The SM "Round-the-World-Four"

THE unquenchable rumors that television is here in form simple enough for home experimentation have led to increased interest, if that be possible, in short wave reception. Many of the experimental television transmissions take place on short waves, such as that from WRNY, New York and WLEX, Boston, Mass. A short wave receiver was used in these experiments, and it is certain that no matter what the form, television impulses must be tuned in upon receivers of more or less conventional design, but of a higher degree of performance than is necessary simply for short-wave code reception.

The short wave receiver illustrated and described herewith provides this higher degree of performance, plus freedom from radiation, for the oscillating detector is isolated from the antenna by a screen-grid R.F. amplifier tube. While the average three-tube short wave set will have ample sensitivity for code signals when in an oscillating condition, the performance when not oscillating is seldom, if ever, satisfactory for modulated or telephone reception (broadcast programs for instance). This is because of the fact that amateurs, interested primarily in C.W. code signals heterodyned by an oscillating detector, have taken little or no pains to obtain the smooth regeneration control absolutely necessary to satisfactory modulated signal reception. In the development of the four-tube set illustrated, great care was taken to obtain smooth regeneration control; telephone broadcast programs weakly heard, if at all, on ordinary short wave sets are satisfactorily tuned in on this receiver with considerably greater strength due to careful design and layout and to additional amplification provided by the screen-grid R.F. amplifier tube. This R.F. tube does not add a tuning control, its input circuit being untuned, yet it boosts telephone signal volume quite a lot, and entirely eliminates "dead spots" at which the set will not oscillate, since it effectively isolates the antenna from the sensitive detector circuit.

LIST OF PARTS

1 S-M 317 or Amsco .00014 tuning condenser, C1
1 S-M 316B or Amsco .00035 tickler condenser, C2
1 each S.M. 131-T, 131-U, 131-V, and 131-W coils, L2
1 S-M 512 5-prong socket
2 S-M 277 R.F. chokes, L1, L4
1 S-M 275 R.F. choke, L3
1 S-M 818 hook-up wire (25 feet)
1 S-M 734 aluminum shielding cabinet with terminal strip
1 S-M 255 first stage A.F. transformer, T1
1 S-M 256 second stage A.F. transformer, T2
3 S-M 311 tube sockets
1 Yaxley 20-ohm midget rheostat, R4
1 Yaxley 500 switch attachment, SW
2 Yaxley insulated tip jacks
1 Na-Ald 481XS spring socket for detector
1 Polymet .00015 condenser, C5
1 Polymet .002 condenser, C6
1 Polymet .005 condenser, C4
1 Polymet grid leak mount
1 Polymet 5 megohm grid leak, R3
1 Durham 50,000 ohm resistor, R5
1 Sprague ¼ mf. condenser, C3
2 Carter H-10, 10-ohm resistors, R1, R2
1 Carter H-2, 2-ohm resistor, R6
8 binding posts consisting of 8/32 screw, nut, and insulated top
2 National type B vernier dials.

An unusual degree of smoothness of regeneration control, freedom from "putting" and "fringe effect" as the set goes into oscillation is effected by careful circuit and coil design, notably by using a small coil, which on the lower waves (particularly around 20 meters and below) provides smoother and sweeter control than the two, three, and even four inch short wave coils generally used. The coils are actually a refinement of the popular "tube base" or "Scottish" idea which has been found to give such excellent and economical results. These forms are slightly larger and longer than the average tube base, by dimensions sufficient to allow more efficient coils than are possible on the ordinary tube base (often not available except at the expense of breaking good tubes). A winding space 1½" long and 1½" in diameter is available, with tickler slot ⅛" deep and 1/16" wide at the filament end. On the bottom of the moulded form are five hollow pins, properly positioned to fit any five-prong A.C. tube socket. These coil forms are so inexpensive that any number of experimental coils for different wave bands can be wound at little cost, to be tuned by any size of condenser that may suit the builders' fancy. In this matter of "builders' fancy," however, it is well to incidentally remark that, while a *code* receiver can be thrown together almost any old way and still work, physical placement of parts and wiring details must be most rigidly watched in order to get a good *modulated signal* receiver.

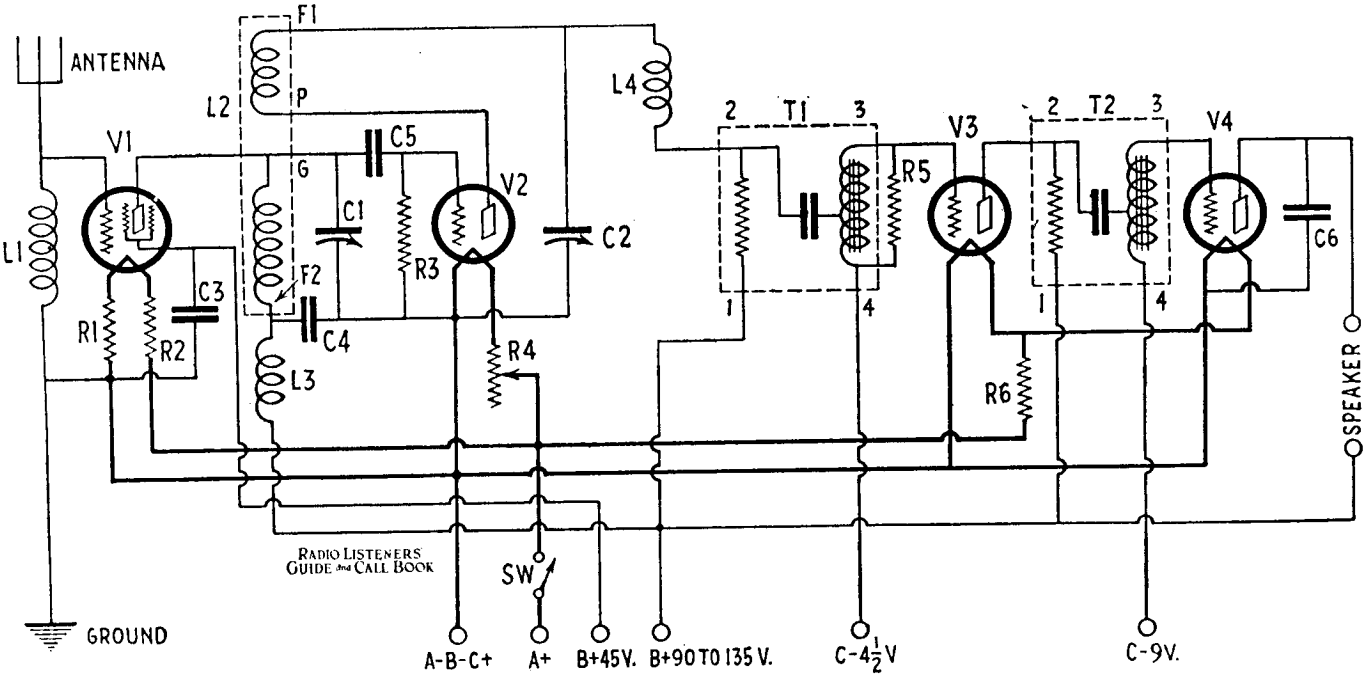
The set illustrated is mounted on the top and front of a satin-finished aluminum cabinet, 14" long, 6" wide, and 6" high, with all parts placed in a simple straight line as in a schematic diagram, instead of being tied up in a knot difficult of assembly and "trouble shooting." Looking at the inside of the receiver with bottom and sides removed, the antenna choke coil is seen at the left; next to it is the screen grid R.F. tube socket, then the screen grid tube by-pass condenser and plate choke. The 5-prong coil socket is mounted on the other side of the top, on 1" studs, directly above the screen grid tube socket and by-pass condenser. Next is the grid leak and detector socket, with the tuning condenser directly in front of them; then the plate choke, regeneration condenser, two audio tube sockets, and two S-M Clough-type audio transformers. A 20-ohm rheostat with switch attachment is placed on the panel to control detector filament voltage. All binding posts and speaker tip jacks are mounted on a small bakelite strip at the rear of the cabinet.

National vernier dials are used. The matter of a good short wave variable condenser is an interesting one, for few good broadcast condensers, even of properly reduced capacity, are good at 20 meters and below, for bearing noises develop to

an annoying degree. A noisy broadcast type of condenser can often be quieted for short wave use by insulating its bearings, at increased cost and labor. However, the type of compression bearing found in the Amsco and Silver-Marshall condensers is quite quiet at 20 meters, and offers all the advantages of a good mechanical bearing of brass and steel, yet perfectly quiet in operation. This feature of quiet bearings may be possessed by other types on the market as well.

In building this set, the parts should be placed as shown. A short direct ground can be obtained by connecting direct to any mounting screw fastening of the aluminum cabinet. All wiring should be short, direct, and well soldered, and care taken to avoid the possibility of "closed loops" of wiring which would pick up energy and possibly cause irregular regeneration control. The apparently unnecessary by-pass condenser, shown connected from the second audio tube plate to ground, should be used; its purpose is to cut out the stray radio frequency currents in the audio amplifier, all in the interest of a good smooth set.

The parts used in the model are listed above, and are all standard parts selected for their high quality. The circuit was carefully designed around them to make sure that all builders will obtain the same results in spite of minor variations bound to occur in home assembly; therefore substitution should be made only when absolutely necessary. (Do not substitute for R.F. chokes, coil form size and variable condensers unless willing to "smooth up" your own particular set's operation by the "cut and try" scheme of adding by-pass condensers, R.F. chokes and resis-



Schematic wiring diagram of the S-M "Round-the-World Four." A 222 type tube is used in socket V1; two 201-A's in V2 and V3 and a 112-A in V4.

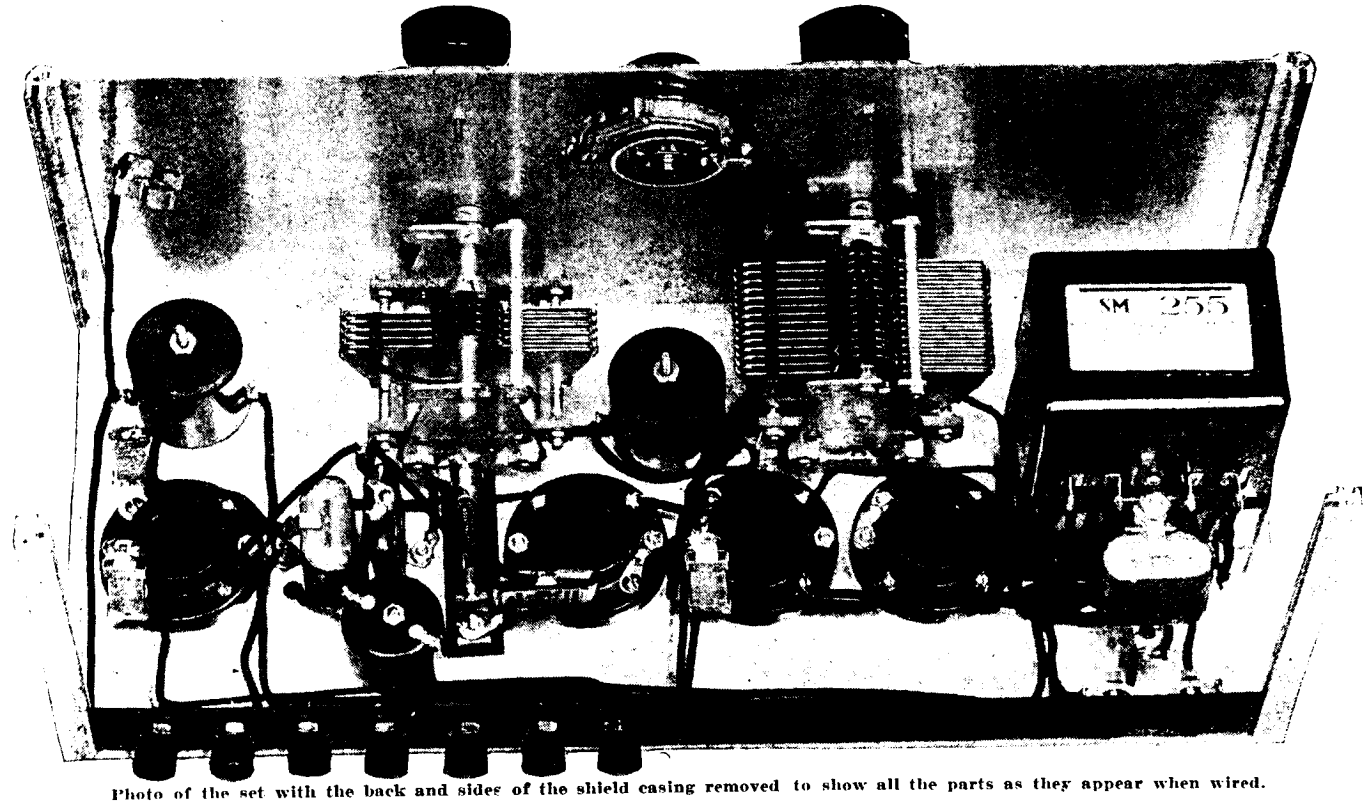
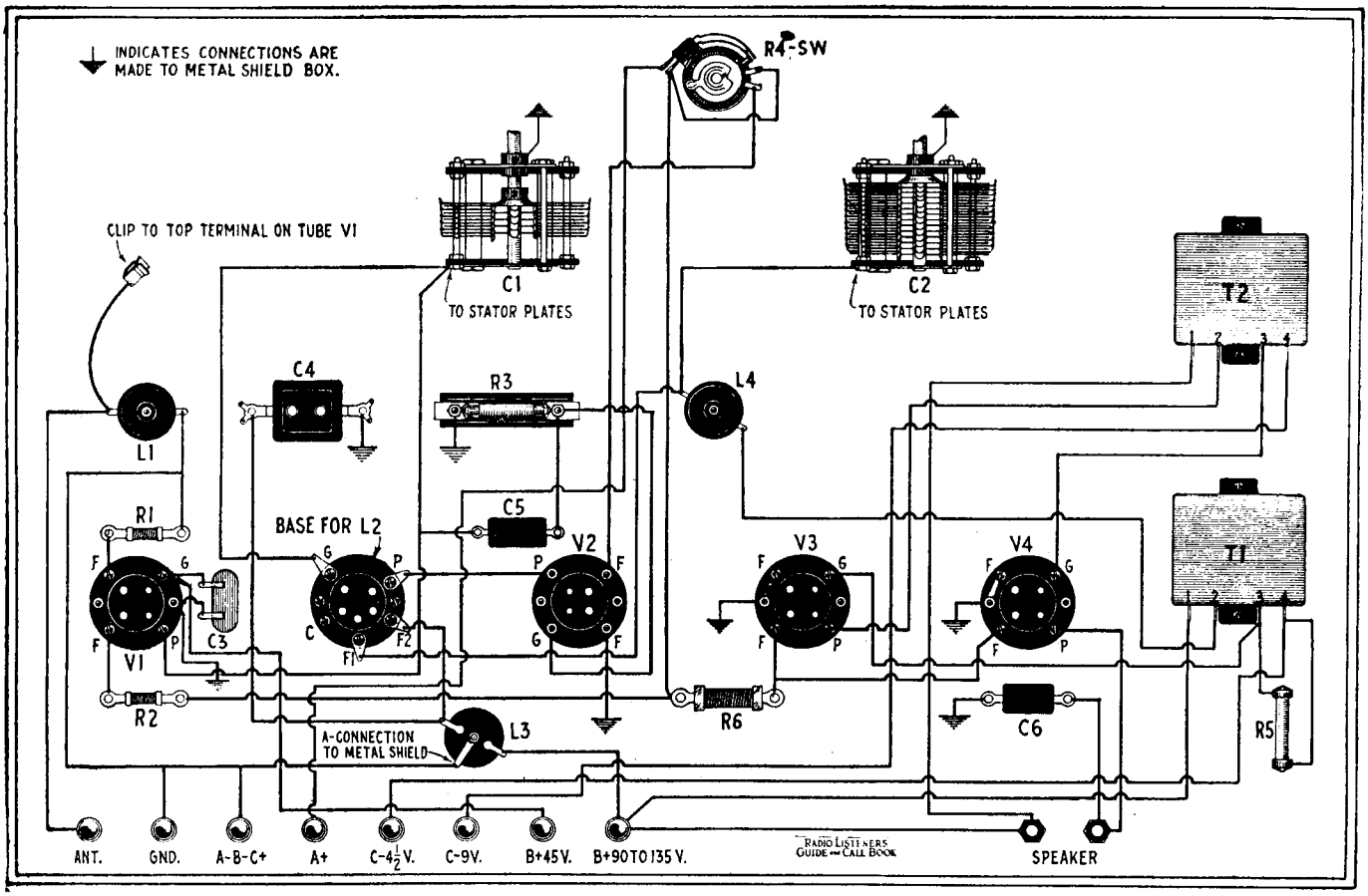


Photo of the set with the back and sides of the shield casing removed to show all the parts as they appear when wired.



A picture wiring diagram of the set. All parts are indicated to correspond with the list of parts, schematic diagram and layout.

tors at needed points and trimming coils —or unless you are only interested in code reception.)

The coils are all wound on the same type of Silver-Marshall forms, with No. 34 D.C.C. wire for the ticklers, and No. 22 P.E. wire for the secondaries (except the large coil which uses No. 24 D.C.C.). All secondaries have turns so spaced that the windings cover the full 1½" of form space. The windings are so connected that the top or start of the secondary terminates in the "G" post of a standard 5-point tube socket, and the bottom or end in the right-hand "F" post (the "F" post nearest the "P" or plate post). The slotted tickler, wound in the same direction,

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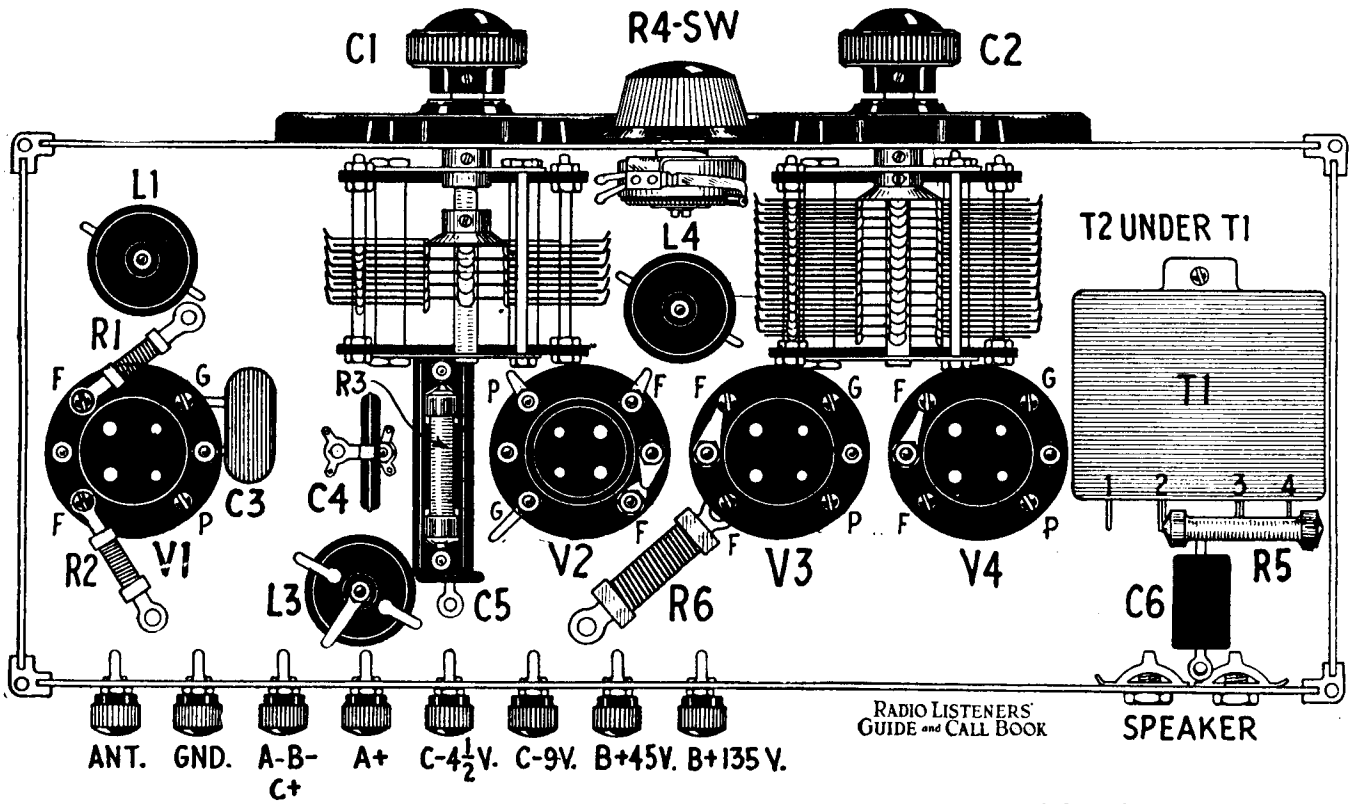

This is the layout of parts showing the location of each component. Note the neat compactness of the entire arrangement.

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starts at the "F" post nearest the "C" or cathode post and ends at the "P" post.

The number of turns necessary to cover the four bands from 17 to 240 meters is given below, using an S-M 317 tuning condenser of .00014 capacity and a .00035 tickler condenser.

SHORT WAVE COIL WINDINGS

	SECONDARY		TICKLER	
Coil Number	Wire Size	No. of Turns	Wire Size	No. of Turns
131-T	No. 22 Plain Enamel	6½	No. 34 double cotton	5½
131-U		13½		5½
131-V		25½		9½
131-W	No. 24 double	49½		15½

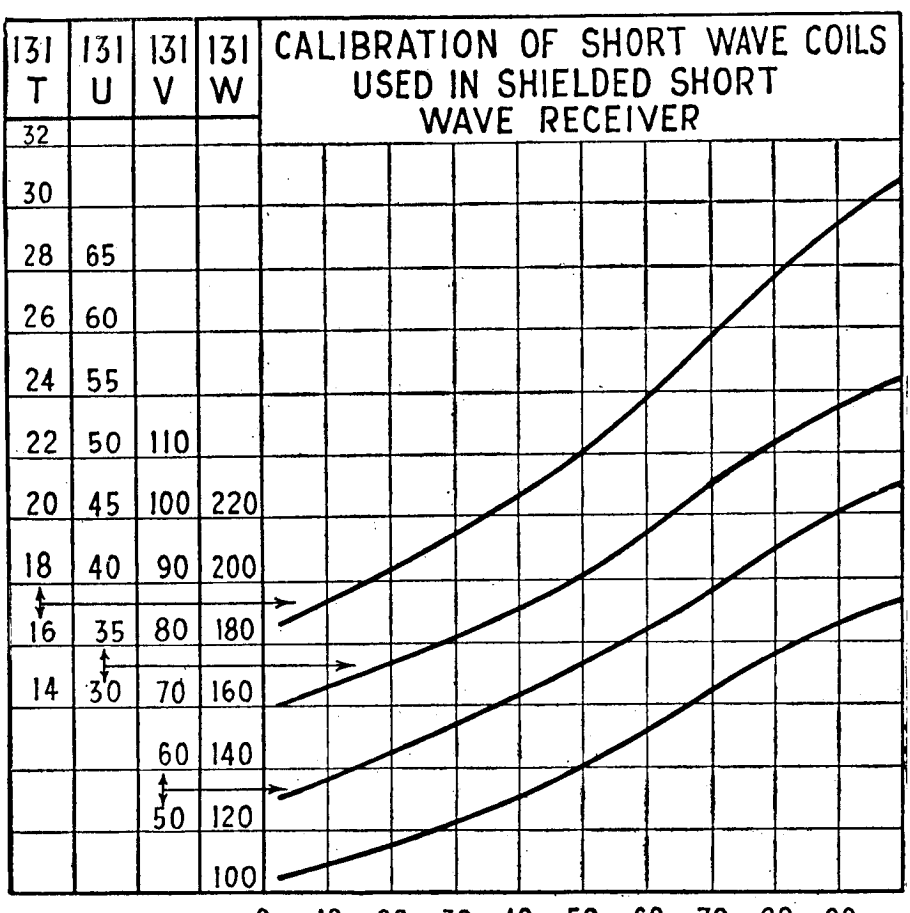
The tuning curves for a particular set of four coils are given as an aid in finding stations when the set is first operated, and it will be seen that the amateur wave bands fall well away from the ends of the condenser scale, so that with good vernier dials no difficulty is had in tuning amateur code signals.

To duplicate the curves given, it may be necessary to trim coils a bit once they are wound, but this is easily done, or coils simply rewound on the small bakelite forms. Coils of fewer or greater numbers of turns for other wave bands, can be quickly wound for the "Round-the-World Four."

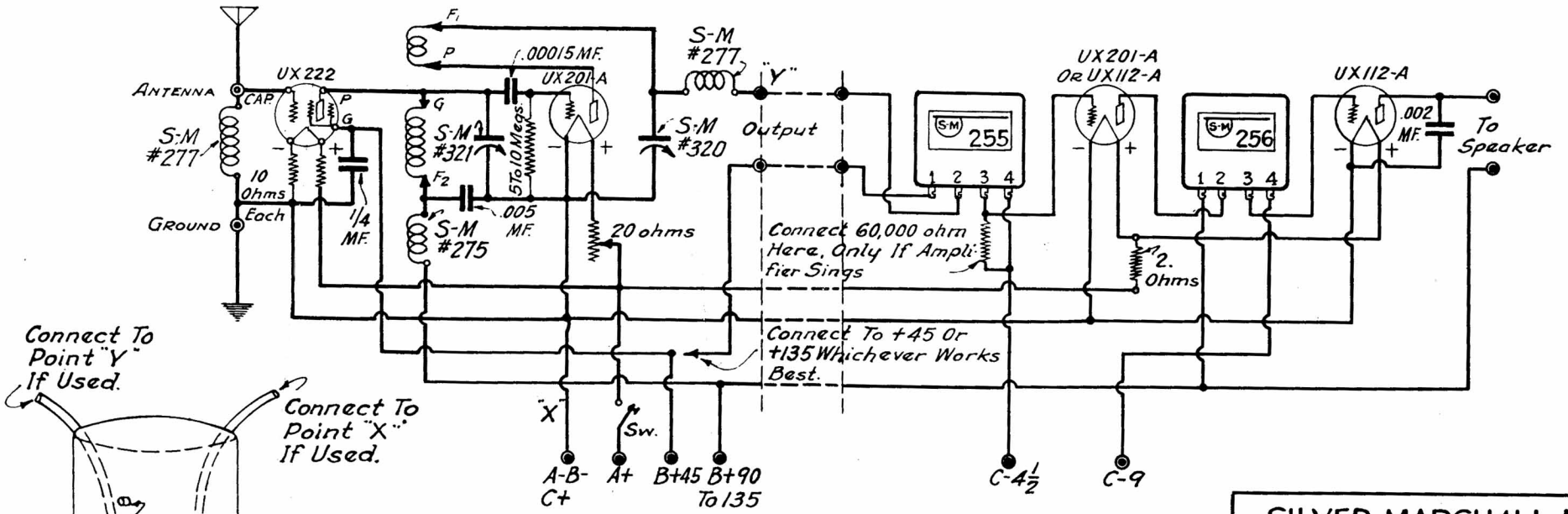
The operation of the set is simple, almost any antenna from fifteen to fifty feet giving quite good results; even a long broadcast antenna does not seem to destroy the sweet control of the set. Any good storage battery, 9 volts of "C" battery, and 135 to 180 volts of "B" battery (or as low as 90 will do) are all that is necessary for operating power.

Eliminators are generally noisy on short waves and are not to be recommended, for the detector tube at least. Two 112-A audio tubes, a 201-A or better yet, a 112-A detector, a 222 screen-grid R.F. tube, and phones or loud speaker make up all the equipment needed to listen in on almost all of the world from England to Australia, Africa to Alaska, and back again (if reports of short waves circling the world are true). One may be certain though, of the thrill of 5,000 or 10,000 mile reception as a fairly regular thing, and will have the tried and proven performance of a good short wave receiver as a known factor to start with in the experimental reception of television.

The thrill of short wave reception cannot be appreciated until one has actually experienced the reception of signals emanating from a station located at the other end of the world. Short waves—the greatest annihilator of space.



Calibration chart of short wave coils used in the S-M "Round-the-World-Four."



NOTE:-FOR TWO TUBE SHORT WAVE ADAPTER TO BE USED WITH ANY STANDARD RADIO SET:-

A - OMIT ALL PARTS TO RIGHT OF DOTTED LINES.

B - CONNECT UPPER "OUTPUT" LEAD (FROM #277 CHOKE) TO PLATE PIN OF OLD TUBE BASE.

C - CONNECT "A-" LEAD TO F- PIN OF TUBE BASE.

D - CONNECT BATTERY BINDING POSTS TO RADIO SET BATTERIES.

E - INSERT OLD TUBE BASE ADAPTER IN DETECTOR SOCKET OF REGULAR RADIO SET, WHICH WILL JOIN THE TWO TUBE SHORT WAVE ADAPTER TO THE AUDIO AMPLIFIER OF SET.

SILVER-MARSHALL, INC.

S-M ROUND-THE-WORLD FOUR 4 TUBE SCREEN GRID SHORT-WAVE RECEIVER

May 11, 1928.