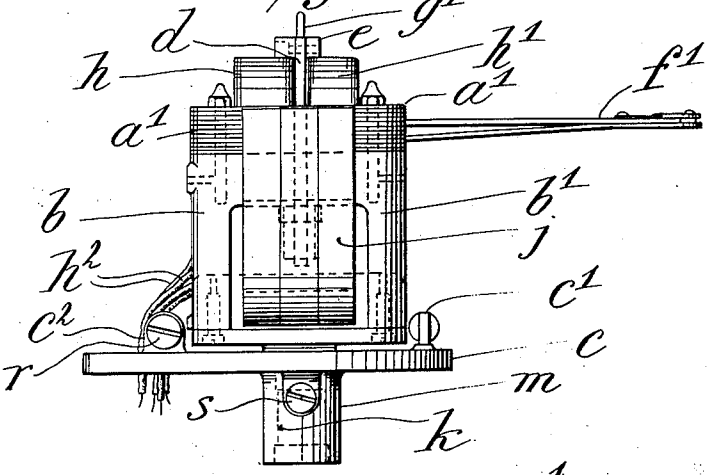
Oct. 18, 1927. 1,646,234

F. G. CREED

ELECTROMAGNETIC APPARATUS

Filed March 6, 1925 2 Sheets-Sheet 1

Fig. 1.



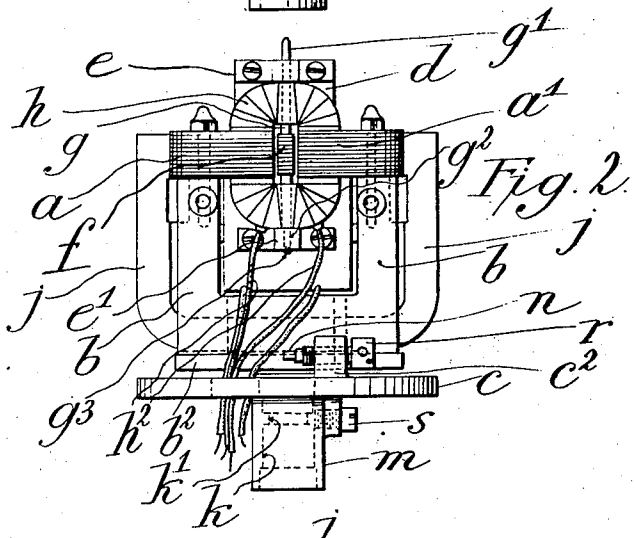
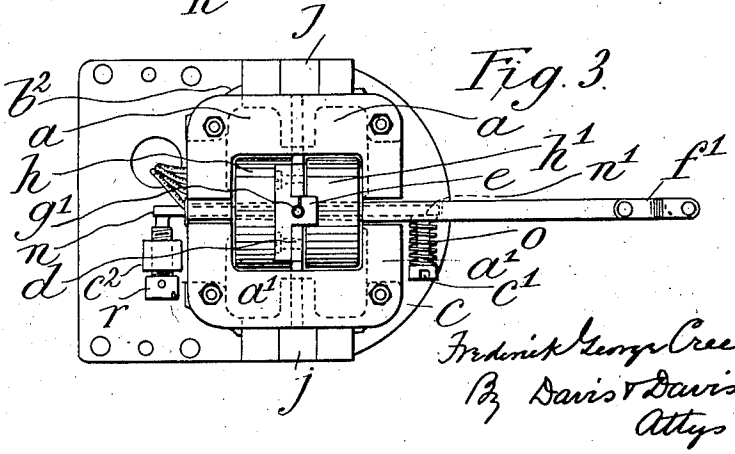


Fig. 2.

Fig. 3.



Frederick George Creed
By Davis & Davis
Attys

Oct. 18, 1927. 1,646,234

F. G. CREED

ELECTROMAGNETIC APPARATUS

Filed March 6, 1925 2 Sheets-Sheet 2

Fig. 4.

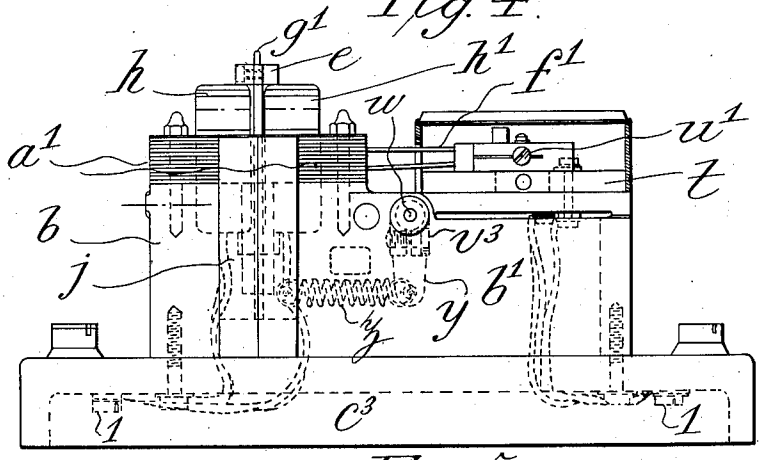


Fig. 5.

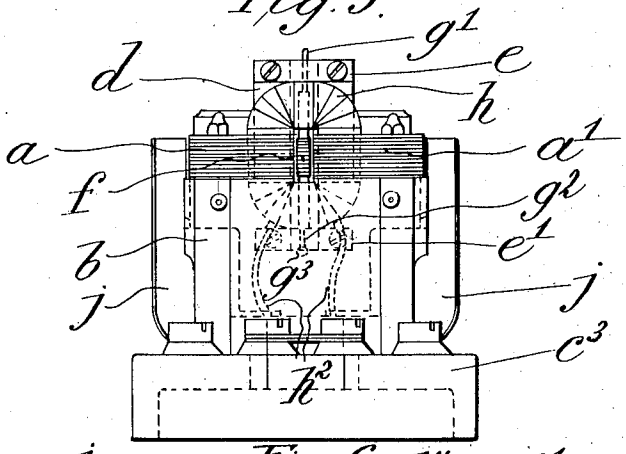
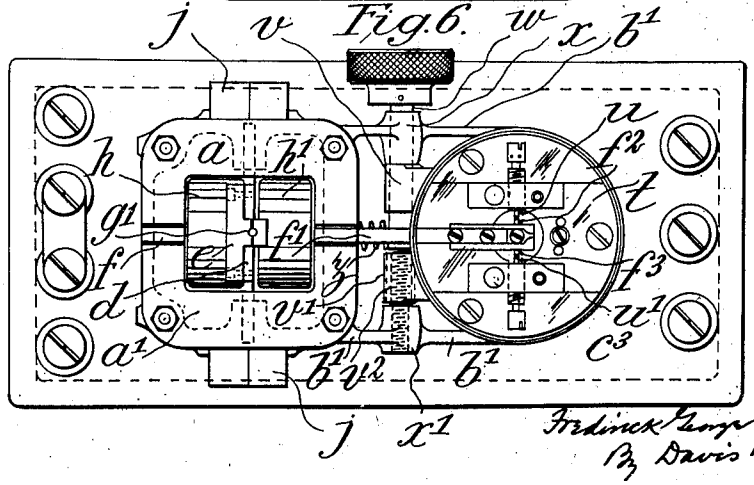


Fig. 6.



Frederick Geo. Creed
By Davis & Davis
Attys

Patented Oct. 18, 1927. 1,646,234

UNITED STATES PATENT OFFICE.

FREDERICK GEORGE CREED, OF CROYDON, ENGLAND.

ELECTROMAGNETIC APPARATUS.

Application filed March 6, 1925, Serial No. 13,474, and in Great Britain March 11, 1924.

This invention relates to electro-magnetic apparatus of the kind described in the specification of former Letters Patent No. 1,552,676, and which is specially suitable for use as a relay, switch, motor or like device, and it has for its object to simplify and improve the general construction and working of such apparatus, to permit of ready removal and replacement of the armature and its magnetizing winding, of effective lubrication of the pivots of the armature and of ready adjustment of the apparatus.

To this end, electro-magnetic apparatus of the kind referred to is constructed as will now be described with reference to the accompanying illustrative drawings, wherein Figs. 1 and 2 are elevations at right angles to one another and Fig. 3 a plan showing one construction of apparatus embodying the present invention. Figs. 4, 5 and 6 are similar views, to Figs. 1, 2 and 3 respectively, showing a modified construction.

In each of the examples shown, oppositely and constantly polarized massive inverted U shaped laminated pole pieces a and a^1 are, according to the present invention, fixed upon the upper ends of a non-magnetic support or frame, formed, in the examples of two members b, b^1 adapted to be carried by a base plate c and provided with a centrally arranged vertical plate d, also of non-magnetic material, which may be made in one piece with the frame, or, as shown, may be a separate plate inserted therein and to which are secured upper and lower bearings e, e^1 of which the upper one is readily removable. The laminated armature f, composed of stampings of magnetic material, some of which are extended at one end to form an armature lever f^1 as before, is fixed to a relatively long vertical spindle g that extends through it and the upper and lower ends of which are adapted to form pivots g^1, g^2 which extend into the said upper and lower bearings, the arrangement being such that the armature can be readily removed and its pivots easily and effectually lubricated. The lower pivot g^2 may bear upon a hard steel ball g^3, carried by the lower bearing e^1.

The armature winding comprises two coils h, h^1 that fit into the rectangular shaped openings formed in the two pole pieces a, a^1, are arranged at opposite sides of the centrally arranged vertical plate d, and are carried by the support or frame b, b^1 either directly, or, as shown, by the lower bearing e^1 part of which extends below the coil h and another part of which projects laterally through the vertical plate d and extends below the coil h^1. The coils are held in position vertically by the removable upper bearing e part of which extends over one coil h and another part of which projects laterally through the vertical plate d and extends over the other coil h^1. The coils are without spools or cores and the horizontal hole through each of them, to accommodate the armature, is of rectangular shape in cross section, as before, and the sides thereof are arranged as closely as possible to the sides of the armature, but so as to admit of the necessary oscillation of the armature, which however is of small extent. By arranging the inner sides of the coils close to the armature as described, the maximum magnetizing effect on the armature is obtainable with any given size of coil and value of electric current flowing therethrough. The ends of the coils are connected by leads h^2 that extend through one side of the support or frame, to terminals fixed to the baseplate or other supporting means.

The two oppositely arranged pole pieces a, a^1 made massive and formed of laminated magnetic material, and provided with polar projections having broad flat faces between which the armature f is mounted to oscillate, are magnetized by vertically arranged U shaped permanent magnets j the upper ends of which bear closely against the said pole pieces and the lower horizontal and intermediate portions of which extend through the non-magnetic support or frame b, b^1 which is made hollow or of an openwork character.

Electro-magnetic apparatus as described may be so constructed or arranged as to admit of relative adjustment between the armature and the pairs of flat faces of the pole pieces a, a^1 between which it works, to suit requirement.

For this purpose, in the example shown in Figs. 1, 2 and 3, the two side members b, b^1 of the hollow support or frame are fixed to a bottom plate b^2 provided at its lower side with a centrally arranged downwardly extending plug k that projects into a corresponding socket m extending from the lower side of the base plate c, and from opposite sides of the support or frame b, b^1 extend two projections, formed in the example shown, by the ends n, n^1 of a transverse bar, against one of which, namely n^1, acts a coiled

spring o supported at one end by a lug c^1 on the base plate c and against the other of which, namely n, bears a horizontal adjustable screw r carried by a bearing c^2 on the base plate. The arrangement is such that by turning the screw r in one direction or the other, the support or frame b, b^1 and attached parts can be adjusted, under the control of the spring o, about a vertical axis that is coincident with the axis of the armature spindle g, in order to vary the position of the armature in relation to the pole faces of the massive pole pieces a, a^1 with which the armature co-operates. The plug k and attached parts can, by means of a screw s extending through the wall of the socket m and into an annular groove k^1 in the plug, be prevented from rising.

In the modified arrangement shown in Figs. 4, 5 and 6, the two parts b, b^1 of the support or frame are fixed to a base plate c^3 and upon the part b^1, which is made wide, is mounted a plate t carrying, on its upper side, insulated electric contacts u, u^1, or a contact and a stop, between which the armature lever f^1 can work, and which, as shown, may be in the form of adjustable screws. The plate t, which may be of circular shape, in plan, is provided at one side with tubular lugs v, v^1 through which extends an endways adjustable transversely arranged spindle w, one lug, namely v, being plain and encircling a plain portion of the spindle w and the other lug, namely v^1, being provided with a screwed lining v^2 that is prevented from turning by means of a clamping screw v^3 and fits a correspondingly screw threaded portion of the spindle w. The spindle is mounted to turn in bearings x, x^1 that are carried by the part b^1 of the support and one of which, namely x, is plain and the other, namely x^1, screw threaded and fits a correspondingly screw-threaded portion of the spindle w, the two threaded portions of the spindle having different pitches. The arrangement is such that by turning the spindle w in one direction or the other, the plate t with stationary contacts u u^1, or contact and stop, can be moved transversely in relation to the massive pole pieces a, a^1 by an amount corresponding to the difference in pitch of its screws, per revolution of the spindle o, and thus alter the position of the armature in relation to the faces of the said pole pieces. The plate t can be caused to bear firmly upon the lateral extension b^1 by providing it at one side with a lever arm y to which is connected one end of a coiled spring z the other end of which is connected to the hollow support or frame b, b^1. The ends of the armature coils h, h^1, the armature contacts f^2 and f^3, or contact, and the stationary contacts u, u^1, or contact, may be connected to terminals 1, fixed to the underside of the base plate c^3, which is recessed as shown, to receive them. The base plate may be of insulating material.

What I claim is:—

1. Electro-magnetic apparatus of the kind herein referred to, comprising two oppositely arranged massive inverted U shaped laminated pole pieces having polar projections with broad flat faces, a non-magnetic support for said pole pieces, U shaped permanent magnets carried by said support and arranged to constantly magnetize said pole pieces, an armature winding consisting of a stationary pair of removable coils extending through the rectangular shaped openings in the two pole pieces, and into said support, a laminated armature extending through said coils and between the pairs of broad flat faces of the polar projections of said pole pieces, the armature having a lateral extension or lever arm, a vertical spindle fixed to said armature and extending therethrough between the coils in each direction to points above and below said coils, and stationary bearings for the upper and lower ends of said spindle.

2. Electro-magnetic apparatus of the kind herein referred to, comprising two oppositely arranged massive inverted U shaped laminated pole pieces having polar projections with broad flat faces, a non-magnetic hollow support for said pole pieces, means for polarizing said pole pieces, a stationary vertical plate of non-magnetic material arranged centrally within and carried by said support, upper and lower bearings carried by said plate, a vertical spindle having its end portion journalled in said bearings, the upper of which is removable, a laminated armature arranged horizontally between the pairs of polar projections of said pole pieces and fixed to said spindle and an armature winding consisting of two stationary coils extending through the rectangular shaped openings formed in the two pole pieces and arranged at opposite sides of said plate and so as closely to surround the armature whilst leaving the same free to oscillate to the desired extent.

3. Electro-magnetic apparatus of the kind herein referred to, comprising two oppositely arranged massive inverted U shaped laminated pole pieces having polar projections with broad flat faces, a non-magnetic hollow support for said pole pieces, permanent magnets carried by said support and arranged to permanently magnetize said pole pieces, a stationary vertical plate of non-magnetic material arranged centrally within and carried by said support, upper and lower bearings carried by said plate, a vertical spindle having its end portions journalled in said bearings, the upper of which is removable, a laminated armature arranged horizontally between the pairs of polar projections of said pole pieces and

fixed to said spindle and an armature winding consisting of two stationary coils extending through the rectangular shaped openings formed in the two pole pieces and arranged at opposite sides of said plate and so as closely to surround the armature whilst leaving the same free to oscillate to the desired extent.

4. Electro-magnetic apparatus according to claim 2, wherein the pair of armature coils are retained in place vertically, in a readily removable manner, by and between the upper and lower spindle bearings.

5. Electro-magnetic apparatus of the kind herein referred to, comprising two oppositely arranged massive inverted U shaped laminated pole pieces having polar projections with broad flat faces, a non-magnetic support for said pole pieces, vertically arranged U shaped permanent magnets the upper ends of which closely embrace the said pole pieces and constantly polarize them and the lower intermediate portions of which extend through said non-magnetic support, an armature winding consisting of a stationary pair of removable coils extending through the rectangular shaped openings in the two pole pieces and into said support, a laminated armature extending through said coils and between the pairs of broad flat faces of the polar projections of said pole pieces, the armature having a lateral extension or lever arm, a vertical spindle fixed to said armature and extending therethrough between the coils in each direction to points above and below said coils, and stationary bearings for the upper and lower ends of said spindle.

6. In electro-magnetic apparatus according to claim 2, the combination with the armature and the pole pieces with which it co-operates, of means whereby the normal relative positions of said armature and pole pieces can be adjusted.

7. Electro-magnetic apparatus of the kind referred to, comprising two oppositely arranged massive inverted U shaped laminated pole pieces having polar projections with broad flat faces, a non-magnetic support for said pole pieces, means for magnetizing said pole pieces, an armature winding extending through the rectangular shaped openings in said pole pieces and into said support, a laminated armature extending through said winding and between the faces of the said polar projections, a vertical spindle fixed to said armature, bearings for said spindle, a lever associated with said armature, devices between which said lever extends, and means for adjusting said device relatively to said lever.

8. Electro-magnetic apparatus of the kind referred to, comprising two oppositely arranged massive inverted U shaped laminated pole pieces having polar projections with broad flat faces, a non-magnetic support for said pole pieces, means for magnetizing said pole pieces, an armature winding extending through the rectangular shaped openings in said pole pieces and into said support, a laminated armature extending through said winding and between the faces of the said polar projections, a vertical spindle fixed to said armature, bearings for said spindle, a lever associated with said armature, devices between which said lever extends, a carrier for said devices, adapted to slide on said support in a direction substantially at right angles to said lever and provided with lateral lugs one of which is provided with an internal screw thread, bearings on said support one of which is provided with an internal screw thread of a different pitch to that in the said lug, and a rotary adjusting spindle extending through said lugs and bearings and provided with screw threads of different pitch adapted to co-operate with those in the screw threaded lug and bearing, for the purpose set forth.

9. Electro-magnetic apparatus of the kind referred to, comprising two oppositely arranged massive inverted U shaped laminated pole pieces having polar projections with broad flat faces, a non-magnetic support for said pole pieces, means for magnetizing said pole pieces, an armature winding extending through the rectangular shaped openings in said pole pieces and into said support, a laminated armature extending through said winding and between the faces of the said polar projections, a vertical spindle fixed to said armature, bearings for said spindle, a lever associated with said armature, devices between which said lever extends, a carrier for said device adapted to slide on said support in a direction substantially at right angles to said lever and provided with lateral lugs one of which is provided with an internal screw thread, bearings on said support one of which is provided with an internal screw thread of a different pitch to that in the said lug, a rotary adjusting spindle extending through said lugs and bearings and provided with screw threads of different pitch adapted to co-operate with those in the screw threaded lug and bearing, a lever arm connected to said carrier and adapted to turn about the axis of said spindle and a spring arranged to act on said lever arm and press said carrier against the part of the support on which it slides.

Signed at Croydon in the county of Surrey, England, this nineteenth day of February, 1925.

FREDERICK GEORGE CREED.