TIPS ON WINDING COILS

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One of our readers recently made a Dispel (HAM NEWS, Vol. 8, No. 2) and swore up and down that he coated exactly as described but the thing wouldn't work properly. Come to find out, he had made what he thought were unim­portant substitutions. In the first place, he used a ceramic trimmer—which has a much lower Q than the mica trimmer specified. Secondly, and more important, he used a different size wire—the "nearest thing on hand"—in winding the coils.

COIL WINDING

Almost all of the radio apparatus the average amateur uses involves wire-wound inductors, known generally as "coils." And unless the amateur has enough spending money to buy all the parts he desires, he is almost certain to use at least in construction (definitely not an "average ham"), sooner or later he will be faced with the problem of winding such coils.

Now, very few amateurs design their own coils, and it would take far too much space to go into all of the factors involved in such design. Most of us pattern our gear after circuits printed in the various handbooks and radio publications, taking care to follow as closely as possible the directions given for the construction and the winding of the necessary coils. This is not always easy, however, as inductance wire comes in a great variety of wire sizes and with a number of different insulating materials. It is not infrequently happens that when the coil design calls for, say, No. 28 double-cotton-covered wire, all we have on hand anywhere near that size is some No. 30 Formex wire. And when the nearest radio store is practically DX—to what do we turn?

WIRE TYPES

To begin to answer this question, let's first take a look at some of the different types of insulated wire that are used for coils.

Black enamelled wire is coated with a baked-on resin film that makes the wire relatively non-conductive. This film has a moderate degree of heat stability, and its dielectric strength is adequate for amateur applications, but it is considerably more brittle and fragile than the other wires. This is plain in Formex wire. Some varieties of this wire must be removed from the coil before winding or peeling of the insulating film. Also, the enamel is easily softened by organic solvents, and may be accidentally removed by improper application of coil varnish.

...susceptible to moisture and dirt...

Formex is the registered trade-mark for G-E magnet wire enamelled with a very tough golden-colored plastic known as "Formico." This material is really tough the wire can be pulled, beaten, bent, and twisted to a re­markable extent without breaking the insulating film. The insulation does not deteriorate at temperatures as which the common black enamel fails rapidly, and it has a high dielectric strength. It is not greatly affected by most organic solvents and, all-in-all, it is considerably superior to black enamelled wire for most purposes. There are four grades of Formex wire—F, D, T, and Q—with successively thicker coatings of enamel. For radio-coil purposes the single thickness F grade is nominally satisfactory. A sample of No. 30 Formex wire, on which the enamel film was only 1000- 1250, did not fail under 1250 volts in a dielectric strength test.

Double-Cotton-Coated wire (d.c.c.) is, as the name implies, bare copper wire wound with two layers (reversed) of cotton cord. Until impregnated with a coil dope, the cotton covering serves merely as a spacer between turns. This unsealed coil is suitable with d.c.c. wire are susceptible to moisture and dirt which may cause them to fail at lower voltages than the insulation at the closed ends and lower the Q of the coil. This type of wire is used mainly where some spacing between turns is desired, since such construction gives somewhat higher values of Q than the other types.

Single Cotton Enamelled wire (c.e.) is black enamelled wire covered with a single wrapping of cotton. Except for the added spacing between turns in the wound coil, it has no advantages over enamelled wire, and is adversely affected with contamination unless var­nished.

Silk Covered wire (s.c.) is rarely specified nowadays, and may be difficult to obtain. It is doubtful if the small advantage in using this type of wire over cotton­covered would justify the stand. Bare Wire or Tubing generally is used for coils with widely spaced turns, such as high-power transmitting inductors, in which there is no likelihood of turns being displaced and shorting.

HOW ABOUT SUBSTITUTIONS?

To find one might get into by making substitutions, several tests were wound on 1/4-inch polystyrene forms and measured on a Q meter.

Coils A and B were wound on 5/8-inch Amphenol forms to 100 turns each of No. 28 black enamel wire and No. 30 Formex wire, respectively. Since the
thickness of the enamelled layer was nearly the same on both types of wire, the over-all lengths of the windings were close, 1/4 inches for coil A and 1 3/4 inches for coil B. At a frequency of 2 megacycles, coil A required 59.5 micro-microfarads to resonate, its Q was 127, and the distributed capacity was about 3.5 micro-microfarads. At the same frequency, coil B required with 60.5 micro-microfarads, its Q was 128, and the dis tributed capacity was about 2 micro-microfarads. All this means is that although Formor is slightly lower diodieric bars and a slightly lower dielectric constant than black enamel, the two types of wire are closely similar and could be used interchangeably except under more rigorous conditions of handling and operation where the superior physical properties of Formor would make it more desirable. Also, using a wire with a thicker insulation, such as No. 50, 30 TP, would lower the distributed capacity of coil B. It was calculated to be about 90 microfarads and actually measured 100 microfarads.

Sometimes coil designers specify length of winding only—that is, a number of turns—and here is where the amateur constructor can really get into trouble. Coil C was wound to the same length as coil B, but with No. 31F Formor, only one wire size different and almost identical in appearance. It had, however, 112 turns in the length of 1 1/2 inches. It required only 48.5 micro-microfarads to resonate at 2 megacycles, had a Q of 130, and a distributed capacity of about 3.5 micro-microfarads. Admittedly, the difference between 60.5 micro-microfarads and 48.5 micro-microfarads does not seem large, but remember that at amateur frequencies, conducting stray capacities, tube capacitances, and the distributed capacity of the coil itself, this difference might be significant in the operation of a particular apparatus. When ten coils were removed from coil C (leaving 102 turns), it resonated at 3 megacycles with 65.5 micro-microfarads, closer, but still over 8 percent off. Using a wire two sizes removed from the specification and winding to equal length would result in a much closer match. Yet the general design is as described by the designer.

Coil D was wound to a length of 1 3/4 inches with No. 30 double-cotton-covered wire. It had only 62 turns, and required 132.5 micro-microfarads to resonate at 2 megacycles. The Q of this coil was 132, and the stray capacitance was about 3 micro-microfarads. This coil is almost hopeless as a substitute for coil A. It very possibly could not be made to resonate at the design frequency with the specified capacities and the chances are that if it could, the resulting impedance mismatch would result in impaired performance. (This makes little sense.)

COIL WINDING HINTS

Incidentally, if you do have to design your own coils, here are a few handy hints.

1. The optimum shape of coil for a given inductance is neither a very long coil of small diameter nor a short wide coil, but one of intermediate proportions. A ratio of length to diameter of about 3 to 1 seems to be good practice. Most coils in commercial equipment can be taken in examples of reasonable proportions.

2. Although there will be a particular wire size best suited for a given frequency (higher Q), in general it is a safe procedure to use the largest wire size that can be wound with the required number of turns in the space available. Coils wound with some degree of spacing between turns generally have higher Q values than close-wound coils, but for many amateur applications the difference may not be very important. Optimum spacing is about equal to one wire diameter between turns.

3. Ordinary round wire is the best shape for the inductance with the specified capacities, but it is better at the broadcast frequencies, but poorer at amateur frequencies.

4. Application of a good varnish, such as the grease made under the G.R. registered trademark Gylscape or Dico cement, to coils wound on low-pass filter transformers, improves coil performance, and generally should be made to protect the coils.

Preserving Antenna Components

If you want to protect wooden parts of masts, beaks, and other structures from rotting—or if you want your antennas made from metals that might otherwise "rust" treating them with a strong solution of penta chloroform ("Plasdone") before putting them up, using the home-made type of rust that had been noted with this solution standing in sample ground for three months and with the paint being toxic by stabilisation. It was just as strong after several years of exposure to the elements as ever.
One Cure for Ignition Noise

The following trick for curing ignition noise brought to mind an article onoise elimination (QST, April, 1962) by W2DP1, supervisor, Engineering Research Department, Delco-Remy Division, General Motors Corporation. We asked his opinion. Following are both the trick of W2DP1 and comments by W2DP1.

—Stiphonos Berry

After trying all the usual stunts in removing ignition noise from my mobile receiving setup in the fairly gas-stoggy, I tried the following trick which proved so effective I am now able to receive most signals with my noise limiter switch in the off position.

First, remove the distributor rotor from the distributor. This is made accessible by disconnecting the distributor cap clips, turning the cap to one side and pulling the rotor from the shaft (is just a push-on type). Loos the metal tab (on the various plug wires) on a flat steel ruler or cotton block and press out with a small hammer. Repeat this until the tab just barely leaves a mark on the metal contacts inside the distributor cap checking it frequently so as not to "burn" the tab out too much.

This whole operation only takes about five minutes but it sure makes a world of difference in the noise in the receiver. In fact, most of my ignition noise comes from passing cars now.

GILBERT V. VOYLES, W2HHD

We have never found an installation where all of the ignition noise originated in the rotor gap, which must have been the case in Mr. Voyles' car. In such a case, a short that caused the trouble undoubtedly would greatly reduce the noise.

There are reasons why his procedure may be a dangerous one. The cap inserts are held in place by a thin plastic sector. If extreme care is not used, the cap may become cracked in making the rotor insert longer. Manufacturing dimensional tolerances are such that most cases the center of the insert radius is not exactly at the same point as the center of rotation of the rotor. This fact would lead us to conclude that quite a large amount of metal would have to be removed from some inserts to ensure a wipe contact on all. Removal of enough metal would further increase the possibility of breaking the cap, or of breaking the rotor.

In the higher compression modern engines, the igni-
tion voltage requirement is greater than in older models. Since then a small decrease in the size of the rotor gap is essentially the same as it has been used in ignition systems for some time, it is likely that the gap may not have ideal ignition voltage high enough in magnitude to fire the plug. When, plugs become aged they accumulate a deposit of relatively low resistance parallel with the plug gap. This parallel resistance causes a loss in energy that is a function of

\[ S = \frac{1}{\cos \theta} \]

where \( S \) is the instantaneous voltage across the plug, \( R \) is the resistance across the plug, and \( t \) is time measured

from the instant voltage is impressed on the plug. Since the voltage is not impressed until the rotor gap is broken down, a reduction of rotor gap length will increase the factor \( \cos \theta \). The loss in ignition energy could well cause missing in an automobile that otherwise would operate satisfactorily.

We should recommend the use of 5000-ohm suppressors at each of the output towers of the distributor, and a 10,000-ohm unit at the center tower to cure the particular noise Mr. Voyles reduces by passing his rotor.

BROOKS H. SHORT, W2DP1

Male Octal Chassis Connector

Here is an idea that I have used successfully for several years. I would like to enter it in Tricks and Topics in G.E. HAM NEWS.

A very good octal male chassis-mounting connector can be made from the waffle base from an octal metal (or metal-based glass) tube, and one of the metal mounting plates supplied with retainer-ring mounted tube sockets and 110-volt connectors made by Amphenol.

These plates have a 3/4-inch diameter hole with a lug in them. This lug is filed down a bit, and the lug bent to one side of the plate a bit (perhaps 15 degrees or so). Then, the waffle base is inserted in the hole, with the lug fitting into one of the notches where the tube skirt was originally crimped. The base is inserted into the side of the plate towards which the lug was bent. It will now be found that the other three notches are accessible to use for running wires. Into these slots little strips of thin metal, about 3/16 inches are inserted, bent back on both sides of the plate, and crimp flat with pliers. That's all.

A few notes: Amphenol specifications supplies a thicker mounting plate. Only the thinnest one can be used here. They seem to be the most convenient kind. Also, a vise or pair of pliers can be used gently to push the base into the plate. I was a good size for this.

The connector can be mounted in a standard socket hole in your octal chassis, or at the outside of the chassis. If a base 1/4-inch in diameter is used, the plate can be put inside. Perhaps the base could be put directly into a hole in the chassis without the plate, using the strip of metal in all four notches. We have tried this as my socket-base stretch is 1/4 inches. The base must be a snug fit in the hole.

I hope you find this idea interesting. I have used it a number of times, and it works very well, especially if it occupies almost no space under the chassis.

PHILIP H. BYRNE, VE1AXX
Using 24-volt Relays

I have a task to catch my Eye in Topics and Topics section of G-E HAM NEWS. It concerns 24-volt supply relays which have so doubt been the subject of many tricks. I have been using several in my rig by obtaining power from a 50 or 80 holer up in a half-wave circuit with transformer plates tied together. The output voltage of this supply with one microfarad condenser for filters is about 50 volts or sufficient to operate 2 relays in series, but the current available is sufficient to operate two or three strings of relays.

The high vacuum rectifiers will also supply any extra current necessary to pull in some types of relays which would damage the dry disk type rectifiers unless it is well over-rated under normal operating conditions. Most ham rigs will have the necessary 5-volt filament winding available especially if any surplus transformers are use in the rig.

In closing, I wish to thank you for the large amount of enjoyment I have obtained from G-E HAM NEWS.

HUGUE E. WHITE, WANO

Easy Way to Top Poly

Plexiglas, lucite, polystyrene, and other thermoplastic compounds are easily tapped by means of the following trick. Drill with the proper size drill, fasten a screw of the desired pitch and diameter to one of those " Turk " on screwdrivers and heat in a gas flame. The screw will not thread as if it were going through rubber. Be careful not to get the screw too hot.

JOHN G. LAWTON, WIVY

Mounting Can Capacitors

Here’s a little trick which may save some of your readers time and energy. It has to do with mounting the rectangular can-type high-voltage filter capacitors after they have been sold. Mounting brackets have been lost or diverted to some other use.

It will be observed that such can-type capacitors have at both top and bottom a bead running all around the edge, and that this bead is about 3/8 inch thick. Such capacitors are usually mounted with the terminals projecting through the chassis.

I FORM STRAP

Measure the distance across the capacitor inside the headed edges, and fabricate, from soft aluminum 3/8 x 0.11 thick, a mounting strap to pass over the capacitor. The width of this strap should be slightly less than the distance between the beads on the capacitor. Bend " foot " at the ends of the strap to permit mounting to the chassis.

Punch the chassis to pass the terminals, fit the strap over the capacitor, and bolt to the chassis. It will be observed that some portion of the capacitor is still present. To eliminate this motion, place the end of a screwdriver blade on the aluminum just inside the corner of the bead and tap smartly with a hammer.

Do this at each corner of the capacitor bottom. The screwdriver blade will deform the aluminum, pressing down a small section. These pressed points will serve as the base of the bead at each corner and prevent further movement.

HOWARD A. BOWMAN, WOGIR

Low Drain Pilot Lamp System

Effective and lower power consumption pilot lamps on 110-volt tires can be economically made with 200,000 ohm resistors in series with NE-2T pagen type transformer lamps.

Space and money can also be saved by mounting the light lamps inside grommets 1/4-inch inside diameter. This type pilot lamp draws about 1/35 of a watt as compared with at least 14 watts drawn by a standard 110-volt pilot lamp.

HERMAN H. ROED, JR., WIVYP

Transmitting Recorded CW—on CW!

To transmit recorded CW contacts in the front bands all you have to do is set the mike in front of the tape or wire recorder and turn on the rig and recorder. But how to retransmit such recorded CW contacts on CW! Here’s how I solved the problem of converting the a-f out of the recorder to me.

From Recorder

To KEYED CIRCUIT

As the accompanying diagram shows, all you need is a 14- or grid trap transformer, a common diode, and a 10,000-ohm plate relay. I use a BC-55 plate relay bought in the surplus market.

GEORGE BRAND, WIVFI

How did you solve that last problem that almost killed you? Zork it aloud, tubes, antennas, circuits, etc. The Automatic Larry would like to tell the rest of the hams about it. Send for each " zork " published you win $10 worth of 0-E Electronic Tubs. Mark your letter " Cruz tricks and Topics " and send to Automatic Larry, Tube Department, General Electric Capacity, Schenectady, New York, or in Canada to Canadian General Electric Company, Ltd., Toronto, Ontario. The Quotations are to be made on the right, without obligation beyond the above, to publish and use any material submitted to this column. No entries returned.

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Quite a few of the editors of radio club bulletins send us copies of their publications and we sure enjoy reading what they say in the different sections of the country are doing. If your club puts out a regular bulletin or newsletter of any kind, please tell the editor that we will be glad to exchange publications with him. And speaking of club membership, 1'd like to pass on the comment from several clubs that the effect that a club publication—be it the humblest sort of an internal publication—has in keeping the members interested in club activities is a fine form of 'retention' that we all have here once.

The cost is not prohibitive. The principal stumbling block is the work involved. In the first place, it should not be made a one-man job. The load generally is just too heavy for one man. A club bulletin should be run by a standing committee—call it the editorial board if you like. You need at least one member to write news, and the chances are that he could use a helper or two to gather the news. Then you need a member to handle the publication—be it typescript, hectographed, or printed. And, with a publication of any size, this production man can use some help, too. The third problem that calls careful attention in distribution—which means for the most part, addressing and mailing. At least one member is needed here.

Of course, with small clubs and small bulletins it is quite possible for one member to handle all these items. But while the complete production of one issue of a small publication is not difficult, the timing part is the repetition of this work load time after time. And so we suggest splitting up the work on even the smallest publication between at least two members—preferably three.

H H

The editor came in looking pretty down-in-the-mouth the other day and we learned the source of his woe was trying to substitute a 480 for a 681 in his receiver. He has a surplus BC-348 and wanted the extra diode in the 480 for a noise limiter. This stunt has been used successfully in many mobile installations. But apparently what he had another day was different. He never did get to building the noise limiter on that diode he bought in the store and plugged in the 681 about 40 different things happen—first the audio voice, the voice was no go. He brought this up by changing the cathode resistor associated with the triode section of the tube—no go, still the problem. In the end he isolated the trouble on the additional changes he would have to make. For the BC-348, there are many good diodes available as a unit in which all stages and sections are inter-dependent in varying degrees. Changing one part requires changing many others.

But he interrupted. "Larry, if you think I'm going to change the design of the receiver to put in a noise limiter, you're nuts."

"If you think you're going to substitute tubes without regard for the design, then you're nuts," we retorted.

We compromised. He put in an extra tube—a 681—no noise limiter. The reason he didn't want to do that in the first place is that he is still using the original 480's in the receiver and doesn't want to fuss around with a spare set. If he's open to the thought of doubling up, he could hold of somebody and didn't want to disturb that string with an extra tube. In the end, though, he put in a small fluorescent tube for the 681. Incidentally, we stopped out at his house a few days later and he demonstrated the quiet limiter. Works good. In case you're interested, he's in the circuit, which he gets from W36IFU and WICVF:

H H

It seems most of the objections to single-sideband operations come from fellows who say they "must hear an SSB signal and feed it just as wide as an AM signal." The complaint precisely points up the purpose of a single-sideband receiver adapter such as the "Siglizer." (G E HAM NEWS Vol. 5, No. 4).

For you can receive SSB signals with an ordinary communications receiver, you cannot get full advantage of the relative narrowness of an SSB signal without a "Signalizer" or the equivalent. And you can't see by installing a "Signalizer" because it will slice out QRM when copying AM, CW or NBFM, too. To conveniently answer the increasing number of requests for general information about our SSB equipment, I've gotten up a "SSB Package" consisting of copies of G E HAM NEWS which describe the "Signalizer," "SSB Jr.," "Larry Linear," and "Power Peaker." Let me know if you want a set of these.
THE EDISON RADIO AMATEUR AWARD

The Award Committee solicits your nominations for 1953 candidates

Here is your opportunity to spotlight the meritorious work of a radio amateur you may know who has served the public by means of his hobby. Enter his name for the Edison Award.

You will be promoting the best interests of amateur radio, and you can win for yourself an expense-paid trip to the city where the Award will be presented. Judges will consider only amateurs who are nominated by your letters.

1952 saw Don Mullican, W9HPH, receive the Edison Award as a result of his outstanding work in the March tornado disasters in Arkansas. Special citations were given four other amateurs who performed especially notable services.

The acclaim for these five was a tribute to the important and unselfish efforts of amateurs everywhere. The 1953 Award will bring recognition to a new trophy winner—will once more dramatize amateur radio's achievements in the public interest.

Read the rules at right. Then select your candidate . . . and send your letter of nomination to Edison Award Committee, Tech Department, General Electric Company, Schenectady 5, New York.

RULES OF THE AWARD

WHO IS ELIGIBLE: Any man or woman holding a radio license is eligible for the Edison Award for the U.S., Canada, and Mexican Radio amateurs. Service is limited to amateurs in space. The service must have been performed while the candidate was furnishing his hobby as an amateur within the continental limits of the United States.

WINNER OF THE AWARD will receive the Edison trophy in a public ceremony in a convenient location in New York City, where the presentation will be made. The trip will be paid. As a further honor of appreciation the U.S. will present five other awards with a special citation each to amateurs in foreign countries (the person recognized by the number of the Award) whose candidates will be voted to reflect the public interest, and their expenses will be paid. 

WHO CAN NOMINATE: Any individual, club, or association familiar with the service performed.

HOW TO NOMINATE: Include a letter of the candidate's name, address, call letters, and a full description of the service performed. Your letter must be postmarked not later than January 1, 1954.

BASES FOR AWARDS: All entries will be reviewed by a group of distinguished and impartial judges. Their decision will be based on (1) the general merit of service performed, (2) the manner in which it was performed, and (3) the degree of hardship displayed in performing the service. The judges will be:

C. ROLAND KELLERHORN President, The Amateur Radio Council

GEORGE S. STECKING Consultant, Federal Communications Commission

GEOGRPHY, L. YOLDOU President, American Radio Relay League

President and Editor, "QST" Magazine

WINNER WILL BE ANNOUNCED on or before Thomas E. Edison's 100th birthday, February 11, 1954.

Employees of the General Electric Company may not make nominations for the Edison Radio Amateur Award, but are not precluded to receive the Award.
**GENERAL DESCRIPTION**

Another addition has been made to the 6V6 family—the 12V6-GT. This is a 12-volt filament version of the beam power pentode, and was designed for use in automobile radios operating on the new 12-volt ignition systems. Amateurs undoubtedly will have occasion to use the 12V6-GT in the 12-volt auto systems come into more general use in the next few years.

**BASE DIAGRAM**

![Diagram of the 12V6-GT](image)

**MAXIMUM RATINGS**

- **Heater Voltage (a-c or d-c)**: 12.5 Volts
- **Heater Current**: 0.25 Amp
- **Plate Voltage**: 315 Volts
- **Screen Voltage**: 285 Volts
- **Plate Dissipation**: 120 Watts
- **Screen Dissipation**: 20 Watts
- **Heater-cathode Voltage**: 90 Volts
- **Grid Number 1 Circuit Resistance**: With Plate Boost: 0.4 Megohm
  With Cathode Boost: 1.0 Megohm

**TYPICAL OPERATION**

**CLASS AB, AMPLIFIER (VALUES FOR TWO TUBES)**

- **Plate Voltage**: 285 Volts
- **Screen Voltage**: 285 Volts
- **Grid Number 1 Voltage**: -19 Volts
- **Peak A-F Signal Voltage (Grid to Grid)**: 28 Volts
- **Plate Resistance (Each Tube)**: 70,000 Ohms
- **Peak A-F Signal Current (Full Tube)**: 3000 Mho
- **Zero-Signal Plate Current**: 70 Mhos
- **Max. Signal Plate Current (Approx.)**: 92 Mhos
- **Zero-Signal Screen Current**: 4 Mhos
- **Max. Signal Screen Current (Approx.)**: 15.5 Mhos
- **Effective Total Load Resistance (P-F)**: 8900 Ohms
- **Total Harmonic Distortion (Approx.)**: 5.5%