

# MRL 20 CRYSTAL SET CIRCUITS

by Elmer G. Osterhoudt

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## FOREWORD

The lowly Crystal detector, long delegated to the Old Timers or Youngsters, has again taken its place among the fundamental components of Radio. In recent years, millions of Diodes have been manufactured for use in microcrowave receivers, which played an important part in the War.

It is so important that large companies like G.E., Sylvania, DuPont, Bell Labs., Westinghouse and others have spent young fortunes in its further development and use. In 1946, the Mass. Ins. of Tech. published a 443 page book "Crystal Rectifiers" devoted entirely to Crystal diodes.

The principle of Diodes is identical to that of Steel galena - or adjustable catwhisker type of crystal. One may be substituted for the other, with gain or loss in efficiency. We seem to push our pet Fixed Carborundum and flashlight cell, as being very stable in operation and with plenty of volume to back it up. It has many possibilities.

The wide diversity of Crystals is matched by the variety of set layouts. The sketches shown give our ideas along this line, but you may build them to suit your own preferences.

A good pair of phones, with as

high resistance as possible, is a prerequisite to good DX reception. The impedance is about 5 times the DC resistance, in case you wish to figure them out.

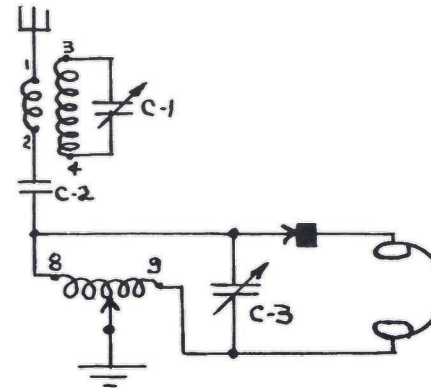
As to Aerials, we prefer about 50 ft. in the City; 100 feet in the Country. A good ground is essential, altho not always required in the City. Height is more important than length for DX. Use good standard Aerial wire and never small magnet wire for your Sky Hook. The Experimenter should always have several Aerials, - each hooked to a single S.P.S.T. knife switch so the proper combinations may be had.

Good joints are essential. They are usually the result of a hot iron - say 85-100 watts. Be careful around celluloid forms.

Most circuits are from our original BP-17, but changed in a lot of ways. Three circuits have been substituted, as the ones in BP-17 included a tube, and HB-17 is purely Crystal. Two more have been added, as BP-17 only contained 18 circuits.

Am sure that if you follow the plans enclosed, along with the Detail prints given, you will become an ardent Crystal set Fan. Small sets are fast becoming one of the most interesting hobbies.

## MRL #1 CRYSTAL SET. (DP-26)



## PARTS LIST:

- C-1 .00035 Variable Condenser.
- C-2 .0001 mica Condenser.
- C-3 .00035 Variable Condenser.
- 1-2-3-4. MRL QRM Coil (page 23)
- 8-9 MRL #1 Crystal Set Coil.
- 1 Knocked down Crystal Stand.
- 1 Steel galena or Diode Xtal.
- 1 Switch lever.
- 12 " " points.
- 2 " " stops.
- 2 1/4" Bar knobs and scales.
- 1 Compo. panel 1/8" x 6" x 7"
- 5 ft. #18 str. hookup wire.
- 3 ft. #22 " " " for coil
- 2 1" Fahnstock clips for A-G.
- 2 Phone tip jacks.

This is the set that started us in the mail-order business. We were so surprised at its performance, we figured others may like to build it. It has piled up an inch stack of reports - some running over 2000 miles and 500 miles at night on a magnetic speaker, under good conditions.

See page 23 for data on QRM coil. This may be mounted on the rear of left-hand condenser. The field of the QRM does not interfere with the tuning coil, so may be placed in any position.

Coil (8-9) is wound on a 2XM celluloid form 2" dia. x 4 1/2" in length. Starting at end with the small ring, wind 75 turns #22 DCC. Tap at 3-6-9-12-15-20-25-30-35-40-45-50, making 12 taps in

all. See winding page 23. Best way to mount the coil is horizontally; above the condensers. Suspend it by a 6-32 x 1 1/2" R.H. machine screw and several nuts. Mount "hot" and near the switch points. This coil tunes the primary, or A-G circuit, and helps in selectivity and volume of the set. There is no particular setting of the switch, except where it works best. When making connections to switch points, be sure to solder the joints well. Tin the pts. first, and then hold a screwdriver on the joint until it cools. Having good joints is most important for a trouble-proof set.

Condenser (C-2) is very important, and the type depends on your type of aerial, as height, length and location. We have used a 15 mmfd. trimmer with good success. Also, a .0001 mica up to .01 is OK. Try several until you find one best for your particular conditions. The smaller the condenser, the more taps you will have to use on the coil.

Any type of crystal may be used, as Steel galena, Xtal diode, or a Carborundum with 3 volts in series. There are so many variations, you are not limited to certain types.

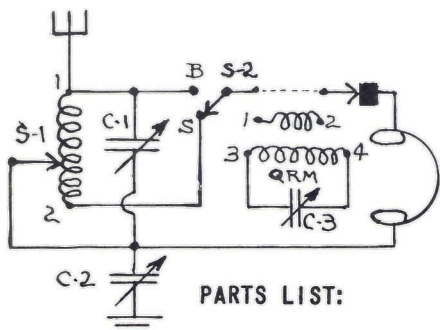
For an aerial, naturally the higher the better. Length of 50' in the city, to 100 ft. in the country, away from stations with a strong ground wave.

Naturally, phones of high impedance are better. They give less leakage of high frequency current around the crystal.

When tuning, bring in the loudest station, as strong as possible. Then, slowly turn (C-1) until it cuts down, or out altogether. Leave it on this station and go ahead and tune the other stations. If very loud and near, it will be loud enough for comfort when you hit it.

Some may prefer a 50-500 mmfd. trimmer on the QRM Coil. However we prefer the use of 2 .00035 mfd. variables to tune from the front of panel. In this way you may control the tuning of some good DX stations.



**MRL #2 DX CRYSTAL SET. (HB-2)  
(DP-22).**

**PARTS LIST:**

- C-1, 2 .00035 Var. Condensers.  
 C-3. 50-500 mmfd. Trimmer cond.  
 1-2 MRL #2 Cell. Crystal coil.  
 1-2-3-4. MRL QRM Coil (p. 23).  
 S-1. 1" Switch lever.  
 10 Switch points & nuts.  
 2 " stops " "  
 S-2. S.P.D.T. toggle switch.  
 1 Compo. panel 1/8 x 5 1/2 x 7.  
 1 Knocked/down Xtal stand.  
 1 MRL Steel galena or other.  
 1 1/4" Bar knobs & scales.  
 2 Phone tip jacks.  
 2 Fahnstock clips for A-G.  
 1 6-32 x 1/4" R.H. Machine.  
 3 6-32 nuts for same.  
 2 ft. #18 Stranded hookup wire.  
 3 ft. #22 " for coil leads.

Radio Fans have praised this circuit since 1933. Piles of long distance records have been made, up to 7000 miles under the best of conditions. In good average locations, like the broad Mississippi valley - 1000 miles is the usual DX record. In others, where the set is handicapped by mountains, desert country and dead spots, several hundred miles is often obtained. Due to varying conditions, one fellow will get 1000 miles while down the street a few blocks - another will be limited to a hundred - so it goes.

This circuit uses 2 standard .00035 tuning condensers. One is used to tune the secondary, while the other regulates the primary to ground - making it a 2-dial set. While the 2 condensers often track, some prefer to use two separate condensers to make sure

of finer tuning.

On the back of the panel, it may be good to mount a QRM coil and trimmer condenser between the switch (S-2) and the crystal stand. Tune this trimmer to any bothersome station and leave it on all the time. The other stations will now come in without any trouble. If station is very strong, you will still get it with comfortable volume. Tune the bad station out like we did in circuit #1.

You will find the switch (S-2) will give you selective tuning for city operation, or broader tuning in the country, away from stations with a strong ground wave. It is a good idea to make up a log book so you can always get the best settings for finest reception of all stations.

DP-22 and HB-2 give all kinds of details about construction & operation of this highly efficient set.

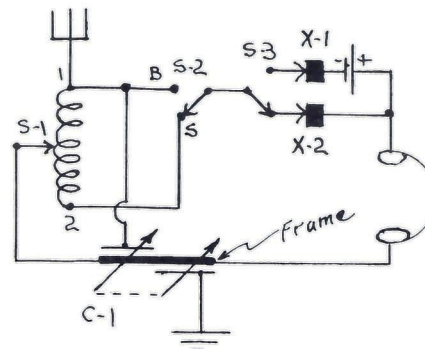
Coil (1-2) is 2" dia., wound with 90 turns #22 DCC. It is tapped at 5-10-16-23-31-40-50-61-73-90. Mount it horizontally with the panel, just over the 2 var. cond. Hold it away from panel by the 6-32 x 1 1/4" screw. Adjust the nuts for clearance of parts and cinch them up good.

When wiring the set, be sure to use the heavy wire for the set, and the smaller #22 wire for leads from coil to switch points. See page 23.

We used to bend a tip of one plate of cond. (C-2) so it shorts when clear in, but we do not use it any more, as one usually requires all the selectivity he can get.

City aeriels run about 50 feet and the ones in the country up to 100 ft. long. Height is the most important for DX.

If one wants to work this set strictly on short waves, we suggest using 2 or three separate coils - in diameters from 1 1/2" to 2". Plug them in by using banana plugs and jacks. Do not use the switch points when experimenting with short waves. Many have been playing lots of SW on this set.

**MRL #2-A DX CRYSTAL SET. (HB-2).  
(DP-22-A).**

**PARTS LIST:**

- C-1. .00035 2-gang var. Cond.  
 1-2. MRL #2 Cell. Crystal coil.  
 S-1. 1" Switch lever.  
 10 Switch points and nuts.  
 2 " stops " "  
 S-2, 3. S.P.D.T. Toggle switches.  
 1 Compo. panel 1/8 x 5 1/2 x 7.  
 1 Knocked/down Xtal stand.  
 1 MRL Steel galena or other.  
 1 MRL Fixed carborundum Xtal.  
 1 Dry cell.  
 1 1/4" Bar knob and scale.  
 2 Phone tip jacks.  
 2 Fahnstock clips for A-G.  
 1 6-32 x 1/4" R.H. Machine.  
 3 6-32 nuts for same.  
 2 ft. #18 Stranded hookup wire.  
 3 ft. #22 " for coil leads.

This is a variation of the #2 circuit. In many cases one cannot easily obtain single variable condensers, and it is necessary to use the 2-gang. This makes a single dial Xtal set.

The above circuit is drawn so you may use a Steel galena or a Crystal diode (X-2) on one side. On the other side of the switch you may use a fixed Carborundum and drycell (X-2). If the battery is left in circuit over a long period of time, it will run down. Therefore, when not in use be sure to throw switch over to the Steel galena.

The QRM Coil may still be used between switches (S-2, 3) as in #2 circuit, if desired.

It is to be noted that kits do

not contain these variations, but only items shown on the DP's.

The 2-gang condenser for this rig mounts in the lower middle of the panel. Cement the dial scales on evenly with Heavy celluloid cement or glue. Stand the panel up and stand away from it, to see if dial scale is level.

The coil is identical to the #2 set, so no need to repeat it here. Mount it horizontally as in #2 - except it may have to be raised a little higher to clear the 2-gang condenser. Before you mount the coil, run a little pc. of fine sandpaper over the taps, and tin them. When coil is mounted, soldering will be much facilitated. HB-2 gives plenty of good advice on connecting coils, etc. We have found #22 DCC to be about the best. If you use smaller wire, the set will be more selective but the volume will be decreased. If larger wire, then the set tunes broader but may get more DX, if not too close to a powerful station.

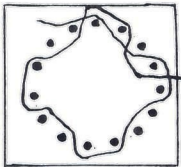
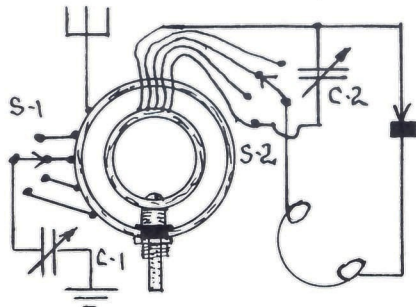
In some of the Crystal circuits a .00025 mica is placed across the phones. Theoretically, this is right, but very little is accomplished in results. Years ago we used to place a .002 mica across the phones as a bypass. You will find this lowers the tone by allowing the high notes to flow thru it.

For selectivity, the switch (S-1) is used. For average reception it is used on the Broad side. When on Selective side, the coil is raised above the ground circuit, electrically, to make it more selective. In this way, the HF doesn't leak across the crystal, which may have a fairly low resistance to signals, although the resistance on an ohmmeter may be fairly high.

Some prefer this set to the 2-A, and vice versa. If one wants sharper tracking they may use a 2-gang cond. with trimmers, and adjust them on the HF stations. If no trimmers come with the var. cond. you may add them. Get a "peanut," or DX station tuned in good and adjust trimmers. The set will then tune OK on others.



## MRL #3 SELECTO-DYNE XTAL. (DP-64)



## PARTS LIST:

- C-1,2. .00035 Variable cond.  
 2 Switch levers.  
 8 " points & nuts.  
 4 " stops & " .  
 1 Compo. panel 1/8 x 7 x 8.  
 3 1 1/4" bar knobs & scales.  
 50 ft. #22 DCC for rotor.  
 100 " #24 DCC " primary.  
 1 1/4" wooden shaft 4" long.  
 1 Bearing for shaft.  
 1 Knocked/down Xtal stand.  
 1 Steel galena or other.  
 2 Phone tip jacks.  
 3 ft. Loop wire for rotor leads.  
 5 " #18 stranded hookup wire.  
 2 Fahnstock clips for A-G.

While this set was originally designed for old-time spiderweb, or pancake coils, we prefer a solenoidal winding. This type of winding is the basket-weave coil - or even, a loose-coupler may be used. The internal resistance of a flat coil is much less than the pancake type, or spiderweb.

The sketch shows method of winding a basket-weave coil. You may select any diameter, just so you use an uneven number of pegs on your form. Drive in finishing nails, say 6 or 8 penny, and you are ready to go. Wind over 2 and then under 2 as you go around. When thru, lace it up with a pc. of string and darning needle, in

a sort of looping action. Cinch the string taut and remove. Then paint with Light coil cement.

For the primary, use about 100 turns of #24 DCC, 3" in diameter and tap it in 4 places. Next is the secondary of 75 turns on 2" form, also tapped in 4 places. Force a 1/2" wooden shaft thru the front of secondary, and put a small wood screw and washer on the end of the shaft. Force a 1/2" bearing thru the front of the secondary. Cover it with tape so you won't scrape the insulation on the wires. Let bearing stick out so you can mount the assembly to the panel. Force a 1/2" hole thru the back of primary, so the 5 leads from secondary may slide thru and make connections to the (S-2) switch on the panel.

This is a similar circuit to #10 - and should play Amateurs, police, SW BC, etc. You will find it very advantageous when separating strong local stations. Like previously mentioned, make up a log book so you will know the settings for best results. Put a dial scale and knob on the rotor so this may be logged, too, as a change in this, will change the setting of the secondary.

If you wish, you may use 1/4" dowels (shafts) for the coil-winding form. Pegs may be pulled out, as you wish. Wooden pegs tend to protect insulation.

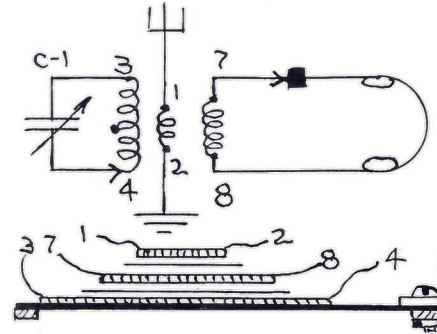
(S-2) controls part of the selectivity. As you approach the crystal side, on the switch, it becomes more selective. When you get the best position of the rotor, log it down. You will find a certain spot where it works best, under all conditions. It's possible to separate some of the most obstinate stations by using this rig.

If obtainable, you may use an old-style Vario-coupler instead of the basket-weave coil. You'll have to solder several extra taps onto the secondary.

As in #10 set, the primary, antenna and condenser (C-1) work together. If you have a larger antenna, you will use less coil and condenser.

Any type of crystal is okeh.

## MRL #4 SELECTIVE CRYSTAL. (DP-58)



## PARTS LIST:

- C-1. .00035 Variable condenser.  
 1 MRL #4 Crystal Set coil.  
 1 Compo. Panel 1/8 x 6 x 7.  
 1 1 1/4" Bar knob and scale.  
 1 Knocked/down Xtal stand.  
 1 Steel galena or other.  
 2 Fahnstock clips for A-G.  
 2 Phone tip jacks.  
 1 S.P.D.T. Tog. sw. (police)  
 2 ft. #18 stranded Hookup wire

This circuit was developed by the early Telefunken Company for use on shipboard. While it is recommended for local use, we have reports of 1000 miles and better. It uses the absorption method of tuning, whereby signals not wanted are damped out of the circuit.

In about 1924 we bought one of these from a salesman, paying him \$4 wholesale. As soon as he got out the door, we ripped her open. We found a cardboard coil, around a variable condenser, with a fixed Pyrites crystal, and it was wired up with bell wire. But it is best to use the celluloid coil specified, and not place it around the condenser, for obvious reasons.

Very easy set to build. Once the coil is wound, and the panel drilled, there is very little to assemble.

COIL. This may be wound on a celluloid form (p. 23) or a Bakelite form. From one end, wind (3-4) of 75 turns #22 DCC, leaving about 6" leads. Wind it according to data on page 28. Over

this, cement a piece of wrapping paper 2" x 9" with heavy coil cement to hold the end down. Next wind (7-8) of 20 turns #22 DCC & fasten the same way. Then another piece of paper 1" x 9" and cement ends down. Put on last winding of 10 turns #22 DCC and bring out leads as usual. Coil may be mounted in any position.

If desired, you may tap (3-4) and use a S.P.D.T. toggle switch for use on police and Amateur stations.

DP shows how this set may be made into a compact postcard-size rig for use on police, etc.

A lot of experimenting may be carried on with this set. For instance, you may try different sized coils on (1-2) and (7-8). Or, the whole coil may be made into a plug-in coil, with 6 banana jacks and plugs, for use on short wave stations. About 3 or 4 sets of coils should cover most of the bands obtainable. A QRM coil and condenser may be placed in series with aerial or ground.

If this set is placed in front of a Radio set, with (1-2) connected to Aerial & ground respectively, it will act as a good booster for any BC signal. No harm can come from its use. It may also be used as a wave-meter - when placed close to an incoming signal in your set. The dial may be calibrated for BC band.

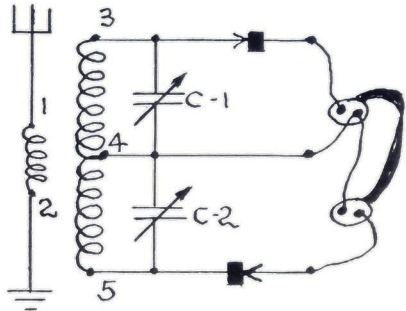
As an absorption type wave-trap, it has many uses experimentally. (1-2) may be placed between cathode and chassis of a tube to trap out a signal. It may be connected between switches (S-2, 3) in set 2-A as a trap. It may be connected in series with an IF transformer to block out a bothersome BC station.

When held near a transmitter, provided coil (3-4) is wound to the correct frequency, a 1/2 watt neon lamp may be used instead of the crystal for visual detection of resonance.

Often when this set is tuned, it may influence other sets in the same house. It may boost the signals or cut them out. So, - anything may happen in this interesting field of Radio.



## MRL #5 DOUBLE CRYSTAL. (DP-32).



## PARTS LIST:

- C-1, 2. .00035 Var. Condensers.  
 1 MRL #5 cell. Xtal coil.  
 1 Compo. panel 1/8 x 7 x 8.  
 2 1 1/4" Bar knobs and scales.  
 2 Knocked/down Xtal stands.  
 2 Steel galenas or other.  
 2 Phone tip jacks.  
 3 Fahnstock clips for A-G.  
 5 ft. #18 stranded hookup wire.  
 1 6-32 x 1 1/2" R.H. Machine.

Many Fans have tried to make 2 crystals work together, but have had little success. By reversing Xtals, as shown, it can be done. Our original #5 circuit used a rotor, controlled from the front of panel. Also, it had 2 audio transformers, or chokes, in series, to bring the Xtal signal back to the ground. We have devised this different method for it is much simpler. However, you may build any variation you prefer. It makes a much smaller set using the phones as shown.

Instead of the original two coils and a rotor, we now prefer one coil and a fixed primary. Wind 170 turns #24 enameled wire on a celluloid, or Bakelite form and tap it at 85 turns (4). Over the center lay a piece of heavy wrapping paper 1" x 9" and cement the ends. Over this wrap 15 turns #22 DCC and bring out 6" leads. This coil can mount horizontally over the 2 var. cond.

For simplicity, one may use a 2-gang .00035 mfd. var. cond. in place of the 2 singles. Be sure the frame connects to (4) on the coil. If using 2-gang, you will

have to use trimmers, in order to make them track.

If not too close to a powerful station, you may ground the secondary at (4) for more volume. The idea to have it "floating" is to make it more selective.

Instead of the 2 audios, or chokes, you may take a center tap off your phones, as shown. Run it to a phone tip so it may be plugged into tip jack with the phones. A funny trick to play on a friend, is to tune the set so condensers tune to 2 different stations. Then each phone will have a different station. It may dumbfound him!

Any kind of crystal may be used. Fixed carborundums with separate batteries may be used. Two Xtal diodes may be used with good success. The main point is to place them so they are reversed in polarity.

In our original circuit we used center taps on each coil for the police bands. If you wish to do this - add 2 S.P.D.T. toggle switches.

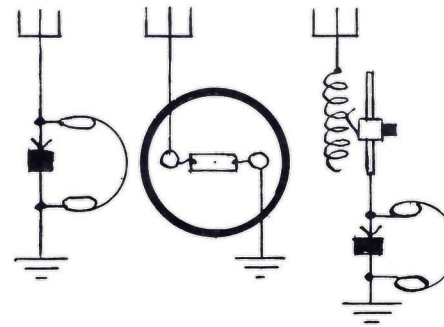
We have had some very good reports on this set. Some reports of trans-oceanic reception have been received.

You may also put on a larger primary, and tune a .00035 var. cond. in series, in case you desire to tune the primary.

If you would like to use two separate coils, wound on 2XM forms, wind about 75 turns of #22 DCC on each, in same direction. Set them about 1/2" apart so wooden rotor shaft will go between, out thru the panel to a knob. 15 or 20 turns of #20 DCC may be used on the rotor form which should be about 1" in diameter. The set would require a compo. panel 6 x 12, and a base 5" x 11" if using larger coils. The coils would be mounted behind the condensers, on the base in this layout. We give you all these variations - because the use of any of them will be OK.

You may check the sensitivity of 2 different Xtals with this set, under the same ideal conditions and see which is best.

## MRL #7 POCKET RADIO. (DP-33).



## PARTS LIST:

- 1 Single headphone and band.  
 1 Fixed pyrites or Xtal diode.  
 1 MRL #7 loading coil.  
 1 Slider  
 1 3/16" sq. rod 4 1/2" long.  
 2 Fibre bushings 1/4" high.  
 2 4-40 x 3/4" B.H. machine  
 2 Fahnstock clips for A-G.

Most all pocket Radios are a form of Xtal set, unless tubes are mentioned in their advertising. If they say "no Crystals to adjust" - it means they are using a fixed Xtal or Xtal diode. If they say "Radar type" Xtal it still means a diode.

While #7 is purely a local set - we have reports of over 1000 miles. These were from Fans operating in wide, flat country, at night under good receiving conditions.

We prefer attaching the Xtal diode or Fixed pyrites on the outside terminals of the phone. If phone has only inside connections, a couple of pieces of enameled magnet wire can connect to the Xtal, on the outside. The diodes are so small, it is possible to place them inside most headphones. If so, be sure to insulate it with a piece of tissue paper. Altho polarity may make a difference, it is not noticeable.

If you are in the midst of a large number of stations, a certain station will predominate. This may depend on several conditions, e.g., power of station, distance and length of aerial.

The only tuning you get is from the length of the aerial.

Therefore, varying length of the aerial will change stations. As this is impractical, we prefer an adjustable loading coil.

The regular #7 loading coil is wound on a 2" Bakelite form 4 1/2" long. 100 turns of 22 Enameled with Light coil cement painted around the edges of winding. You mount a slider rod 1/4" above the

coil by means of the 4-40 x 3/4" binding head machine screws and the 2 1/4" high fibre bushings. File the path for the slider and clean off filings with a brush. It is a good item to build for a Radio Experimenter's bench, as it often comes in handy. It has been argued that one loses stations between turns, but on 6" of wire, and considering the Xtl set tunes a little broad, it is not possible you'll miss many.

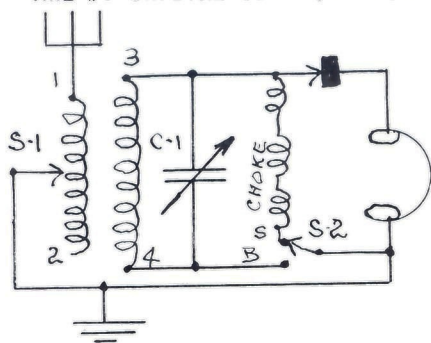
While an outside aerial is the best, there are many possibilities around a crowded city. It may work on a fixture and water pipe. Or, a pie-plate under a telephone and the bedsprings. You may be surprised how many things you can use for an aerial. In our kitchen in Reno, we used an ornamental metal border strip on a linoleum top table.

Pocket Radios using Crystals have their limitations. A small coil is less efficient and will not give the volume of a larger one with larger wire. As with the mantel Radios it's possible to amplify any signal enough by the aid of tubes. A pocket set may have a Xtal diode and a tube, but there must be some form of amplification.

Also, some are advertised as "no headphones to wear." In this case a headphone is placed behind a grill in a box. If you use a large aerial next to a powerful transmitter, it can be heard all over the room. Any other condition will be ineffective. For weaker stations, you'll have to wear the phones. It's a way to get money from the unwary. Firms that tell the truth about Pocket Xtal Radios, won't do any biz.



MRL #8 CRYSTAL SET. (DP-23).



## PARTS LIST:

- C-1. 00035 Variable condenser.
- 1 MRL #8 Crystal set coil.
- 1 Broadcast R.F. Choke.
- 1 Switch lever.
- 12 " points and nuts.
- 2 " stops " " "
- 1 S.P.D.T. toggle switch.
- 1 Knocked/down Xtal stand.
- 1 Steel galena or other.
- 1 Compo. panel 1/8 x 6 x 7.
- 1 1/4" Bar knob and scale.
- 2 Phone tip jacks.
- 2 Fahnstock clips for A-G.
- 5 ft. #18 stranded hookup wire.
- 3 ft. #22 " for coil leads.
- 1 6-32 x 1/4" R.H. machine.
- 3 6-32 x 5/16 nuts for same.

This set was originally designed by us for use by an Oregon mining Engineer. He received stations over 1800 miles away on it. Like the #2 set, it has a switch (S-2) that gives a choice of broad tuning for DX and selective for sets used near powerful transmitters. A very simple set to build and a most efficient one to work.

Coil is wound on 2XM celluloid form (p. 23) of 75 turns #22 DCC with no taps. Leave 6" leads for mounting. Over this winding, put a piece of heavy wrapping paper, 2 1/2" x 9" long, and cement the end down. Next wind 20 turns #20 DCC loosely over the whole 2 1/2" of paper, and fasten the ends down with tape (p. 23). Spread the turns out evenly. Solder taps on this coil at 4-6-7-8-9-10-11-12-14-16-18-20 - 12 in all. This

gives closer tuning for the primary, and makes set efficient on any type of aerial. You will notice the primary tuning is very critical. Mount the coil horizontally over the var. cond. with the 6-32 x 1/4" machine screw and 3 nuts.

When (S-2) is set on B it puts the Xtal right across the coil & condenser. This makes the set broad, due to the leakage across the Xtal and phones. This is called damping. In the wide, open country, you'll use this side altogether. However, if you want selectivity, put it on S side, when it uses the Broadcast choke in series with the crystal and phones. Due to only one side of the tuned tank circuit being led off to the crystal, the set becomes very selective. As it is necessary to build up some form of inductance in series with the Xtal, we use a Broadcast R.F. choke. A S.W. choke is OK, but you'll get more volume with the BC choke. A BC choke usually tests about 50 ohms DC. Drawing shows a 3-section choke, but a single section is OK. The Xtal circuit also picks up some of the ground wave on the return lead and helps some in volume of the signal.

Use Steel galena or Xtal diode - altho any Xtal is OK, including a Fixed carborundum and battery of 1 1/2 to 3 volts.

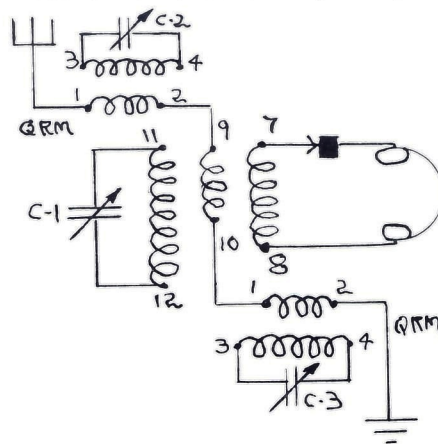
Wire the body of the set up with heavy #18 stranded wire as HF signals travel better on a large surface. Busbar is OK if U get the joints solid. The smaller hookup wire is used for wiring up the coil leads.

The principle of the floating coil may be used in various circuits - even its use with tubes has many possibilities. When #2 set is placed on selective side, the same thing happens - but it still has about 17 turns in use, while the #8 has none.

The DP shows complete layout, as well as pictorial diagram.

Length of aerial is not as critical with this set as with some of the others.

MRL #9 CRYSTAL SET. (DP-24).



## PARTS LIST:

- C-1. 00035 Variable condenser.
- C-2,3. 50-500 mmfd. Trimmers.
- 1 Compo. panel 1/8 x 6 x 7.
- 1 1/4" Bar knob and scale.
- 2 MRL QRM Coils. (p. 23).
- 1 Knocked/down Xtal stand.
- 2 Phone tip jacks.
- 1 MRL #9 Crystal set coil.
- 2 Fahnstock clips for A-G.
- 1 Steel galena or other.
- 5 ft. #18 stranded hookup wire.
- 1 6-32 x 1/4 R.H. & nuts.

This set is especially designed for cutting out local interfering stations. Around S.F. we separate 14 stations on it and bring them in with good volume, up to 25 miles away. We also have reports of good DX reception. It is similar to our #4 set, except we use 2 QRM coils in series with the aerial-ground circuit.

Different from our original #9 - we use 2 trimmer condensers & permanently set them on interfering stations, as one is up against the same stations locally.

The coil has three windings, constructed the same as #4. However, the first winding (11-12) has 75 turns #22 DCC; (7-8) has 30 turns of the same; (9-10) has 15 turns of the same. All separated by paper, the same as #4. Place the coil horizontally, a-

bove the variable condenser. You mount it away from panel with the 6-32 x 1/4" R.H. machine.

QRM Coils, with their trimmers attached, may be mounted in any convenient place. Their fields do not interfere with the tuning of the main coil and condenser. Some of you fellows may be surprised to know that 2 QRM coils are used. You may use a dozen in series, if you want, each tuned to a different station. The principle is that when you have a tuned circuit, say 1000 kc, and you place another tuned circuit of 1000 kc. in series with it, you will dampen, or block out the 1000 kc. signal. For extremely powerful stations, it won't be entirely cut out. However, the weaker stations will be knocked clear out. You may detune it a little so the station will come in at the desired volume, when you hit it with the main tuning condenser.

## Adjusting the QRM Coils

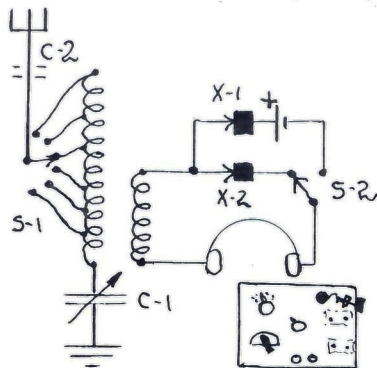
To adjust the QRM coils, tune in a bothersome station good and loud, Then, with a screwdriver, adjust one of the trimmers in a QRM coil, until it goes out, or cuts down. Then, do it with your next worst station. If you wish, you may mount another .00035 var. cond. on the panel, and manually control one of the QRM coils, especially if you do not have a lot of stations around. It is extremely effective on DX stations. If you have a code, or ship station near you, a special coil may be wound for it, and it placed in series with the other coils.

While there are some drawbacks to Radio, there are also some very good advantages. The trap circuit is one of the very good ones.

When one gets a set to working good on a panel, it is a good idea to build up a cabinet. If U have a dado saw, you may use 3/8" plywood, and dado a slot 1/4" back from front of cabinet to slide the panel in from the bottom of cabinet. Nail on the bottom and back, and you have a nice box.



## MRL #10 CRYSTAL SET. (DP-34)



## PARTS LIST:

- 1 Compo. panel 1/8 x 5 1/2 x 7.
- C-1. .00035 Variable condenser.
- C-2 .00015 mica, or other.
- 1 MRL #10 Crystal coil.
- 1 1 1/4" Bar knob and scale.
- S-1. Switch lever.
- 6 " points and nuts.
- 2 " stops " "
- S-2. S.P.D.T. toggle switch.
- 1 Knocked/down Xtal stand.
- 1 MRL Fixed carborundum.
- 1 #2 Flashlight cell.
- 2 1 1/2 x 1 1/2 x 1" brackets.
- 2 Phone tip jacks.
- 2 Fahnstock clips for A-G.
- 1 Steel galena or other.
- 5 ft. #18 stranded hookup wire.
- 2 ft. #22 " for coil.

Many changes have been made on our original #17 plans. We hope our recent experiments have also improved it. We added 2 more taps to the coil for SW; added a fixed carborundum/battery combination with toggle switch. Parts are now smaller, so panel size has been cut down.

Sketch shows panel layout. You mount battery upright with two brackets, underneath the stand. Solder the carb. xtal side to upper bracket lug, so it may be easily adjusted, if necessary.

**COIL.** On a 2" celluloid form 4 1/2" long (p. 23) wind 40 turns #20 DCC on small ring end. Push the finishing wire thru the form to keep it out of the way. Over this wind heavy wrapping paper 2" x 10" and cement end down.

Slit the paper, that laps over end of coil, with scissors in about 8 places, lengthwise of the coil. Over this, from starting end, wind 160 turns #28 DCC. Tap it in 6 places 5-10-20-60-100-160. Cement edges of coil. Mount coil horizontally like #2 set. Mount and wire it after set has been wired up.

We experimented in Reno, Nev. on different aerials, etc. With a 35 ft. Ant. we got the same readings as 115 ft. wire with a .00015 (C-2) in series, but with more volume on the latter. As SW stations are scarce, we used a signal generator, and obtained the following readings:

Tap	Turns	100 on dial	0
1.....	5.....	5000 kc.	12000 kc.
2.....	10.....	4500.....	8500
3.....	20.....	1800.....	4700
4.....	60.....	925.....	1900
5.....	100.....	625.....	1350
6.....	160.....	400.....	950

Of course these will vary with different aerials and tuning and mica condensers. You may even try a .00035 var. cond. in place of (C-2) until you approximate the best capacity for selectivity, volume, etc. Some stations will come in on several taps. Make a log of the set and mark where they come in best.

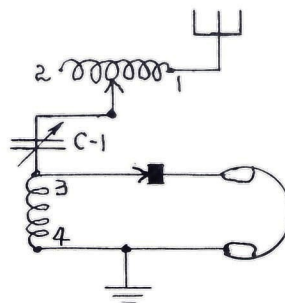
We found the Steel galena and fixed carborundum to work best. Xtal diodes, while sensitive, are very broad, due to low impedance to the circuit. We also found Xtal diodes broad on other sets, for the same reason. Be sure to throw the switch over to Steel galena when not in use, to conserve the battery. Steel galena should be better on DX stations.

Many good DX reports have been made on this set. Set really has a wollup, especially on BC and police stations.

When fishing for SW stations, you must be fairly close to them or have a good location for DX. Tune them slowly. Nights are best the same as for BC stations.

Phones of 24,000 ohms impedance will help admirably in getting in those DX stations.

## MRL #11 CRYSTAL SET. (DP-56).



## PARTS LIST:

- C-1. .00035 Variable condenser.
- 1-2. MRL #11 Celluloid coil.
- 3-4. MRL #11 " "
- 1 Compo. panel 1/8 x 7 x 8.
- 1 Knocked/down xtal stand.
- 1 Switch lever.
- 12 " points and nuts.
- 2 " stops " "
- 1 Steel galena or other.
- 2 Phone tip jacks.
- 2 Fahnstock clips for A-G.
- 5 ft. #18 stranded hookup wire.
- 3 ft. #22 " for coil.
- 1 1 1/4" bar knob and scale.

Altho simple, this is a very efficient Crystal set circuit. You will note the similarity between the #10 and the #11. The #10 tunes the primary, and inductively couples it over to the secondary, which is aperiodically tuned. However, the #11 tunes the aerial circuit, which includes both coils and condenser. The crystal section is aperiodic and takes off the signal from (3-4) coil. In this respect, we have added a few more turns and larger wire - instead of original on BP-17. In this way we have added more volume to our crystal circuit.

**COILS.** Wind coil (1-2) on 2XM

celluloid form (page 23) of 132 turns #24 DCC, bringing it out to 12 taps of 11 turns each. Our old circuit had 8 taps. This is better, as it gives a greater range and better tuning on the Short wave bands. This coil may mount horizontally, above the condenser, as in circuit #2.

For the other coil (3-4) wind it on P2XM, or celluloid form 2" in dia. x 2" long. Wind 40 turns of #20 DCC, with no taps. This coil may mount in any convenient place, or on the back of the variable condenser by means of a bracket. Its field does not bother the other coil, so may be put anywhere. A good place is under the crystal stand, as shown in the sketch.

We have reports on this set up to several thousand miles, in a good location. One fellow reported 750 miles the first night. Others report stations all over the U.S., Canada and Mexico. It brings in all the Broadcast band as well as police, Amateurs, etc. Be sure to tune slowly when trying for SW broadcast stations. You may add a 15 mmfd. trimmer in series with the Aerial if you want to experiment with the very Short waves - around 15 to 25 meters. Many in the East are near enough to some of these powerful SW stations, that it is easy to bring them in on this rig.

DP-56 shows the use of plug-in coils and a QRM interference coil to set on any local station that bothers.

It seems that with this set, you may use a Crystal diode OK. as the crystal and coil are in series-parallel with the Aerial-ground tuning circuit.

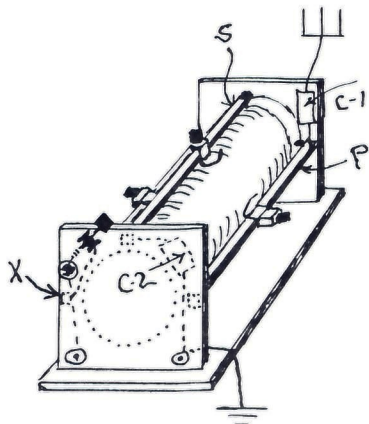
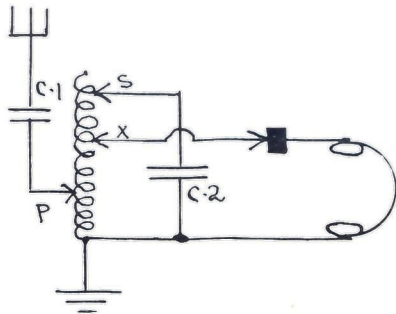
By using the secondaries of plug-in coils, as shown on DP-56 - you eliminate some dead-end effect one gets with the long 132 turn coil. This may be more efficient on Short waves, as the coils may be tried at will when you locate a SW BC station.

One may use a fixed carborundum and battery in this circuit. Also silicon, Iron pyrites, or any type of crystal is alright.

Experimenting is interesting.



## MRL #12 CRYSTAL SET. (DP-69).



## PARTS LIST:

- 1 MRL #12 Bakelite Xtal coil.
- C-1, 2. .00015 mica condensers.
- 3 Slider rods 3/16" sq. x 4 1/2"
- 3 Sliders.
- 6 Fibre bushings 1/4" high.
- 6 4-40 x 3/4" B.H. Machine sc.
- 6 4-40 nuts for same.
- 1 Knocked/down Xtal stand.
- 1 Steel galena or other.
- 2 Phone tip jacks.
- 2 Fahnstock clips for A-G.
- 3 ft. #18 stranded hookup wire.
- 2 Ply end blocks 1/4 x 3 x 3.
- 2 Rnd blocks 3/8 x 1-7/8 dia.
- 1 Ply base 1/4 x 3 1/2 x 5 1/2.
- 6 2 x 1/2 R.H. wood sc. (form).
- 6 2 x 3/4 F.H. " " (base).

The slider set goes back to the turn of the Century, - so far

back it is impossible to get data on them now. Nevertheless, it is still a good rig to have.

Instead of using the stand by itself, we have mounted it and the phone tip jacks on the end. Condensers (C-1, 2) are mounted inside as shown. Because we use the secondary slider (S) most, we have placed it on top. Next is primary slider (P) on the right. At the back is the Xtal slider (X) which controls selectivity. Because it is seldom used, once set, we have placed it behind. A left-handed fellow may want them changed. One may connect Aerial & Ground leads to Fahnstock clips, thus making it a portable set at all times.

**COIL.** On a 2" Bakelite form 4 1/2" long, make 2 tiny holes 3/8" from each end to anchor the winding. Wind the wire on taut and close-up. It takes about 120 turns #22 Enamelled to fill the space. When winding is finished, paint Light coil cement on the edges. On the end toward the stand, leave a few inches of wire, but cut the other end off and anchor it.

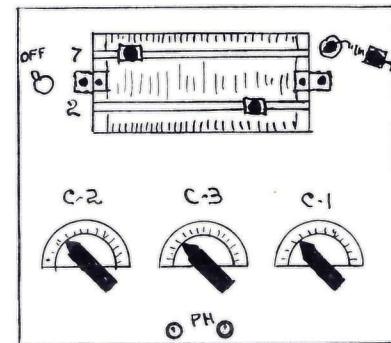
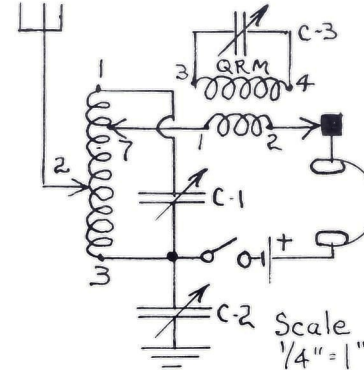
With a coping saw, cut 2 form blocks from soft wood 3/8" thick and 1-7/8" in dia. Next cut end blocks 3" sq. from plywood. Nail, or screw the form blocks to the end blocks as shown. Then, drill 3 holes in each end of the form, to hold it to the blocks. Mount the 3 sliders and rods 1/4" above the coil, on the fibre bushings, with the heads inside the form. This gives a binding post effect to the sliders. Fasten the end blocks to the base, with the coil fitting loosely in place. After end blocks are fastened with the 2 x 3/4 F.H. wood screws, screw the coil in place, with R.H. screws.

Make track for sliders with a fine file. Brush off filings and run Light coil cement near each track to keep wires in place.

(C-1) allows you to use more wire on the primary, with better tuning. In this way you tune the primary and the secondary. Any length of Aerial is alright.

(X) controls selectivity, so any Xtal or diode may be used, as impedance matches each crystal.

## MRL #13 SLIDER CRYSTAL. (DP-52).



## PARTS LIST:

- 1 Compo. panel 1/8 x 7 x 8.
- C-1, 2, 3. .00035 Var condensers.
- 3 1 1/4" bar knobs and scales.
- 1 MRL #13 Bak. xtal coil.
- 2 Sliders.
- 2 Slider rods 3/16" sq. x 4 1/2"
- 1 MRL QRM Coil (page 23).
- 1 S.P.S.T. toggle switch.
- 1 Knocked/down Xtal stand.
- 1 MRL Carborundum crystal.
- 1 Drycell for Carborundum.
- 2 Phone tip jacks.
- 2 Fahnstock clips for A-G.
- 4 Fibre bushings 1/4" high.
- 4 4-40 x 3/4 B.H. machine sc.
- 4 4-40 nuts for same.
- 5 ft. #18 stranded hookup wire.
- 2 Brass brackets for battery.

This 2-slider set is similar to #12, except the coil is controlled from the panel. The extra slider may be added if you want some Short-wave tuning. The QRM

coil is in the crystal lead, and will cut out a station in a jiffy. We have placed its control on the panel, in case you desire to use it on DX stations. From our original DP-52, the potentiometer has been eliminated as it tends to short the batteries. Instead, we use but 1 drycell in series with Carborundum crystal. As a special precaution, we have added a S.P.S.T. switch to keep from running battery down if catwhisker is left on crystal. You may use a fixed Carborundum, but we feel it would be better to use an adjustable one for this set. Mount drycell upright, on brackets, same as set #10.

A novel feature of this rig is the regulation of the 2 sliders from the front. Of course, they must be placed close together, as in sketch, and not like #12. By adjusting the brackets at end of form, the coil may be extended forward as much as you like. Sliders need not be adjusted so very often, but (2) to Aerial is used the most, so place it on the bottom.

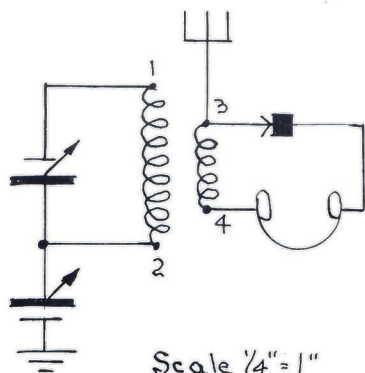
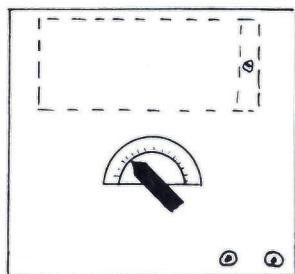
**COIL.** This is a 2" Bak. form 4 1/2" long, wound with 120 turns #22 Enamelled, the same as #12, except for the mounting. Operation of the QRM coil is given under circuit #1. The coil is a self (or auto) transformer. That is, the turns between (2-3) form the primary. Between (1-3) is the secondary.

While this was called the "200 Miler" - it is too conservative. Many Fans report distances over 1000 miles. Due to its flexibility, many variations in tuning may be had, to help offset different locations and conditions. The variable ground condenser (C-2) is very effective, in combination with slider (2) for the matching of the Aerial to the signal.

Time changes many circuits. We attempt to show all the best of methods in our latest literature - so if a previous circuit is made differently, it is not a mistake. Combinations have no end in this interesting hobby.



## MRL #39 CRYSTAL. (DP-6).

Scale  $\frac{1}{4}'' = 1''$ 

## PARTS LIST:

- 1 Compo. panel  $1/8 \times 5\frac{1}{2} \times 6$ .
- 1 2-gang .00035 Var. Cond.
- 1  $1\frac{1}{4}''$  Bar knob and scale.
- 2 Phone tip jacks.
- 1 Crystal diode or other.
- 1 MRL #39 Crystal coil.
- 1 6-32 x  $1\frac{1}{4}''$  R.H. machine
- 3 6-32 nuts for mtg. coil.
- 2 Fahstock clips for A-G.
- 4 ft. #18 stranded hookup wire.

Mr. R.B. Richardson, of Los Angeles, was good enough to send us this diagram, for use of other Fans. He said: "A super-selective circuit. Five of these sets were put together for my friends, in the past 3 years and really tune sharp. Can cut out every station in L.A. and surrounding towns. One of them really amazed a Radio Service man, when it was hooked up to a 10-watt amplifier and would still cut them in and out."

And, can you imagine a more simple circuit? This uses the old Telefunken circuit, the same as #4, except we use a 2-gang .00035, connected as shown. And the Aerial hooks direct to the secondary, at the crystal. When we first built it up on our Rdo. bench, it operated on 8 locals with only 3 ft. of Aerial and a ground. With a 100 ft. Aerial, the volume and selectivity were both very good. Police stations came in at the bottom of the dial.

**COIL.** On a 2XM Celluloid form, (p. 23), wind 80 turns #22 DCC. Over this, wrap a piece of heavy wrapping paper  $2\frac{1}{2}'' \times 9''$  long & cement end down. Then, wind on secondary (3-4) of 40 turns #20 DCC and bring out 6" leads. Mount the coil above condenser across the back, as shown.

We tried tapping the primary (1-2) in the center. It brought in the HF BC stations louder, but much broader. It is possible, if one uses a plug-in coil with a 40 turn primary and 20 on secondary, the SW stations would be much improved. It could be mounted on a 4-pr celluloid coil form OK. The set now brings in police stations very good.

Because secondary is untuned a Crystal diode works good. You may use a catwhisker and Steel galena or fixed Carborundum and a battery as you wish.

You will notice the similarity of the 2-A tuning and this, and the secondary like the #4. In Australia, a similar secondary circuit is used, but connected to a whip aerial.

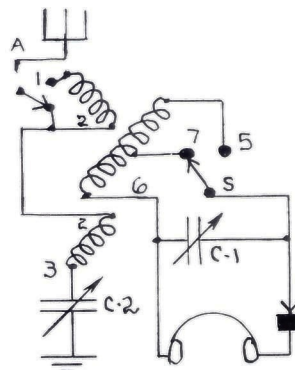
More efficiency could be had if one obtained the correct number of secondary turns to correctly match the impedance of the crystal. This should give a lot more volume, and probably some more selectivity.

A precaution in building is to be sure frame of condenser connects at (2). And be sure to use a compo. panel. Aerial is many times louder connected at (3) than at (4). Polarity of crystal seems to make little difference.

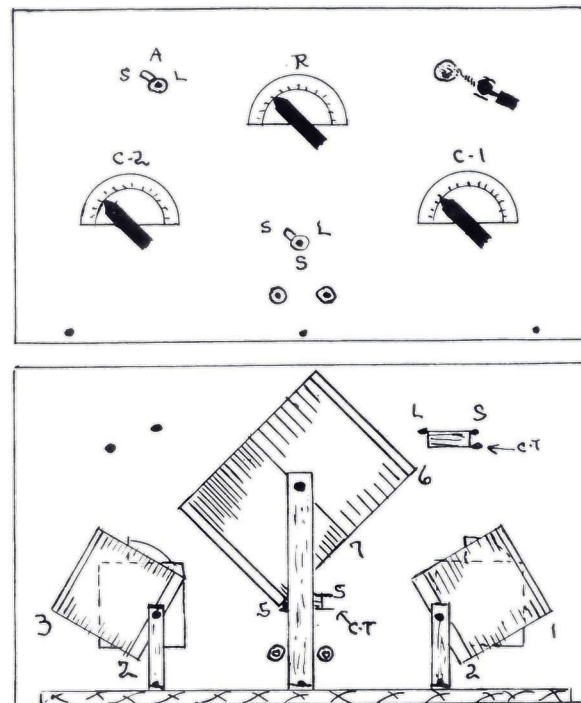
Why not give it a whirl?

## MRL #15 CRYSTAL SET.

(DP-27)



Rear panel view.

Scale  $\frac{1}{4}''$  to  $1''$ 

## PARTS LIST:

- 1 Compo. panel  $1/8 \times 7 \times 12$ .
- 1 Plywood base  $1/4 \times 6 \times 11$ .
- 2 .00035 Var. condensers.
- 2 S.P.D.T. toggle switches.
- 3 MRL #15 Crystal set coils.
- 3  $1\frac{1}{4}''$  Bar knobs and scales.
- 1 Knocked/down Xtal stand.
- 1 Steel galena or other.
- 2 Phone tip jacks.
- 2 Fahstock clips for A-G.
- 1 Bracket  $\frac{1}{2}''$  wide x 5" long.
- 1 Wooden dowel  $1/4'' \times 6''$  long.

Hundreds of these sets were sold around S.F. in the 20's for \$12.50, and some still working. The principle is the proper adjustment of the loose-coupling for best selectivity.

**COILS.** For rotor (5-6) use 3" Bak. tubing 4" long. Drill a  $\frac{1}{8}''$  hole thru both sides for wooden shaft. About  $\frac{1}{4}''$  from each end, drill 2 tiny holes to anchor the windings. Wind 24 turns #20 DCC

from one end and anchor it. Turn coil over and, in same direction, wind 45 turns #22 DCC. Solder 2 coils together. From front of the rotor, run 3 pus. loop wire out to switch (S). Mount coil to the base with the bracket.

Other coils are alike. Wind on each 60 turns #24 Enameled, on P2XM celluloid forms  $2'' \times 2''$  and raise them on  $1\frac{1}{2}''$  brackets. Tilt coils for best operation.

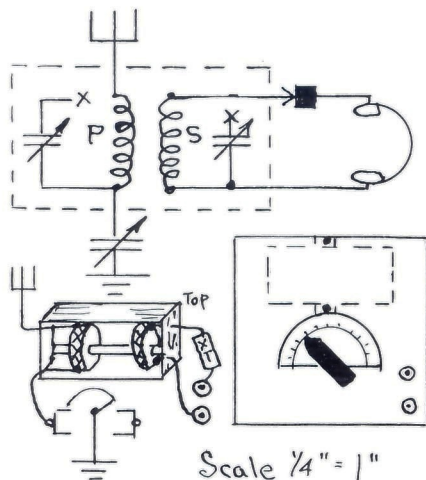
Rest of circuit is fairly well shown. Police and Amateurs come in good on SW tap. By adjusting the 3 coils you'll be able to block out all interference, no matter how bad. We have had reports of DX reception, but it's not built for that.

Later you may make stops to prevent rotor from swinging too far.

Works fine coupled to a power amplifier as fidelity of tone is result of crystal's operation.



## MRL #40 CRYSTAL SET. (DP-7).



## PARTS LIST:

- 1 Compo. panel 1/8 x 4 x 4.
- 1 .00035 Var. condenser.
- 1 Int. Freq. Transformer.
- 1 1/4" Bar and scale.
- 2 Phone tip jacks.
- 1 Crystal diode or other.
- 2 Fahnstock clips for A-G.
- 2 ft. #18 stranded hookup wire.

This is a very simple set that can be mounted on a 4" x 4" panel. After a few adjustments, you will have a neat little rig that will separate most stations.

The original circuit came from a magazine, but we have had to make several changes. In the first place, it won't work with the two trimmers hooked up, so you'll have to disconnect them at (X). Also, if you use a standard 456 k.c. IFT, you will get a couple of stations on the bottom of your dial. Just goes to show you, you can't depend on circuits in magazines.

Mount the condenser, dial and phone tip jacks, as shown, using 1/4" scale. Remove the coil assembly from the can, and disconnect one side of each trimmer, as shown. Then, hook up the coil, using the one in the top for the secondary. This need not be al-

tered so we'll work on the primary (P), which is handier.

Notice where stations come in. If too low on the dial, start taking 10 turns off the primary at a time. It will peel easily. Keep taking off and re-checking until you get the HF Broadcast band on the bottom of dial. Also see if LF Broadcast touches the top of the dial. When finished, melt a drop of sealing wax on the wire, where it leaves the coil, and anchor end down.

If you'll recall our use of QRM coils in set #9, you'll see why we can't use the trimmers. When we hit the same frequency as the condenser and trimmer, the station is blocked out. Also, the secondary tends to tune to the frequency of the condenser and coil, which is near 456 k.c. What we want is an aperiodic, or untuned secondary. As a result, with this rig, we have stations in the background all over the dial. Once you throw out the two trimmers, you get sharp tuning. On a 115 ft. Aerial in Reno, it tunes 4 loud stations sharply.

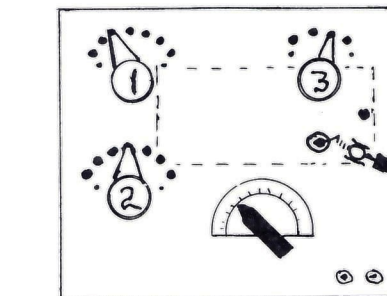
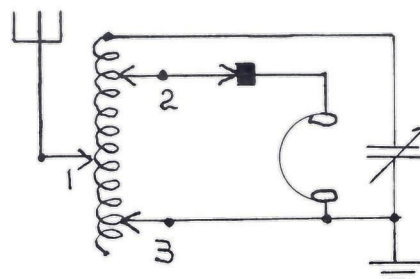
If you are near ship, or coast-stations, you may reach them by leaving the primary winding intact. It is also possible to add another coil in series and get Airport beacons, etc. - at least we did in the shop.

Another advantage is when the coil is placed back into the can it shields it from powerful BC stations. Mount the can above the variable condenser by means of a strap.

We prefer a Crystal diode as we don't worry about the low-impedance in an untuned circuit. You may use a Catwhisker type or fixed Carborundum and battery. But for compactness, we recommend the Crystal diode.

If you'd like more pickup between primary and secondary, you may solder a piece of hookup wire where the Aerial comes in. Then, wrap it loosely several times around the lead coming out to crystal. Be sure it's insulated from the latter. This is what they call "hi-gain" in the midget sets.

## MRL #17 CRYSTAL SET. (DP-65).



## PARTS LIST:

- 1 Compo. panel 1/8 x 6 x 7.
- 1 .00035 Var. condenser.
- 1 #17 Crystal set coil.
- 3 Switch levers.
- 18 " points and nuts.
- 6 " stops " "
- 1 Knocked/down Xtal stand.
- 1 Steel galena or other.
- 2 Phone tip jacks.
- 1 1/4" Bar knob and scale.
- 2 Fahnstock clips for A-G.
- 4 ft. #18 stranded hookup wire.
- 6 ft. #22 " " for coils.

This is our "Pinole (Calif.) Special." Many good DX reports have been made on it, mostly due to its close-coupling to the Aerial. It is a very unusual set in operation. It has three sets of switch points for better regulation in tuning.

**COIL.** Wound on 2" celluloid form (p. 23) of 111 turns #24 DCC. Tap it at 20-36-46-51-56-66

76/83-89-96-111. Lay out panel as shown, using 1/4" scale. Switches (1) and (2) go to the same taps, so would advise wiring the 7 switch points of each together first. For instance, #20 tap goes to #1 on switch (1) and (2) and so on. Switch (3) has only 4 taps, or the last ones on coil. Mount the coil above the var. condenser, as shown by dotted lines. Mount it last, when everything else is wired up.

You will note switch (1) tunes the Aerial-ground circuit. (2) controls selectivity of the secondary by varying the impedance to match the crystal. (3) helps tune the secondary as well as the primary.

Our original circuit used #22 DCC wire, but #24 tunes a little sharper. This is because there are more turns in a given space, and higher distributed capacity between turns. Make taps as shown on page 23. Use small wire for them. Because this coil has the primary and secondary altogether it is called an auto-transformer with a step-up ratio.

Any type of crystal is OK, even a Xtal diode, fixed Carborundum and battery, etc. As impedance of crystal is varied this makes up for loss of selectivity of any crystal. If a crystal has high resistance, it allows the set to tune sharper. If it allows current to flow more easily - it will give broad tuning.

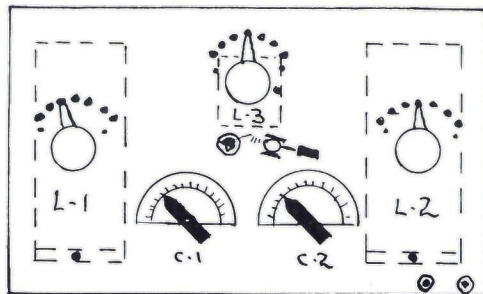
Make a log of your dial and switch settings for best operation of each station so you can come back to them quicker.

You may try a .00035 variable condenser in series with Aerial or ground and it often improves reception.

More long distance reception may be obtained on Crystal sets if you tune after powerful locals have gone off the air. In the smaller towns most of these stations sign off early. This allows the DX Fan to get out a great distance. It isn't a matter of your set not being as selective as necessary, but due to strong ground waves of locals, which come from various angles.



## MRL #41 CRYSTAL SET. (DP-8).



## PARTS LIST:

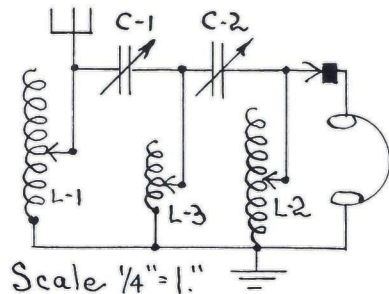
- 1 Compo. panel 1/8 x 6 x 10.
- 3 MRL #41 Crystal set coils.
- 2 .00035 Var. condensers.
- 2 1/4" Bar knobs and scales.
- 3 Switch levers.
- 21 " points and nuts.
- 6 " stops " " "
- 1 Knocked/down Xtl stand.
- 2 Phone tip jacks.
- 1 Steel galena or other.
- 3 6-32 x 1/4" R.H. machine.
- 9 nuts for same.
- 10 ft. #18 stranded hookup wire.
- 6 ft. #22 " for coil leads.

R.B. Richardson (W7HJY, W6WHM) sent us this circuit. It was originated, in 1933, by Mr. H.H. Hulme, Post Falls, Idaho. It got a writeup in "Radio Craft" on the DX records it made.

Mr. Hulme started building crystal sets at the age of 70, and at the age of 89, was still going strong. He gets a kick out of comparing the DX properties of this set with those of a Hallicrafter's he runs.

**COILS.** The two coils (L-1) and (L-2) are identical. Each is of 75 turns #22 DCC on a 2" celluloid form 4 1/2" long (page 23). Tap each at 5-15-27-40-54-60-75. Wind coil (L-3) on a 1" Bakelite tubing 1" long of 35 turns #26 enameled. Tap it at every five turns, for a total of 7 taps. The latter coil has a choking effect on the circuit, as it has a higher distributed capacity of smaller wire, diameter, etc.

A good layout of the 6" x 10" panel is shown, using 1/4" scale. Dotted lines show position of



the coils. Hold them out from the panel with 1 1/4" machine screws so the lever misses the coil. Each switch lever controls 7 points.

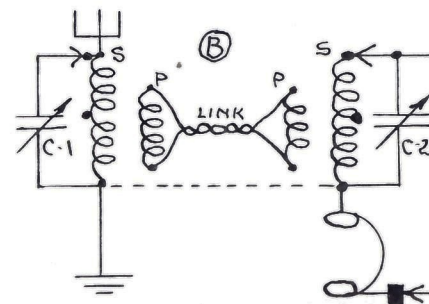
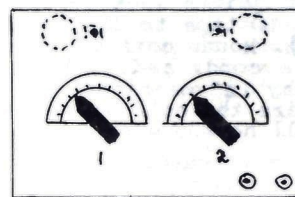
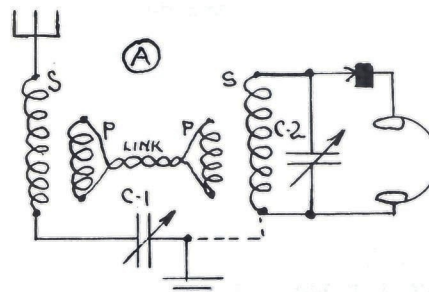
Any type of Crystal is alright so you have your choice. A Carborundum and catwhisker with a battery in series works fine. Lift the catwhisker when not in use to conserve battery.

This is a conductive, or direct coupled circuit. The coupling is obtained thru the inductance (L-3) which is common to the two circuits. This type is equivalent to inductive coupling. It also acts like the auto-transformer in circuit #12. They utilize a common inductance, capacitance and resistance, respectively. Because the two condenser circuits are usually in resonance, the circuit is very efficient. This makes for selectivity. We advise you to log the best tuning for each station.

As this is one of the larger crystal sets, we have eliminated a lot of details on building. When you have completed this set you can start on tube sets.

In laying out your panel it is first a good idea to draw a 1/4" scale - if you don't have one. Use a pair of dividers on the drawing and transfer it to the scale. It is always a good idea to fasten a piece of heavy wrapping paper to a panel, whether metal or wood, with cellophane tape. Lay it all out and then make your centers with center-punch. This prevents scratching your panel.

## MRL #42 CRYSTAL SET. (DP-9).



## PARTS LIST:

- 1 Compo. panel 1/8 x 4 x 6.
- 2 .00035 Variable condensers.
- 1 AC-DC Antenna RF Coil.
- 1 " Detector " "
- 2 1/4" Bar knobs and scales.
- 1 Crystal Diode or other.
- 2 Phone tip jacks.
- 6 ft. #18 stranded hookup wire.
- 2 6-32 x 3/8" R.H. machine.
- 2 " nuts for same.
- 2 Fahnstock clips for A-G.

Several variations of this Xtl circuit have come out, but most of them similar to circuit (B). Upon experimentation, we have found the one at (A) to be best for volume and selectivity. On (A) we got stations that weren't

audible on (B). This is due to the series tuning of the Aerial-ground circuit of circuit (A). This method packs a wollup, as you will see in circuit #10 when you tune the series condenser.

This set has been arranged on a 4x6 panel, altho a smaller one may be used if desired. Mount the condensers, tip jacks and coils as shown on sketch. A baseboard may be used if you wish.

The set requires 2 standard AC-DC coils as used in midget sets. If you forget, the one with primary closer to secondary is the second, or detector coil. Mount them at the back on their brackets. With an Ohmmeter, or battery and phone, check their continuity. Many diagrams furnished with coils are obsolete. It is easy to hook up. Try reversing the secondary of the last coil for more volume. Also, circuits may be closed at the dotted lines for more volume.

To build the link, just take 2 pieces of 18 stranded hookup wire and twist them together, & tin the ends. Possibly reversing one side of the link may increase the efficiency. This is a modification of inductive coupling, and acts as a transmission line to transfer mutual inductance between the two sets of coils. Usually a link is made up of 10 to 20 turns, so you may try winding these over the secondary for further experimenting. This would eliminate using the primaries for the link.

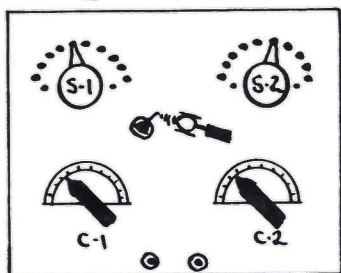
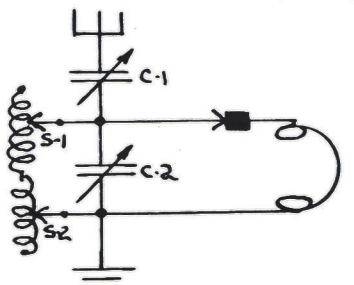
In variation (B) you will find the secondaries tapped for police calls. Some coils are made this way. If not tapped, just make a tap in the center of the secondaries. Circuit (A) may be tapped the same way. Use two S.P.D.T. switches for this.

If one can push the primaries closer to the secondaries, you will get more volume, as you'll get greater transference of energy.

The 1N34, or other type of Xtl diode is very good. As we aren't bothered with the impedance of the crystal it is not too critical in operation.



## MRL #43 CRYSTAL SET. (DP-10).



Scale 1/4" = 1"

## PARTS LIST:

- 1 Compo. panel 1/8 x 5 1/2 x 7.
- 1 MRL #43 Crystal Set coil.
- 2 .00035 Variable condensers.
- 2 1 1/4" Bar knobs and scales.
- 2 Switch levers.
- 20 " points and nuts.
- 4 " stops " "
- 1 Knocked/down Xtal stand.
- 2 Phone tip jacks.
- 2 Fahnstock clips for A-G.
- 1 Steel galena or other.
- 4 ft. #18 stranded hookup wire.
- 6 ft. #22 " for coils.
- 1 6-32 x 1 1/4" R.H. machine.
- 3 6-32 nuts for same.

This circuit was sent in by Dan. M. Cupp, Mt. Solon, Virginia. He says: "The sketch describes the simplest, most selective Xtl set. Has a slight gain in volume over most sets. Will separate equal to a single-dial tube set. I discovered it thru experiments some years ago. Construction of the coil gives many combinations in tuning. Coils, wound in this manner, were formerly used for testing purposes."

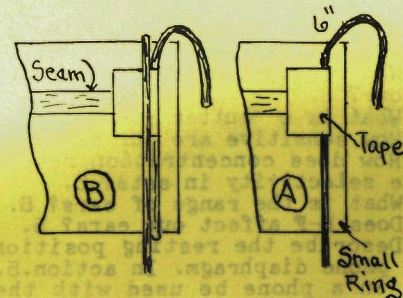
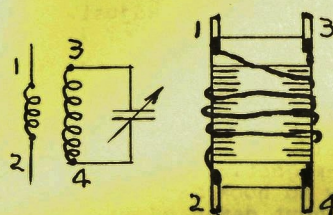
**COIL.** Turns weren't given by Mr. Cupp, but we have devised the following. On a 2" celluloid form 4 1/2" long, wind 100 turns #27 Enameled, tapping it at every 10 turns, as per page 23. When you reach the end of the winding, punch two holes in the form. Then thread a pc. of wire thru the 2 holes and anchor the wire, without cutting it. Reverse direction of winding and make an identical coil with 10 taps, and bring out 6" leads. Sandpaper the wire for taps, making sure you get good joints when soldering. Connect 10 taps to (S-1) and 10 to (S-2). Mount coil horizontally above cond. and back of the levers by 1 1/4" machine screw and nuts. Wire the coil up last with the small hookup wire.

A 5 1/2" x 7" panel makes a nice layout, as per sketch. You may use a baseboard, if desired.

This is a very interesting circuit. It uses a non-inductive, or bucking coil, because half is wound in the opposite direction. Half neutralizes the other - or plus 1 minus 1 is zero. The whole coil makes an inductance near to zero and acts more like a resistance. When a few turns are used on one side to buck the other, it acts as a damper on the sigs. You may use a large inductance on upper half and small on bottom, or vice versa. In conjunction with the Aerial and condenser (C-1) we can get many values of inductance, resistance, etc. Likewise, small capacity of (C-1) gives more selectivity.

There are other types of bucking coils. A flat winding, as a coil wound around a flat pc. of Bakelite - one field bucks the other. A twisted pair wound on a form, with one set of ends connected, and other set running to tuning, gives a bucking coil. Non inductive windings are used in rheostats, potentiometers, etc. A bucking coil, in a dynamic type of speaker, tends to balance out the AC hum. A bell trans., having 2 windings connected in series, may boost the voltage 10 volts, or buck it by 10 volts less.

## MRL QRM COIL. (DP-18)



One of the handiest gadgets on any Broadcast Radio. To avoid repetition, we are only showing it here. Placed in parallel with a tuning circuit, it boosts and sharpens the signal. In series, it acts as a trap to cut out, or deaden a bothersome station. DP-18 shows several other uses.

A fibre form is better than Celluloid or Bakelite, due to more impedance. Cut a 1" diameter fibre form 1 1/2" long. Drill four holes for Eyelet lugs as shown. Also, 2 #50 drill holes for tank - or tuning circuit, 1" apart. Drawing is half-size. Mount the four eyelet lugs.

Fill the 1" space with about 110 turns #32 Enameled wire and solder ends to (3-4) lugs. Paint coil with Light Coil Cement and let it dry.

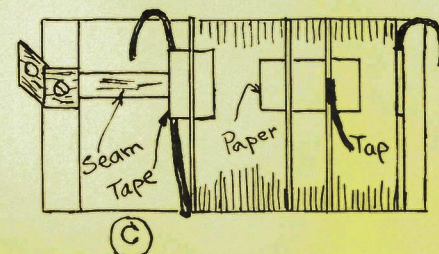
Over this, space-wind 15 turns #24 DCC and solder to (1-2) lugs and cement this coil down. Over this, stick a 1/4" wide piece of paper to make (1-2-3-4) on.

QRM Coil may be tuned from the panel with a .00035 var. cond. Or, a 50-500 mmfd. trimmer cond. with a screw-driver adjustment may be used. May be tuned to the interfering station and left on it continuously.

## WINDING 2" CRYSTAL COILS. (DP-5.)

Our 2XM celluloid forms are usually specified for most Xtal sets. It has been proven they are best for DX due to low-loss.

However, the winding specifications given here are also applicable to Bakelite, and other plastics, as their properties are very similar.



When making taps (C), slip a 1/2" strip of light cardboard under each turn to be tapped. Slip end of paper under turns for a neater job.

After end has been reached, cut wire 6" long for lead. Back off one turn, folding tape over wire as shown. Push tape under next to last turn, and pull tape and wire taut. Secure flap of tape down with cellophane tape. Then cement all edges with Light Coil Cement.

When coils are mounted vertically, use a bracket to the base. If horizontal, hold coil away from panel with 6-32 x 1 1/4" R.H. machine screw and nuts. It makes shorter leads to switch and also helps to clear condenser, etc.

Good Luck in DX Fishin'....



## HOW TO SOLVE YOUR HEADPHONE PROBLEMS...

- What were phones called? p. 2  
What is the Page effect? 3.  
Who really invented the telephone? 3.  
What is a "butter stamp"? 3.  
How sensitive are our ears? 4.  
How does concentration resemble selectivity in sets? 5.  
What is the range of ears? 5.  
Does H-F affect our ears? 5.  
Describe the resting position of phone diaphragm. In action. 5.  
Can a phone be used with the permanent magnets removed? 6.  
How does DC sound in the phone - also A.C.? 6.  
What is Resonant Frequency, and where used? 6.  
What is difference between old Wireless phones and present? 6.  
What is a beat note? 6.  
In what resistance ranges have phones been made? Best? 7.  
Why do Ampere-turns mean so much in phone construction? 7.  
What is Magnetomotive force, & how produced? What is symbol? 7.  
Compare open and closed-core transformers and phones. 7.  
What is Reluctance? What kind of phones have the most? 7.  
What is the advantage of using the center of the diaphragm? 7.  
What phones used this? 7.  
Why build magnets small? 8.  
Give size of magnetic field. 8  
Compare 2000 and 75 ohm phones for efficiency on Crystal sets. 8  
When to use phones in series or parallel connection. 8.  
What is difference between the Resistance and Impedance? 8.  
What is difference between the Radio and Line phones? 9.  
What is a Continuous-current receiver? Where used? 9.  
When should phone caps be removed? How often? 9.  
What typifies a super-sensitive phone? What test? 10.  
What thickness diaphragm is best for sensitivity? 10.  
How many diaphragms be bent and how much? How to adjust. 10  
How are cords made? 11.  
Why are tiecords used? What about the red tracers? Use? 11.  
How do you test phones for polarity? Importance of it? 11.  
Best way to fit tips. 11.  
Re-magnetizing phones. 12.  
How to hook magnets in series.  
How about damaging magnets? 13.  
Re-winding methods. 14.  
What current will damage your phones? Is a 1-tube OK? 15.  
Best way to hook phones between tubes. To Dynamic spkr. 15.  
Hooking to output, power stage without injuring phones. 16.  
Easy way to connect 1 to 3 pairs of phones. 16.  
How to make a parts tester in an easy manner. 17.  
Name methods of making spkrs. from Headphones. 17.  
How to make a pillow speaker for night listening. 17.  
How to stop rattling of your phones when used as speaker. 17.  
Preventing burn-outs. 17.  
What is an Exponential horn? How made? Reflex speaker? 17.  
Using phone as Microphone. How to hook to a Steel Guitar. 18.  
Building 150' telephone line, without batteries or power. 18.  
Describe Bell batteryless line phone. Draw line phone cir. 19.  
Name 5 types of phones now in use. Describe the classes. 19.  
Describe Miniature phones, as Hearing aids, Army phones. 20.  
How does a Telex Monoset phone work? What are advantages? 20.  
Describe Baldwin phones and principle. How to re-adjust. 21.  
How to re-wind Baldwins. 22.  
Describe Dynamic phones. How do they resemble speakers? 22.  
Describe Brush Crystal phones. Explain piezo-electric effect. 23  
How is Quartz grown? 23.

ABOVE ANSWERS, are on specified pages of MRL HB-1 "Headphones: Operation & Repair." Order at same price and source as this one. Most of the information is not found in Radio texts or libraries. HB-1 tells how to keep phones operating; how to prevent injury and repairing kinks. A HB that pays for itself many times over. HB-1..another MRL Handbook.