Dec. 29, 1931. M. L. JEFFREY ET AL 1,838,836

ELECTROMAGNET

Filed Aug. 7, 1931

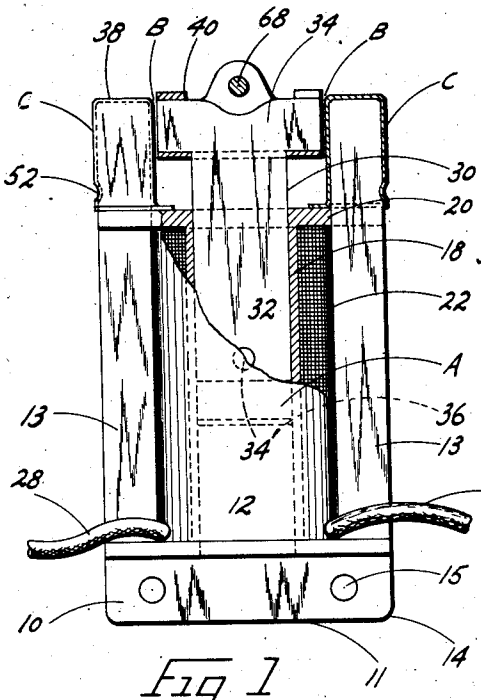


Fig 1

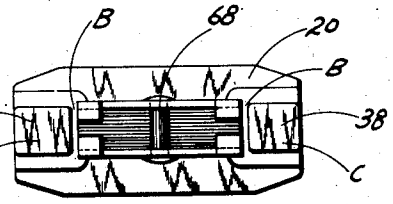


Fig 2

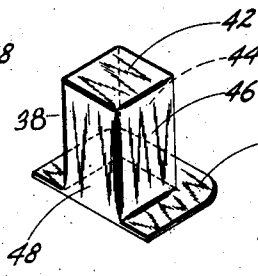


Fig 4

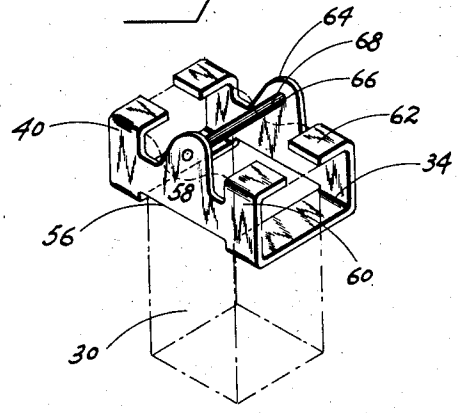


Fig 3

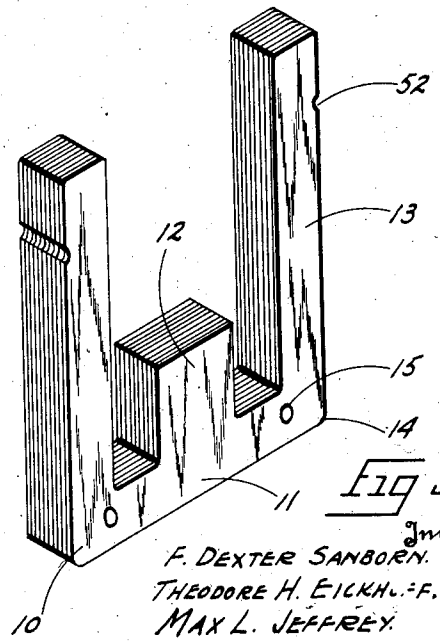


Fig 5

Inventor
F. DEXTER SANBORN. JR,
THEODORE H. EICKHOFF.
MAX L. JEFFREY.

By Rickey & Hatte
Attorney

Patented Dec. 29, 1931 1,838,836

UNITED STATES PATENT OFFICE

MAX L. JEFFREY, THEODORE H. EICKHOFF, AND FREDERICK D. SANBORN, JR., OF CLEVELAND, OHIO, ASSIGNORS, BY MESNE ASSIGNMENTS, TO THE M. L. JEFFREY CORPORATION, OF CLEVELAND, OHIO, A CORPORATION OF OHIO

ELECTROMAGNET

Application filed August 7, 1931. Serial No. 555,796.

The present invention relates to electro-magnets of the type which employ a movable actuating plunger which is adapted upon movement thereof to actuate an element or elements of machine design as for example a printing platen, the pawl of a dial counter ratchet mechanism, or other movable arrangement of a recording apparatus of the type shown in the copending application of Max L. Jeffrey, Serial No. 443,052, filed April 10, 1930. The principles of the invention, however, are applicable to electro-magnets of the solenoid type in which a movable plunger is drawn by magnetic action into the core of an iron clad magnet.

Electro-magnets of the solenoid type, of the iron clad type and of the type disclosed in this application are frequently formed with magnets that are formed of laminated iron. One of the pole pieces is divided and is arranged on opposite sides of the other pole piece to mechanically and magnetically protect the coils which surround the center pole piece. This type of electromagnet assembly possesses certain inherent limitations that it is the object of the present invention to remove.

In devices of this nature the plunger-head overlies the ends of the divided pole pieces and thus a variable air gap is created for the path of the magnetic flux. The present invention, by bringing the plunger head within the confines of the divided pole piece, eliminates this variable air gap and provides a constant air gap of extremely small proportions.

Because of the laminated nature of the magnet and of its pole pieces in a device of this type and because of the laminated nature of the plunger, the edges of the plunger and of the divided pole piece present to each other an uneven irregular surface where the laminations fall short or project beyond each other. Uniform magnetic conditions under conditions of mass production of the electro-magnets is therefore not attained and the present invention contemplates the provision of an electro-magnet in which the opposing surfaces of the movable member and of the magnet poles are uniformly presented to each other.

Another limitation that is inherent in electro-magnets of this type resides in the fact that the laminations of the magnet are secured together by means of rivets. These rivets are passed through holes extending through the laminations of the magnet and inasmuch as these holes must be comparatively large to provide a rigid construction, the magnetic circuit is interrupted or restricted. The same holds true of the movable plunger. The present invention dispenses with this limitation by providing a core member and a magnet the ends of which are held together without the necessity of drilling holes for rivets. A still further advantage associated with this latter feature of the invention is the provision of an electro-magnet in which the instrumentalities which hold the laminations together also serve to retain the field coil spool core in position on the center pole piece.

Convenience of arrangement of parts, ruggedness and durability, simplicity in construction and consequent comparative inexpense of manufacture are further desiderata that have been borne in mind in the production and development of the present invention.

Other objects and advantages of the invention not at this time more particularly enumerated will become more readily apparent as the nature of the invention is better understood and the same consists in the novel combination, construction and arrangement of parts shown in the accompanying single sheet of drawings, in which:—

Figure 1 is a side elevation partly in section of an electro magnet of the plunger type manufactured in accordance with the principles of the present invention.

Figure 2 is an end view of the device shown in Figure 1.

Figure 3 is a perspective view of a stamping employed for securing the laminations of the movable plunger together.

Figure 4 is a perspective view of a thimble employed for securing the laminations of the divided pole pieces of the magnet in position.

Figure 5 is a fragmentary perspective view of the divided pole piece ends showing the thimbles thereon.

In all of the above described views like characters of reference are employed to designate like parts throughout.

The magnet proper is designated at 10 and is formed of a series of laminations 11. The central pole of the magnet is designated at 12 and the other pole is divided and is designated at 13. The magnet is provided with a base portion 14 connecting the pole pieces 12 and 13, the laminations of which base portion are secured together by means of rivets 15. Disposed about the pole 12 is a spool 18 having lateral flanges 20 at its upper end and having lateral flanges (not shown) at its lower end for retaining the wire field coil windings 22 in position on the spool. While this spool may be made of any suitable material and in any suitable manner it is preferable that the same be of some insulating material such as fibre, bakelite or the like on account of the rigidity and durability of the same.

The conductors which conduct current to the field windings 22 are designated at 26 and 28 respectively, and these conductors lead into the field coils at the base of the magnet.

Slidably mounted within the spool 18 is a plunger 30 having a stem 32 and a head 34. This plunger is also formed of soft iron laminations which are held together at the lower end of the stem 32 by means of a rivet 34'. A fibre disc 36 is disposed upon the upper end of the pole 12 and serves as a shock absorber to eliminate noise caused by the impact of the stem of the piston on the pole 12. The head 34 of the piston fits snugly between the inner side of the divided pole piece 13.

The upper ends of the divided pole piece 13 have fitted therearound thimbles 38 while the upper end or head of the plunger 30 has fitted therearound a stamping 40 for the purpose of securing the respective laminations of the divided pole piece and of the plunger together and also for the purpose of modifying the air gap between the inner sides of the divided pole piece and the plunger head as will be more fully described hereinafter.

The thimbles 38 are preferably formed as light sheet metal stampings. One of these thimbles is shown in perspective in Figure 4. This thimble is provided with a top portion 42, an inner side portion 44, front and rear side portions 46 and an outer side portion 48. The inner ends of the side portions 44 and 46 terminate in a substantially continuous flange 50 which bears against the flange 20 and serves to hold the spool 18 in position on the core 12. The flange 50 is omitted on the outer side 48 of the thimble. The outer sides of the divided pole piece 13 are provided with transverse groove 52. In assembling the magnet the thimbles 38 are inserted over the upper ends of the laminated divided pole pieces 13 and a tool is applied to the outer side 48 of each thimble to force the material of the sides into the grooves 52 to hold the thimbles or caps 38 securely in position on the ends of the divided pole piece 13.

The stamping 40 shown in Figure 3 is provided with a central aperture 56 which is inserted over the stem 32 of the piston 30. This stamping is provided with sides 58 which are bent upwardly over the front and rear sides of the piston head 34. The sides 58 are provided with upwardly extending lugs 60 carrying ears 62 which are bent inwardly and extend over the corners of the rectangular piston head.

The sides 58 are provided with upwardly extending ears 64 which project upwardly above the top of the piston head 34 and these ears are provided with aligned apertures 66 through which there is received a bolt 68 which serves not only to hold the sides 58 of the stamping against the piston head but which also serves as an attachment member for a connecting rod or other actuating instrumentality for causing action of some remote machine element.

It is to be particularly noted because of the smooth inner sides 44 of the thimble 38 the air gap between the piston head and the inner sides of the divided pole piece is substantially uniform. Because the head 34 of the piston 30 is closely fitted between the inner sides of the pole piece, the air gap remains substantially constant and the magnetic flux or flow offered is of a constant but small resistance.

Because of the fact that rivet holes in the upper ends of the dividing pole pieces have been eliminated, a substantially continuous uninterrupted path is provided and consequently a magnet which is of greater strength results.

The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawings or described in this specification as various details in the construction may be resorted to without departing from the spirit of the invention. Only in so far as the invention is particularly pointed out in the accompanying claims is the same to be limited.

Claims:

1. A laminated plunger for electro-magnets formed of a plurality of sheets of metal, said sheets being secured together at one end of said plunger by a rivet, the other end of said plunger having laminations thereof secured together by a metal sheathe.

2. A laminated plunger for electro-magnets having a head portion and a shank portion, the laminations of said shank portion being secured together by a rivet, the lamina-

tions of said head portion being secured together by a metal sheathe partially surrounding said head.

3. A laminated plunger for electro-magnets having a head portion and a shank portion, the laminations of said shank portion being secured together by a rivet, the laminations of said head portion being secured together by a metal sheathe partially surrounding said head, and means on said sheathe for attaching an operating member thereto.

4. A laminated plunger for electro-magnets comprising a head portion and a shank portion, means for securing the laminations of said shank portion together, a metal stamping having a central aperture through which said shank portion extends, said stamping having side portions bearing against the sides of the laminations of said head for holding said laminations together and an attaching ear on said stamping for attachment thereto of an operating member.

5. A laminated plunger for electro-magnets comprising a shank portion and a head portion substantially in the form of a parallelopiped, a sheathe having a central aperture through which said shank portion extends and having portions overlying the bottom sides and top of said head portion for clamping the laminations thereof together, there being ears formed on opposite sides of said sheathe and a pin bridging said ears for holding the sides of said sheathe in position and for attachment thereto of an operating rod.

6. An electro-magnet having a central pole piece and a divided laminated pole piece on opposite sides of said central pole piece, a field coil surrounding said central pole piece and having a plunger slidable therein, and a pair of thimbles secured over the ends of said divided pole piece for holding the laminations thereof together, said thimbles having each a flange bearing against said field coil for holding the same in position.

7. In an electro-magnet a laminated magnet of low retentiveness, said magnet having a central pole piece on opposite sides of said pole piece, a spool having an upper radial flange, said spool surrounding said central pole piece and being disposed within said divided pole piece, a field coil wound upon said spool, a plunger having a head presenting air gaps to said divided pole piece and having a shank slidable within said spool, a pair of thimbles capping the ends of said divided pole piece, said thimbles each having a flange bearing against the flange of said spool member to hold said spool member and field coil in position.

8. In an electro-magnet having a pair of laminated pole pieces and having a plunger, a head formed on said plunger, said head having a pair of flat surfaces, a pair of thimbles each having a smooth side opposing said surfaces, said thimbles being inserted over the ends of said pole pieces, and being formed of thin material to reduce the air gap presented to said flat surfaces.

9. In an electro-magnet a pair of laminated pole pieces having inner opposed parallel flat surfaces, a plunger having a head thereon, said head having oppositely disposed flat surfaces opposing the respective flat surfaces of said pole pieces thus presenting parallel air gaps, said plunger being movable in a direction parallel to the axis of said pole pieces whereby said gaps are maintained substantially constant in width regardless of the position of said plunger.

In testimony whereof we hereunto affix our signatures this 3d day of August, 1931.

MAX L. JEFFREY.
THEODORE H. EICKHOFF.
F. DEXTER SANBORN, Jr.