

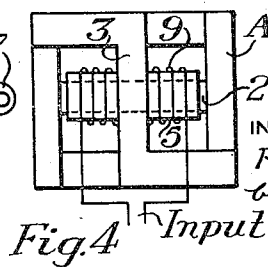
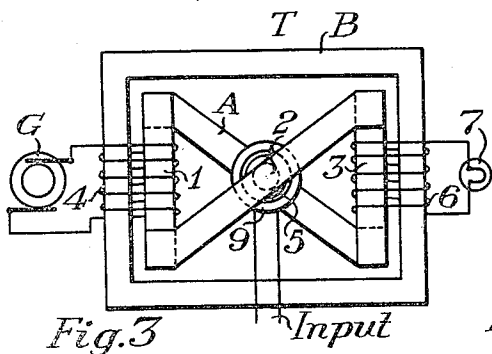
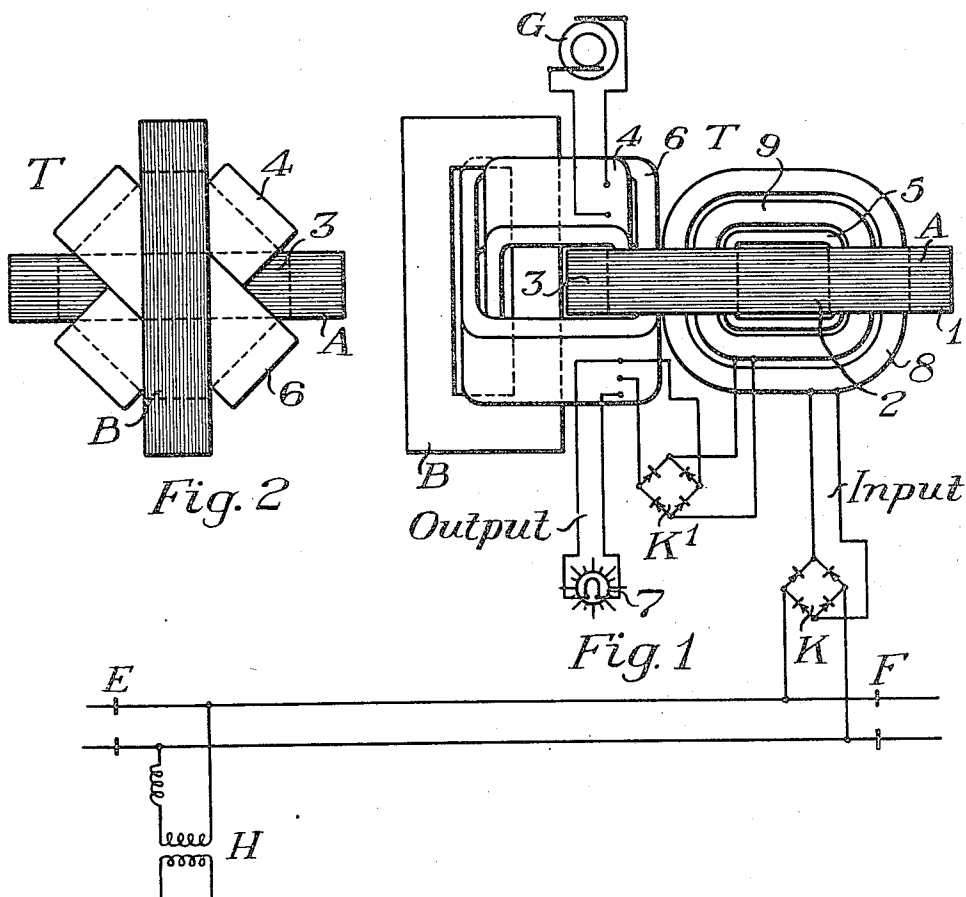
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ELECTRICAL TRANSLATING APPARATUS

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ELECTRICAL TRANSLATING APPARATUS

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My invention relates to electrical translating apparatus, and particularly to apparatus of the type comprising an input circuit which is at times supplied with current and an output circuit in which the flow of current is controlled in accordance with the current supplied to the input circuit.

One feature of my present invention is the provision of electrical translating apparatus of the type described, in which substantially no current is delivered by the output circuit when the current supplied to the input circuit is of normal value.

I will describe two forms of electrical translating apparatus embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a diagrammatic view illustrating one form of electrical translating apparatus embodying my invention as applied to the control of a trackway signal. Fig. 2 is an end view of the translating apparatus shown in Fig. 1. Fig. 3 is a diagrammatic view showing a modified form of the apparatus shown in Figs. 1 and 2 and also embodying my invention. Fig. 4 is an end view of the core A of Fig. 3.

Similar reference characters refer to similar parts in each of the several views.

Referring to Figs. 1 and 2, the reference character T designates a transformer which, as here shown, comprises two cores A and B of magnetizable material. Core A is of the well known shell type, and comprises three legs 1, 2 and 3 connected in parallel to form two magnetic paths with the leg 2 forming a bridging member common to both paths. The core B is shown as a single path core, but this particular form is not essential. Alternating flux is supplied to the transformer T by a primary winding 4 which links the end leg 3 of core A and which also links the core B. The winding 4 is supplied with periodic current from some suitable source here shown as an alternating current generator G. The reference character 6 designates a secondary or output winding which supplies energy to any suitable output

circuit. Winding 6 also links core B and the leg 3 of core A.

For the purpose of controlling the electromotive force induced in winding 6, an input winding 8 is located on the bridging member or middle leg 2 of core A and current is at times supplied to this winding to vary the permeability of core A. It is preferable, though not essential, to supply the winding 8 with unidirectional current, and if the source of controlling current delivers alternating current, a rectifier K may be included in circuit with winding 8. The parts are so adjusted that when a predetermined value of current is supplied to winding 8 (usually when this current is zero), substantially no current is drawn by the device supplied from the output circuit. As shown in the drawing, this adjustment is accomplished by locating cores A and B in planes disposed at an angle. As here shown, this angle is substantially 90°, and the windings 4 and 6 are also disposed at an angle so that the fluxes created in the cores A and B by current in the primary winding 4 flow in opposite directions at the same instant through the output winding 6. The proportions of the parts are such that the net electromotive force induced in winding 6 for zero current in winding 8 is substantially zero. This result can be accomplished by proportioning the parts so that under normal conditions the flux from winding 4 divides equally between cores A and B. If the flux density in core A were equal to the flux density in core B, the electromotive force induced in winding 6 would remain at zero for all voltages applied to winding 4. Since it is inconvenient to construct the parts with equal densities for the two cores, it is desirable to work the iron of each core at a point sufficiently high on its saturation curve that the changes in the permeabilities of the two cores will be substantially equal over a wide range of variation of the voltage applied to the winding 4. With this adjustment, the zero value of induced electromotive force in winding 6 will be substantially independent of variations in the electromotive force supplied by generator G.

When current is supplied to winding 8 there

is created in the middle leg 2 of core A, a magnetic flux which decreases the permeability of core A to flux resulting from current flowing through winding 4. The result is that the primary flux from winding 4 in core A is decreased and a correspondingly greater proportion of this primary flux is forced through core B. These changes in the distribution of flux from winding 4 are cumulative in their effect on winding 6 and the result is that an electromotive force is induced in the winding 6 which is available to supply current to the device connected therewith. Furthermore, it will be apparent that a comparatively small change in the current supplied to winding 8 will produce a comparatively large change in the current supplied to device 7 by winding 6.

In order to prevent the passage of alternating flux through the middle leg 2 of core A, I prefer to place a conducting sleeve 5 around this leg, thereby forcing the alternating flux through legs 3 and 1 and preventing "feed-back" into the control winding 8 and the circuits connected therewith.

Although the apparatus may be utilized to control the supply of current to any form of output load, I have shown it controlling a signal lamp 7 in a railway signaling system. Thus E—F is a section of railway track which is normally supplied with current from a track transformer H connected across the rails adjacent one end of the section. The input winding 8 of transformer T is connected, through the rectifier K, across the rails adjacent the other end of the section. The lamp 7 controlled by output winding 6 may then indicate proceed traffic conditions in section E—F. It will be plain that when section E—F is unoccupied, current is supplied to the winding 8 and lamp 7 is then lighted. If section E—F is occupied by a train, however, current is shunted away from winding 8 and the fluxes in cores A and B will then be equal so that no electromotive force is induced in winding 6 and lamp 7 is then extinguished.

In addition to the parts thus far described it may be desirable, in some instances, to make the transformer T, regenerative. This may be accomplished by placing a winding 9 on the middle leg 2 of core A and supplying energy to this winding from the secondary winding 6 through a rectifier K¹. With this construction, it will be plain that when current is not being supplied to the input winding 8 so that no electromotive force is induced in winding 6, no current is supplied to winding 9. When the input winding is energized, however, thus destroying the normal balance between the fluxes in the cores A and B, the resulting electromotive force in winding 6 is available to supply current to winding 9. The parts are so connected that the current thus supplied to winding 9 creates in leg 2

of core A, a flux which aids the flux created by current in winding 8, and therefore assists in decreasing the permeability of core A. This change causes a further increase in the electromotive force induced in winding 6 and the cycle of operation continues until a state of equilibrium is reached.

It is apparent that by means of the winding 9 a ratio of amplification can be obtained which is greater than that conveniently obtained without the use of this winding.

Rectifier K¹ may be connected across a sufficient portion of the winding 6 to obtain the desired results, and it should be noted in this connection that if the degree of regeneration is sufficient it is possible to adjust the parts so that once the electromotive force induced in winding 6 has become sufficiently high due to the presence of direct current in winding 8, the output will not return to zero when the supply of current to winding 8 is discontinued. The operation of the translating device, under these conditions, is analogous to the operation of a "stick relay" and after the supply of current to the load 7 controlled by winding 6 has once commenced it can not be interrupted by discontinuing the supply of current to the input winding 8.

In the modified form of apparatus illustrated in Figs. 3 and 4 the same principles are utilized as in the modification described above, but the arrangement of parts is somewhat different. The core B is a closed magnetic core similar to that shown in Figs. 1 and 2, but core A, as shown in Figs. 3 and 4 is shaped somewhat like a figure 8. The end legs 1 and 3 of core A are adjacent to and parallel with opposite sides of core B, and the middle leg 2, as here shown, is at right angles with these legs and carries the conducting sleeve 5 and the input winding 9. The primary winding 4 is connected with the alternator G and links the end leg 1 of core A and the adjacent portion of core B. Secondary winding 6 is connected with the load 7 and links the leg 3 of core A and the adjacent portion of core B. The parts are so proportioned that when no current is being supplied to the input winding 9, the primary flux delivered by primary winding 4 divides equally between cores A and B. It will be seen that the fluxes in cores A and B traverse the secondary winding 6 in opposite directions, so that for zero input to winding 9, no current is supplied to the load 7. When current is supplied to winding 9, however, the permeability of core A is decreased, so that an increased proportion of the primary flux from winding 4 traverses core B. As a result, there is induced in secondary 6 an electromotive force which supplies current to the load 7.

It will be seen from the foregoing that the same principles are involved in both embodiments of my invention herein shown and de-

scribed, and that in both cases the secondary winding is linked by two magnetic paths in which the fluxes are balanced for normal values of input current, but are unbalanced to produce a resultant induced secondary electromotive force when the input current has any other value.

Although I have herein shown and described only two forms of electrical translating apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. A transformer comprising a first winding supplied with periodic current, two magnetic paths both linking all of said first winding, a second winding linking both said magnetic paths in such manner that the fluxes in said paths due to current in said first winding induce opposing electromotive forces in such second winding, and means for controlling the distribution of flux from said first winding between said two paths.

2. A transformer comprising a first winding supplied with periodic current, two magnetic paths both linking all of said first winding, a second winding linking both said magnetic paths in such manner that the fluxes in said paths due to current in said first winding induce opposing electromotive forces in such second winding, a third winding associated with one said path, and means for at times supplying current to said third winding to vary the distribution of flux from said first winding between said two paths.

3. A transformer comprising a first winding supplied with periodic current, two magnetic paths both linking all of said first winding, a second winding linking both said magnetic paths in such manner that the resultant electromotive force normally induced in such second winding is substantially zero, and means for at times varying the permeability of one said magnetic path to vary the distribution of flux from said first winding between said two paths.

4. In combination, two magnetizable cores having adjacent portions disposed in angular relation, two windings each embracing the adjacent portions of both said cores and disposed in angular relation, means for supplying periodic current to one said winding, and means for varying the permeability of one said core to vary the electromotive force induced in the other said winding.

5. In combination, two magnetizable cores having their planes disposed in intersecting planes, two windings disposed in intersecting planes and both linking the same portions of both said cores, means for supplying periodic current to one said winding, and means for

at times varying the permeability of one said core to vary the electromotive force induced in the other said winding.

6. In combination, a closed magnetic core, a shell type core disposed at an angle with said closed core and having one end leg adjacent a leg of such closed core, two windings disposed at an angle and both linking the adjacent legs of both said cores, means for supplying periodic current to one said winding, a third winding on the middle leg of said shell type core, and means for at times supplying current to said third winding to vary the permeability of the associated core.

7. In combination, a first winding supplied with periodic current, two magnetizable cores each threading all of said first winding and normally carrying equal portions of the flux created by current in such first winding, a second winding linking both said cores in such manner that the resultant electromotive force induced therein by equal fluxes in said cores is substantially zero, and means for at times decreasing the flux in one core and simultaneously increasing the flux in the other core to produce a material electromotive force in said second winding.

8. In combination, a first winding supplied with periodic current, two magnetizable cores both linking said first winding, a second winding linking both said cores, means for varying the permeability of one said core to vary the electromotive force induced in said second winding, and means responsive to the electromotive force induced in said second winding for varying the permeability of said one core.

9. In combination, a closed magnetizable core, a shell type core disposed at an angle with said closed core and having one end leg adjacent a leg of such closed core, two windings disposed at an angle and both linking the adjacent legs of both said cores, means for supplying periodic current to one said winding, a conducting sleeve located on the middle leg of said shell type core, a third winding on the middle leg of said shell-type core, and means for at times supplying current to said third winding to vary the permeability of the associated core.

10. In combination, two windings, means for supplying periodic current to one said winding, two magnetizable cores each linking both said windings in such manner that the fluxes produced in said cores by current in said one winding flow in opposite directions at an instant through the other winding, means for varying the permeability of one said core to vary the electromotive force induced in said second winding, and means responsive to the electromotive force induced in said second winding for varying the permeability of said one core.

11. In combination, two windings, means for supplying periodic current to one said

winding, two magnetizable cores each linking both said windings in such manner that the fluxes produced in said cores by current in said one winding flow in opposite directions at an instant through the other winding, means for varying the permeability of one said core to vary the electromotive force induced in said second winding, and a third winding on said one core receiving energy from said second winding for varying the permeability of said one core.

12. In combination, two windings, means for supplying periodic current to one said winding, two magnetizable cores each linking both said windings in such manner that the fluxes produced in said cores by current in said one winding flow in opposite directions at an instant through the other winding, a third winding on one said core, means for at times supplying current to said third winding to vary the electromotive force induced in said second winding, a fourth winding on said one core, and means responsive to the electromotive force induced in said second winding to supply current to said fourth winding to increase such variations in the electromotive force induced in said second winding.

13. In combination, two windings, means for supplying periodic current to one said winding, two magnetizable cores each linking both said windings in such manner that the fluxes produced in said cores by current in said one winding flow in opposite directions at an instant through the other winding, means for at times varying the permeability of one said core to change the electromotive force induced in said second winding, a third winding on one said core, and means responsive to the electromotive force induced in said second winding for supplying energy from said second winding to said third winding to increase such changes in the electromotive force induced in said second winding.

14. In combination, two windings, means for supplying periodic current to one said winding, two magnetizable cores each linking both said windings in such manner that the fluxes produced in said cores by current in said one winding flow in opposite directions at an instant through the other winding, means for at times varying the permeability of one said core to change the electromotive force induced in said second winding, a third winding on one said core, and means including a rectifier for supplying energy from said second winding to said third winding.

In testimony whereof I affix my signature.
PHILIP H. DOWLING.