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RADIO RECEPTION

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Fig. 1.

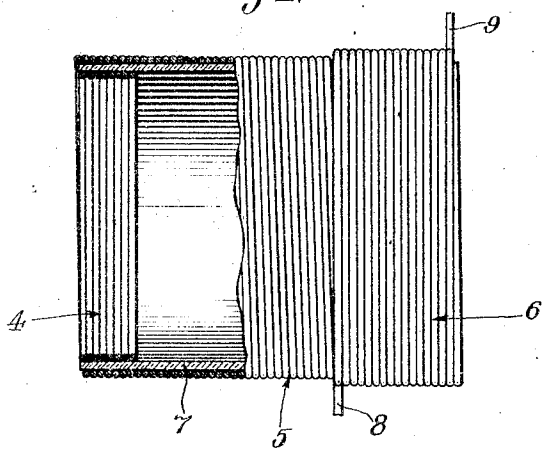
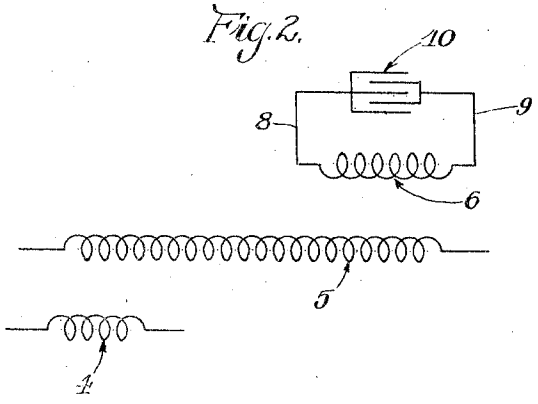


Fig. 2.



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RADIORECEPTION.

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The present invention has to do with improvements in radio reception. It has to do especially with improvements in the reception of very high frequency radio waves such as are used for transmission of signal and speech.

More especially the features of the present invention are applicable to the reception of radio transmitted sound and I will particularly describe this application of the invention. In so doing, however, I do not intend to limit myself to any particular application of the invention, except as I may do so in the claims.

The invention has reference particularly to improvements in radio frequency transformers used in the receiving circuit. The main object of the invention is to provide a radio frequency transformer of such construction and arrangement that it will operate in a greatly improved manner over a wide range of operating conditions encountered in actual service. These operating conditions include a wide variation in the frequency and wave length of the radio frequency current which is to be tuned, and also a wide variation in the "load" on the radio frequency transformer occasioned by variable loading of the vacuum tubes.

When using previous forms of radio frequency transformers there is generally produced an annoying screech or howl when the tuning condensers are adjusted to certain capacity values; or a different but equally annoying noise in the loud speaker when the filament current in the vacuum tube used for radio frequency amplification is increased above a certain definite value.

Various theories have been advanced as to the exact reason for these objectionable effects, but without the need of considering the same in detail, it may be stated here that by using radio frequency transformers embodying the features of the present invention I have been able to largely and often fully overcome the aforesaid objectionable effects in many cases where they previously existed, and over ranges of wave length and radio frequency and "load" far in excess of the commercial demands of the circuit.

I have discovered that the above mentioned objectionable effects, as well as others, may be overcome or eliminated by providing the radio frequency transformer itself with an additional or third coil of proper size and properly related to the primary and secondary coils and properly arranged, the presence of which third coil has been actually and repeatedly demonstrated in practice to fully overcome the above mentioned objectionable features and provide a greatly improved operation in all conditions.

Radio frequency transformers provided with this improved feature may be used in a large number of different arrangements of circuit and "hook ups" and in systems of simple arrangement as well as those which are more complicated and elaborate.

In actual practice I have discovered that by building the radio frequency transformer with both its primary and secondary coils wound in the same direction, and then by placing a third winding in juxtaposition to the aforesaid windings, said third winding being preferably wound in the opposite direction as compared to the primary and secondary, and the terminals of said third winding being left open circuited, very remarkable improvement in operation of the receiving circuit is produced provided the coils of the transformers are properly related to each other. In this connection, I have obtained very satisfactory results if the secondary coil is composed of a single helix of closely wound wire placed on the outside of a thin shell, such as a bakelite tube, and the primary consists of a smaller number of turns of wire closely wound into a single helix and placed within one end of the tube on which the secondary is placed, both primary and secondary being wound in the same direction, the third coil preferably consisting of a single helix of wire having its turns closely wound in the opposite direction, the number of turns of the third coil being intermediate in number between those of the primary and secondary, and the third coil being placed immediately outside of the secondary coil and at the opposite end thereof from the position of the primary.

In a given instance seventy-five turns of No. 24 double cotton covered copper wire were wound on the outside of a bakelite tube 2⅜ inches outside diameter and 2¼ inches inside diameter and 3 inches long. This winding constituted the secondary of the transformer. Eleven turns of No. 24 double cotton covered copper wire were wound on a mandril of such diameter that the finished coil would just enter the bake-

lite tube, said coil being then placed immediately under one end of the secondary winding and within the tube. This winding constituted the primary of the transformer. Both the primary and secondary windings were wound in a clockwise direction.

A third winding was then placed immediately on top of the secondary winding, said third winding comprising a coil of No. 24 double cotton covered copper wire wound in a counter clockwise direction and with its terminals left open or in some cases connected to a small fixed condenser which formed no part of the normal receiving circuit. In the instance mentioned there were provided approximately twenty-five turns on this third winding.

It was found that this transformer can be used in many forms of circuit, including the so-called tuned radio frequency. It was found that when the primary winding has one end connected to the plate of a vacuum tube and the other end to the plus terminal of a B battery, and when the secondary is connected in multiple with a variable condenser, the tendency to produce an annoying screech or howl when the tuning condenser is adjusted to certain capacity values is eliminated and also that the tendency to produce an annoying noise in the loud speaker when the filament current of the vacuum tube is increased above a certain definite value, is eliminated.

The above example of a certain specific embodiment of the present invention is given merely by way of illustration and not with any intention to limit the invention to the sizes of coils or numbers of turns of the various windings. In this connection, I may state that experience has demonstrated that in a six tube tuned radio frequency outfit of definite characteristics, very satisfactory results are obtained when there are provided approximately twenty turns in the third winding of the antenna coil, twenty-five turns on the third winding of the first radio frequency transformer and twenty-five turns on the third winding of the second radio frequency transformer. This illustrates the fact that the number of turns on the third winding is variable within certain limits, and that in some cases the best results are obtained by using coils of different numbers of turns at different points in the circuit.

Referring now to the drawings—

Figure 1 illustrates a side view of a transformer embodying the features of the present invention, a portion of the transformer being shown in longitudinal section so as to better illustrate the position of the primary winding; and

Fig. 2 shows diagrammatically the relative positions of the windings of the transformer of Fig. 1. In Fig. 2 there is also illustrated a small condenser of fixed capacity across the terminals of the third winding, but in many cases no such condenser will be provided, the terminals of the third winding being left entirely open circuited.

Referring to the drawing, the transformer therein illustrated includes the primary winding 4, the secondary 5 and the third open circuit winding 6. The secondary winding 5 is preferably placed on the outside of a thin cylinder 7 preferably of insulating material of low capacity such as bakelite. The primary winding 4 is preferably placed inside of the shell 7 and beneath one end of the secondary winding 5, as illustrated. In the illustrated construction, the ratio between numbers of turns of secondary and primary is approximately 6½ to 1. The turns of both primary and secondary are wound in the same direction.

The third winding 6 is preferably placed immediately outside of the secondary winding 5 and at the opposite end from the position of the primary winding 4. This third winding is preferably of greater number of turns than the primary, preferably having approximately twice as many turns as the primary. Furthermore, it is wound in the opposite direction of both primary and secondary.

Ordinarily the terminals 8 and 9 of this third winding will be left entirely free and unconnected either to each other or to any other electric element. This is the arrangement illustrated in Fig. 1. In Fig. 2 I have shown diagrammatically a fixed condenser 10 of very small capacity connected across the terminals 8 and 9, but in many cases this condenser will not be used.

I am not prepared to state with definiteness the exact reason for the improved operation which is established by the presence of this third coil. It is believed, however, that the objectionable noises and operation heretofore encountered under certain capacity conditions and certain loading conditions of the tube filament have been due to the interference occasioned by the electrostatic field on the coils of the transformers; and that the presence of the third winding sets up a reversed electro-static field on the secondary winding of the transformer, which when powerful enough neutralizes the entire electro-static field of the coil with consequent improvement in operation. This belief is also borne out by the fact that in the example mentioned in the early portion of this specification it was found that when the third coil is provided with approximately as many turns as the secondary, the capacity of the variable condensers could no longer be reduced sufficiently to tune broadcasting stations ordinarily requiring a maximum of capacity. Upon removing those turns of the third coil immediately over the

position of the primary it became possible to receive broadcasting from stations ordinarily requiring considerable capacity in the variable condensers, but the volume of sound produced in the loud speaker was much less than usual. It was, however, impossible to produce the undesirable noises either by adjusting the variable condensers or by increasing the filament current in the tubes. It was found that upon further decreasing the number of turns of the third winding broadcasting stations were received with increased volume and with the condensers set more closely to their normal positions. When the number of turns of the third winding was reduced to approximately twenty-five the condenser settings for broadcasting reception were almost normal, and it was impossible to produce undesirable noise in the loud speaker and the tone quality and volume were entirely satisfactory.

Upon reducing the number of turns of the third coil below twenty-five it was possible to produce the objectionable noises when special attention was given to this feature, and upon reducing the number of turns to sixteen the receiving set could be made to howl with very little effort.

When the third winding was placed over the primary there was a very notable improvement as compared to any arrangement in which no third winding was present, but the results were not so satisfactory as when the third winding was placed at the other end of the secondary coil.

When the third winding was wound in the same direction as the primary and secondary windings, it lost all of its desirable properties. I have also discovered that the body capacity of the receiving outfit is greatly decreased when the transformers are equipped with suitable third windings. Preferably also the number of turns of third winding on each of the radio frequency transformers should be adjusted individually to the best conditions.

I wish also to point out the fact that transformers embodying the features of the present invention may also find useful application in other types of electrical apparatus than in circuits for the reception of radio transmission.

While I have herein shown and described only a single embodiment of the features of my present invention, still I do not intend to limit myself to the same, except as I may do so in the claims.

I claim:—

1. As a new article of manufacture, a radio frequency transformer comprising a relatively thin cylindrical shell of insulating material of low dielectric, a primary winding consisting of a relatively small number of turns of wire closely wound as a single helix and located directly within said shell at one end thereof, a secondary winding consisting of a larger number of turns of wire closely wound as a single helix and located directly on the outside of the shell with one of its ends overlying the position of the primary winding, and a third winding consisting of an intermediate number of turns of wire closely wound in the reverse direction as a single helix and located directly over the second winding at the opposite end from said primary winding, both primary and secondary windings being wound in the same direction, and a condenser of very small capacity connected between the ends of the third winding, substantially as described.

2. As a new article of manufacture, a radio frequency transformer comprising a relatively thin cylindrical shell of insulating material of low dielectric, a primary winding consisting of a relatively small number of turns of wire closely wound as a single helix and located directly within said shell at one end thereof, a secondary winding consisting of a larger number of turns of wire closely wound as a single helix and located directly on the outside of the shell with one of its ends overlying the position of the primary winding, and a third winding consisting of an intermediate number of turns of wire closely wound in the reverse direction as a single helix and located directly over the secondary winding at the opposite end from said primary winding, both primary and secondary windings being wound in the same direction, substantially as described.

3. As a new article of manufacture, a radio frequency transformer comprising a relatively thin cylindrical shell of insulating material of low dielectric, a primary winding consisting of a relatively small number of turns of wire closely wound as a single helix and located directly within said shell, a secondary winding consisting of a larger number of turns of wire closely wound as a single helix and located directly on the outside of the shell overlying the position of the primary winding, and a third winding consisting of an intermediate number of turns of wire closely wound in the reverse direction as a single helix and located directly over the secondary winding, both primary and secondary windings being wound in the same direction, substantially as described.

4. As a new article of manufacture, a radio frequency transformer comprising a relatively thin cylindrical shell of insulating material of low dielectric, a primary winding consisting of a relatively small number of turns of wire located directly within said shell, a secondary winding consisting of a larger number of turns of wire located directly on the outside of the shell overlying the position of the primary winding, and a third winding consisting of an intermediate number of turns of wire wound in the re-

verse direction as a single helix and located directly over the secondary winding, both primary and secondary windings being wound in the same direction, substantially as described.

5. As a new article of manufacture, a radio frequency transformer comprising a primary winding consisting of a relatively small number of turns of wire closely wound as a single helix, a secondary winding consisting of a larger number of turns of wire closely wound as a single helix and overlying the position of the primary winding, and a third winding consisting of an intermediate number of turns of wire closely wound in the reverse direction as a single helix and located directly over the secondary winding at the opposite end from said primary winding, both primary and secondary windings being wound in the same direction, substantially as described.

6. As a new article of manufacture, a radio frequency transformer comprising a primary winding consisting of a relatively small number of turns of wire, a secondary winding consisting of a larger number of turns of wire overlying the position of the primary winding, and a third winding consisting of an intermediate number of turns of wire wound in the reverse direction and located directly over the secondary winding, both primary and secondary windings being wound in the same direction, substantially as described.

7. As a new article of manufacture, a radio frequency transformer comprising a primary winding consisting of a relatively small number of turns of wire, a secondary winding consisting of a larger number of turns of wire overlying the position of the primary winding, and a third winding consisting of an intermediate number of turns of wire wound in the reverse direction and located directly over the secondary winding, both primary and secondary windings being wound in the same direction, substantially as described.

8. A radio frequency transformer in which is combined primary and secondary windings disposed in the same direction, the latter overlying at least a portion of the former, and a third winding in the reverse direction overlying at least a portion of the secondary winding, substantially as described.

9. A radio frequency transformer in which is combined a primary winding in inductive relation to one end of a secondary winding the turns of which are in the same direction as those on the primary winding, and a third winding whose turns are disposed reversely to the other two disposed in overlying relation to the opposite end of the secondary winding, substantially as described.

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