

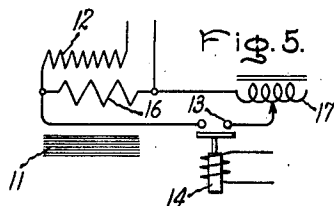
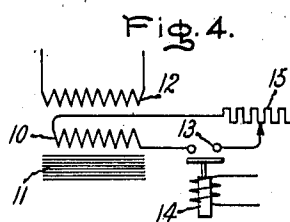
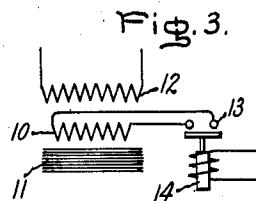
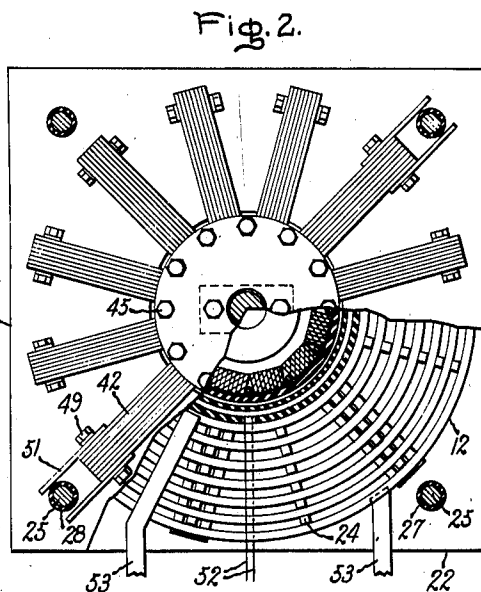
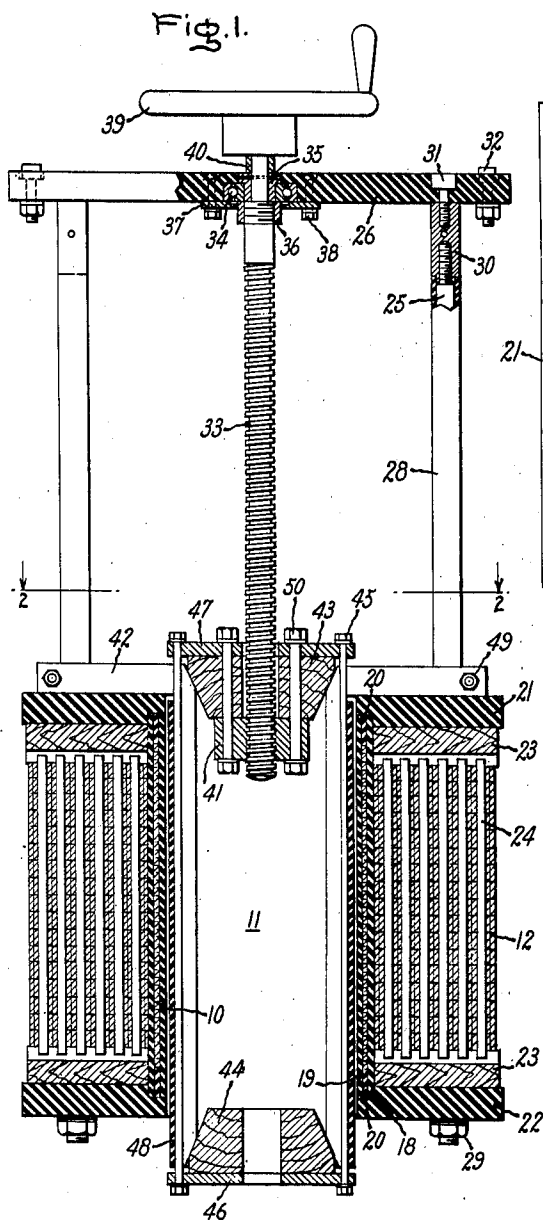
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H. S. HUBBARD

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REACTOR

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## UNITED STATES PATENT OFFICE

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## REACTOR

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1 Claim. (Cl. 171-242)

My invention relates to self-induction devices known as reactors. Such devices are commonly employed in alternating-current circuits to control the flow of current therethrough. When it is desired to adjust the current flow in a circuit, the reactor is made adjustable for this purpose.

Occasions arise, however, where it is desirable to transmit a substantially uniform current value through an adjustable reactor without disturbing its adjustment for the transmission of a different current value. For example, in arc welding systems when the welding current is adjusted to a low value, arc starting is facilitated by increasing the current flow to a predetermined value during the arc starting period and a variable reactor capable of such current control is of great utility.

It is an object of my invention to provide an adjustable reactor with electromagnetic means for altering its reactance for a desired value of current flow without disturbing its adjustment for another value of current flow.

Further objects of my invention will become apparent from the following description taken in connection with the accompanying drawing, Figs. 1 and 2 of which illustrate the physical structure of one embodiment thereof; Figs. 3 and 4 of which diagrammatically represent control circuits associated with the reactor of Figs. 1 and 2; and Fig. 5 of which diagrammatically illustrates another embodiment of my invention.

In accordance with my invention, means including a core of magnetizable material is adjustably positioned relative to a coil for controlling its impedance, and additional means, including a circuit of controlled impedance inductively associated with said coil and switching means for making and breaking said circuit, is used for controlling the impedance of said coil independently of the impedance control resulting from the adjustment of said core relative thereto.

In the embodiment illustrated in Figs. 1 and 2, the reactor is of the adjustable core type. A control coil 10 located between the core 11 and the main coil 12 is employed for obtaining a desired reactance independently of the relative position of the core and main coil. The control coil when shorted through the contacts 13 of a relay 14, as shown in Fig. 3, opposes the flux produced by the main coil and prevents its linkage with the core, thus decreasing the inductance of the main coil and causing the current of the main coil to rise in proportion to the extent of change in flux path brought about by the control coil.

As shown in Fig. 4, the control coil may be shorted through an adjustable resistance 15. Instead of an adjustable resistance 15, an adjustable reactance may be used and may prove preferable where it is desired to obtain a final adjustment of the current in the control coil without designing it to include the necessary value of inductance.

As shown in Fig. 5, the control coil may be coil section 16 of the main coil 12 in which case it is preferably shorted through an adjustable impedance 17. The use of impedance 17 in this case is most desirable since the impedance of the control coil section as a part of the main coil is not of the proper value when this section is used as a control coil. As indicated in Fig. 5, I prefer to use as the control coil the turn layer of coil 12 most closely adjacent core 11.

The control coil, or section of the main coil used as a control coil, does not necessarily have to be located next to the core. It is preferable, however, to so locate it since in this position it is most effective for its intended purpose. The main coil is effective, however, within the limits of its placement within the main coil or surrounding the main coil.

Referring again to Figs. 1 and 2, it will be noted that main coil 12 of the reactor is mounted on a cylinder 18 which in turn surrounds a cylinder 19 on which control coil 10 is mounted. Cylinders 18 and 19 are spaced from one another at their ends by rings 20. The ends of these cylinders and rings are clamped between supports 21 and 22 in recesses adjacent central cylindrical openings therein for the core 11. The ends of coil 12 are spaced from and clamped between supports 21 and 22 by a plurality of radially disposed blocks 23. These blocks are grooved to accommodate the projecting ends of the spacing strips 24 inserted between the turn layers of coil 12.

The assembly just described is held together by four studs 25 which extend through supports 21 and 22 and project above support 21 for attachment of a mounting plate 26. These studs are surrounded by sleeves 27 and 28 which act respectively as spacers for supports 21 and 22 and as means for clamping the assembly together. The lower ends of the studs 25 are threaded and provided with nuts 29 which react against support 22 and the upper ends of these studs are threaded for nuts 30 which engage the upper ends of sleeves 28. It will thus be seen that the tightening of nuts 29 and 30 applies a clamping pressure through sleeves 27 and 28 which holds the parts

in their assembled position illustrated in the drawing.

Mounting plate 26 is attached to the upper ends of nuts 33 by cap screws 31. This mounting plate may in turn be supported on another structure through the agency of bolts 32 extending there-through.

One end of an adjusting screw 33 is journaled in a ball bearing 34 held in place thereon between a nut 36 and a collar 35. Nut 36 is threaded on the end of screw shaft 33 and collar 35 is pinned thereto. Bearing 34 is held within a recess in mounting plate 26 by means of a clamping ring 37 which is attached to the mounting plate by bolts 38.

The end of adjusting screw 33 which extends above mounting plate 26 is provided with a hand wheel 39 which is spaced from the above referred to collar 35 by a bushing 40. The threaded lower end of adjusting screw 33 extends into the structure of the core 11 and engages a nut 41 forming a part thereof.

This core structure is made up of a plurality of bundles of L-shaped laminations 42 which are clamped between conical blocks 43 and 44 through the agency of bolts 45 which extend through and engage collars 46 and 47 which in turn exert a clamping pressure on the ends of blocks 43 and 44. The upper and lower ends of the principal legs of the core laminations are bevelled to the same slope as the sides of conical blocks 43 and 44 and under the clamping action of these blocks are forced outwardly against the inner wall of a cylinder 48 which forms the outer surface of the core structure 11 which extends within the assembly including coils 10 and 12. The laterally extending end portions of the lamination bundles are secured together by bolts 49. Nut 41 threaded on adjusting screw 33 is attached to the inner end surface of conical block 43 through the agency of bolts 50 which pass through and clamp together this nut, conical block 43 and collar 47. Blocks 43 and 44 are provided with central openings for the passage of adjusting screw 33.

By using L-shaped laminations for the magnetic structure of the core 11, it is possible to obtain the effect of a long core without correspondingly increasing the length of the assembly including it, since the laterally projecting portions located between the coil assemblies and the mounting plates 26 give the effect of a long core and require very little additional spacing of the coil assemblies from mounting plate 26 from that required by the desired relative movement of the core and coils.

Plates 51 bolted to the ends of diametrically opposed lamination bundles 42 straddle diametrically opposed sleeves 28 and studs 25 to prevent turning of the core structure when the adjusting screw is operated to move the core assembly axially with respect to the assembly including coils 10 and 12.

As shown in Fig. 2, the control coil 10 is provided with leads 52 which extend through notches in the ends of the cylinder 18 and the main coil 12 is provided with strap terminals 53. These terminals correspond to the terminals for the coils 10 and 12 diagrammatically represented in Figs. 3, 4 and 5.

Except for the lamination bundles 42, bearing 34 and hand wheel 39, the metallic members of the reactor assembly above described are made of some non-magnetic material such as brass. The cylinders 18, 19 and 48, the rings 20, the supports 21 and 22, and the mounting plate 26 are preferably made of some molded insulating material, and the sleeves 27 and 28 and collars 46 and 47 are preferably made of some insulating material such as fiber. The nut 41 may also be made of an insulating molded composition. The spacing blocks 23, spacing strips 24, and conical blocks 43 and 44 may be made of wood. The bolts 45 may be insulated from the lamination bundles 42 by strips of fiber insulation and the bolts 49 may be insulated from lamination bundles 42 through the agency of fiber bushings and washers.

It is, of course, apparent that many modifications may be made in the particular structure described and illustrated without departing from the spirit and scope of my invention as defined in the appended claim.

What I claim as new and desire to secure by Letters Patent of the United States is:

A variable reactor comprising a main coil and a control coil of substantially equal lengths concentrically located in fixed positions relative to one another, means for completing a circuit of predetermined impedance through said control coil, a support for said coils, an open magnetic core having a main portion dimensioned to pass through said coils and an end portion extending laterally into the space between said coils and said support, and means mounted on said support for moving the main portion of said core into and out of said coils through a travel limited only by the movement of the end portion of said core through the space between said coils and said support.

HORACE S. HUBBARD.