as to keep both inductance and capacity low. The coil forms, switch bodies and bushings are of Isolantite and the

normal leakage resistance of the boxes is stated to be in excess of 1,000,000 megohms or 1,000,000,000,000 ohms. Calibration is to .1%. The individual resistors will dissipate 1 watt each; more if the aluminum case is oil-filled. Four binding posts are provided to permit voltage-divider ("potentiometer") connections. The boxes are made with steps of 10,000 to 1,000,000 ohms and total resistances from 1,100,000 to 60,000,000 ohms. Write for bulletin 900.

Have you subscribed? Otherwise you miss future issues.

AS PLAINLY AS POSSIBLE

One of our readers asks for some clarity on the variable-mu tube snarl, which seems to consist of a mass of contradictory claims.

First off—most of the confusion is due to advertising enthusiasm. "Variable-mu", "Multi-mu" and "super-control" all refer to the same general sort of tube. Similarly, "Our Engineering Department has developed—" (when seen in a tube-maker's ad. or a set-maker's ad.) means simply—"After we bought a license to make variable-mu tubes our engineers worked out a mechanical construction that suited our machinery". This is in the class with the automobile ads. in which every maker invented 4-wheel brakes. Exception to this must be made in favor of one tube-making organization and a pair of set makers who co-operated very actively with Boonton Research Corporation when the commercialization of the Snow-Ballantine variable-mu 551 was under way.

Now then—if there is only *one* sort of tube why do we hear of '51 tubes and '35 tubes? Is there a difference? Yes, there is; but it is one of detail and not in principle. The '51 is the Snow-Ballantine design. It gives a very large range of control and can handle a very strong signal before getting into the overload difficulties of the '24. The plate current is only a little larger than for the '24. However it is NOT interchangeable with the '24 and a set built for '51 tubes will not work decently with '24 tubes. This is because of the very large range of grid bias (30 volts minus as a maximum) which is needed to give the full control range. The '35 type is due to one of the various incarnations of R. C. A. (Information does not agree as to which one). Its plate current is materially larger than that of the '51 or the '24, the control range somewhat lower and the grid-voltage-plate-current curve somewhat straighter. In one sense one may look at the '35 as a compromise between the '51 and the '24. This is at least true to the extent that a '35 socket can in a pinch be filled by a '24, although one of course loses the variable-mu feature in making the change and restores the chance of overload. Do not carry this inexact statement any further than it has already gone; in other ways the '35 does not lie between the '51 and '24 at all.

This is, fortunately, becoming history. The 235 has been modified repeatedly and is now essentially a 551, and interchangeable with the 551. Thus for tubes shipped today one may forget everything said about the 235's habits.

Finally, unless you are having cross modulation, stick with the 224 and save yourself work and money. DON'T IN ANY CASE change tubes in an automatic volume control set—it will not work. Neither do variable-mu tubes create automatic volume control in themselves.

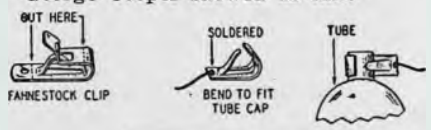
They *will* decrease cross-modulation and, of course, if the set is designed for automatic volume control with '51 tubes everything will be lovely.

Did you see page 28?

Polymet makes small fixed condensers in capacities of 3 to 50 micro-microfarads with a guaranteed accuracy of 5%. These are glass-and-tinfoil and have the same general appearance as a gridleak with pigtails.

Hurry-up Grid Clips

George Cooper showed us this.



AIR INSTEAD OF WATER

Boyd Phelps of Press Wireless calls attention to the fact that the rather messy water-cooling arrangements which deter most prospective users of water-cooled tubes are not necessary if the tube is to be under-run as it usually is in an amateur or small commercial station. For instance the 507 or 207 tubes will dissipate as much as 3 kw. when run with a simple forced-air cooling system—and are cheaper and longer-lived than any air-cooled tube-combination to handle similar loads. A single 207 or 507 makes a very nice modulator.

"Short-Circuits" at W2BP*

A $37.50 broadcast receiver is worth approximately $37.50.

We've just been told about a simple way of improving the tone of old broadcast receivers. One removes the output tubes and warms them gently until the bases can be removed. That's all.

Man—the believer in free will—invented time payments.

We hear tell that a condenser microphone compensates for everything that's wrong with the audio system.

A push-pull UX-250 amplifier makes a good heater for a 300-egg incubator.

In the proverb we were told—"The truth will out". In the newspaper radio ads the truth is indeed "Out".

Valuable data are anything the wife threw away when cleaning.

It pays to advertise—but it must be tough on the announcer's conscience.

We swipe from *Life* the idea that all radio receivers are portable now—the finance company carries them.

A man over in Collinsville wants to buy a used A-eliminator to replace the storage battery in his Ford.

After having sent VVVV and ABC through all those radio channels for so many months RCA must have them warmed up almost to the point of being able to begin sending messages through them.

100% modulation—what I have at my station.

Triumph of mind over matter—the 15c lightning arrester.

Why this amateur eagerness to work a 5 watt pentode into a headset? The thing has no more gain than a 227 and is too heavy for the job—like a raccoon coat in California.

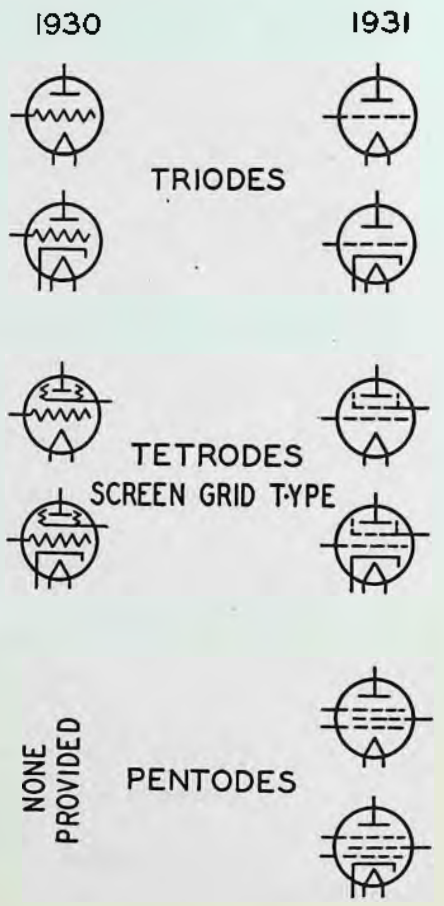
* Station and column operated by Boyd Phelps.

We know a man who fell off the top of the 600 foot tower at NAA and lived through it—he lit on the platform which is about 595 feet up the same tower. Think of having the scare and yet not getting the experience.

NEW SYMBOLS IN OUR DIAGRAMS

Herewith are shown the simplified 1931 I.R.E. tube symbols which we will use exclusively after this issue, unless our readers find them less clear.

We will continue to show a variable condenser by means of a straight line (stator) and a curved arrow (rotor) but in other regards will follow I.R.E. standards closely.



THE STAFF OF "MODERN RADIO"

Collectively the staff of "Modern Radio" has:

Designed five successful receivers.
Designed and built 22 transmitting stations.
Contributed to every major American radio magazine.
The articles have been reprinted in all principal countries of the world.
Has operated 29 commercial, broadcast, amateur and experimental stations.
Had 12 years' experience in radio retailing and jobbing.
Had over 14 years' experience in radio service work.
Has participated in many sorts of radio experimental work.
Has had 42 years of experience in radio transmission.

EDITOR—Robert S. Kruse, E.E.—Formerly with Western Electric Co., International Tel. & Tel., Radio Section of the Bureau of Standards, Hammond Radio & Research Corp., Technical Editor QST for five years. Editor Sterling's Radio Manual and of several books now in preparation. Designer of a number of broadcasting and high-frequency transmitters, co-designer of National's S. W. 5 Thrill Box, Pilot's Wasp and Super-Wasp, also other commercial receivers. Has contributed to Radio News, Radio Design, Radio Broadcast, Popular Radio, Radio, Short-Wave Craft. His writings have been reprinted in all continents. At present Consulting Radio Engineer.

ASSOCIATE EDITOR—L. W. Hatry—Best-known during 1920-24 as owner and operator of 5XV at Port Arthur, Texas; also three other calls. Articles contributed to Radio, Radio News, QST, Radio Journal, Popular Radio, Radio Broadcast, Short-Wave Craft, Radio Craft, Wireless Age, Radio News Canada, many having been reprinted in the major countries of the world. Was department Editor and Information-service QST, Radio Editor the Hartford Times, recently active in short-wave super-heterodyne design. Participant in short-wave and amateur radio for eleven years. Has been first grade commercial shore-station operator, also operator of broadcasting station and station engineer.

BUSINESS AND ADVERTISING MANAGER—Nicholas T. Young—Experimenter and radio operator since 1912 (starting with a coherer and decoherer) until 1917, amateur station in Brooklyn, N. Y. Graduate of School for Enlisted Specialists, Radio Section, Fortress Monroe, Va. Radio Sergeant U. S. A., in charge Fort Winfield Scott radio station WUO at San Francisco, California; Instructor in radio to commissioned officers and enlisted men in France; Ship operator, stations KMS, KIP, KMA and KMX; Broadcast station operator WDAK; 9 years managing experience in retail and wholesale radio.

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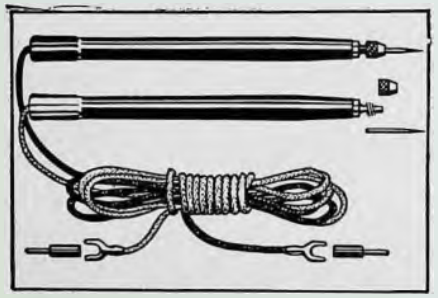

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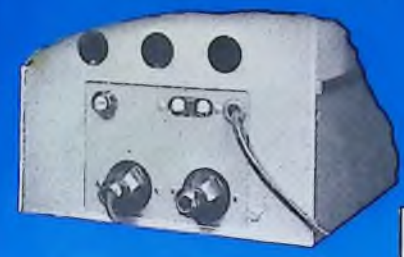
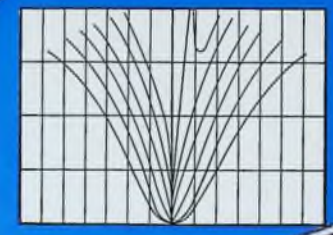


PORTABLE OR AC OPERATION

TEN COIL RANGES



WIDE RANGE CRYSTAL FILTER

MOVABLE COIL TUNING SYSTEM

The NC-200 has

TEN COIL RANGES

The NC-200 has ten calibrated coil ranges. Six of these ranges provide continuous coverage from 490 KC to 30 MC. The remaining four ranges cover the 10, 20, 40, and 80 meter bands, each band being spread over the major portion of the dial scale.

WIDE RANGE CRYSTAL FILTER

An improved wide range crystal filter is used in the NC-200. Selectivity is adjustable in six steps corresponding to bandwidths from 200 to 7600 cycles. The phasing circuit provides rejection ratios as high as 10000 to 1 when the interfering signal is only a few hundred cycles from the desired signal.

MOVABLE COIL TUNING SYSTEM

RF and oscillator coils, together with their associated padding condensers, are completely enclosed in separate pockets in a heavy cast aluminum shield. This shield moves bodily on a track, bringing the desired coils into operating position directly below the tubes and condenser, and taking the unused coils out of the way.

PORTABLE OR AC OPERATION

Typical of the refinement of detail in the NC-200 is the provision for operating standard AC models on batteries for emergency or portable use. All that is necessary is to plug in a battery cable in place of the dummy plug supplied with the receiver. This makes all necessary connections, and leaves the speaker and standby switch in operation. The B-supply filter is left in the circuit to assist in filtering vibrator and dynamotor B-power units.

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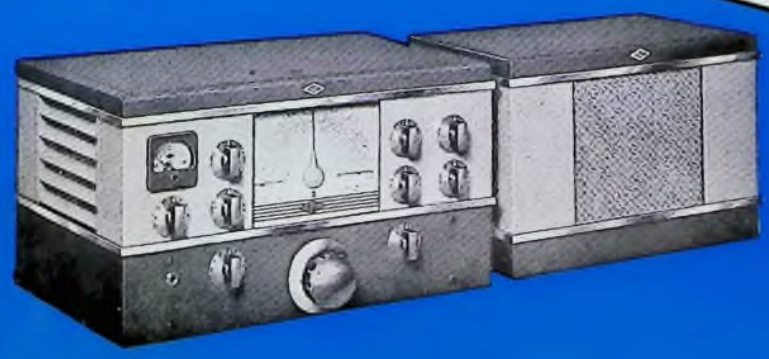

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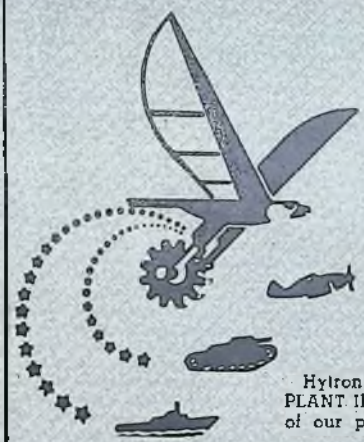

HYTRON

PART OF THE ARSENAL OF DEMOCRACY

Hytron is authorized to display this official DEFENSE PLANT IDENTIFICATION, signifying that more than 50% of our production is devoted to the needs of defense.

Measured in radio tubes, this figure represents more than a casual devotion to Defense. Important, indeed, are the tasks which Hytron tubes will perform during long, routine hours and in sudden, crucial moments.

To loyal Hytron users—to all who know of the many basic improvements developed here—it will be no surprise to find these better tubes taking key positions in the vast military mosaic of America and Britain. What should be emphasized now is:—*Defense is getting what it needs from Hytron, with no serious effect upon our ability to supply the radio industry, nor any slightest relaxation in quality.*

The needs of our regular customers, increasing heavily, have put Hytron capacity to a double test. That additional trial is also being met—in a plant whose flexibility astonishes even ourselves—by a master-combination of men, women and machines that seems ever capable of doing more and more!

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Not content with record-making tubes like the HY75, HY615 and HY69, Hytron has already added several new types, such as the HY65. This exceptional newcomer is used throughout in the 100 transmitters made by Cover Dual Signal Systems, Inc. for the radio intercommunication net of the huge Ravenna, Ohio, ordnance plant. No resting on oars here! Hytron keeps on developing "only-one-like-it" tubes . . . to serve YOU better and maintain Hytron leadership.

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