H. L. IDE.

ELECTRICAL TRANSFORMER.

APPLICATION FILED OCT. 6, 1920.

1,394,555. Patented Oct. 25, 1921.

Fig. 1.

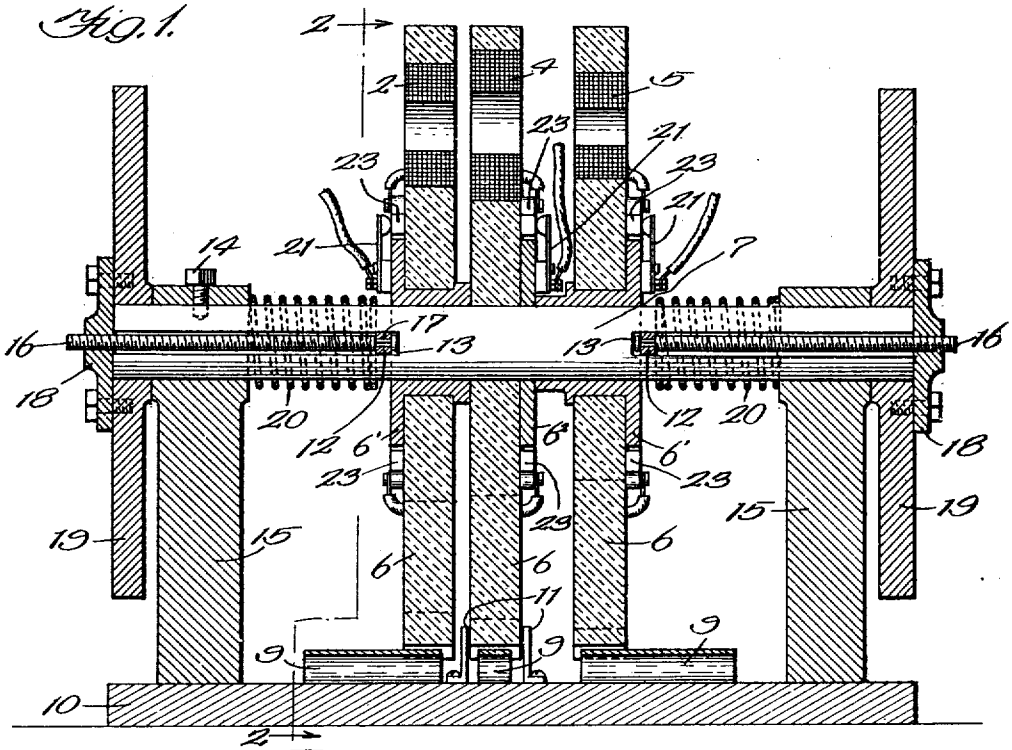


Fig. 2.

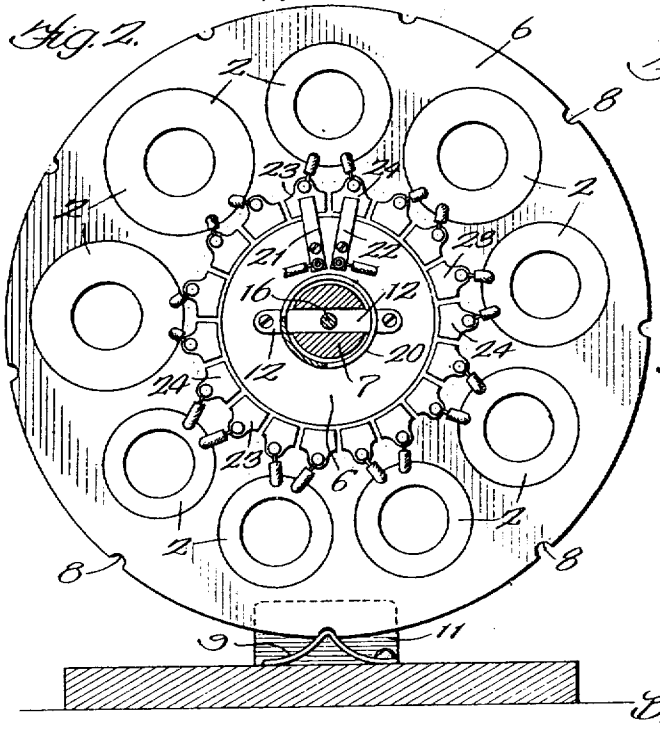
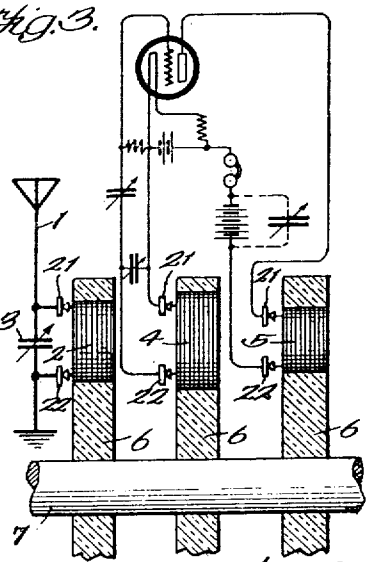


Fig. 3.



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UNITED STATES PATENT OFFICE.

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ELECTRICAL TRANSFORMER.

1,394,555. Specification of Letters Patent. Patented Oct. 25, 1921.

Application filed October 6, 1920. Serial No. 415,033.

To all whom it may concern:

Be it known that I, HARRY L. IDE, citizen of the United States, residing at Springfield, in the county of Sangamon and State of Illinois, have invented a certain new and useful Improvement in Electrical Transformers, of which the following is a full, clear, concise, and exact description.

My invention relates to electrical transformers and employs two relatively movable members, one including a plurality of coils of differing numbers of turns and the other including a coil adapted to be brought into and out of its full inductive relation with any coil of the first member by relative movement between the members.

In the preferred embodiment of the invention each of the members of the transformer is rotatable and includes a plurality of coils of differing numbers of turns arranged in a circular row whose axis is substantially coincident with the axis of relative rotation of said members, each coil of one member being adapted to be brought into and out of its full inductive relation with any coil of the other member by relatively moving said members. A switch is desirably coupled with each member and connected to be operated by such member to include in circuit only the coil of such member that is placed to be in its full inductive relation with a selected coil of the other member.

In the transformer of my invention the ratio of transformation between the primary and secondary coils may readily be adjusted without rewinding either of the coils.

The transformer of my invention is of particular service when employed in wireless systems of communication and especially in the receiving equipment of such systems although the invention is not to be limited to any particular use to which it may be put. When employed in the receiving station of the wireless telegraph or telephone system, the transformer may be employed to tune the primary aerial circuit and may be also employed to adjust the inductive relative between the so-called tickler circuit and the secondary circuit of the receiving equipment if such equipment should employ a tickler circuit. When a transformer includes rotatable members each having a circular row of coils of differing numbers of turns a very wide adjustment of the ratios of transformation is possible of the inductively related circuits.

I will explain my invention more fully by reference to the accompanying drawing showing an adaptation thereof to a wireless receiving station equipment. In the drawing Figure 1 is a longitudinal sectional view of one embodiment of the transformer of my invention; Fig. 2 is a sectional view on line 2—2 of Fig. 1; and Fig. 3 is a diagram illustrating one wireless telegraph receiving station circuit arrangement.

Like parts are indicated by similar characters of reference throughout the different figures.

The aerial 1 is grounded through a primary coil 2 which is shunted by a variable condenser 3. A secondary coil 4, in conjunction with the primary coil 2, forms a tuning transformer. The transformer coil 5 is in secondary relation to the coil 4, the whole arrangement illustrated in Fig. 3 being what is termed a three honey comb coil arrangement used as an inductively coupled tuner with an inductive regenerator coupling as set forth in the text book by Elmer E. Bucher entitled "*The Wireless Experimenter's Manual*" copyrighted in 1920.

In the device of my invention, as the invention is preferably practised, there are a number of coils 2, of differing numbers of turns, that are interchangeable in the aerial circuit, and there are also a number of tuning secondary coils 4, of differing numbers of turns, that are interchangeable in the secondary or tuning circuit. If a tickler circuit is employed there may be a number of coils 5, of differing numbers of turns, that are interchangeable in the tickler circuit.

The members of the transformer respectively having the coils 2, 4 and 5 desirably include disks of wood or other insulating material 6 which are co-axial and rotatively mounted upon and with respect to a shaft 7 that passes through and is co-axial with these disks. Each disk is provided with a circular row of openings that is co-axial with the shaft and therefore with the axis of rotation of the transformer members. these openings receiving the coils which are positioned to have their axes substantially parallel with the common axis of rotation of the transformer members. There is thus provided upon each transformer member a circular row of coils of differing numbers of turns, such circular row being substantially co-axial with the common axis of rotation of the transformer members. While the

coils of each transformer member are desirably substantially evenly distributed about the common axis of rotation of the members, I do not wish to be limited to the extent of each circular row of coils as it is obvious that the row of coils upon each member of the transformer may extend throughout only an arc of a circle as well as throughout a complete circle and the expression "circular row" is used herein in this broader aspect.

Each of the disks 6 is provided with notches 8 in its periphery to receive the holding spring 9 mounted upon the base 10 of the equipment. When embodied as illustrated and described, the middle disk 6 that carries the tuning secondary coils 4 is limited to a single plane of rotation by means of the guides 11 between which the disk 6 carrying these secondary coils is disposed. The end disks 6 which respectively carry the aerial primary coils 2 and the tickler coils 5 are also movable along the shaft 7 whereby the inductive relation between the coils 2 and 4 and also the inductive relation between the coils 4 and 5 may be adjusted by the longitudinal movement of the outer carriers 6. In order that each of the outer carriers or disks 6 may be longitudinally movable and yet may be held in any position of rotary adjustment, the outer holding springs 9 are elongated to be co-extensive with the range of longitudinal movement of the end disks 6. The mechanism that is preferably employed for effecting the longitudinal movement of each end disk includes a bar 12 screwed to the outer face of each end collar 6′ and passing through a slot 13 formed in each outer end of the shaft 7, this shaft being held from rotation by means of a set screw 14 passing into engagement with the shaft through one of the shaft supporting uprights 15. Each of the threaded rods 16 has a square end portion 17 passing through the correspondingly shaped hole in the corresponding bar 12 whereby each rod 16 is held from rotation. The collars 6′ are flanged at their inner and outer ends to form annular recesses in which the end disks 6 are received, these end disks being rotatable upon the collars which themselves are prevented from rotation by the construction just previously described. The rods 16 are in threaded connection with the end plates 18 that are screwed upon the hand wheels 19. The coiled springs 20 surround the outer portions of the shaft 7. The inner ends of these coiled springs press against the bars 12 and their outer ends press against the uprights 15 whereby the hand wheels 19 are confined to single planes of rotation to which they are subject whenever the end disk 6 and the transformer windings upon these disks are to be moved in or out, such in and out movement of these end disks resulting because of the anchorage of the inner ends of the rods 16 to the bars 12 and the threaded connection of these rods with the end plates 18.

In the preferred embodiment of the invention a switch is coupled with the disk 6 of each transformer member, such switch being connected in a manner to cause only one coil to be included in the transformer circuit corresponding to the transformer member having such coil. Each switch includes a pair of wipers 21 and 22 mounted upon the non-rotatable collar 6′ in the case of the outer transformer members and upon the non-rotatable collar 6^2 in the case of the intermediate transformer member. The outer ends of these wipers 21, 22 are in the circle of the corresponding circular row of contacts 23, 24. Each coil of each transformer member has a pair of such contacts which is brought into the corresponding transformer circuit when engaging the outer ends of the brushes 21, 22 that constitute switching terminals of such circuit.

While I prefer to provide each member of the transformer with a plurality of coils each adapted to replace another in its transformer relation, I do not wish to be limited to this arrangement as it is obvious that one member of the transformer may have only one coil adapted to be brought into transformer relation with any of the coils of another member. I prefer, however, to provide each transformer member with a plurality of coils as the range of adjustment of the ratio of transformation is thereby so largely extended.

While I have herein shown and particularly described the preferred embodiment of my invention I do not wish to be limited to the precise details of construction shown as changes may readily be made without departing from the spirit of my invention, but having thus described my invention I claim as new and desire to secure by Letters Patent the following:—

1. An electrical transformer comprising two relatively movable members, one including a plurality of coils of differing numbers of turns and the other including a coil adapted to be brought into and out of its full inductive relation with any coil of the first member by relative movement between the members.

2. An electrical transformer comprising two relatively movable members, each including a plurality of coils of differing numbers of turns, each coil of one member being adapted to be brought into and out of its full inductive relation with any coil of the other member by relatively moving said members.

3. An electrical transformer comprising two relatively rotatable members, one including a plurality of coils of differing numbers of turns arranged in a circular row

whose axis is substantially coincident with the axis of relative rotation of said members and the other including a coil adjacent said row of coils and adapted to be brought into and out of its full inductive relation with any coil of the first member by relative movement between the members.

4. An electrical transformer comprising two relatively rotatable members, each including a plurality of coils of differing numbers of turns arranged in a circular row whose axis is substantially coincident with the axis of relative rotation of said members, each coil of one member being adapted to be brought into and out of its full inductive relation with any coil of the other member by relatively moving said members.

5. An electrical transformer comprising two relatively movable members, one including a plurality of coils of differing numbers of turns and the other including a coil adapted to be brought into and out of its full inductive relation with any coil of the first member by relative movement between the members; and a switch operated by the member that is moved and connected to establish the circuit of any coil of the first member when this coil is placed relatively to said coil of the second member to be in full inductive relation therewith, said switch then excluding the remaining coils of the first member from circuit.

6. An electrical transformer comprising two relatively rotatable members, one including a plurality of coils of differing numbers of turns arranged in a circular row whose axis is substantially coincident with the axis of relative rotation of said members and the other including a coil adjacent said row of coils and adapted to be brought into and out of its full inductive relation with any coil of the first member by relative movement between the members; and a switch operated by the member that is moved and connected to establish the circuit of any coil of the first member when this coil is placed relatively to said coil of the second member to be in full inductive relation therewith, said switch then excluding the remaining coils of the first member from circuit.

7. An electrical transformer comprising two movable members, each including a plurality of coils of differing numbers of turns, each coil of one member being adapted to be brought into and out of its full inductive relation with any coil of the other member by relatively moving said members; and a switch coupled with each member and connected to be operated by such member to include in circuit only the coil of such member that is placed to be in its full inductive relation with a selected coil of the other member.

8. An electrical transformer comprising two rotatable members, each including a plurality of coils of differing numbers of turns arranged in a circular row whose axis is substantially coincident with the axis of relative rotation of said members, each coil of one member being adapted to be brought into and out of its full inductive relation with any coil of the other member by relatively moving said members; and a switch coupled with each member and connected to be operated by such member to include in circuit only the coil of such member that is placed to be in its full inductive relation with a selected coil of the other member.

In witness whereof I hereunto subscribe my name this 4th day of October, A. D. 1920.

HARRY L. IDE.