June 26, 1934. H. L. TANNER 1,964,230

ALTERNATING CURRENT INDICATING OR TELEMETRIC SYSTEM

Original Filed Feb. 11, 1930

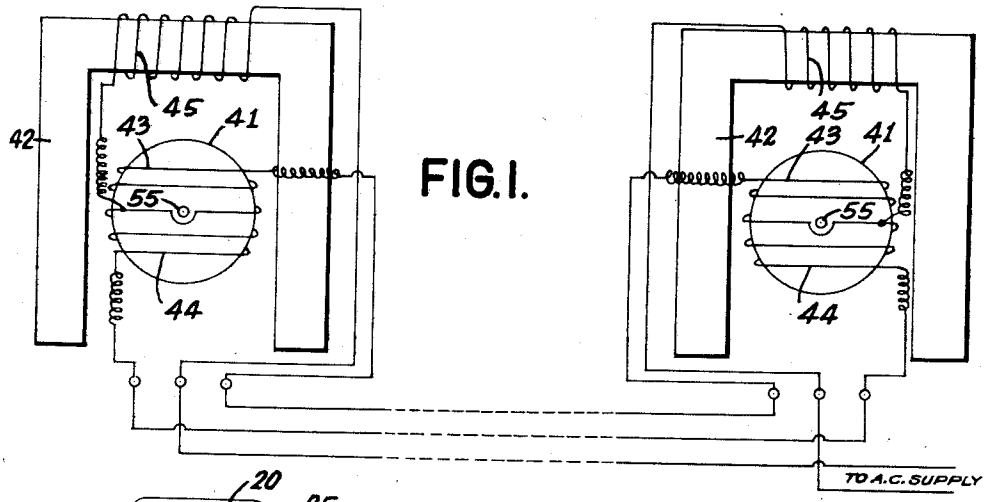


FIG.1.

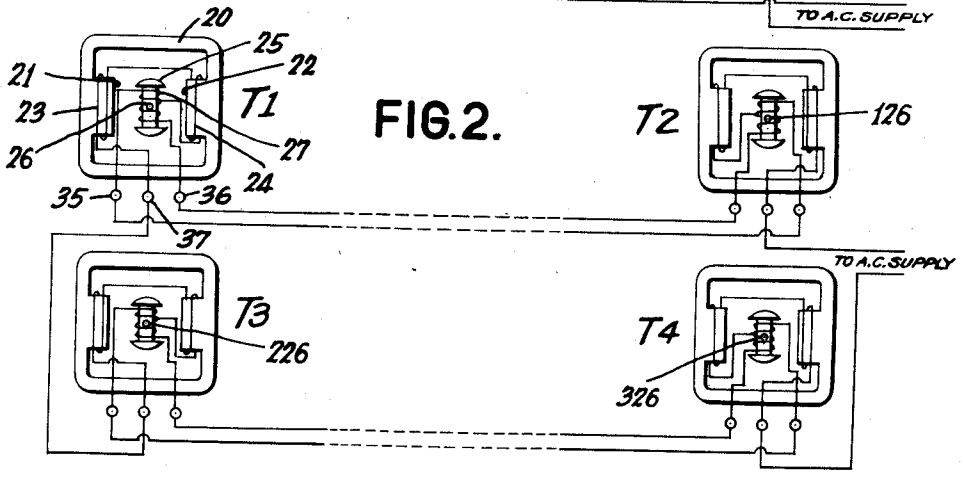


FIG.2.

FIG.2a.

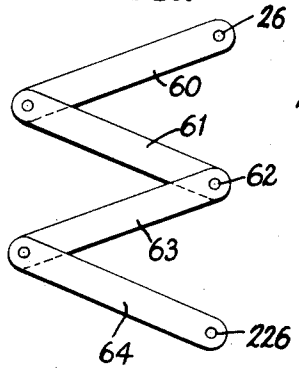


FIG.3.

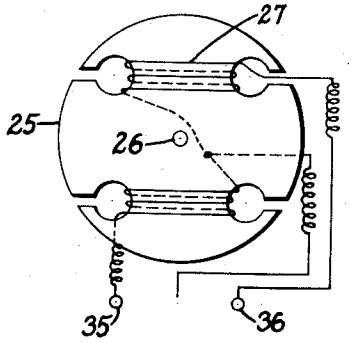
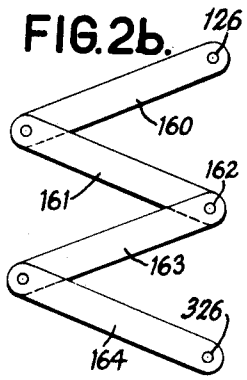


FIG.2b.



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UNITED STATES PATENT OFFICE

1,964,230

ALTERNATING CURRENT INDICATING OR TELEMETRIC SYSTEM

Harry L. Tanner, Brooklyn, N. Y.; The National City Bank of New York, executor of said Harry L. Tanner, deceased, assignor, by mesne assignments, to Wallace & Tiernan Products, Inc., Belleville, N. J., a corporation of New Jersey

Application February 11, 1930, Serial No. 427,475
Renewed March 26, 1934

7 Claims. (Cl. 172—239)

This invention relates to telemetric systems. More particularly, it relates to alternating current telemetric systems; i. e., systems of telemetry, or for producing remote indications of the movements of an object or objects.

The objects of the invention include the following: to provide systems of the class described which are comparatively simple and inexpensive in construction and installation, yet thoroughly reliable in operation. Other objects and advantages will be apparent as the invention is hereafter disclosed.

Referring to the drawing, which illustrates what I now consider preferred forms of the invention:

Fig. 1 is a diagrammatic view showing one form of system embodying features of my invention.

Fig. 2 is a diagrammatic view showing a more elaborate system of somewhat modified construction.

Figs. 2*a* and 2*b* are detail plan views showing certain structural details which may be employed in applying my invention to one of its many uses.

Fig. 3 is a fragmentary end view of a rotor and its connections that may be employed in my system.

The instrument shown at the left hand side of Fig. 1 (which duplicates in construction that shown at the right hand side of the same Fig. 1) is the same as that shown at the left hand side of the drawing of my copending application Serial No. 361,041, filed May 7, 1921, which is a division of my application Serial No. 104,662, filed April 26, 1926, now Patent No. 1,741,590, patented on December 31, 1929. Each of the four instruments shown in Fig. 2 of the present application duplicates in construction the instrument shown in Fig. 10 of my copending application Serial No. 356,636, filed on April 20, 1929.

I shall now proceed to describe the instrument shown at the left hand side of Fig. 1. While this instrument might assume the form of that shown in Fig. 1 of Patent No. 1,741,590, I prefer at present to use the form herein illustrated and which, as stated, was also disclosed in another and canceled figure of the application for Patent No. 1,741,590.

The instrument comprises a stationary stator 42 of ferrous or magnetizable material having a stator winding or coil 45, a rotor 41 also of ferrous or magnetizable material carrying a rotor winding 43—44 and adapted to rotate or oscillate about the axis of its suitably journaled shaft 55 to which it is secured. It will be understood, of course, that the electrical leads to the rotor 41 are sufficiently flexible to permit the desired movements of the rotor about its axis. When the winding 45 is energized by alternating current there will be set up in the stator and through the rotor, an alternating magnetic field or flux. When the rotor 41 is in the mid-position illustrated, no E. M. F. will be induced in its winding 43—44 by the alternating flux set up by the winding 45. However, when the rotor is moved to either side of this mid-position, there will be induced in its winding 43—44, by the magnetic flux, an E. M. F. having an instantaneous value in one direction or the other depending upon the direction of deflection of the rotor from mid-position, and the magnitude of such induced E. M. F. will depend upon the extent of deflection of the rotor from mid-position.

The construction of the instrument shown at the right hand side of Fig. 1 is, as stated, the same as that of the instrument at the left hand side. The two instruments are shown electrically connected as follows: from one side of a line supplying alternating E. M. F. at suitable frequency (say 60 cycles, single phase) to the stator coil 45 of the right hand instrument, from the other end of this stator coil to a midpoint tap of the rotor windings 43—44 (i. e., the junction of the parts 43 and 44 of the rotor winding) of the right hand instrument, one end of the tapped winding 43—44 of the right hand instrument is connected through a line wire to one end of the tapped rotor winding 43—44 of the left hand instrument, the other end of the tapped winding 43—44 of the right hand instrument is connected through another line wire to the other end of the tapped rotor winding 43—44 of the left hand instrument, the mid-point tap of the left hand rotor winding 43—44 is connected to one end of the left hand stator winding 45 of the left hand instrument, and the other end of the left hand stator winding 45 is connected to the other side of the A. C. supply line.

It will be understood that the two similar instruments shown in Fig. 1 may be more or less remotely spaced as indicated by the dotted line portions of the line wires connecting them. It will be noted that even though a completely metallic circuit is illustrated, there are but three line wires extending between the instruments. The design, construction, and connections of the system are such that it will operate as follows.

Assume that the left hand shaft 55 is operated by a float (not shown) whose movement in ac-

cordance with liquid level is to be indicated by a suitable indicator (not shown) operated by the right hand shaft 55 and that alternating E. M. F. is being supplied at the A. C. supply line. When the left hand rotor 41 is in, or moved to, any position within its total range of movement (say about 90°), and the right hand rotor 41 is not in a corresponding position, the right hand rotor will automatically move to a position corresponding to that of the left hand rotor 41. An explanation of this automatic operation is, briefly, as follows:

The magnetic flux set up by each stator coil 45 through its corresponding rotor 41 induces in its corresponding rotor winding 43—44 an alternating E. M. F. When the two rotors 41, 41, occupy corresponding positions, the E. M. F. induced in one rotor winding 43—44 equals and opposes that induced in the other rotor winding. When, however, the position of the right hand rotor 41 does not correspond to that of the (float-operated) left hand rotor 41, the E. M. F. induced in the right hand rotor winding 43—44 is not equal to that induced in the left hand rotor winding 43—44 and a current resulting from this difference of induced E. M. F's. flows through the circuit that connects the left hand winding 43—44 in series with the right hand winding 43—44. This current causes an electrodynamic torque to be exerted upon the right hand rotor 41 (the left hand rotor being held against movement by the float), which torque moves this rotor to the position corresponding to that of the left hand rotor, in which relative position the E. M. F. induced in the right hand rotor winding 43—44 is equal to that induced in the left hand rotor winding 43—44 and which, as stated, it opposes.

Either of the two instruments shown in Fig. 1 may be employed as a transmitter and the other as an indicator or repeater of the transmitted indication.

In Fig. 2 I have shown a system embodying four instruments T1, T2, T3, T4 which are similar so that a description of one will suffice for all.

The instrument T1 is the same in principle as that shown in Fig. 1. Its stator is of the somewhat different shape shown and embodies two field coils or windings 23, 24 which are serially connected so as to cause magnetic flux to pass from one of the poles 21, 22, through the rotor 25 to the other of said poles, when the coils 23, 24 are energized. The rotor 25, which, it will be seen, differs somewhat in shape from the rotor 41 of Fig. 1, is provided with and supports a tapped winding 27 corresponding to the tapped winding 43—44 in Fig. 1. The rotor winding 25 is connected across the terminals 35, 36 of the instrument, the mid-tap of the rotor winding is connected to one end of the stator coil 24, the other end of the stator coil 24 is connected to one end of the stator coil 23, and the other end of the stator coil 23 is connected to the terminal 37 of the instrument.

The operation of the instrument T1 is substantially the same as that shown in Fig. 1 and one may be substituted for the other, the rotors being preferably constructed as hereafter described.

The electrical connections of the system shown in Fig. 2 are, as will be seen, as follows: one side of the A. C. supply line is connected to the middle binding post or terminal of the instrument T2, the other two terminals of the instrument T2 are connected respectively through two line wires to the corresponding outer terminals 35, 36, of the instrument T1, the middle terminal 37 of the instrument T1 is connected to the middle terminal of the instrument T3, the outer terminals of the instrument T3 are connected respectively through two line wires to corresponding outer terminals of the instrument T4, and the middle terminal of the instrument T4 is connected to the other side of the A. C. supply line.

Among its other uses the system shown in Fig. 2 may be employed to operate a so-called telautograph system. For such use the linkages shown somewhat diagrammatically in Figs. 2*a* and 2*b* may be employed.

The rotor shaft 26 of the instrument T1 has secured thereto an arm 60 which is pivotally connected at its other end to one end of a link 61. The other end of the link 61 is pivotally connected by means of a stylus 62 to one end of a link 63 whose other end is pivotally connected to one end of an arm 64 secured at its other end to the rotor shaft 226 of the instrument T3. The rotor shafts 126 and 326 of the instruments T2 and T4, respectively, are connected by means of a similar linkage 160—161—163—164, adapted to operate or to be operated by a stylus 162.

The system of Fig. 2 when used in conjunction with the mechanisms shown in Figs. 2*a* and 2*b* is designed, constructed and connected to operate as follows.

Movement of the stylus 62, as in writing, will cause the rotor shafts 26 and 226 of the instruments T1 and T3, respectively, to be moved about their axes. The rotor shaft 126 will automatically repeat the movements of; i. e., move in correspondence with, the rotor shaft 26 and the rotor shaft 326 of the instrument T4 will automatically repeat the movements of the rotor shaft 226 of the instrument T3. The stylus 162, at the station more or less remote from the station at which the stylus 62 is located, will therefore automatically repeat the movements of the stylus 62 and will record the message written with the stylus 62 while it is being written. Conversely, a message written with the stylus 162 will be automatically and simultaneously recorded by the other stylus 62.

Any of the rotors shown in Figs. 1 and 2 may be quite satisfactorily constructed and wound as shown in Fig. 3; i. e., substantially as follows.

The rotor is a cylindrical drum built up of substantially circular laminations each stamped or punched out to provide winding slots, as shown, and all secured to the rotor shaft which constitutes the axis of the cylinder. It will be convenient to refer to the parts shown in Fig. 3 by means of the same reference numerals used in connection with the instrument T1 shown in Fig. 2, the elements 25, 26, 27, 35, and 36, being at once recognized. The mid-tap of the rotor winding 27 is to be connected to the stator winding as elsewhere indicated. It will be noted that curls of wire are shown in Fig. 3 to provide the desired flexibility in the three leads to the rotor winding 27. It will be understood, of course, that more or less winding slots may be employed as desired. The rotor 25 may be wound in other ways. For example, the winding 27 may consist of two wires insulated from each other (i. e., a so-called bifilar winding instead of a single winding) but wound together on the rotor as the one wire is in Fig. 3. In such case the starting end of one of the wires

would be electrically connected to one of the terminals 35, 36 (say, the terminal 35), the finishing end of the other wire would be electrically connected to the other of the terminals 35, 36 (say, the terminal 36), and the finishing end of the first wire and the starting end of the second wire would be electrically connected to each other (to constitute the mid-tap of the rotor winding) and to the stator winding.

In accordance with the provisions of the patent statutes, I have herein described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiments thereof, but I desire to have it understood that the apparatus disclosed is only illustrative and that the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combinations and relations described, some of these may be altered and other omitted and some of the features of each modification may be embodied in the other without interfering with the more general results outlined, and the invention extends to such use.

What I claim is:—

1. In combination, an electrical instrument, a remotely located electrical instrument, each of said instruments comprising a stator, a rotor, and stator and rotor windings; means connected to one of said rotors for actuating that rotor and means connected to the other of said rotors to be actuated thereby when the first mentioned rotor is actuated; a circuit extending from one instrument to the other and including the rotor windings of both instruments, and means for causing the actuating rotor of one instrument automatically to repeat the position of the actuated rotor of the other instrument; the last mentioned means including a source of alternating current, and a circuit, having two parallel branches, for conveying current through the stator winding of one instrument, thence through the said branch circuits, and thence through the stator winding of the other instrument; the said two branches each including a different conductor of the first mentioned circuit.

2. An electrical system comprising, in combination, a transmitting instrument and a repeating instrument each comprising a stator, a rotor, a stator winding, and a two part rotor winding; a rotor-energizing circuit including the rotor windings of both instruments and cumulatively connecting the two parts of said two part rotor winding of each instrument, and a stator-energizing circuit including the stator windings of both instruments and differentially connecting the two parts of the two part rotor winding of each instrument.

3. An electrical system comprising, in combination, a pair of remotely located instruments, means including circuits connecting said instruments for causing one of said instruments to repeat movements of the other of said instruments, each of said instruments having a stator winding and a pair of rotor windings connected in parallel with respect to each other and in series with their stator winding, the said circuits comprising a rotor-energizing circuit and a stator-energizing circuit, the said rotor-energizing circuit including the rotor windings of both instruments, and the said stator-energizing circuit including the stator windings of both instruments and having two branches, one of which branches includes one of the pair of rotor windings of each instrument and the other branch including the others of the pairs of rotor windings.

4. In a system of the class described in combination, a pair of similar instruments remotely located with respect to each other, each of said instruments having a stator, a rotor, a stator winding, and a rotor winding; a source of alternating current connected at one side to one end of the stator winding of one instrument and at its other side to one end of the stator winding of the other instrument; each of said stator windings being electrically connected at its other end to an intermediate point of its adjacent rotor winding; a line wire connecting one end of one rotor winding of one instrument to one end of the rotor winding of the other instrument, and a line wire connecting the other ends of said rotor windings.

5. In an electrical system of the class described, in combination, a pair of remotely located electrical instruments each comprising a stator, a rotor, a stator winding and a rotor winding; and means including a source of alternating current and electrical circuits extending from one instrument to the other, for causing the rotor of one instrument to repeat movements of the rotor of the other instrument, one of said circuits including one winding of each instrument, and another of said circuits including another winding of each instrument and having intermediate the instruments two parallel branches each including a different conductor of the first mentioned circuit.

6. An electrical system comprising, in combination, a transmitting instrument and a repeating instrument each comprising a stator, a rotor, a stator winding and a rotor winding, one of said windings on each instrument being a two part winding; and circuits for energizing the stators and rotors of both instruments, one of said circuits including the said two part windings of both instruments and cumulatively connecting the two parts of said winding of each instrument, and another of said circuits including other windings of both instruments and differentially connecting the two parts of said two part winding of each instrument.

7. In an electrical system of the class described, in combination, an electrical instrument having a stator, a rotor, a stator winding and a rotor winding, one of which windings is connected to an intermediate point of the other of said windings; a remotely located electrical instrument having a stator, a rotor, a stator winding and a rotor winding; and means including a source of alternating current and electrical circuits extending from one instrument to the other, for causing the rotor of one instrument to repeat movements of the rotor of the other instrument, one of said circuits including the intermediate-tapped winding of the first-mentioned instrument and a winding of the second-mentioned instrument, and another of said circuits extending through the other winding of the first-mentioned instrument to the aforesaid intermediate point of the tapped winding, and thence through adjacent portions of the tapped winding and its associated conductors of the first-mentioned circuit in parallel, and also extending through another winding of the second-mentioned instrument.

HARRY L. TANNER.