

April 27, 1954

W. D. CANNON ET AL

2,677,028

POLAR RELAY

Filed July 6, 1951

2 Sheets-Sheet 1

FIG. 1

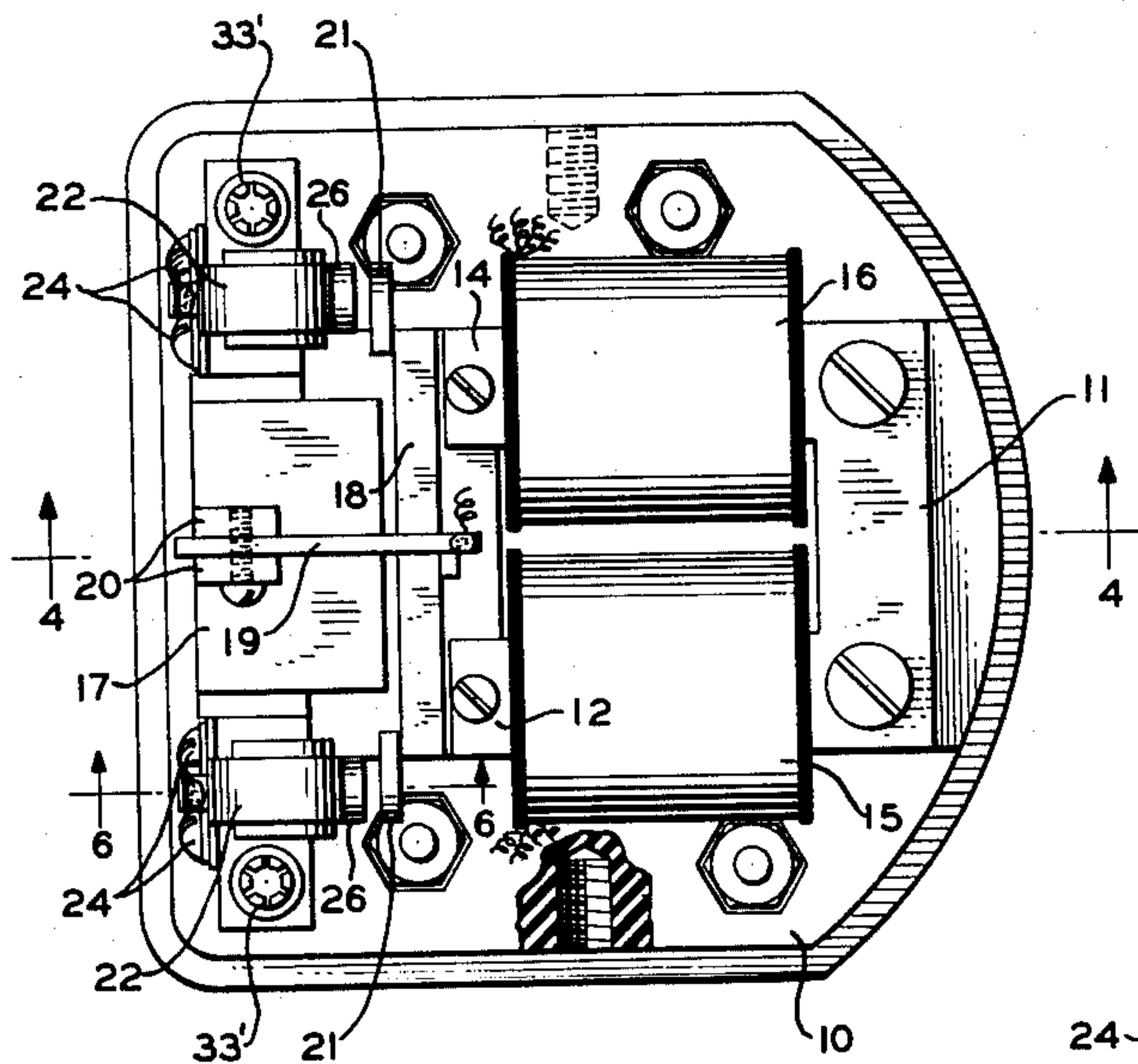


FIG. 6

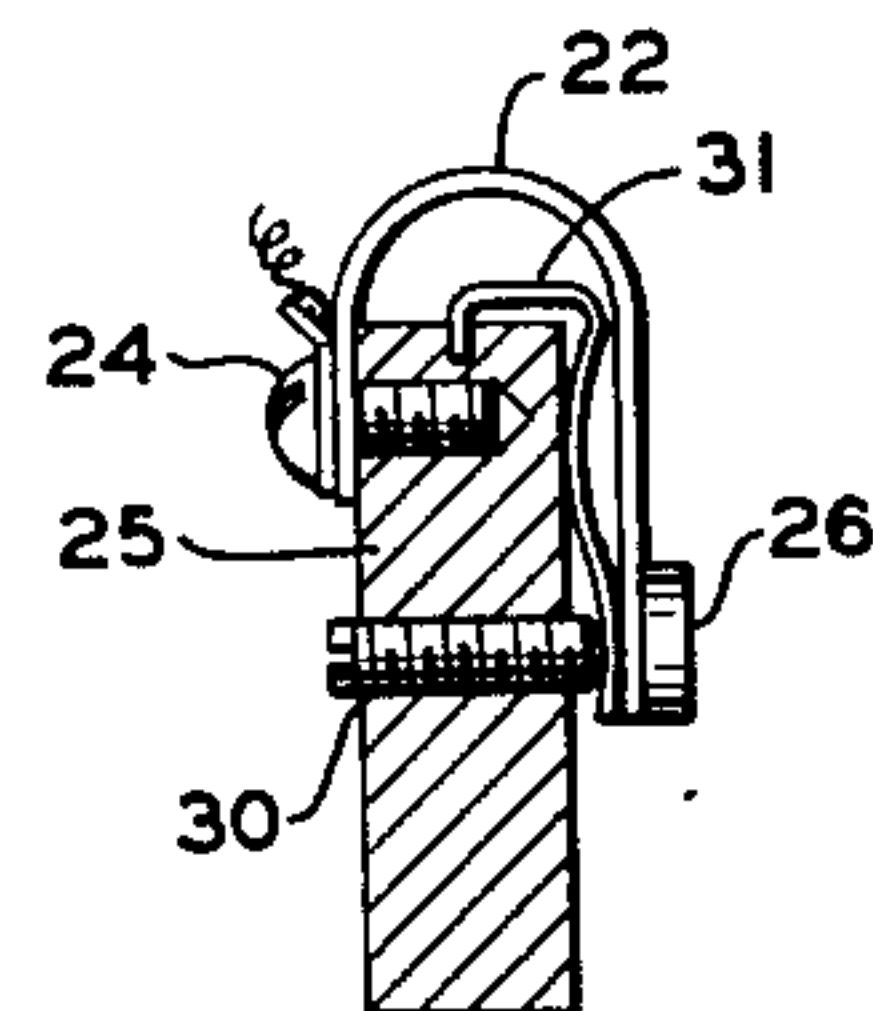


FIG. 2

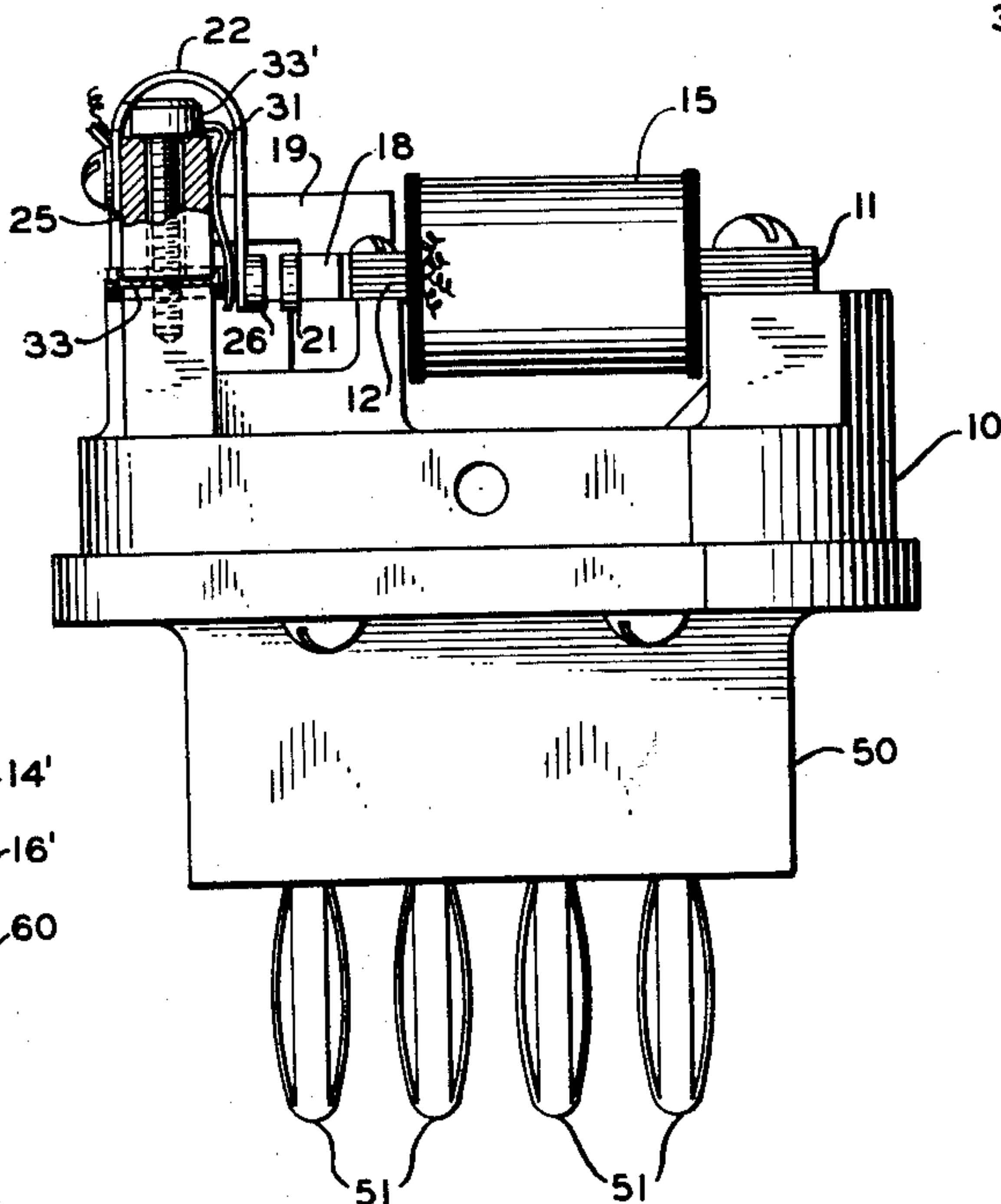
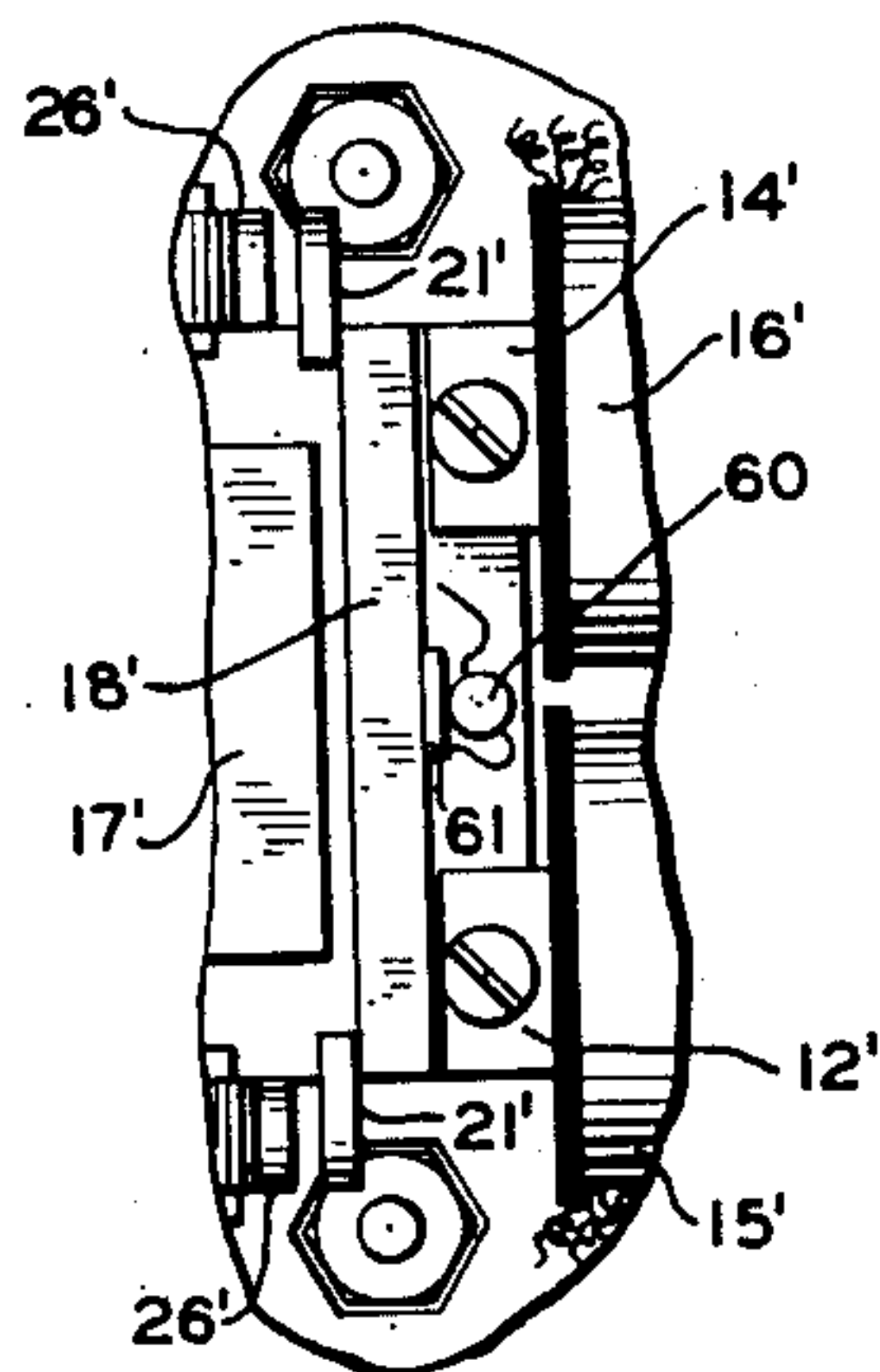


FIG. 7



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2 Sheets-Sheet 2

FIG. 3

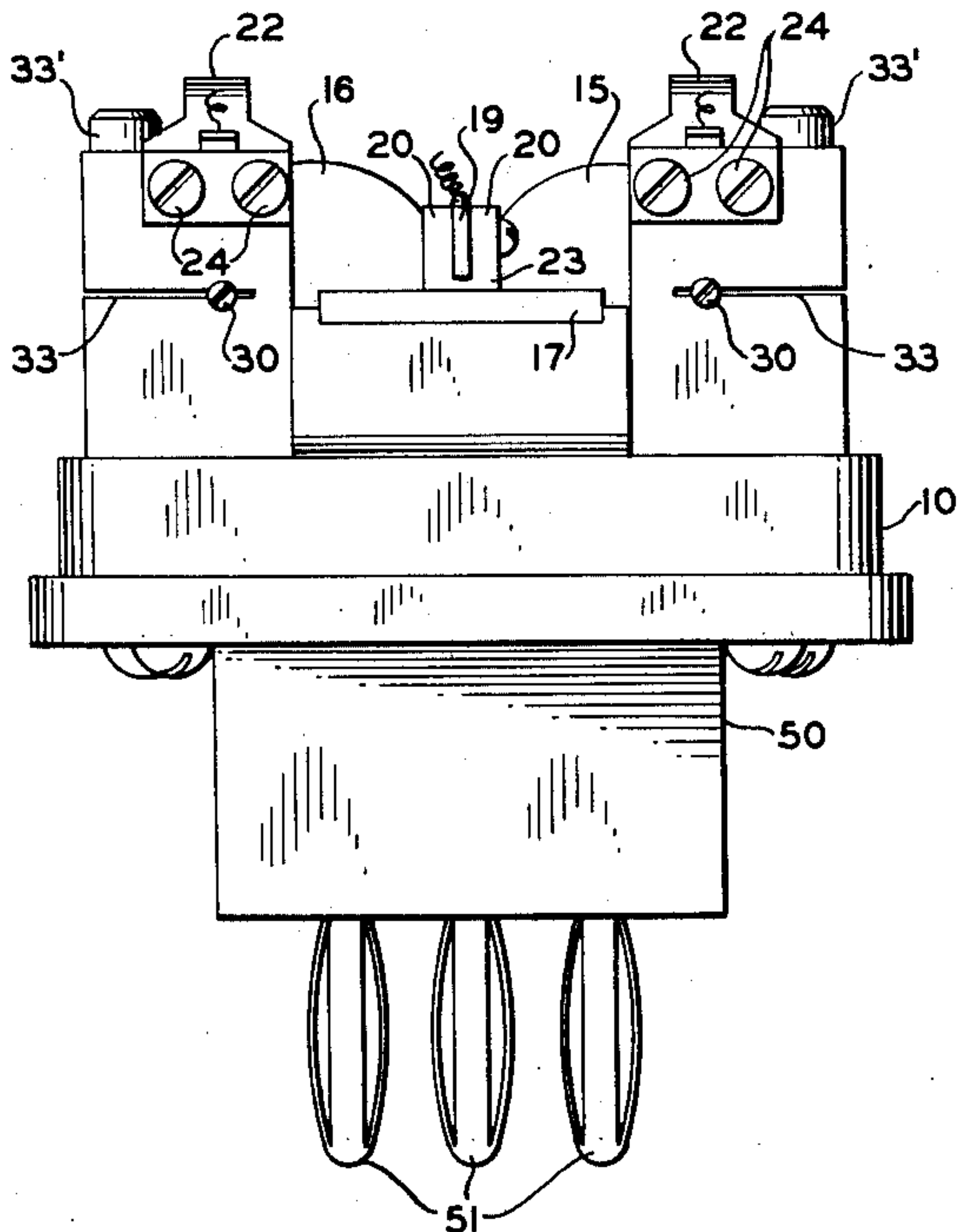


FIG. 4

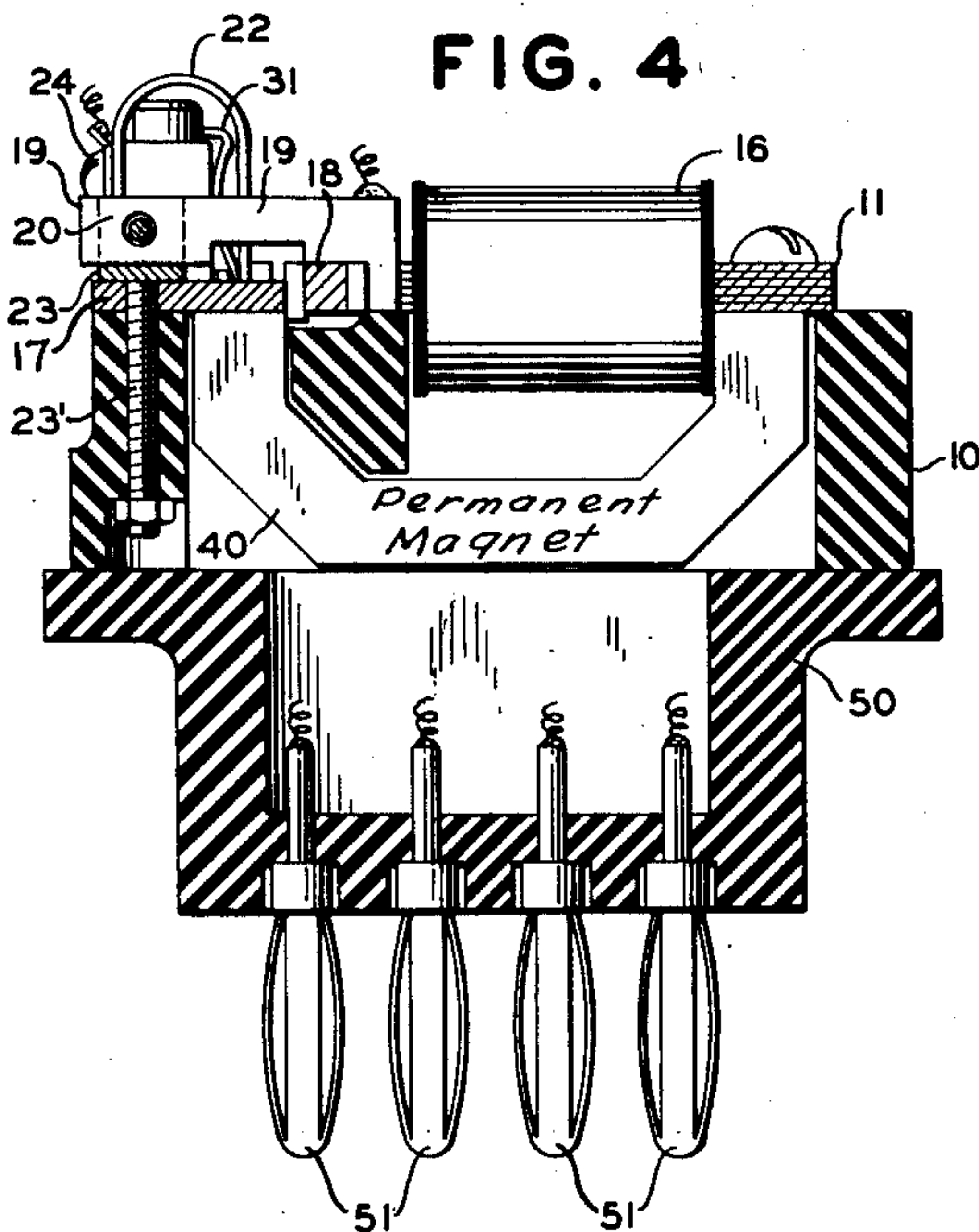
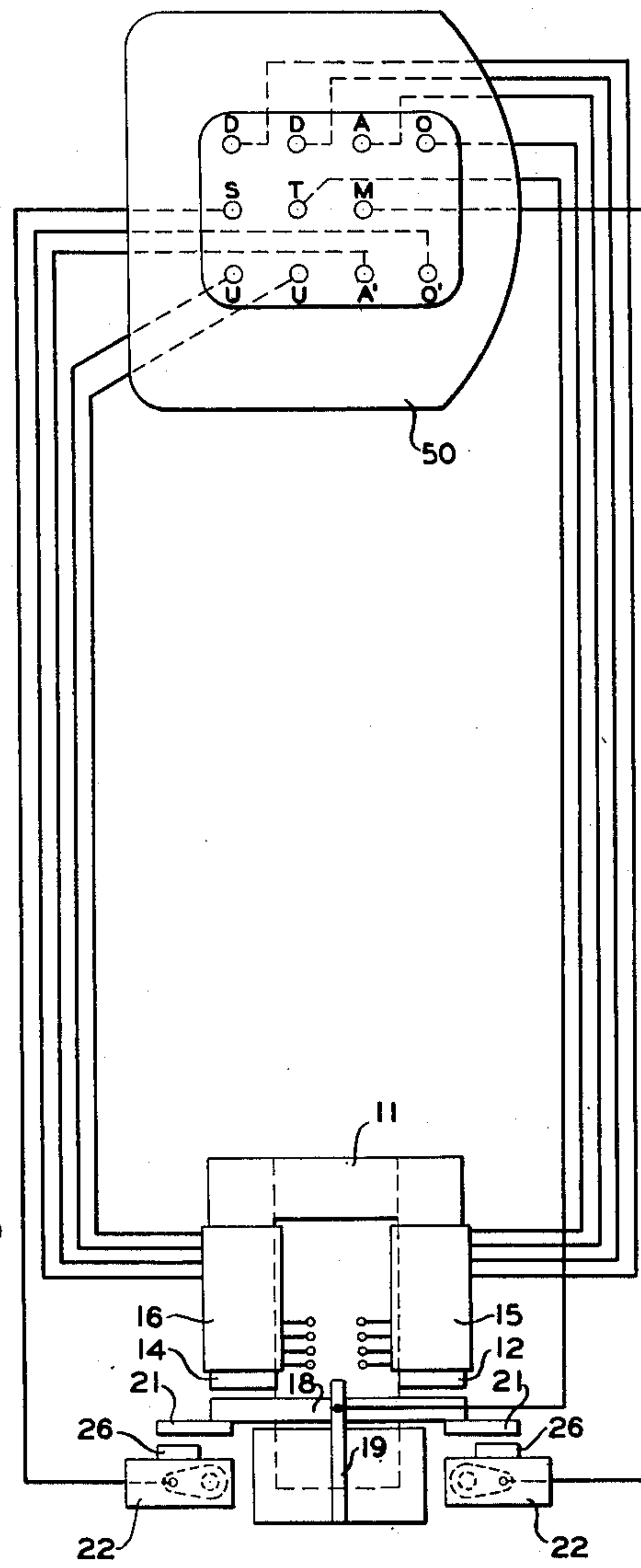


FIG. 5



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POLAR RELAY

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Application July 6, 1951, Serial No. 235,492

5 Claims. (Cl. 200—93)

1

This invention relates to relays and more particularly to polar relays especially adapted for use in the telegraph industry.

Heretofore many types of polar relays have been used in the telegraph industry all of which have possessed disadvantages such as required jeweled bearings, the necessity for frequent adjustments, and rapid wear of bearing surfaces, contacts and the like.

An object of the present invention is to provide an improved polar relay which is of utmost simplicity and which is so constructed as to eliminate the requirement for special bearings subject to wear and the like.

Another object of the invention is to provide a polar relay of relatively small size in which a minimum number of parts is employed.

A further object of the invention is to provide a relay of the foregoing character in which a substantially rigid armature is mounted for rocking motion in the space between the ends of a core and a pole shoe.

A further object of the invention is to provide a relay as aforesaid in which the armature is restrained from other than rocking motion substantially entirely magnetically.

A further object of the invention is to provide such a relay in which undesired motion of the rigid armature is prevented both mechanically and magnetically.

A still further object of the invention is to provide a relay in which the bar-type substantially rigid armature is spring mounted for rocking motion for a consequent wiping of movable contacts against fixed contacts.

In carrying out the foregoing and other objects of the invention, a polar relay is made up of a laminated metallic core on the legs of which are located the usual coils having the conventional windings incorporated therein. Spaced from the ends of the legs of the core is a pole shoe, and a permanent magnet extends from the pole shoe to the connection between the legs of the pole piece. A pair of adjustable contacts are mounted adjacent the respective ends of the pole shoe, and for cooperation therewith use is made of a substantially rigid bar armature carrying contacts at the ends thereof, and mounted or positioned for rocking movement in the space between the core and the pole shoe so that the contacts on the armature can make contact alternatively with the adjustable contacts.

This bar armature can be held in position in either of two different ways. In one form of the invention a flat spring extends over the pole shoe

2

and has the bar armature secured thereto near the outer free end of the spring. This spring, which can have suitable tension, restrains the armature against motion, other than rocking motion, which rocking motion will occur when the relay is suitably energized to cause either one or the other of the contacts on the armature to engage one or the other of the adjustable contacts.

In another form of the invention, the armature supporting spring has been eliminated and in lieu thereof, use is made of the magnetic field of the relay for retaining the armature in proper position. Further, rocking motion is assured by having the midpoint of the armature bear against an upright post against which it is held by magnetic force in such fashion that the armature in effect rotates or rocks about the post from one position to the other thereof.

Other features, objects and advantages of the invention will become apparent by reference to the following detailed description of the accompanying drawings wherein—

Fig. 1 is a plan view of a relay embodying one form of the invention;

Fig. 2 is a side elevation of the relay;

Fig. 3 is an end view thereof;

Fig. 4 is a section taken substantially on the line 4—4 of Fig. 1;

Fig. 5 is a circuit diagram of the relay and associated spring plug members;

Fig. 6 is an enlarged section taken substantially on the line 6—6 of Fig. 1; and

Fig. 7 is a fragmentary plan view similar to Fig. 1 of another embodiment of the invention.

Referring now to the drawings, 10 indicates the base of a relay construction embodying the invention, such base being made of a suitable block, either solid or composite of insulation material such as fibre, a phenol condensation product, or the like. Secured to the base 10 is a laminated core 11 around the respective legs 12 and 14 of which are located coils 15 and 16 which will be described in more detail later. Secured also to the base 10 and spaced from the ends of the legs 12 and 14 is a metallic pole shoe 17. Positioned in the space between the ends of the legs 12 and 14 and the pole shoe 17 is a substantially rigid or inflexible armature bar 18 supported by a flat leaf spring 19, one end of which is secured between forks 20 of a standard 23, the threaded end 23' of which extends through the pole shoe into the base where it is locked by a nut, as shown in Fig. 4. The armature bar 18 is made of suitable metal and has secured to the ends thereof contact members 21 made of some

3

suitable material which resists wear. In practice, tungsten carbide has been found to serve this purpose admirably. The spring 19 can be secured to the bar 18 by solder or in any other suitable manner.

For cooperation with the contacts 21 of the armature 18, provision is made for mounting a pair of bowed spring members 22 which are, when flattened out, of generally T-shape. The cross-head portion at one end of each spring 22 is secured by screws 24 to uprights 25 secured to the base 10. The other ends of the springs 22 are provided with contact members 26 made of material similar to the contacts 21. The uprights 25 are provided with threaded through openings for the passage of an adjusting screw 30 which can be used for determining the position of the contacts 26 relative to the contacts 21. Each upright 25 is slit as shown at 33 and has an aperture which is threaded below the slit to receive a locking screw 33' which compresses the slit and locks screw 30 in adjusted position. If desired, use may be made of helper springs 31, the major part of each of which is of substantially ogee curvature, and one end of each of which is embedded in the top of an upright 25. The ogee curvature part before mentioned lies adjacent an expanse of a spring 22 as shown in Fig. 6, and the end of the screw 30 bears against the helper spring. Thus by rotation of the screw 30 in one direction, the contact 26 may be moved closer to the pole piece or if the screw is moved in the opposite direction the contact 26 will be moved further away from the pole piece due to the natural resiliency of the spring 22 and also the helper spring 31. It will be understood, of course, that the helper spring may be omitted if desired.

A permanent magnet 40 is positioned in a cut-out portion of the base 10 as shown in Fig. 4, with one end of the magnet engaging the pole shoe 17 and the other end of the magnet engaging the connecting expanse between the legs of the laminated core 11. In accordance with well known practice in polar relay structure two magnetic paths for the magnetic fluxes are provided, one for the flux produced by the permanent magnet 40 and the other for the flux produced by the operating current in the coils 15 and 16. The path for the flux from the permanent magnet is arranged in the form of a bridge with respect to the armature 18 so that a center position of the armature exists at which the forces due to the permanent magnetic flux in the two sides of the bridge cancel. A slight movement of the armature from this center position results in the magnetic forces being unbalanced, the resulting changes on the armature acting in the same direction that the armature is moved from the center position. This motion is limited by the contacts 26 disposed on opposite sides of the center position, and ordinarily the armature will rest on either contact to which it is moved. An operating current in one direction unbalances the forces in the bridge in one direction, and current in the opposite direction unbalances the forces in the opposite direction, so that the armature movement depends upon the direction of the operating current.

Referring to Figs. 1 and 4, it will be seen that the path for the flux from the left hand pole of the permanent magnet 40, as viewed in the figures, includes the pole shoe 17 from which the flux flows in two parallel branches across the

4

first air gap, transversely through the end portions of the armature 18, and across the second air gap and through the legs 12 and 14 of the laminated core or pole piece 11, and thence to the right hand pole of the permanent magnet. The path for the flux produced by the operating current in the coils 15 and 16 is a series path through legs 12 and 14 of the core 11, the adjoining air gap and lengthwise through the armature 18. Thus the path of the flux generated by the operating current does not include the permanent magnet 40 which has high reluctance and is not a suitable material for carrying the flux generated by the operating current.

Secured to the undersurface of the base 10 is a sub-base 50, in the bottom of which are mounted a plurality of spring plug members 51. The sub-base can be secured to the base in any suitable fashion and like the base is made of an insulating material such as fibre, a phenol condensation product, or the like.

The coils 15 and 16 are made up each of a plurality of windings in the usual manner, the windings of each coil being four in number as is customary in polar relays of the type used in the telegraph industry. A schematic wiring diagram has been shown in Fig. 5 wherein it will be seen that four leads from the coil 16 extend to four of the plugs 51 while four leads from the coil 15 likewise extend to four of this same group of plugs. In addition, one lead extends from one plug to one of the spring contact members 22 while another lead extends from another plug to the other contact 22. A final lead extends from the last plug of the group to the spring 19 whereby the eleven connections conventionally used in this type of relay can be effected. Four leads from each of the windings of coils 15 and 16 can be interconnected in the customary fashion, such connections having been omitted from Fig. 5 for purposes of simplicity.

With the relay constructed in the foregoing manner, it will be seen that the armature bar 18 is mounted for rocking action relative to the stationary contacts 26, such rocking action being permitted by the flexible spring 19 which supports the bar. Due to rigidity of this bar 18, substantially all whip has been eliminated and consequently contact bounce has been reduced to a minimum. Furthermore, since the bar rocks about an axis determined by the location of the mounting of the end of spring 19, it follows that as one contact 21 engages a fixed contact 26, it does so with a sliding action instead of a straight rectilinear action. This sliding action serves to wipe one contact across the other, preventing the building up of any deposit on either contact. It will be noted by reference to the drawings that the fixed contacts 26, the term "fixed" being relative, can have their position varied to vary the length of contact movement to an absolute minimum, so that contact travel time can be materially reduced thereby effecting increased efficiency of telegraph transmission.

The relay may be either of the two-position or three-position type, depending on the thickness and strength of spring 19. If this spring is thin and relatively weak, the armature 18 will have one or the other of its contacts in engagement with its fixed contact in normal condition. If the spring is relatively thick and strong, the armature normally will be in a neutral position, as shown in Fig. 1, moving to contact closing position only when the relay is energized, and

5

maintaining that condition only as long as the energizing impulse continues.

A slightly modified form of the invention has been shown in Fig. 7 which is a fragmentary plan view similar to Fig. 1. The parts of Fig. 7 are all similar to those of Fig. 1, with the exception that the spring 19 has been omitted and instead thereof use is made of an upright post 60 preferably made of some hard metal such as tungsten carbide or the like, and supported by the base of the relay. In addition, the contact bar 18' of this modification has secured thereto a bearing boss 61 preferably of the same material as the post 60 to bear against the post 60. In this modification of the invention the armature 18' is held firmly against the post 60 by the magnetic field of the relay and in practice it will be found that normally the bar will be in a position in which one contact 21' or the other will be in engagement with its corresponding contact 26'. This armature is held against motion longitudinally or cross-axially of the post 60 or undesired rocking about the same solely by the magnetic field of the relay and thus there is no mechanical restriction against longitudinal movement of the armature and the resulting sliding action between the faces of the contacts during operation of the relay. With this construction all bearings, jewelled or otherwise, commonly found in relays of this type have been eliminated. It will be understood, of course, that the post 60 is connected by a suitable lead to one of the plugs in the sub-base instead of the connection from spring 19 to such plug, and the post is electrically connected by a conductor to the armature. In practice it has been found that an armature so held in place magnetically and having engaging surfaces of wear resistant material will operate indefinitely without such wear as would require repeated adjustments of the so-called fixed contacts 26'. It will be noted that both the spring-mounted and magnetically-retained armatures are floatingly mounted since they are capable of rocking movement for alternative engagement of the contacts at the ends of the armature and also lengthwise movement in a direction to produce a sliding action between the faces of the contacts during operation of the relay.

From the foregoing it will be seen that the present invention in either embodiment illustrated and described herein provides a new, simple and efficient polar relay which overcomes the difficulties and disadvantages inherent in prior types and which employs a minimum of parts with a resultant minimum of required adjustment and the like. It is to be understood that the invention is to be limited solely by the scope of the following claims.

What is claimed is:

1. A polarized relay comprising a core having at least two legs and electromagnetic coil structure for producing operating fluxes in said legs, a pole shoe spaced from the ends of the legs of said core, a permanent magnet positioned in close proximity to said core and said pole shoe so as to polarize said core and said pole shoe, a substantially rigid armature positioned for oscillatory movement in the space between said pole piece and pole shoe, fixed contacts positioned to be engaged by movable contacts on the ends of said armature, and means for supporting said armature substantially at its longitudinal mid-

6

point for component movement in longitudinal and transverse directions and mounted in a position to cause said oscillatory movement to take place about an initial point that is spaced transversely a substantial distance from the plane of the contact surfaces of said fixed contacts sufficient to enable lengthwise movement of the armature in a direction to effect a substantial sliding action between the faces of said fixed and movable contacts during operation of the relay.

2. A polarized relay comprising a core having at least two legs and electromagnetic coil structure for producing operating fluxes in said legs, a pole shoe spaced from the ends of the legs of said core, a permanent magnet positioned in close proximity to said core and said pole shoe so as to polarize said core and said pole shoe, a substantially rigid armature positioned for oscillatory movement in the space between said pole piece and pole shoe, fixed contacts positioned to be engaged by movable contacts on the ends of said armature, a flexible spring having one end thereof fixed and the free end thereof rigidly secured to said armature for supporting the armature substantially at its longitudinal midpoint for component movement in longitudinal and transverse directions, the fixed end of said spring being mounted in a position to cause said oscillatory movement to take place about an initial flexural point that is spaced transversely a substantial distance from the plane of the surfaces of said fixed contacts sufficient to cause lengthwise arcuate movement of the armature in a direction to effect a substantial sliding action between the faces of said fixed and movable contacts during operation of the relay.

3. A relay according to claim 2, in which said flexible spring is a leaf spring flexible in a direction to cause said oscillatory movement to take place.

4. A relay according to claim 2, in which the flexible portion of said spring extends over the space between the pole piece and the pole shoe.

5. A polarized relay comprising a core having at least two legs and electromagnetic coil structure for producing operating fluxes in said legs, a pole shoe spaced from the ends of the legs of said core, a permanent magnet positioned in close proximity to said core and said pole shoe so as to polarize said core and said pole shoe, a substantially rigid armature positioned for oscillatory movement in the space between said pole piece and pole shoe, fixed contacts positioned to be engaged by movable contacts on the ends of said armature, means for supporting said armature substantially at its longitudinal midpoint for component movement in longitudinal and transverse directions and comprising an upright post against which the armature is held magnetically for oscillatory movement relative thereto, the armature being mechanically unrestrained from lengthwise movement thereof, said post being mounted in a position to cause said oscillatory movement to take place about an initial point that is spaced transversely a substantial distance from the plane of the contact surfaces of said fixed contacts sufficient to enable lengthwise movement of the armature in a direction to effect a substantial sliding action between the faces of said fixed and movable contacts during operation of the relay.

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