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THE NEWSPAPER FOR
THE HOBBYIST OF VINTAGE
ELECTRONICS AND SOUND

THE HORN SPEAKER

100 TH EDITION

SHORT WAVE CRAFT for APRIL, 1933

National "FB-7"

By JAMES MILLEN*

Fig. 3. Little need be said concerning this top view of the new receiver. Its compactness, symmetry of design and complete expressability are immediately apparent.

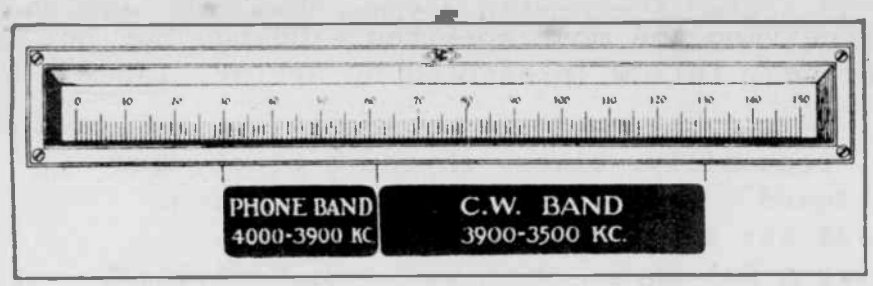


Fig. 4. One of the remarkable characteristics of the new receiver is graphically portrayed in the accompanying illustration. Here we have indicated the performance characteristics of the receiver when the "band-spread" coils for the 80 meter band are employed. It will be observed that the spread from 4,000 to 3,500 kc occupies 100 divisions on the dial, leaving an overlap of approximately 25 divisions at either end. Due to the special characteristics of the plates used on the condensers, the amateur phone band of 100 kilocycles occupies approximately half the space occupied by the 400 kilocycles in the adjacent C.W. channel.

● Nearly all of us recognize that there is an increasing demand for short-wave receivers which are highly selective and very sensitive, simple to control and comparatively reasonable in price. There has been a great deal of discussion regarding the advisability of making a combination broadcast receiver which will also perform satisfactorily on short-wave. Several extremely satisfactory receivers of this general type have been marketed and are performing a very valuable service in familiarizing the broadcast listener with the extremely interesting programs which are now available on short-waves. Then, too, several very satisfactory short-wave receivers for amateur communication purposes have been introduced and have been giving a very satisfactory account of themselves.

The combination broadcast and short-wave receivers, if they are of the high quality to which we have referred above, are also very expensive and the majority of amateur radio telephone and telegraph communications enthusiasts ("hams," as they are called among themselves) demand characteristics in a communications receiver which are not generally found in the combination type.

Before embarking upon a description of the particular characteristics of the new receiver to be described here, it may be well to clear up one point which has been causing a considerable amount of discussion among short-wave enthusiasts and engineers as well. The question has to do with the desirability of covering a great band of wavelength without the necessity of changing coils. Experience has led us to the conclusion that the most satisfactory type of receiver for short-wave use is one which employs changeable coils. We have made several receivers, in which the change from one frequency band to another has been accomplished by a switching arrangement with coils mounted directly in the receiver itself. I do not believe that any receiver can be made to function as well on all of the wavelength bands, unless it is provided with *changeable coils*. Other radio engineers who have argued against this policy have recently come around to this way of thinking and several companies, formerly engaged exclusively in the making and selling of high-grade combination receivers, are now introducing special receivers designed for short-wave operation exclusively.

*General Manager, National Company

Purpose of the New Receiver

In consideration of all these factors and in view of the extremely satisfactory performance which the AGS receiver is delivering in all fields of communication on short-waves, the impression grew that many of the design features incorporated in that receiver could be applied to a simpler set which would be ideal for use by the *short-wave broadcast listener*, who is particularly interested in the reception of "foreign" programs, as well as the amateur operator who, for his communication purposes, requires a far better short-wave receiver than the average and who at the same time cannot afford to avail himself of the commercial type.

General Characteristics

This new receiver carries the designation "FB-7". This designation is particularly applicable to a receiver especially suited to the needs of the amateur communication enthusiasts. FB stands for *phone band* and in the vernacular of the "ham" it also means *fine business*, which is an expression commonly employed to indicate satisfactory results.

The FB-7 is essentially a short-wave superheterodyne of the most advanced type, incorporating many of the features only to be found in the most expensive and elaborate receivers of the strictly commercial type. As may be seen from the accompanying illustration, the entire receiver is comparatively compact, while all of the component parts are completely accessible. The tuning scale is of the full vision type and is thoroughly illuminated. Tuning is accomplished by a single knob and there are no additional adjustments of any kind, other than the volume control. The tuning range of the receiver is from 15 to 200 meters or 20,000 kilocycles to 1,500 kilocycles. Five different sets of coils, with suitable overlap, are used to cover this range; they are of the regular National commercial type and plug directly into the front panel of the receiver. Provision is made for both telephone and loud speaker operation and the receiver may be operated from the regular National power supply unit or from batteries. "Hams" who desire to use this type of receiver for communication purposes sometimes find it desirable to operate from a small filament transformer and "B" batteries. This enables them to duplicate the performance of the receiver operated from the regular power supply, at slightly reduced cost.

To be more specific:

Determining upon the circuit which would most nearly meet all of the conditions required for the communication services, for which this type of receiver was designed, was the subject of a great deal of study. Another important subject was the determination of the particular types of tubes which would best function in a receiver from which so much was to be demanded. From antenna to loud speaker, we believe that the FB-7 is the satisfactory solution to a great many receiver problems. The following tubes have been selected because they seem to suit the

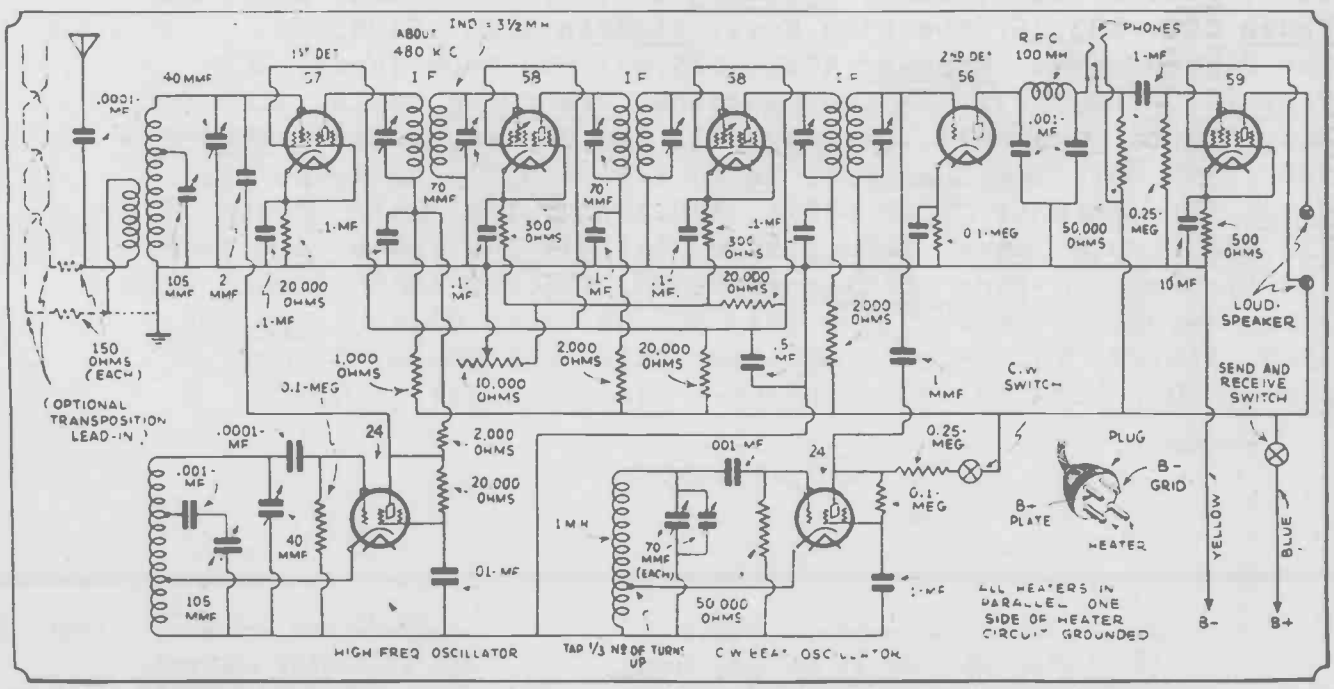
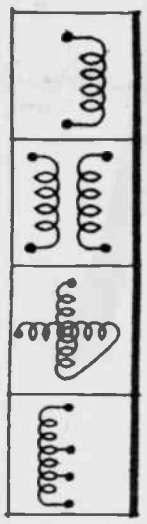


Fig. 1. The complete circuit diagram of the new National FB-7 Short-Wave Superheterodyne Receiver. Seven of the latest tubes are employed and the receiver is ideal for use in connection with many services as a study of the circuit will disclose. All of the heaters are connected in parallel. It will be noticed that one side of the heater circuit is grounded to prevent radiation from the beat oscillator. Other systems, commonly employed, were found inadequate.

requirements admirably. The first detector is the type 57; the high frequency oscillator and the beat oscillator are of the 24 type; the two intermediate frequency amplifier tubes are 58's; the second detector is the 56 and the output tube is the type 59 pentode. A complete diagram of the circuit employed in this receiver appears in Fig. 1, but many of the important features of the receiver are not immediately obvious from a study of the diagram. A study of the various portions of the circuit and the reasons for their selection will give a very much more definite idea of the performance which may be expected for particular types of service.



Take the antenna, for instance. For suitable tuning over a wide band of frequencies, it is desirable to have an antenna circuit in which antenna tuning effects are reduced to a minimum. A large size primary coil is always desirable but in most cases its use has always been accompanied by high inductance and capacity which, in turn, have made a tuning free antenna system almost impossible. My experience in the design of short-wave receivers and the success obtained in connection with National standard plug-in coils for example, resulted in following a somewhat similar procedure in connection with the coils designed for the FB-7. The antenna primary is *interwound* with the secondary, in a manner which brings about a considerable loading effect which is constant and also permits utilizing the advantage of close coupling, without any noticeable antenna tuning effects.

Furthermore, the particular type of antenna circuit employed permits taking full advantage of the desirable features which a modern tuned doublet and suitable transposed transmission lines bring about. The use of the tuned doublet is becoming generally recognized as standard practice, where the best type of receiving engineering is involved. Interference, of the *man-made* variety, is reduced to a considerable degree by the elimination of the ordinary ground connection in the antenna circuit. It is possible to take full advantage of the benefits which the ground connection sometimes brings as a result of grounding the chassis, without the necessity of having the ground connected to the antenna system, which is permitted to function as an almost separate entity from the remainder of the receiver.

In selecting the proper tubes for the first detector, a considerable amount of time was spent in investigating the performance of the type 58 tubes. This was abandoned in favor of the 57 because it was found that, with a 24 employed as the high frequency oscillator, having its plate coupled through the comparatively small condenser (approximately 2 mmf.) to the grid of the 57 detector tube, provided an arrangement which gave a coupling which automatically increased as the coils covering higher frequency ranges were plugged in.

Stable operation of the high-frequency oscillator, resulting in an unwavering signal response, has been obtained by using the 24 tube in what is called an *electron-coupled* circuit. The other 24 tube, employed for providing the beat frequency, when the reception of continuous waves is desired, is also of the electron-coupled type. The intermediate frequency amplifier employs two type 58 tubes and standard National commercial type intermediate frequency transformers, which are of the Litzendraht, ultra high gain variety. In other respects, the intermediate amplifier is fairly conventional.

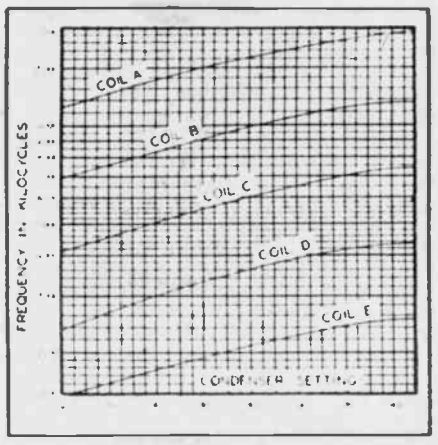


Fig. 5. Tuning Curves for FB-7, with "general coverage" coils.

off the record

Re: RESULTS OF RECENT MAIL AUCTION OF COLLECTIBLE PHONOGRAPH RECORDS.

L. R. "Les" Docks, of San Antonio, Texas, reports that supplying record collectors' wants remains a "sound business." Docks' assessment is based upon the results of his largest record auction to date, which consisted of several sections: 78 rpm hillbilly, country-western, western swing, and cajun; 78 rpm jazz, dance bands, swing, "sweet" bands, personalities and popular vocalists; 78 rpm blues, rhythm & blues, gospel and other "race" records; 78 rpm rock 'n' roll, rhythm & blues, rockabilly, and popular hits of the late 1950s (usually found in 45 rpm form); 45 rpm rock 'n' roll, rhythm & blues, blues, rockabilly, novelty. Most of the 6,000+ records offered were sold (although there are some left-overs). Intense interest was apparent in each category offered, but the highest prices, as expected, were brought by 78 rpm blues and 45 rpm rockabilly discs. Some highlights of the auction- records receiving the most spirited bidding, but not necessarily the highest prices, follow (presented by artist, label, and number)

In the 45 rpm section, rockabilly, blues, rhythm & blues, and rock 'n' roll collectors found the following most interesting: John Ashley, Dot 15775, $24.65; Phil Barclay & The Sliders, Doke 102, $58.25; Red Berry & Bel Raves, 20th Fox 169, $104.14; Big Bopper, D 1008, $22.12; Jules Blattner & Teen Tones, Bobbin 105, $33.10; Bobby Brown & The Curios, Vaden 100, $88.25; Ray Burden, Cullman 6403, $82,30; Jimmy Carroll, Fascination 2000, $24.65; Les Cole with The Echoes, D 1010, $26.00; Dick D'Agostin, Dot 15773, $40.00; Jeff Daniels, Meladee 117, $60.51; Wailin' Bill Dell, OJ 1003, $40.00; Lee Denson, Kent 306, $26.00; Billy Dev-Roe, Tampa 133, $38.25; Floyd Dixon, Aladdin 3135, $25.88; Larry Dowd, Spinning 6009, $28.00; Bill Duniven, Vaden 306, $33.16; The Five Keys, Aladdin 3113, $103.00; The Fluorescents, Hanover 4520, $25.88; The Four Tunes, RCA Victor 50-0008, $31.11; Lou Giordano, Brunswick 55115, $191.95; Rudy "Tutti" Grayzell, Starday 321, $42.00; Wayne Haas, Choice 5607, $20.00; Jimmy Haggett, Vaden 116, $15.21; Buddy Holly, Coral (Promotional Copy) 62074, $20.25; Howlin' Wolf, Chess 1528, $33.00; Elmore James, Meteor 5000, $43.51; The Jayes, Arc 4443, $23.11; Bobby Milano, Challenge 59005, $15.00; Johnny Moore with Jimmy Haggett's Band, Vaden 111, $42.99; Gene O'Quin, Capitol 1508, $16.98; The Orioles, Jubilee 5115, $36.06; J. D. Orr, Summit 105, $287.40; Royce Porter, Mercury 71314, $18.00;

(To be continued)

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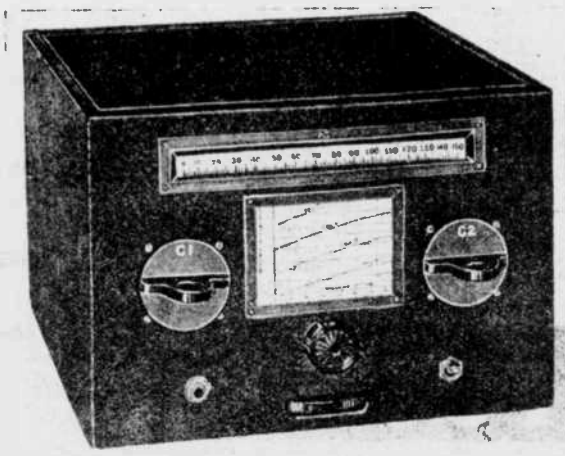


Fig. 2. Front view of the new FB-7 receiver. The full vision scale is marked off in 150 divisions. The tuning calibration curve for each one of the five sets of coils is mounted on the panel. Directly below the tuning control there is the calibrated volume control, of the type which has proven so popular in measuring signal intensity. The coils plug in from the front. Phone jack is located at the lower left-hand corner of the front panel; switch in lower right-hand corner throws the beat frequency oscillator in and out of circuit.

For the second detector a 56 tube was selected because it can supply a high audio output, for the ease with which the radio frequency component may be removed from the plate circuit without sacrificing high audio frequency, and its adaptability for use with headphones.

The beat frequency oscillator is of the *electron-coupled* type. The usual difficulty of a broad zero-beat region, excessive noise in the intermediate frequency circuit as well as an apparent "pulling in" of strong signals as the volume control is advanced, has been overcome by suitable shielding of the oscillator circuit. As a result of the improved shielding, there is practically no *pick-up* in the input circuits of the intermediate amplifier and first detector.

The output tube is a type 59 pentode, which is coupled to the second detector by the resistance method.

Answers to Most Questions

It is impossible to give a complete description of a receiver of this nature within the space available in a magazine article, but a preview of this receiver has resulted in the answering of a great number of questions and the answers to these questions follow. A few points which have not been brought out by the questions have to do with the selections of the materials necessary for a particular type of service or for general purpose. As a matter of convenience to those who do not require all of the coils the receiver may be purchased with a single set of coils and additional coils may be secured as the need for them arises. Then, too, the regular power supply is optional. The receiver functions very satisfactorily with a storage battery for supplying the filament current and "B" batteries. As is general in the operation of amateur receivers, it is possible to utilize the filament transformer operated directly from the light circuit and have the plate supply come from "B" batteries.

Questions and Answers on the FB-7

For what particular purpose has this new receiver been designed?

The FB-7 has been designed primarily to enable the 80 meter amateur phone operator to secure what corresponds to commercial performance from a receiver designed especially for amateur use at a price heretofore impossible.

What is the output impedance and what type of loud speaker is recommended?

The output impedance is suitable for best operation with any standard 5,000 ohm magnetic or dynamic speaker.

What is the overall frequency range?

Standard coils are available for complete coverage from 20 mc. to 1,500 kc. (15-200 meters). Five pairs of general coverage coils cover the following ranges: 11,500-20,000 kc.; 6,900-12,000 kc.; 4,050-6,900 kc.; 2,400-4,400 kc.; and 1,300-2,600 kc.

Are band spread coils available and for what bands?

Yes. For all of the amateur bands. Each set of these coils provides a spreading of the band over a full 100 divisions of the dials. These 100 divisions come right in the center of the dial scale and there are thus 25 divisions above and 25 below the actual band covered by each pair of coils.

Is this receiver suitable for C.W. reception as well as for phone?

Yes. A switch on the front of the panel controls the special beat frequency oscillator used for C.W. reception.

Is the receiver subject to frequency drift?

No. Both the oscillators are of the electron-coupled type. This completely eliminates any tuning drift common and troublesome in other short wave superheterodynes.

Are the coils shielded?

They are not only shielded but they have been designed to fit right into the apertures in the front panel in the same convenient manner as with the AGS. They are provided with aluminum face plates and convenient grips. It is not necessary to remove the coil shields, or raise the lid of the receiver in order to change the coils.

Can intermediate stages be tuned to assure peak efficiency at all times?

Yes. The trimmer adjustments are located at the top of the intermediate frequency transformers, making it unnecessary to remove the base of the receiver or go to any other complicated trouble to assure peak performance at all times. Peaking the I.F. amplifier is a very simple matter.

Is straight frequency line tuning employed?

Yes. The latest National, illuminated, full-vision dial is used in conjunction with 270 degree straight frequency line condensers. This combination spreads the band, covered by a given set of coils over 50 per cent more dial space, than would be possible with 180° condensers.

Is the receiver thoroughly shielded?

In addition to complete shielding of each of the components, in themselves, the entire receiver is contained in an all-metal cabinet. This double shielding contributes to the inherent stability of the receiver and prevent the picking up of stray interference.

Can the receiver be used with headphones?

Yes. The jack is on the front of the panel and permits ready connection of the headphones into the output of the second detector.

Horn Contour

continued *by* **Bruce C. Edgar**

SB: When did you invent the twin cone diaphragm?

VOIGT: I discovered the advantages of using a twin cone to improve the high frequencies in 1933. But it did not improve the high frequencies as much as the light coil feature later on. The twin cone idea was probably the most "borrowed" of any of my ideas. I was able to license Wharfedale and Goodmans to use my twin cone patent in their loudspeakers, and they both paid their royalties faithfully. Because the war spoiled the high quality sound business, I was granted an extension of time of the life of the patent. However patents do not go on for ever. I did not have patents in other countries. What is the position today? Well, there is not a Hi-Fi shop in the world which does not have a few twin diaphragm loudspeakers in stock. And for every one in stock, how many are in use? So at least if Rice and Kellogg beat me by a few weeks for the moving voice coil loudspeaker, I contributed the twin diaphragm. (Editoral note: Voigt was granted British Patent no. 413,758 for the twin diaphragm idea in 1934.)

SB: How did you develope your Light Coil Twin (cone) version of the Voigt loudspeaker unit?

VOIGT: During the latter 30's, while driving on a long trip to Scotland, my mind returned to the field strengh consequences. My main starting point then was the 1929 design of the Voigt cinema speaker for which I had accomplished 16,000 gauss (the flux density at which iron shows signs of nearing saturation) is the same as 1600 milli Teslas. If you prefer to be strictly scientific and call it 1.6 Teslas and use that value after explaining to a customer how important it is to have the highest practical field strength, he would probably conclude that you were nuts and think you were lying. And the above flux density I had accomplished with 40 Watts dc magnetising.

Now, the only "guidance" on the subject of speech coils I had come across was in an American book by Olsen[6] in which it was proven mathematically that the optimum mass for the speech coil was that which made it equal to the mass of the diaphragm.

That may have been correct relative to the assumptions on which his math was based. But my assumption was that high flux density was important. Anyway, the mass of my aluminum wire speech coil was far less than that of my twin cone diaphragm (main cone 6" diameter). So I was already "guilty" of a major deviation from established ideas.

But, if I were to use a coil weighing as much as the diaphragm, it would be possible to squeeze it into a 2mm gap. To increase the volume of the gap sufficiently for the "established" advice, the electro-magnet would would have to be increased tremendously. My 1929 design already had 8 pounds of wire on it, took 40 Watts and weighed about 30 pounds.

SB: So what hypotheses did you reach?

VOIGT: If I reduced the mass of the speech coil still more, it would cut the moving parts thereby improving the acceleration of the transients and the response of the high frequencies though at the loss of average power. Would there really be a loss, and if there were, would it matter? The possibilities either way produced food for cogitation.

SB: How did you go about redesigning your speaker with these hypotheses?

VOIGT: With a reduced mass of wire, I could reduce the speech coil from 6 layers to 4. That enabled a reduction of the gap from 2mm to 11/2mm. That reduction would push the flux density up further into the saturation region. In practice by about 2,000 gauss (about a 12% density gain).

With only 4 layers instead of 6 of the same wire guage, the resistance would go down 66%. There are two alternatives now. Change the output transformer from a secondary for 30 ohms to one for 20 ohms. Then the voltage would go down about 12% and the current would go up by about 12%. The disadvantage would be the change of a transformer. Were there other disadvantages?

With 2/3's the turns, the ampere-turns were down by 2/3's because of the reduced number of turns and up by about 12% because of the increased current, i.e. only down to 80% considering those two factors alone. But hold it. There is a third factor. With the narrower gap, the flux density will go up. But, by how much? Well, sitting at the steering wheel of a moving car, I had to guestimate. Getting into the iron saturation region, how much would the flux density in the gap go up when that gap was reduced from 2mm to 11/2mm? If the rest of the magnetic circuit was a perfect conductor of magnetism, one could expect the 25% gap reduction to give an approximate 33% increase in flux density. Suppose, since the iron was going into saturation at the pole tips, which were nowhere perfect, that 1/3rd of the above 33% increase would be available in practice, then the third factor would provide a 10% boost. 80% plus one tenth of 80% is 88%.

SB: So what were the ramifications of these questimates?"

VOIGT: First that with a coil mass reduction to 66%, the obvious consequence was that the force would also go down to 66% of the previous value. Although this is correct, it is not final. If the reduction of mass is obtained by reduction of wire length, a change of the input transformer alone helps to counteract the situation and reduces the efficiency drop to 20%. On the good side, the reduction of the coil mass has reduced the inertia loss by 33%.

What I did not mention before is that instead of changing the transformer to suit the reduced resistance load, a change in wire guage can match the load to the existing transformer. In either case, the mass reduction makes possible a reduction of the gap width. That makes possible an increase in flux density. Just by how much is guess work until you can measure it from a live example. The limits are easily imagined but are probably fairy tales. Suppose you have a magic wand that eliminated the resistance of iron to carrying magnetic flux, then a reduction of the gap width to 3/4ths of its previous width would allow the flux density to go up to 4/3rds of its previous value. We had already a force reduction to 80% before considering the benefical effect of increased flux. The 80% relative difference, if multiplied by 4/3 is 107% compared to the original 100% taken as the force. In practice such a magic

wand does not operate in the saturation region, but it works much better at lower flux densities. The other imaginary limit is a lower one. Suppose that the iron circuit refuses to carry more flux, then there is no increase, and the above 80% figure holds good. Thus, until practical measurements are made with the real hardware, the consequence of reducing the coil mass will lie somewhere between a downward change to 80% and an upward change of 107%.

So, that cogitation showed that treble loss could be reduced and transient acceleration improved without any major reduction, and possibly even an increase in electromagnetic force.

To me the idea that, for good results the coil mass should equal that of the diaphragm might be OK when you could not "juggle" with the flux density. But in my case I could. Measurements in the lab showed by reducing the gap to 11/2mm, there was a flux density gain of about 2,000 gauss. Compared with the previous density of slightly over 16,000 gauss, that was a gain of 1 in 8.

SB: What was the result?

VOIGT: The result? I deliberately developed a LIGHT COIL TWIN variation of the Voigt loudspeaker. I knew I was deviating further from the established concept than before. And my title made it clear that I was doing something deliberately.

The practical result was that the extreme high frequencies were so much better, that for radio reception (a.m.) whistle frequency filters had to be put into the circuit to cut out the hetrodyne beat frequency between adjacent wavelength transmitters. For gramophone use, the filter could be cut out if desired, and by daytime it could be switched in when receiving the B.B.C.

My light coil twin corner horn speakers was submitted for review and received favorable reports, i. e. WIRELESS WORLD, March 9, 1939. (Editorial note: After WW II, Voigt consolidated many of his arguments for a low mass speech coil and diaphragm in British Patent no. 667,170 and U.S. Patent no. 2,615,995.)

6. Olson, H.F., Acoustical Engineering, D. Van Nostrand, N.Y., 1940, p 128.

OPERATING NOTES
ANALYSES of RADIO RECEIVER SYMPTOMS

Airline 07B, 32 Volt Farm Receiver. A scratching noise has been traced to the push-pull input transformer in several of these sets. Replacement is the only cure, for the noise is caused by electrolysis within the primary winding.

LEO E. BAER

Stewart-Warner R-120. The complaint was that this set had a steady whine and that it did not pick up short-wave reception. See Fig. 1A. Condenser No. 83216 (0.02-mf. 1,000 V.) open, caused the whine. A new 56 cleared up the short-wave reception.

Atwater Kent 812. The complaint was that the set smoked. This set uses 2 type 83 rectifiers and 2 power transformers. See Fig. 1B. Evidently this set had had a blown fuse, for some one had put a 20-A. auto fuse in place of a 3-ampere fuse. (This caused the power transformer to overheat. In this set there are 2 sets of buffer condensers mounted in one container. One of the buffer condensers was shorted out. This caused the 3-A. fuse to blow.) Replaced the blown buffer with 0.1-mf., 600 V. unit and replaced a 20-A. fuse with one having a 3-A. rating, which cleared up the trouble.

C. A. DAVIS

Philco 1937—620, 630, 640, 650, 9X. These models all have been serviced for one complaint, common to all—that of intermittent reception, wherein the volume level falls sharply, accompanied by resonance hiss. Where a shadowgraph is employed, the indication will widen. In some cases, the condition is not intermittent.

By connecting the aerial to the control-grid of the 6A8 or 6L7 (whichever tube may be employed as the 1st-detector), or placing a finger upon the control-grid, volume level becomes nearly normal and the resonance hiss clears up to a great extent. This procedure would, quite naturally, indicate the trouble to lie within the R.F. stage, and such is the case. However, a volt-ohmmeter or analyzer will not point to the difficulty, which is a snapped lead, from the stator lug of the R.F. section of the gang condenser to a lug on the wave-band switch, at the wave-band switch lug. It is quite unnecessary to remove the assembly to resolder this lead if the soldering tip is only ¾-in. in dia. and at least 2 ins. or slightly less in length. The complaint of hum, which is still present with the rectifier tube removed from its socket may often be remedied by tightening the assembly and mounting bolts and nuts of the power transformer; otherwise, replacement of the transformer becomes necessary.

Philco 1936 Receiver Volume Controls. A constant source of trouble with almost all 1936 Philco receivers has been noisy and intermittent operation of the volume controls. In the majority of cases, replacement has been unnecessary. A light steel wire wound once around the shaft (and the ends twisted) between the soft "U" washer and bushing on the shaft, to remove the end play, has proven very effective and satisfactory. To complete the repair, place a drop of oil upon these parts to prevent excessive wear of the steel wire, washer or bushing.

RCA Victor 28-P. When the complaint of intermittent reception is received, wherein the volume level suddenly decreases sharply and returns abruptly after some interval of operation, check the detector secondary-return bypass condenser for an open-circuiting condition. Unlike many similar failures, striking the condenser seldom discloses any defects, although switching the receiver on and off quickly will bring up the volume level. In some instances, the switching of a room light off or on will produce the same effect. The open-circuiting of the R.F. cathode bypass condenser has been found to cause the same trouble although the decrease in volume is not as great as that experienced when the detector (2nd) secondary-return bypass condenser open-circuits.

Upon the appearance of oscillation and strong motorboating, most likely the second section of the dual dry electrolytic filter block is at fault because of a loss in capacity. The block may either be replaced or the defective section disconnected and an external condenser substituted.

BERTRAM M. FREED

Crosley Model 102. Inoperative due to 0.01-mf. condenser which is connected across secondary winding of power transformer, becoming shorted. See Fig. 1C. Replace with a 600-V. unit. Access to this condenser may be had by removing end plate opposite control side.

Another cause for no reception may be due to the metal cover touching the terminal of the lead from the grid of the I.F. tube. This terminal is attached to the frame but is insulated from same by means of a mica strip. When the cover is removed, the receiver will operate under this condition. Terminal may be bent to position to clear cover. Care must be used in removing the cover of this set, as the loud speaker is mounted on the cover, and connecting leads are short, thus allowing leads to be easily torn from terminals.

Intermittent reception on this model has been found to be caused by breaking of the flexible lead from the R.F. transformer to the gang condenser at the point where a soldered connection is made to the condenser, as the gang condenser is mounted on rubber and is permitted some movement.

Detrola, Warwick Model. Inoperative over part of broadcast band. This condition has been remedied by replacing the voltage-dropping resistor for the screen-grid of the type 57 detector-oscillator tube, with one of lower value. The original resistor is 50,000 ohms and may be replaced with one of 40,000 ohms.

Columbia Radio Corporation, Model SG-9. Lack of reception is often found to be due to an open 1,500-ohm section of candohm resistor; this is marked X in Fig. 1D. A condition reported as "weak and distorted" was found to be due to a leaky condenser, connected from screen-grid of the 4th type 24 R.F. tube to the common cathode-return lead. This is condenser A on the diagram. This condenser and condenser B are connected inside the condenser can as shown in the illustration.

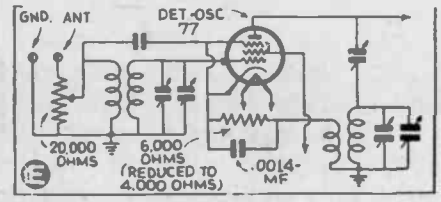
HOWARD J. SURBEY

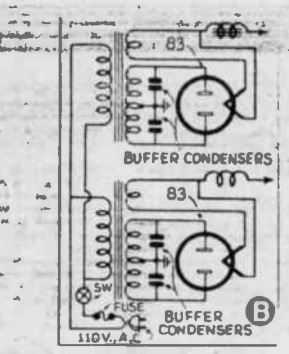
International "Kadette" 4-Tube Set. Out of 11 service jobs on the 4-tube Kadette receiver, 10 of the sets called for the replacement of the double 5-mf. electrolytic condenser used as a bypass across the cathode resistors of the types 36 and 38 tube. The life of this very compact condenser is somewhat shortened by the heat produced in the filament series resistor located beneath the chassis at the back. It is an excellent idea to cut out this resistor and replace with the conventional line-cord resistor made for 4-tube sets. A wiring diagram of this set appeared in the February 1933 issue of *Radio-Craft*.

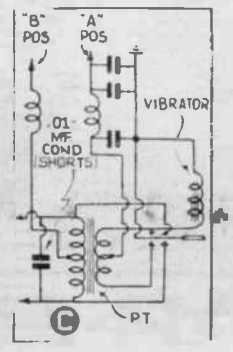
E. L. DEETER

Philco 84. We had a Philco 84 in the shop. The complaint was "intermittent reception." I turned the set on and checked everything that was suspected. Everything tested "normal," including the voltages. Then the set popped on and played the rest of the day, but the next morning it would not play. After having been turned on about 30 mins. without results, it suddenly popped on and played all day satisfactorily. This kept up for 2 or 3 days. Then I got out my diagram and started using a little theory. From the cathode of the detector-oscillator tube there is a 6000-ohm resistor connected through the primary of the oscillator coil to ground. (See Fig. 1E.) I replaced this resistor with a 4000-ohm unit and this cured the trouble completely. The value 6000 ohms, of this resistor was too high and was causing the tube to block.

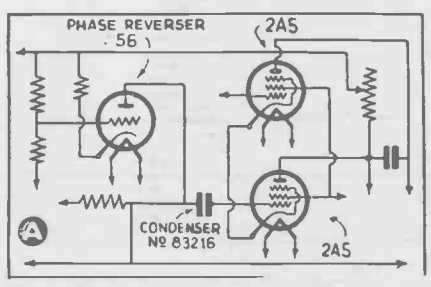
JAMES W. TAYLOR







RADIO-CRAFT for SEPTEMBER, 1937



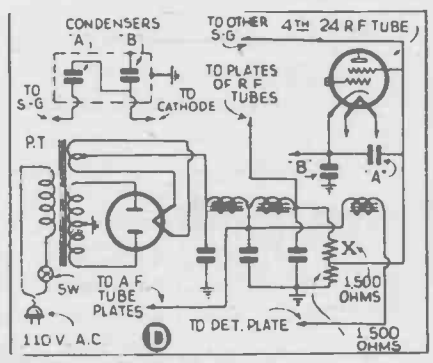


Fig. 1. Circuit details discussed.

letters

Dear Mr. Cranshaw:

I am interested in obtaining information about the value and possible disposal of a radio collection. Your address was obtained from "Vintage Radio."

At pesent I am referring to an assortment of radio tubes, test equipment and Hallicrafter receivers, whose model numbers I realize would be necessary for your further understanding. Also there are several car radios from the 40's and 50's which collectors might desire.

I would greatly appreciate your help in this matter.

Very truly yours,
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650 North Wade Ave.
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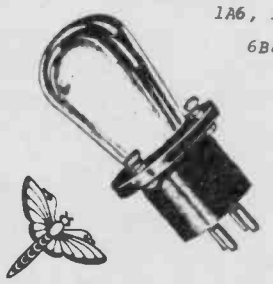

1A6, 1A7, 1B5, 1C5, 1C6, 1D7, 1E7, 1F5, 1G6, 1H5, 1LB4, 1LC6, 1LN5, 1N5, 1P5, 1Q5, 1T5, 5U4, 6A6, 6AC5, 6AC7, 6AG7, 6B8, 6C5, 6C6, 6C8, 6D6, 6F8, 6G6, 6N7, 6P5, 6R7, 6SD7, 6SJ7, 6SN7, 6SR7, 6SS7, 6SU7, 6V6, 6Z4/84, 6X5, 6Y6, 6Z5, 6Z7, 6ZY5, 7A4, 7A5, 7A6, 7A7, 7E6, 7L7, 7Y4, 12A6, 12AH7, 12C8, 12F5, 12J7, 12K8, 12SC7, 12SF5, 12SF7, 12SL7, 12SR7, 14A4, 14H7, 31, 33, 34, 35Z3, 35Z4, 38, 39/44, 41, 44, 46, 56, 58, 76, 78, 84/6Z4, 89, 117Z6, 1622, 1626, 1629, 1852, 2051, 6188.

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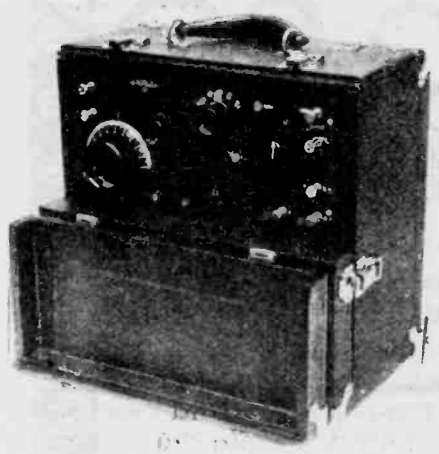


or WD-12 tubes, giving economical life and not necessitating frequent renewal of "A" battery. There is also room for three Eveready No. 764 vertical, intermediate 22½-volt "B" batteries, or the equivalent No. 5158 Burgess or No. 1153 French batteries, thus giving 67½ volts for the plates of the tubes, which means ample loud speaker volume under proper conditions. There is also room for a "C" battery, and provision is made for connecting in a "C" battery if desired. There is also room for one or two coils of insulated flexible wire to be used as an antenna and ground wire, as well as a compartment for head phones.

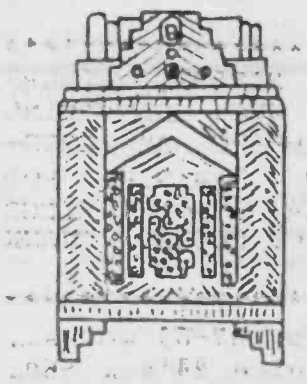
WANTED

SCOTT radio in Napier console (pictured), Scott FM tuner (10 tube), Scott FM converter (3 tube), Scott 26 tube communications receiver, any original Scott literature.

Zenith 25 tube Stratosphere.

These items are wanted for my personal collection, not for resale.

Steve Chapman, 419 Bird Lane, Waxahachie, Texas 75165, Tel. 214-937-2726 (home), or 214-937-2720 (office).



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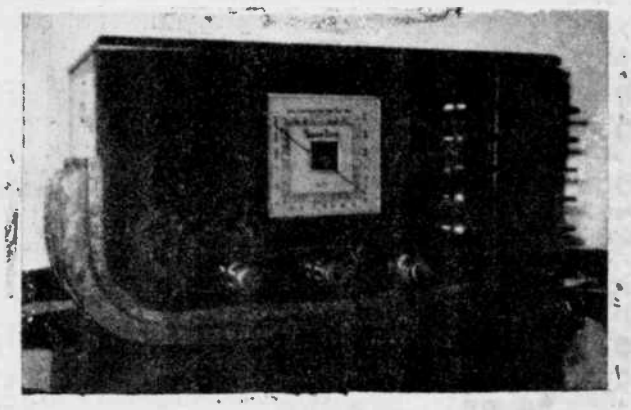
Wanted



PLEASE HELP. I LOVE MIRRORED GLASS RADIOS. IF YOU HAVE ONE OR KNOW WHERE THERE IS ONE, PLEASE LET ME KNOW. I'M ALSO INTERESTED IN ANY "WILD LOOKING" RADIOS FROM THE 1930'S LIKE COLORED CELLULOID RADIOS (FADA, EMERSON, ETC.) AND CHROME RADIOS. BARBARA GORTON, BOX 1252, DAYTON, OH 45401. (513) 253-5073.

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WANTED: SCOTT PHILHARMONIC. Prefer Napier console. Dick Howe, 9318 Wickford, Houston, TX 77024 or call (713) 680-9945 collect.

WANTED: SCOTT PHILHARMONIC - SPECIAL COMMUNICATIONS RECEIVER - PHANTOM DELUXE. Also early All- Wave series in original cabinets. Zenith Stratosphere also wanted Highest cash price paid for any of these sets. Also have rare Federal 161 for trade. Dave Pierson, 635 E. Buchtel, Akron, OH 44304. (216) 762-5978.

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* CRYSTAL SET ITEMS -- galena xtals ..$1.45 each -- cats whiskers (package of 2) ..$1.10 -- crystal detector .. $3.35 each ass'y with xtal -- Headphone replacement cords Brandes and baldwin types ..$4.25 each -- Olde tyme speaker replacement cords (above cords are 5 ft.) ..$3.00 each -- Headphone replacement pin jack tips .. 5 for $1.00 or 25 cents each
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1C5	$6	1LH4	$6	3Q5	$5	6AF6	$9	6E5	$12	6S7	$6	6V6	$5	7N7	$10	12J5	$6	14E7	$6	32	$6	49	$8	89	$6	9003	$5
1C6	$5	1LH5	$6	3S4	$4	6AG5	$4	6E6	$5	6S8	$7	6Z4	$6	7Q7	$6	12J7	$5	14F7	$7	32L6	$4	50	$9	117L7	$9	9006	$6
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1D5	$6	1N6	$6	5AZ4	$8	6AH5	$5	6E8	$7	6SB7	$6	6Z7	$6	7S7	$7	12K8	$6	14H7	$6	33	$6	50B5	$4	117N7	$8	VR90	$4
1D7	$6	1P5	$5	5R4	$5	6AH7	$5	6F5	$6	6SC7	$6	6ZY5	$6	7V7	$6	12L6	$4	1437	$7	34	$6	50C5	$3	117P7	$8	VR105	$4
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1F5	$6	1T4	$5	5Y3	$4	6AT6	$4	6H4	$5	6SH7	$5	7AD7	$6	10	$9	12SF7	$5	15	$9	35W4	$5	51	$7	879	$5	KKL	$6
1F6	$6	1T5	$5	5V4	$5	6AT8	$3	6H6	$3	6SJ7	$5	7AE7	$6	12	$8	12SG7	$6	19	$7	35Y4	$6	53	$15	884	$8	KKFM	$7
1F7	$6	1U4	$5	5Z3	$5	6AU6	$3	6J4	$5	6SK7	$5	7AF7	$8	12A5	$6	12SH7	$5	19T8	$3	3523	$6	55	$8	950	$8		
1G4	$6	1U5	$5	5Z4	$5	6AV6	$4	6J5	$6	6SL7	$5	7AG7	$6	12AE	$6	12SJ7	$5	20	$9	3524	$6	56	$6	951	$8		
1G5	$6	1V	$6	6A3	$6	6B4	$6	6J6	$3	6SN7	$3	7AH7	$6	12AT	$7	12SK7	$5	22	$8	3525	$5	57	$7	955	$7		
1G6	$6	2A3	$10	6A6	$7	6B5	$7	6J7	$6	6SQ7	$5	7B4	$6	12A8	$6	12SL7	$5	24A	$7	3526	$6	58	$8	958	$7		

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