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H. C. COLBURN

1,658,970

RADIO FREQUENCY TRANSFORMER

Filed Jan. 5, 1926

FIG. 1.

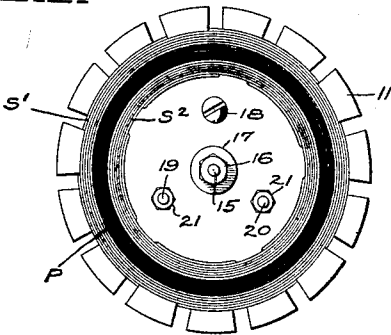
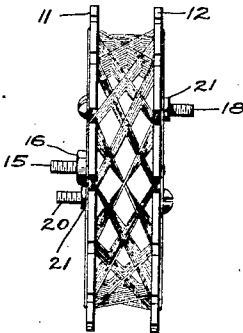


FIG. 2.

FIG. 3.

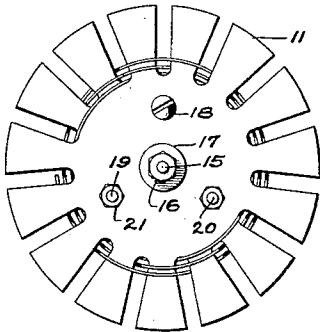
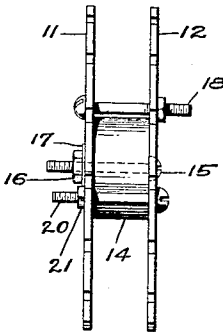


FIG. 4.

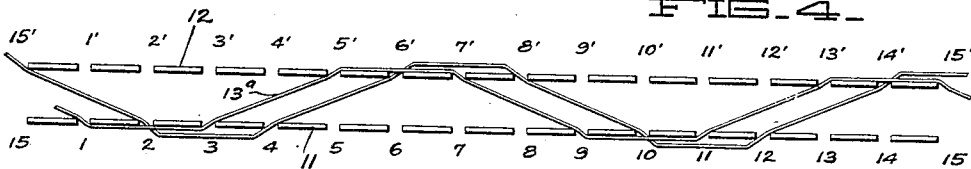


FIG. 5.

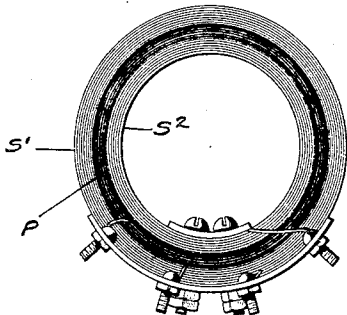


FIG. 6.

INVENTOR
HERBERT C. COLBURN
BY *White & Post*
ATTORNEYS

UNITED STATES PATENT OFFICE.

HERBERT C. COLBURN, OF SAN LEANDRO, CALIFORNIA.

RADIOFREQUENCY TRANSFORMER.

Application filed January 5, 1926. Serial No. 73,235.

This invention relates generally to a radio frequency transformer especially adapted for the purpose of coupling together the stages of an electron relay system.

5 It is an object of this invention to devise a radio frequency transformer which may be tuned by means of a variable condenser, and which when used with an amplifying system for coupling together the different
10 electron relay stages, will cause the system to faithfully repeat signal energy without distortion or without causing local oscillations.

15 It is a further object of this invention to devise a radio frequency transformer in which high frequency losses will be reduced to a minimum.

The invention possesses other advantageous features, some of which with the foregoing will be set forth at length in the following description where I shall outline in full those forms which I have selected for illustration in the drawings accompanying and forming part of the present specification. In the drawings I have shown several forms of my invention, but it is to be understood that I do not desire to be limited thereto, since the invention as expressed in the claims may be embodied in a plurality of
20 other forms.

Referring to the drawings:

Figure 1 is a front elevation of a transformer embodying my invention.

Figure 2 is a side view of Fig. 1.

35 Figure 3 is an elevation of a form for winding a preferred type of transformer embodying my invention, only a fraction of the winding being shown thereon.

Figure 4 is a side view of the form shown
40 in Fig. 3.

Figure 5 is a diagrammatic development of the preferred form of winding; and

Figure 6 is a perspective view of a transformer embodying my invention in which
45 the form is omitted.

The coils of my invention are preferably formed by winding a conductor on a pair of slotted spiders 11 and 12 which are axially displaced from each other by a small amount. These spiders are made from insulation material, such as fibre or the like. The winding is such that the conductor alternately passes from one spider to another while at the same time it progresses angularly about the axis of the spiders. By properly choosing the amount of the angular progressions

of the conductor as it passes along the face of the spiders and from one spider to the other, it is possible to produce a winding in which the successive turns are juxtaposed for only a very short distance. This is due to the fact that they progress in a criss-cross fashion between the axially displaced spiders, the turns crossing each other as in a honey-comb at a few points, and at other points only a small portion of the successive turns parallel each other closely. There is thus ensured that the winding will have little distributed capacity; furthermore, due to the use of the pair of winding spiders 11 and 12, the operation of winding is rendered simple and quick.

The manner of winding is best described by the aid of the diagram, Fig. 5. In this diagram, the radial slots in spider 11 are numbered consecutively from 1 to 15, and the corresponding slots in spider 12 are numbered 1' to 15'. Starting at slot 1, the conductor 13 enters slot 3, the angular distance between slots 1 and 3 being spanned on the outer side of spider 11. Thence conductor 13 crosses the space between the spiders, and enters slot 5', the angular distance traversed by the conductor 13 in so doing being equal in this instance to the angular distance traversed by going from slot 1 to 3. From slot 5' the conductor proceeds along the outer side of spider 12 to slot 7', the angular advance being the same as before. Thence conductor 13 crosses back to spider 11, and enters slot 9. From this point on, the winding procedure is repeated, and may be described merely by the numbers of the slots in which the conductor passes. Thus the succeeding steps may be designated by the slot numbers 11—13'—15'—2—4—6'—8'—etc.

It is to be particularly noted that a complete turn of the conductor ends up between slots 15' and 2, and that the succeeding turn, starting there, is angularly displaced by one slot with respect to the first turn. Furthermore, the succeeding turn is adjacent the first turn for comparatively short angular distances, represented by the distance between slots 2 and 3, for example. This result is due to the fact that step-by-step angular advances of the conductor 13 in passing from one spider to the other are not even divisions of a complete circle, whereby at the end of a turn the conductor is passing between different slots than at the be-

ginning of the turn. This result is secured in the present instance by having an odd number of slots, and by making the step-by-step advance of the conductor 13 equal to the space between an even number of slots: in this instance two. The winding arrangement can obviously be varied considerably from that shown. For example, the step-by-step angular advance of the conductor 13 could be made non-uniform, and the number of slots in the spiders can be varied as desired. The important point is however that successive turns do not occupy similar positions as regards the slots. When that condition is fulfilled, the conductor will gradually build up as successive turns are placed on the spiders to form a criss-cross arrangement between the spiders as shown in Fig. 2.

As best shown in Fig. 1, my invention comprises three separate and distinct coils S^1 , S^2 and P, preferably wound in the manner above indicated, the coils S^1 and S^2 being connected in series and constituting the secondary of the transformer, and the coil P the primary. It will be observed that the primary coil P is positioned between the two secondary coils S^1 and S^2 and that all three coils are radially superimposed upon each other. In the preferred form of my invention, the primary coil P is wound in a direction opposite to the secondary coils S^1 and S^2 . If desired, the spiders 11 and 12 may be used only as a temporary support for the coils, and after winding they may be cut out or otherwise removed, such as is shown in Fig. 6.

In Figs. 1 to 4 however, I show a construction designed for permanent utilization of the spiders 11 and 12. For this purpose a tubular spacer 14 of insulating material is fastened between the spiders 11 and 12, as by the aid of a screw 15 and a nut 16. Washers 17 may also be provided externally of the spiders. This screw is made long enough to serve as a terminal post for one terminal of a conductor wound on the spider. Other terminals are formed by three other screws 18, 19 and 20 and the nuts 21. These screws of course are located radially inside of the smallest diameter turn of the coil. The coils S^1 and S^2 are connected in series, and the free end of coil S^1 may be connected to the screw 18 while the free end of coil S^2 may be connected to the screw 15. One

end of the coil P may be connected to screw 19 while its opposite end may be connected to screw 20, in a manner readily understood.

As illustrated in Fig. 5, the straight portions of the successive turns of conductor overlap each other; for example, as between slots 2 and 3, as well as between slots 6' and 7'. This successive overlapping is a feature of my winding, as well as the crossing over between the two spiders.

It has been determined by experiment that one of the most important features of this invention is the winding of the primary coil in the opposite direction from the secondary. If the primary is wound in the same direction, a radio receiver incorporating such a transformer for coupling together the electron relays in cascade, will oscillate locally even though the connections to the primary coil are reversed. However if the primary is wound in the opposite direction the receiver seems to be stabilized and will not oscillate locally, this condition being independent of the manner in which connections are made to the primary. The exact reason for this effect is not clearly understood but is probably due to the manner in which the capacitance between the primary and secondary coils is distributed, when the primary coil is wound in the opposite direction.

I claim:

1. A radio frequency transformer comprising a bank wound secondary coil, the loops of said coil being latticed across the width of the coil and having circumferential portions joining the latticed portions, and a primary coil wound adjacent one peripheral face of the secondary coil, said primary coil being likewise latticed and wound in a direction opposite to that of the secondary coil.

2. A radio frequency transformer comprising a bank wound secondary wound in two concentric sections, the loops of the wire being latticed across the width of the coil to form a cellular structure and having circumferential portions joining the latticed portions, and a primary coil wound similarly to the secondary coil but in the opposite direction, said primary coil being interposed between the two sections of the secondary coil.

In testimony whereof, I have hereunto set my hand.

HERBERT C. COLBURN.