March 31, 1942. I. B. SERGE 2,278,406

STRIKER-ACTUATING MECHANISM FOR AUDIBLE-SIGNALS

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Fig. 1.

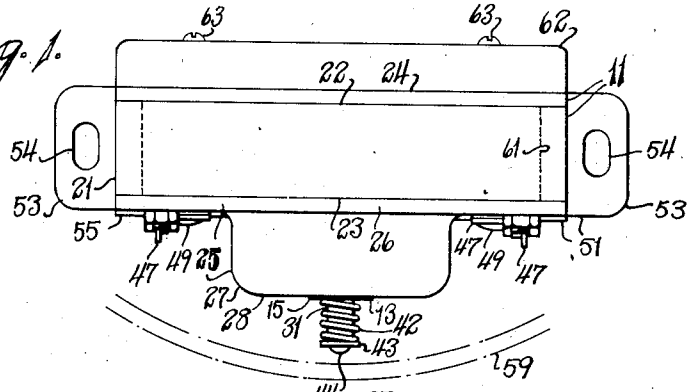


Fig. 2.

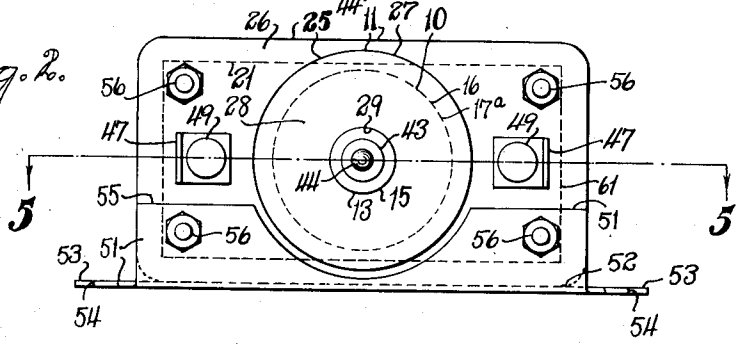


Fig. 3.

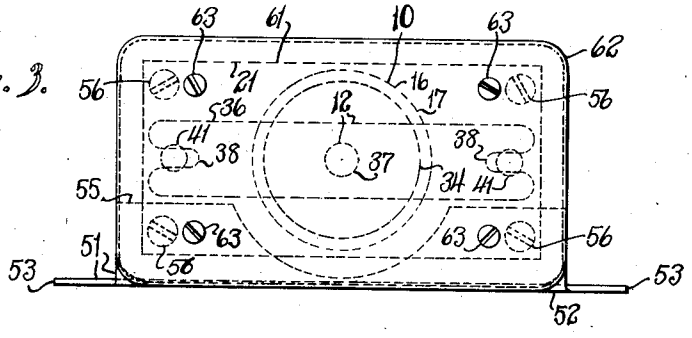
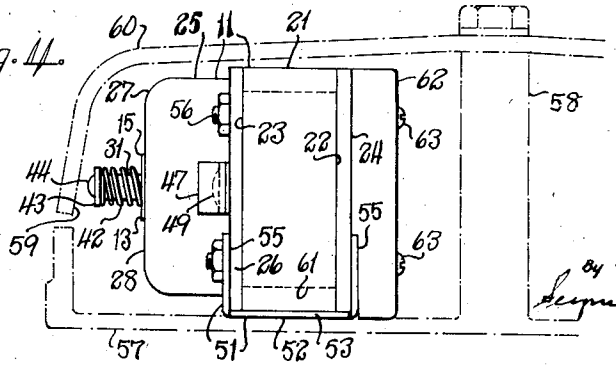


Fig. 4.



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Fig. 5.

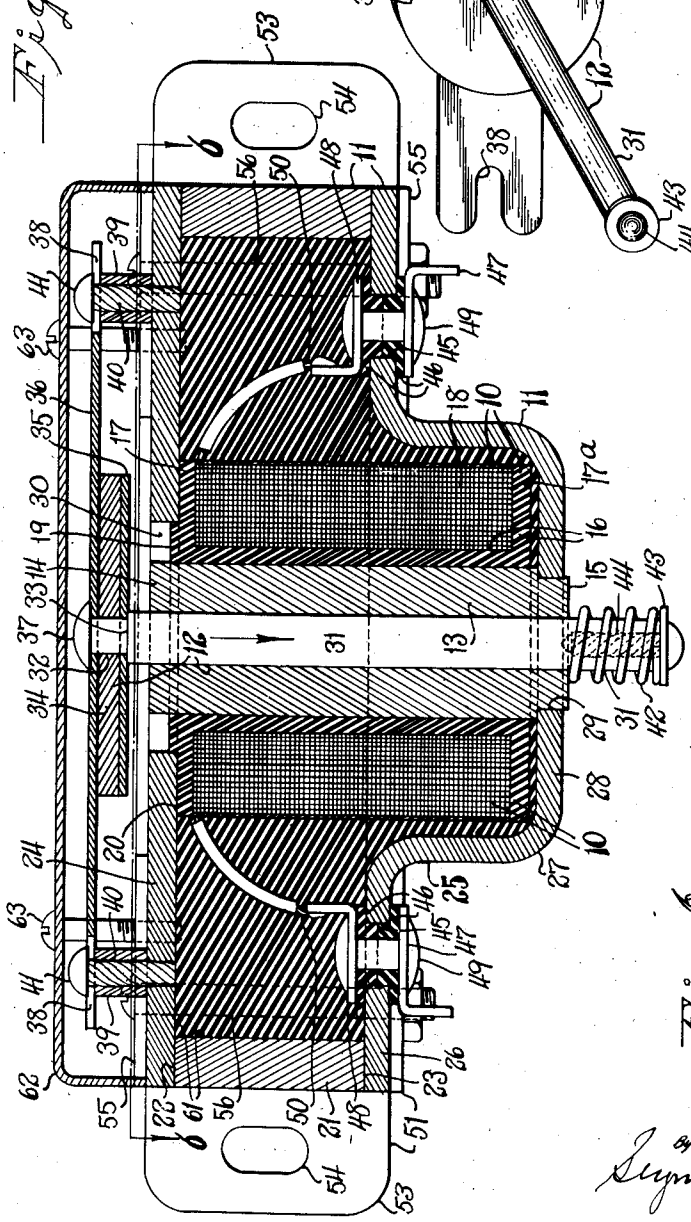


Fig. 7.

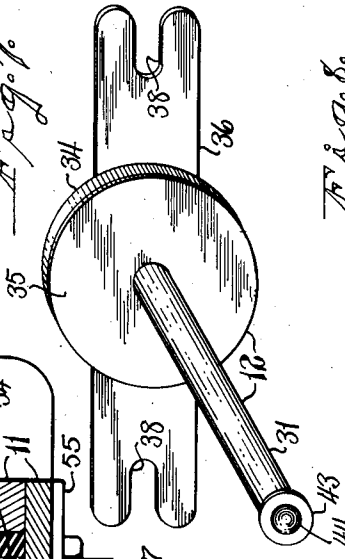


Fig. 8.

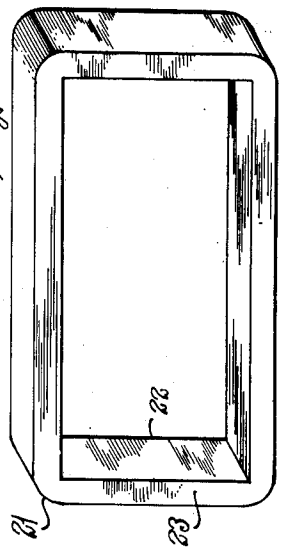
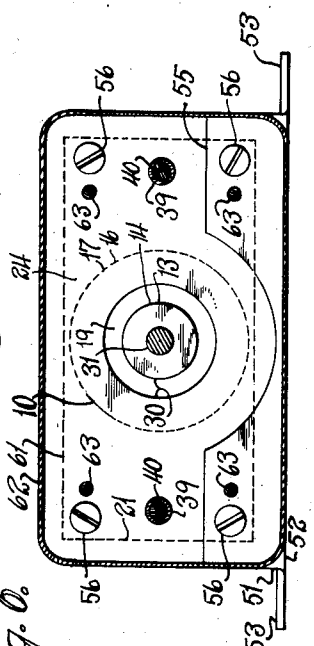


Fig. 6.



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UNITED STATES PATENT OFFICE

2,278,406

STRIKER-ACTUATING MECHANISM FOR AUDIBLE SIGNALS

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Application June 13, 1939, Serial No. 278,813

6 Claims. (Cl. 172—126)

The present invention relates to electrically-operated striker-actuating mechanisms for audible-signals, and more especially to striker-actuating mechanisms of this character in which electromagnets are utilized to operate movable armatures for imparting rapidly-recurring movements to the audible-signal striker-assemblies.

One of the objects of the present invention is to provide an audible-signal striker-actuating mechanism of superior construction that can be economically produced; inexpensively operated; and advantageously utilized in various places where audible-signals of this character are in demand.

For the purpose of economically producing audible-signals having a striker-actuating mechanism of the character hereinafter described, the invention has for another of its objects to provide a superior striker-actuating mechanism comprising a relatively small number of parts of simple and effective construction which can be manufactured and assembled with a considerable saving in time, labor and material costs.

Another object of the invention is to provide a superior construction and arrangement of parts in a striker-actuating mechanism for audible-signals for the purpose of reducing to a minimum the magnetic reluctance of a magnetic circuit including an operating-magnet and a polarizing-magnet therefor and, for this purpose, providing a flux-path of minimum length and maximum cross-sectional area while, at the same time, including in the said flux-path only a single air-gap having a minimum amount of air-gap reluctance.

Still another object of the invention is to provide an exceedingly-compact arrangement of symmetrically-constructed parts in the striker-actuating mechanism to adapt the said striker-actuating mechanism to be mounted on the signal-supporting base of an audible-signal in close juxtaposition to the periphery of a stationary bell on the said signal-supporting base.

A still further object of the invention is to provide an improved overlapping arrangement of the operating-electromagnet, polarizing structure therefor, and the striker-assembly, to make the over-all dimension extending axially of the striker-rod or plunger as small as possible, to render the assembly of parts exceedingly compact, sturdy and effective.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the accompanying drawings, which represent one mode of reducing the invention to practice:

Fig. 1 is a top plan view of an audible signal embodying the present invention;

Fig. 2 is a front elevation of the same;

Fig. 3 is a rear elevation of the same;

Fig. 4 is a view in side elevation taken from the right of Fig. 1;

Fig. 5 is an enlarged horizontal sectional view taken on the line 5—5 of Fig. 2;

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 5;

Fig. 7 is a perspective view of the striker and actuating-armature therefor; and

Fig. 8 is a perspective view of the permanent polarizing-magnet.

According to the embodied form of the invention shown on the drawings for the purposes of illustration, the striker-actuating mechanism comprises an operating-electromagnet generally designated by the reference character 10 which is arranged within and enclosed by a combined polarizing-and-housing-unit generally designated by the reference character 11, and a striker-assembly which is generally designated by the reference character 12 and comprises the moving parts of the striker-actuating mechanism.

As shown particularly well in Fig. 5, the operating-electromagnet 10, which is constructed about a straight-line axis, comprises a tubular core 13 provided at one end with an armature-actuating pole 14 and at its other end with a tubular neck 15 constituting the opposite pole of the electromagnet; a spool 16 provided with circular flanges 17 and 17*a* at opposite ends thereof; and an energizing coil 18 wound on the spool 16. The circular flange 17 of spool 16 is provided with a short tubular neck 19 which projects slightly beyond an annular seat 20 on the rear face of the circular flange 17.

A permanent polarizing-magnet 21 which is preferably constructed in the form of an endless bar, as shown particularly well in Fig. 8, is arranged with its neutral plane transverse to the axis of the electromagnet 10, the said endless polarizing-magnet 21 being magnetized to provide it with poles of opposite polarity in the axially-spaced polygonal surfaces thereof. In the form shown in the drawings, the marginal edge 22, which may for purposes of illustration constitute the north pole of the magnet, is arranged substantially in a common transverse plane, with

the annular seat 20 on the rear surface of the circular flange 17 of the magnet-spool, and is thus arranged to extend around and in overlapping relation to the electromagnet 10 and with its opposite marginal edge 23, which may constitute the south pole of the permanent magnet, arranged in a common transverse plane intermediate to and substantially parallel with the oppositely-presented poles of the said electromagnet.

Seated upon and conforming to the annular seat 20, and to the marginal edge or north pole 22 of the permanent polarizing-magnet, is a pole-member or plate 24 which is preferably constructed of non-permanent magnetic material such, for example, as soft iron or silicon steel, the said pole-member being made of suitable thickness to locate its outer surface substantially flush with the pole-end 14 of the electromagnet-core 13.

Extending across and in close-fitting engagement with the marginal edge 23, or south pole forming-surface, of the polarizing-magnet 21, is another pole-member which is generally designated by the reference character 25. The said pole-member 25 comprises a flat transverse outer wall-portion 26, which conforms to the polygonal outer marginal edges of the polarizing-magnet 21, and a central cupped-portion 27, which protrudes axially from the transverse wall-portion 26 and is preferably made of cylindrical form, to concentrically receive and house the outer end of the electromagnet 10. The said pole-member 25 may be constructed of any suitable non-permanent magnetic material such, for example, as soft iron or silicon steel. The centrally-arranged cupped-portion 27 of the said pole-member 25 has its circular end wall 28 provided with a central aperture 29 and has the marginal edge of said aperture closely interfitted with the tubular neck 15 of the tubular core 13 to provide an uninterrupted magnetic connection between the pole 15 of the electromagnet and the south pole 23 of the permanent polarizing-magnet 21.

As shown particularly well in Fig. 5, the inner peripheral edge of the pole-member 24 forms, with the outer peripheral surface of the armature-actuating pole-end 14 of the electromagnet-core, an annular air-gap 30.

Reciprocably mounted in the tubular bore of the electromagnet-core 13 is a non-magnetic plunger or striker-rod 31 which projects from the tubular core 13 at opposite ends of the electromagnet 10. The end of said plunger or striker-rod 31, which is adjacent to the air-gap 30, is provided with a reduced neck-portion 32 for receiving and holding an armature 34 which is in axial abutment with an annular shoulder 33 formed on the striker-rod 31. Interposed between the annular shoulder 33 and the armature 34 is a non-magnetic stop-disk 35 which prevents the said armature 34 from sticking to the magnetic-pole 14 of the electromagnet 10. The armature-holding neck 32 of the plunger or striker-rod 31 extends through a hole in an armature-holding leaf-spring 36 and is fastened to the said leaf-spring by having its outer end riveted thereto at 37. The armature-spring 36 is provided at opposite ends thereof with end-slots 38—38, by means of which the said armature-spring is slidably mounted at the top of oppositely-arranged tubular posts 39—39 which are rigidly mounted upon the pole-member 24 by means of drive-screws 40—40. The armature-spring 36 is retained against displacement from the posts 39—39 by means of the button-heads 41 formed on the drive-screws 40—40 which pass through the slots 38—38.

As shown particularly well in Fig. 5, the plunger or striker-rod 31 protrudes beyond the tubular neck or pole 15 of the electromagnet-core 13, and carries a cushioning-spring 42 which is interposed between a washer 43 and the end surface of the tubular neck 15, the said washer 43 being retained in position by a drive-screw 44 driven into the outer end of the plunger or striker-rod 31.

Formed in the oppositely-extending end-portions of the flat transverse wall 26 of the said pole-member 25, as shown particularly well in Fig. 5, are two holes 45—45 wherein are mounted two pairs of complementary bushings 46—46 which are constructed of electrical-insulation material. Mounted on the outer and inner complementary bushings 46—46 of each pair are outer terminal-connectors 47—47 and inner terminal-connectors 48—48 which are electrically and mechanically connected together by means of rivets 49—49. Suitable connecting-wires 50—50 are arranged to extend between the inner terminal-connectors 48—48 and the opposite terminals of the electromagnet 10, which is thus prepared to be connected in an alternating-current circuit through suitable line wires (not shown) connected to the outer terminal-connectors 47—47.

As shown particularly well in Figs. 2 and 4, the foregoing striker-actuating mechanism is mounted in a suitable saddle-frame or support 51 comprising a base-plate 52 having fastening-ears 53—53 at opposite ends thereof, provided with slots 54—54 for the reception of screws or other suitable fasteners, and side-plates 55—55.

As shown particularly well in Figs. 2 and 5, the polarizing-magnet 21 is interposed between and rigidly connected to the pole-members 24 and 25 by means of four tie-bolts 56—56, two of which are arranged to extend through the side-plates 55—55 of the saddle-frame or support 51 for connecting the said striker-actuating mechanism thereto.

As shown particularly well in Fig. 4, the axially-foreshortened striker-actuating mechanism, comprising the axially-overlapping electromagnet 10, polarizing-magnet 21 and reciprocatory plunger 31, is of suitable form to be mounted on a circular base-plate 57 of a bell-supporting standard 58 and radially interposed between the said standard 58 and the outer peripheral-rim 59 of a bell 60 mounted on the said standard 58 as shown by broken lines in the figure referred to.

Extending around the electromagnet 10 and within the polarizing-structure therefor, is an annular chamber 61, which is preferably filled with suitable insulating and protective material, such, for example, as pitch. As shown particularly well in Fig. 5, the armature 34, supporting-spring 36 therefor, and contiguous parts are encased by a cover 62 which is securely fastened to the pole-member 24 by screws 63.

It will be understood from the foregoing description of the parts and their relationships, that when the striker-actuating mechanism is supplied with alternating current the tubular core 13 will have its respective opposite ends oppositely magnetized during one-half or one phase of a given cycle and reversely magnetized during the other part or phase of a given cycle of the current. In other words, and by way of example, one phase of the current cycle will create a

north polarity in the pole 14 and simultaneously produce a south polarity in the pole 15 and on the next succeeding phase of the cycle, the pole 14 would have a south polarity and the pole 15 a north polarity.

For the purpose of description, let it be assumed that the portion of the polarizing magnet 21 adjacent the armature side of the assembly, has a permanent north polarity, and that the opposite portion of the said polarizing magnet has a permanent south polarity.

Now when the current supplied to the energizing-coil 18 is of a direction to produce a south polarity in the pole 14 and a north polarity in the pole 15, the armature 34 will be drawn inwardly toward the said pole 14 to cause the said armature to bridge the annular air-gap 30 and to move the plunger 31 into engagement with the bell 60 or other sounding device.

When now the flow of current in the energizing-coil 18 reverses, the pole 14 of the tubular core 13 will become a north pole at the same time that the pole 15 becomes a south pole. Now inasmuch as the polarity of the pole 14 will correspond to the polarity of the pole-member 24 as the same is permanently magnetized by the polarizing magnet 21, the armature 34 will cease to be attracted during this phase of the current cycle and the armature-spring 36 will assert itself to retire the said armature away from the pole 14 preparatory to being moved again toward the same upon the next succeeding current phase which will again impose a polarity upon the said pole 14 opposite to that permanently imposed upon the pole-member 24 by the polarizing-magnet 21.

When the armature 34 is released as above described and is retired by the armature-spring 36, the cushioning-spring 42 will act to resiliently check the retiring movement referred to.

A striker-actuating mechanism constructed according to the present invention, is characterized by the arrangement of a permanent polarizing-magnet having an exceedingly-short flux-path of exceptionally large cross-sectional area. The said polarizing-magnet is arranged to extend around the operating-magnet and in axially-overlapping relation thereto. At the same time, the magnetic circuit, which includes the operating-magnet and polarizing-magnet in series arrangement in a magnetic circuit of minimum length and maximum cross-sectional area, provides a minimum degree of reluctance in the said magnetic circuit and permits the magnet-structure to be operated with a relatively-low consumption of power.

In a mechanical way, the reciprocatory striker-rod or plunger is slidably supported throughout most of its length within the bore of the tubular core of the operating-magnet and with the striker-end thereof firmly supported within a small distance from the bell.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. An alternating-current striker-actuating mechanism for audible-signals, comprising: a polarized alternating-current operating magnet having a rectilinear tubular core; an energizing-coil on said tubular core; an electromagnetically-responsive armature at one end of said tubular core; a permanent polarizing-magnet of ring-shaped form substantially encircling said operating-magnet in a lateral direction and provided with pole-members at opposite ends thereof which extend radially inwardly therefrom toward the tubular core of the said operating-magnet into position to include the said polarizing-magnet in electromagnetic series with the said tubular core one of said pole-members being shaped to form an annular air-gap with the armature-actuating end of the tubular core adjacent which the said armature is located; and a non-magnetic plunger extending through said tubular core and connected to said armature.

2. An alternating-current striker-actuating mechanism for audible-signals, comprising: a substantially-ring-shaped polarizing-magnet constructed of permanent magnet material arranged to provide poles of opposite polarity in parallel planes normal to the axis of a passage extending therethrough; an alternating current magnet extending through the said passage and having a tubular core; two pole-members one of which extends radially inwardly from each of the opposite ends of said polarizing permanent magnet, one of said pole-members having a central portion extending around and forming an annular air-gap with one end of the said tubular core of the said alternating-current magnet and the other of said pole-members having a central portion magnetically connected to the other end of the said tubular core; a non-magnetic plunger reciprocable within the said tubular core; a magnetic armature mounted on the non-magnetic plunger and extending crosswise of the annular air-gap formed between one end of the said tubular core and the adjacent edge of one of the aforesaid pole-members; and means normally yieldingly holding the said armature in spaced relationship with respect to the end of the said tubular core adjacent which the annular air-gap is formed between itself and the adjacent portion of one of the aforesaid pole-members.

3. An alternating-current striker-actuating mechanism for audible-signals, comprising: an alternating-current electromagnet having a tubular core; a polarizing-magnet having a neutral plane disposed transversely to the axis of the said tubular core; pole-members at the respective opposite side faces of the said polarizing-magnet; one of said pole-members having a central portion extending around and forming an annular air-gap with one pole of the tubular core, and the other of said pole-members having a central portion electromagnetically connected to the other pole of the said tubular core; a non-magnetic plunger reciprocable within the bore of said tubular core and having an armature constructed and arranged to be actuated by the combined tractive effects of the oppositely-polarized poles of both of the said magnets on the same side of the said neutral plane as the annular air-gap.

4. An alternating-current striker-actuating mechanism for audible-signals, comprising: an operating-electromagnet symmetrical with respect to an axis and having opposite poles of alternating polarity in axially-spaced planes transverse to the said axis; a permanent polarizing-magnet having oppositely-presented poles disposed parallel to and between the said planes;

pole-members constructed of non-retentive magnetic material permanently connected to the said oppositely-presented poles, respectively, of said polarizing-magnet, one of the said pole-members being constructed and arranged to form a closely-fitted circumferential joint with, and to completely encompass one of the said poles of the operating-electromagnet, and the other of said pole-members being constructed and arranged to extend completely around the other one of the said poles of the operating-electromagnet and to form therewith an annular air-gap; and a striker-assembly including an armature constructed and arranged to be electromagnetically operated by the said operating-electromagnet to close the said annular air-gap when the said polarizing-magnet forms a part of the flux-path therefor.

5. An alternating-current striker-actuating mechanism for audible-signals, comprising: an operating electromagnet having a tubular core constructed about a straight-line axis to provide oppositely-presented poles of opposite polarity in parallel planes normal to the said axis; a striker-assembly including a non-magnetic plunger reciprocable within the said tubular core and an armature mounted on one end thereof to be electromagnetically responsive to the said electromagnet, and a closed housing for the said operating electromagnet, comprising an endless polarizing magnet extending around the said electromagnet and intermediately of the ends thereof; a pole-member constructed of non-permanent magnetic material electromagnetically connecting one pole of the said polarizing-magnet to the armature-actuating pole of said operating-electromagnet with an included annular air-gap of less outside diameter than that of said armature; and another pole-piece electromagnetically connecting the other pole of the said polarizing-magnet to the other pole of the tubular core.

6. An alternating-current striker-actuating mechanism for audible-signals, comprising: an operating-electromagnet having a tubular core constructed about a straight-line axis to provide oppositely-presented poles in parallel planes normal to the said axis; a closed housing for the said operating-electromagnet including a pole-member in the form of an imperforate plate of magnetic material having a central cup-like portion to receive one end of the said operating-electromagnet and provided, in the end wall thereof, with a central aperture, around the marginal edge of which it is in supporting engagement with the adjacent end of the said tubular core; another pole-member in the form of an imperforate plate of magnetic material having a central aperture forming, with the other end of the tubular core, an annular air-gap; an endless permanent polarizing-magnet extending around the said operating-electromagnet between the said parallel planes at the opposite ends of the said tubular core and having opposite polar faces thereof in engagement with the marginal edges of the said pole-members; a non-magnetic plunger reciprocable within the said tubular core and protruding therefrom at opposite ends; and an armature mounted on one end of the said non-magnetic plunger adjacent to the said annular air-gap to be electromagnetically responsive to the combined tractive effects of the said polarizing-magnet and operating-electromagnet when corresponding poles of the said magnets are oppositely-polarized.

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