The Regenaformer

By Glenn H. Browning *

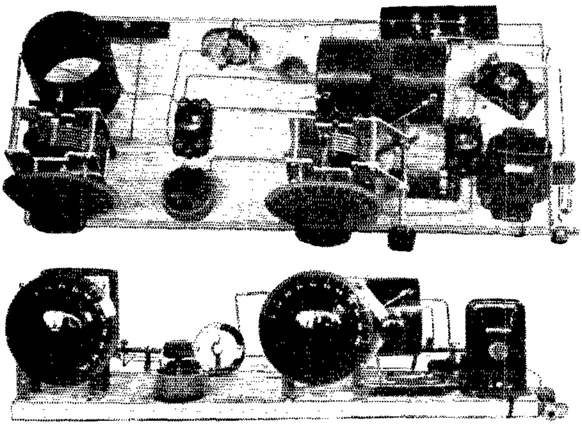
SEVERAL newspapers and magazines have featured the "Regenaformer" (sometimes known as the Browning-Drake set) for the reception of the broadcast band of wavelengths.[1] It has been suggested that the constants be given for a short-wave set covering the range from 15-200 meters.[2]

Before this is done the circuit itself will be reviewed briefly. The "regenaformer" set is built around an efficient tuned radio-frequency transformer. The set has the advantages that it will not radiate and that it is more selective than the usual set with an oscillating detector and audio amplifier.

Development of the R. F. Transformer

In August of 1923, Mr. F. H. Drake showed the writer some mathematics on a vacuum tube used as an amplifier in conjunction with a tuned radio frequency transformer, stating that there was a lack of efficiency in most R.F. transformers, and suggesting a thorough mathematical analysis of the circuit which, together with laboratory measurements, might throw some light on the right constants which were necessary for maximum amplification. Accordingly he and the writer worked together at Cruft Laboratory, Harvard University, for almost a year with the result that considerable information was collected.

The theory of the circuit predicted certain constants which would give the maximum radio frequency amplification, but when an R.F. transformer constructed in the ordinary manner, i. e. the primary and the secondary consisting of a single layer of coils, one fitting inside the other, was tested, the amplification was found to be extremely low. After some tests, it was found that the capacity between the primary and secondary of the transformer shown in Fig. 1, was the cause of the loss, as this introduced an



THE BREADBOARD LAYOUT OF THE REGENAFORMER

e.m.f. in the secondary of the R.F. transformer which was not in phase with the e.m.f. induced by magnetic coupling. A "slot" winding was then adopted with the result that about 90% of the radio frequency amplification predicted was actually obtained. In Fig. 2 curve A shows the theoretical amplification, curve B shows the measured amplification of the system shown in Fig. 1 with slot wound primary, while curve C shows amplification with a transformer wound on two concentric cylinders. In all three curves the same secondary is used while the primary is wound to the same inductance, also the coupling is the same. These curves shown are for the broadcast band of wavelengths, but give a good idea of the efficiency of the two methods of winding.

The analysis of the system and the complete set of curves showing the resistance of the secondary of the Regenaformer, together with the antenna coil, is too long to be included in this article which will deal

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1—The reader will see at once that the "Regenaformer" is simply the well-known neutrodyne, with the difference that the detector is equipped with a tickler. The advantage of the set over the usual neutrodynes is a triple one.

A—The "neutroformer" (here called a "regenaformer") is very well designed and therefore gives unusual amplification.

B—The regenerative detector adds greatly to the sensitivity of the set, also permits the reception of c.w. signals.

C—There are only TWO tuning controls, the third control being a tickler which does not need to be moved every time the tuning is changed.

Without any measurements at all and basing purely on "ear and judgment", one gains the impression that the set accomplished everything that the usual neutrodynes do with one more stage of R.F. amplification—i.e. with another tuning condenser and another tube.

2—Such a set was described by Don. C. Wallace on page 19 of January *QST*.

particularly with the construction of a receiver to cover the 60 to 200 meter band. This data, however, will be given in an early issue of this magazine.

Construction of the Set for 60-200 Meters

Fig. 3 shows a schematic diagram of the circuit.[3]

The coils, L_2 and L_3, are wound as shown, in Fig. 4. L_2 is a single layer selenoid wound

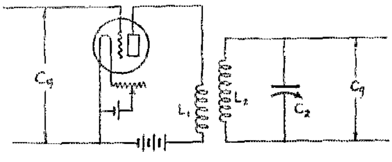

FIG. 1

on a three inch form of good insulating material, and consists of 20 turns of No. 20 D.S.C. wire. A tap is taken off 7 turns from the filament side of the coil for balancing.

A wooden disc with a groove cut in it is then turned out so as to fit snugly inside of tubing on which L_2 is wound. The groove in the disc should be 1/16" wide, and deep enough to take the 6 turns of No. 28 D.S.C. wire which compose L_3. This disc should then be placed so that the winding of L_3 is under the first turn of L_2. L^p, the "Tickler" coil, consists of 12 turns of No. 28 D.S.C. wire on a 2½ form as shown in Fig. 4. It is so mounted that it may be rotated through 180 degrees.

The coils L_0, and L_1 are wound in much the same fashion, L_1 consisting of 20 turns of

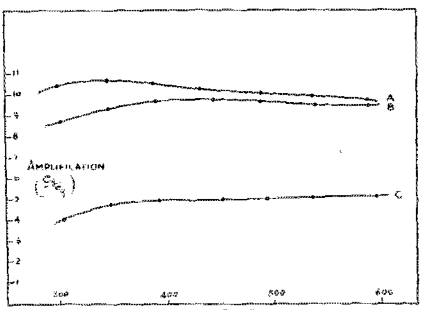

FIG 2

No. 20 D.S.C. wire on a 3" tube, while the primary L_0, is wound on a disc which fits inside the secondary, L_1. L_0 consists of 6 turns of No. 20 D.S.C. wire.

When placing the coils in the set, it is necessary to mount them at right angles to each other, and in such a position that the imaginary line drawn through the axis of the R.F. transformer passes through the center of the winding of the antenna coil. The coils should also be at least seven inches apart. These precautions are taken in order to eliminate magnetic feed-back between the two which would throw the whole system into continuous oscillation.

C_1 and C_2 are two .00025 µfd. low-loss condensers with vernier dials.

R^p and C^g are the ordinary grid leak of about 4 or 5 megohms, and grid condenser .00025 µfd. C^b is a by-pass condenser of .001 µfd. across the audio transformer. BC is a small balancing condenser of about .00003 µfd. UV-199 tubes were used throughout because of their small internal capacity.

Balancing the Receiver

The easiest way to balance the set is to tune in some loud I.C.W. station.[4] Then turn out the first tube leaving it in its socket. You should be able to hear them with the first tube turned out. Then set the balanc-

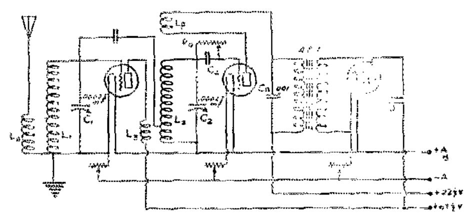

FIG 3

ing condenser so that changing C_1 does not affect the signal strength. This means generally that the balancing condenser will be set for minimum signal when the first tube is not lighted.

No attempt will be made to give the range or any of the stations received on the set, but it is sincerely believed that those constructing it will be more than pleased with the results obtained.

List of Apparatus Used in the Circuit

A list of apparatus used in the set constructed by the writer is given below, though other parts may be used which are equally as good, electrically:

Coils on hard rubber tubing—bakelite is practically as good.

Two National .00025 µfd. condensers with Velvet Vernier Dials.

Three General Radio 30 Ohm Rheostats.

The New General Radio 6-1 audio transformer.

3—See note 1 again, also compare with the diagram in the Wallace article.

4—In other words, almost any amateur station except 9EK. By the way—notice that the term "balance" is used.

Electrad variable grid leak.
Three General Radio UV-199 tube sockets.
The Rathbun Three plate vernier condenser for balancing.

Construction of the 15-76 Meter Set

For the 15-75 meter set the antenna coil, L_0 will have 2 turns and the secondary coil L_1 will have 5 turns, on a 3″ form as before. The secondary L_1 is tuned by a 250-micro-

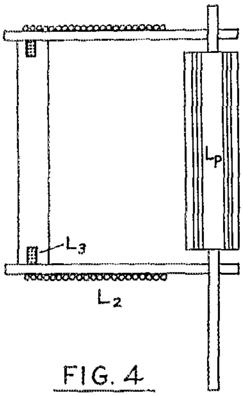

FIG. 4

microfarad[5] condenser with a low minimum.[6]

The R.F. transformer has two turns of No. 26 D.C.C. wire wound in a groove in the 3″ tubing. This is the primary L_3. A layer of insulation is put over this and the secondary wound on. The secondary L_2 has 5 turns of No. 20 D.C.C. wire wound in a single layer. This secondary is tuned by another 250 micro-microfarad variable condenser like that used to tune L_1. The tap for balancing the R.F. transformer should be taken off from the second turn above the filament tap and a 3-plate Rathbun variable condenser can be used for balancing. This is, of course, the condenser "BC."

The list of materials is the same as before.

5—For some reason folks don't seem to understand what a micro-microfarad is. "Micro" means "millionth". Therefore a microfarad is one millionth of a farad. In other words, 1 microfarad = .000 001 farad. Now a "micro-microfarad" is a "millionth of a millionth of a farad". In other words, 1 micro-microfarad = .000 000 000 001 farad. And finally, 1 micro-microfarad = .000 001 microfarad.

Now then—why do we use a thing with a name so clumsy as "micro-microfarad"? Simply because it is a nuisance always to say that "This variable condenser has a capacity of point zero zero zero two five microfarads." Isn't it easier to say—"This condenser has a capacity of two hundred and fifty *micro-mikes*"?

That is why *QST* is going to use the "**micro-mike**". It isn't any harder—just remember that,

1 microfarad equals 1,000,000 micro-mikes.

6—Quite a few condensers fit this description. The National Company makes a 250 micro-microfarad condenser especially designed for this.

For the Broadcast Wavelengths

For a range of 200-600 meters wavelength the following dimensions will serve.

The coils L_0 and L_1 are combined, making a single coil of 52 turns of No. 20 double silk-covered wire on a tube 2¾″ in diameter. This coil is tapped at the 27th turn and the antenna is connected at this point, either directly or through a 100 micro-microfarad (.0001 microfarad) fixed mica condenser. The circuit is then the same as that of Fig. 3 except that the antenna goes to the coil L_1.

The "regenaformer" is made as follows: A length of 2¾″ tubing has a groove cut in it for the primary. The groove is about ⅛″ wide and deep enuf to hold 26 turns of No. 26 or 28 D.C.C. wire which make up the coil L_3. A layer of thin paraffined paper is then wound on to make the surface smooth and the secondary coil L_2 is wound on. This coil starts right at the primary, continues over it and so on until 78 turns have been wound. This makes the coil complete except that a tap must be taken off at the 18th turn for the feedback condenser, just as shown in Fig. 3.

The tickler form is 2⅜″ in diameter and has two grooves ⅛″ wide in which is wound the tickler, using some such wire as No. 28 double silk covered. The number of turns must be adjusted to the goodness of the secondary circuit. The better your circuit, the fewer turns you need. A really good circuit will not need more than 15, a poor one may need as many as 30.

H. Leslie Jones of the C-B ranch in Texas sent in some questions to the Information Department, in a form which more ought to use. He lined his questions up with "yes" and "no" after them so that all we had to do was check one or the other and return the sheets. It took one minute exactly to answer his questions and there were several.

SMZS of Sweden is working every morning at 0600 G.M.T. on 84 meters.

Bill Schudt, Jr., 2CHY, has been made the Technical Editor of the New York "Telegram-Mail". Our congratulations, OM.

How Times Have Changed!
Ham: "I don't get much DX."
Another Ham: "Maybe your wave ain't short enough."

An Ohm saved is a loss earned.