How to Add One Step of Radio and One Step of Audio Frequency to the Reinartz Tuner

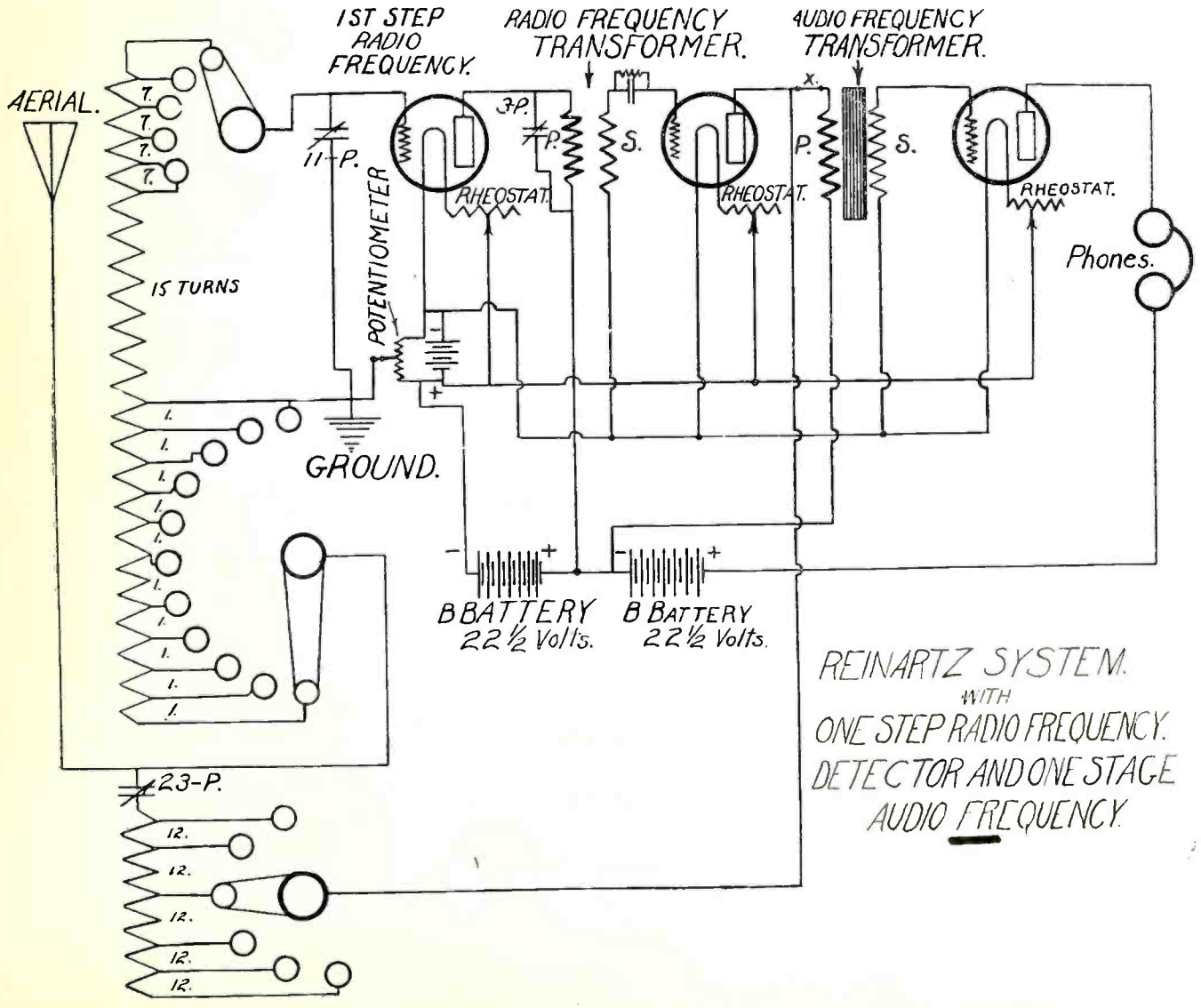
By F. D. PEARNE

WHILE wonderful results have been reported by the makers of the Reinartz set described in the September issue of this magazine and republished in this number, some of which showed reception from distances of 2,500 miles, still there are some of our readers who are anxious to see what this instrument will do with one or two stages of radio frequency added to it. Many amateurs seem to have an idea that radio frequency will add to the volume of the signals received, but this is an error, as I will show by a brief explanation.

Most all of our readers know that "radio frequency" is that in which the oscillations are too rapid to be heard by the human ear (usually calculated at 10,000 per second or more), while those frequencies which are audible (below 10,000 per second) are spoken of as audio frequencies.

The function of the detector tube is to rectify the radio frequency oscillations and bring them down to audio frequency. As the vacuum tube is also capable of magnifying the signals to some considerable extent, the detector may be termed both a rectifier and a relay.

Now let us consider a case in which one step of radio frequency amplification has been prefixed to the detector tube. An amplifier, or "hard" tube is used for this purpose. As all signals which are received upon the aerial come in at radio frequency and as they first enter the amplifying tube (the nature of which is to amplify, rather than to rectify) the signals are greatly amplified, or increased at



radio frequency. They are then carried to the detector tube, where they are rectified and brought down to audio frequency. From this it will be seen that radio frequency amplification will really magnify oscillations received upon the aerial and pass them to the detector tube for rectification.

This makes it possible to hear signals which otherwise would be too weak for detection in the detector tube. In other words, the radio frequency amplification will bring in weak signals from a great distance and strengthen them to such an extent that they can be heard after passing through the detector tube. Consequently it has been said that for long distance reception, use radio frequency amplification. After the signals have been rectified and brought down to audio frequency, they may then be amplified at this lower frequency to the desired volume, by means of audio frequency amplification. Here again the "hard," or amplifying tube is used, as the function of this part of the apparatus is to amplify only and as this amplification takes place at audio frequency, it is possible to listen in on one or two steps as desired. It would do no good, however, to listen in on the different steps of radio frequency, as at these points the oscillations have not yet been rectified and nothing would be heard. If properly designed and constructed, radio frequency amplification circuits will bring in signals from great distances.

The construction of the inductance, switches, etc., used in the Reinartz tuner is described in detail in this number, so only a brief description of that part of it will be given here and more detail will be used in describing the addition of the radio frequency amplification. The Reinartz tuner is due to the work of Mr. John L. Reinartz, of South Manchester, Conn., and consists of a spider-web winding, wound upon a slotted fiber, or bakelite disc, 1-16 of an inch thick and 6 1-2 inches in diameter. Eleven slots 1-8 of an inch wide and two inches deep are cut into it to accommodate the wires. The coils are best wound with No. 26 single silk insulated wire. The winding consists of two coils. The first, or inside coil has sixty turns, with taps taken off every 12 or 15 turns as desired. This coil is connected to the aerial through a 23-plate variable condenser, as shown in the drawing. The second coil contains fifty-three turns tapped and connected as shown. The inner coil of sixty turns is first wound in and out of the slots and the second coil is wound on the outside of it. These two coils are the only inductances used, thereby doing away with the expensive variometers and vario-coupler used in other types of regenerative sets. The adjusting is done by means of switches, the points of which are connected to the various taps shown.

The previous description of this set showed the tuner alone, with one step, and with two steps of audio frequency amplification, and to those readers who are familiar with the set, the arrangement of one step of radio frequency amplification will be seen at a glance. The additional apparatus used in this circuit consists of a potentiometer having a resistance of 400 ohms, a socket and amplifier tube, one additional "B" battery, a radio frequency transformer having a wave band limit of from 200 to 500 meters, and a rheostat.

These parts are the only additional material necessary to give a great increase in the receiving range. The revolving part of the eleven plate condenser must be connected to the ground, and the revolving part of the twenty-three plate condenser must be connected to the aerial. If particular care is not taken to see that these connections are made in this way, no results will be obtained. It has also been found that in case it is necessary to burn the filament of the detector tube at a very high temperature in order to get results when audio frequency amplification has been added, that an extra inductance consisting of a few turns of No. 26 wire connected in the circuit at the point marked "X" on the drawing, between the plate of the detector tube and the primary of the audio frequency transformer will make it possible to burn the filament at a much lower temperature.

This is not always necessary, but when it is needed, the builder should experiment and find out just how many turns are necessary for his particular set. In some cases, six turns will suffice and in others, more turns are needed. This inductance is usually wound on a miniature form similar to that used for the large coils. One "B" battery supplies the radio frequency and the detector tubes and the other takes care of the audio frequency tubes. The second set of "B" batteries can be omitted if desired, but it will be found that the set works better with a high voltage on the plate circuit of the audio frequency amplifier tube. In fact it is a good idea to use forty-five volts on the radio frequency tube, but if this is done it should be a separate battery with the negative terminal connected to the positive terminal of the "A" battery and the positive terminal connected to the plate side of the radio frequency transformer, which is shown in the drawing connected to the positive terminal of the first "B" battery.

The positive terminal of the first "B" battery is left connected as shown. A loud speaker may be substituted for the head phones to give greater amplification to the signals if so desired. The adjusting is done on the three switches and the two variable condensers as shown in the drawing. Any standard make of audio frequency transformer may be used, but in making the selection be sure that the transforming ratio is 10 to 1 for the first step and if another step is added, use a 3 to 1 ratio. Also in purchasing a radio frequency transformer, be sure that it is wound for the wave band which will cover the limit which you want to receive. The large inductance is usually mounted some distance away from the panel on which the switches and condensers are mounted, as this arrangement will give ample room for making the connections to the switch contacts and will also prevent interference caused by body capacity while adjusting the set. Another way to mount the coil is to use a sliding base to which the panel is attached, which will move in and out of the box when the panel is drawn out. The coil is then mounted horizontally on the base and the wires brought up to the switches for connection. It will take some little time and experiment for the operator to become acquainted with the adjustment of this set, as a difference of one point on either of the small switches will cut a station in or out, but after a little practice excellent results will be obtained.

Assistant Inspector

Lawrence E. Dutton, 1340 North Homan Avenue, Chicago, has been appointed an assistant to Radio Inspector E. A. Beane, of the Ninth radio inspection district. Mr. Dutton has commenced his work in the Federal building.