

Feb. 28, 1939.

A. F. HOPKINS, JR

2,148,467

ELECTRIC CONNECTOR

Filed April 25, 1936

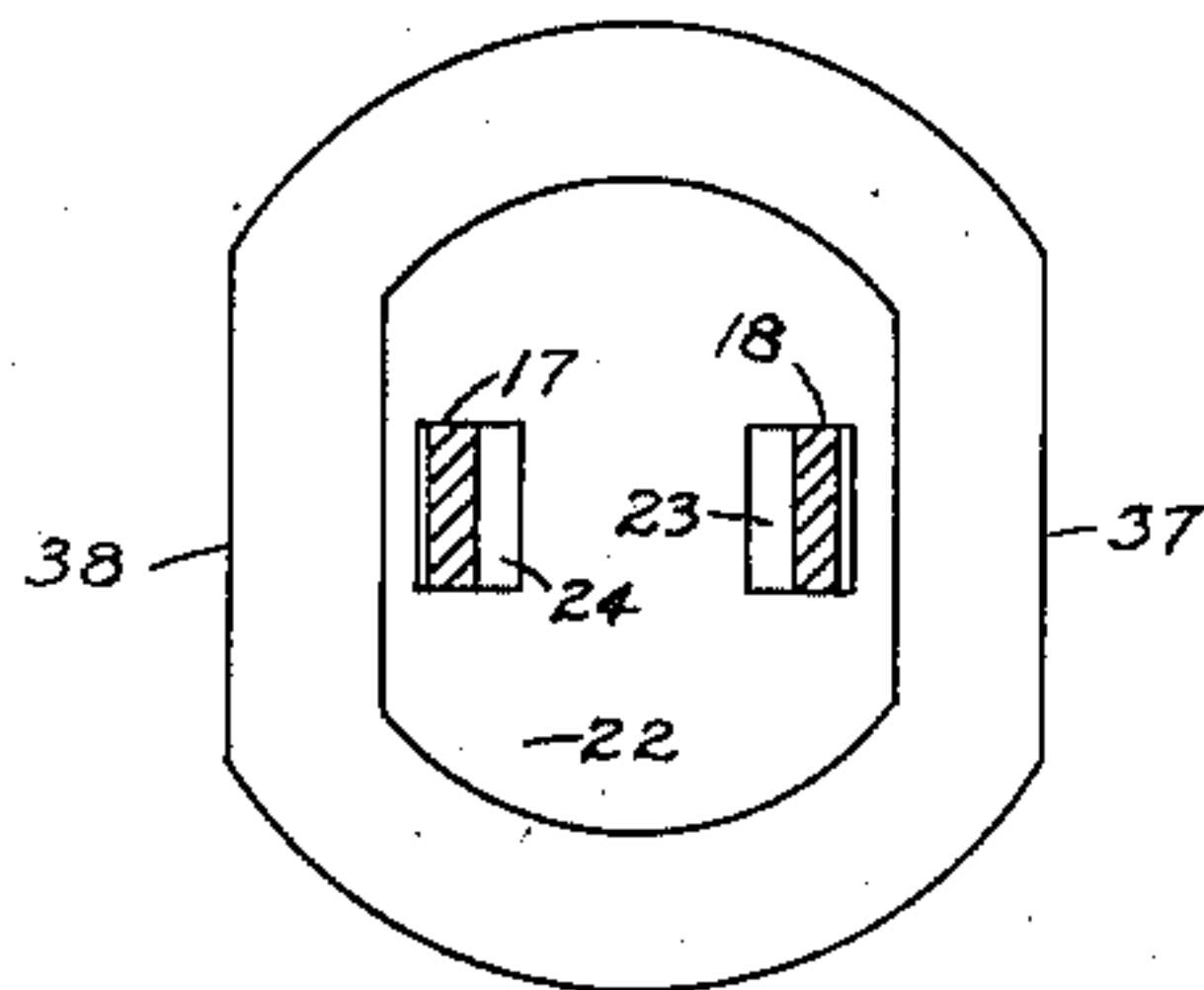


Fig. 1.

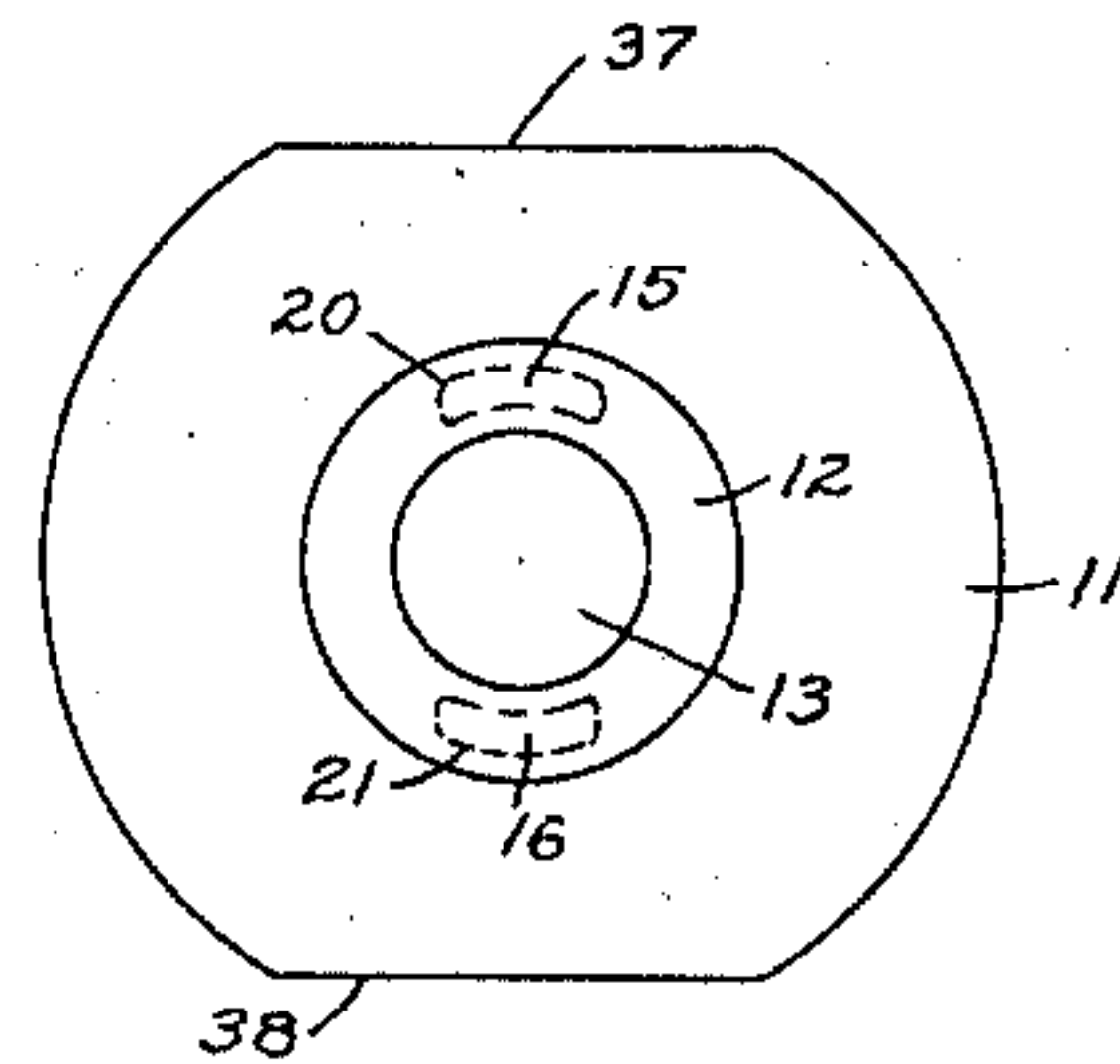


Fig. 2.

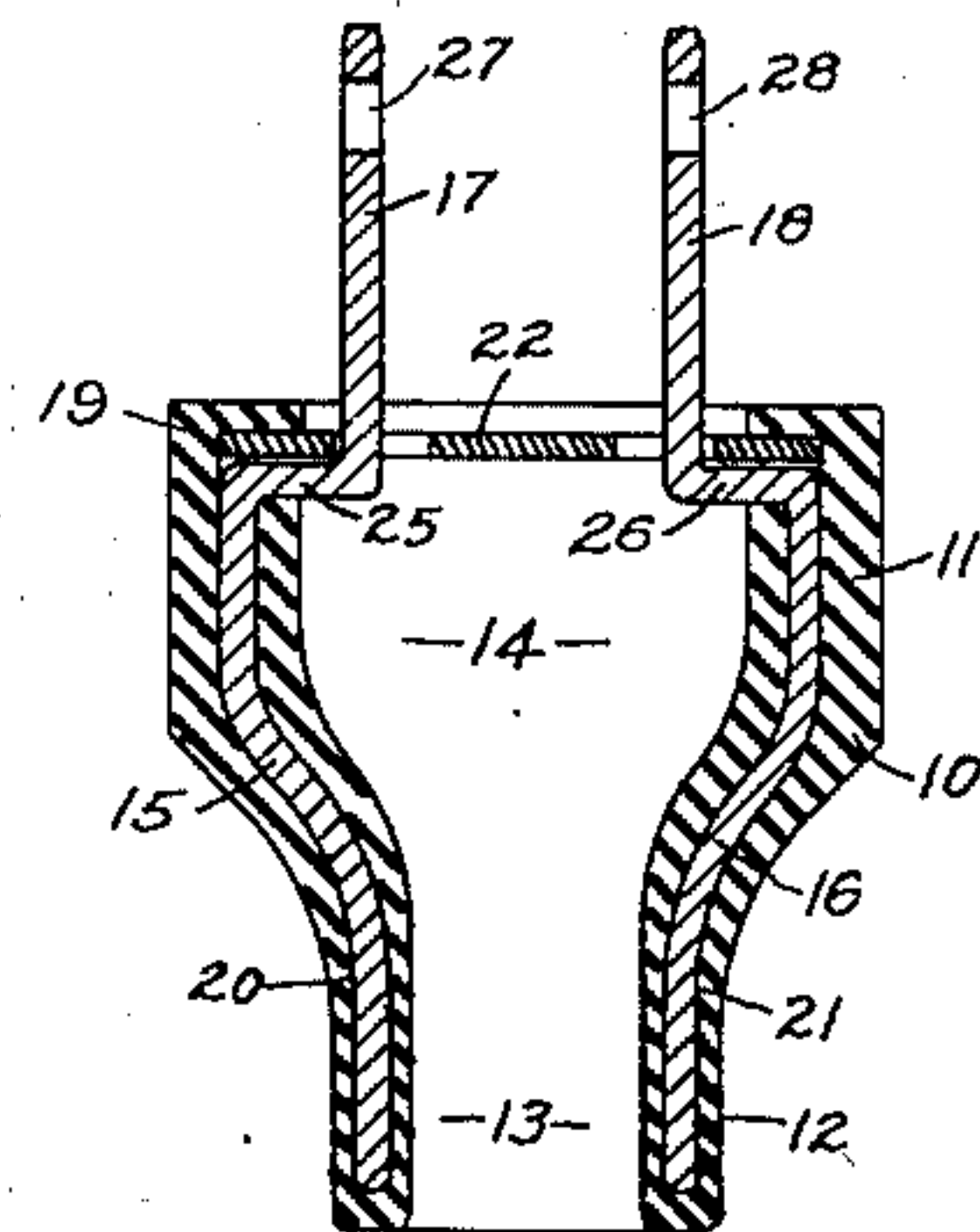


Fig. 3.

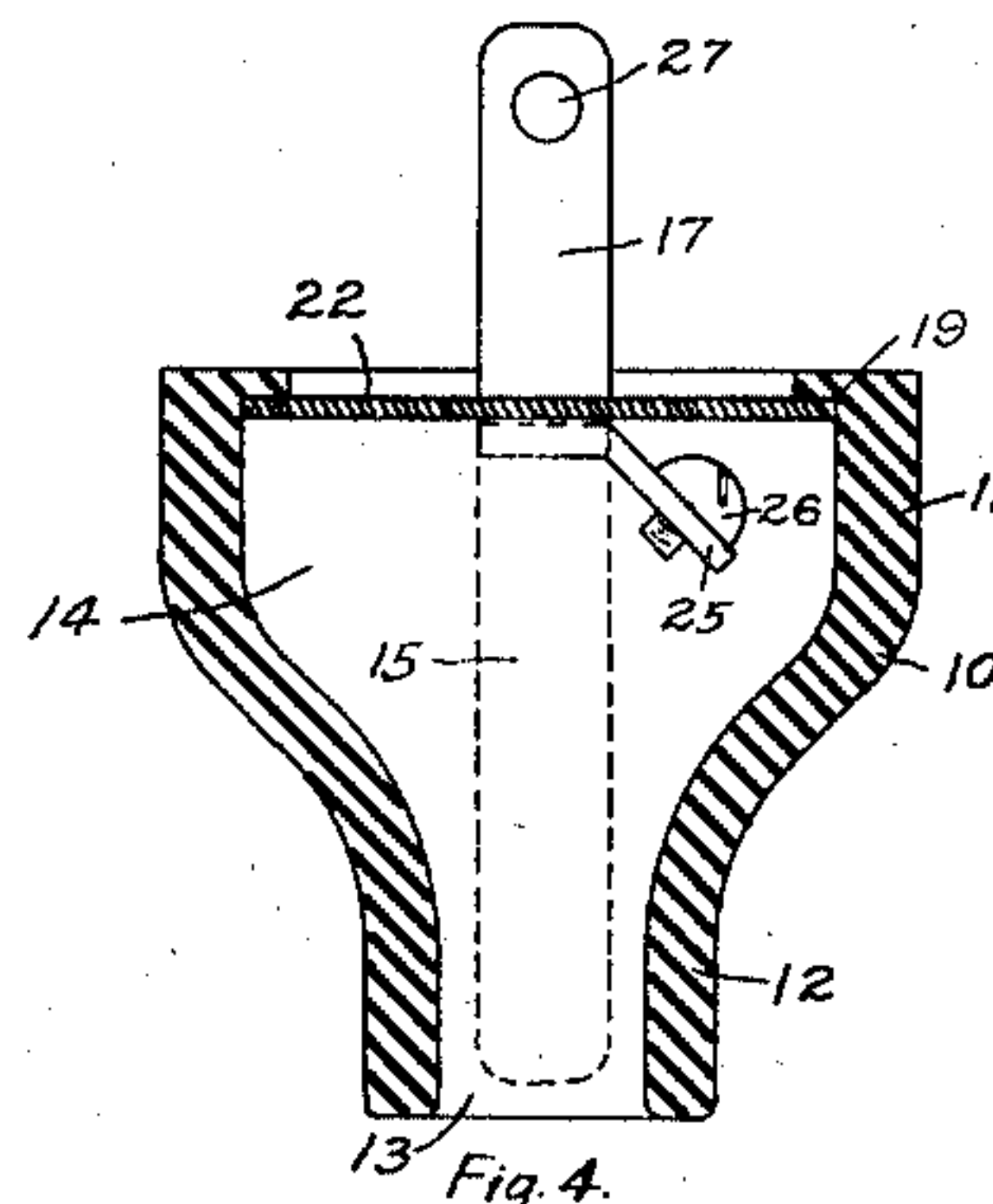


Fig. 4.

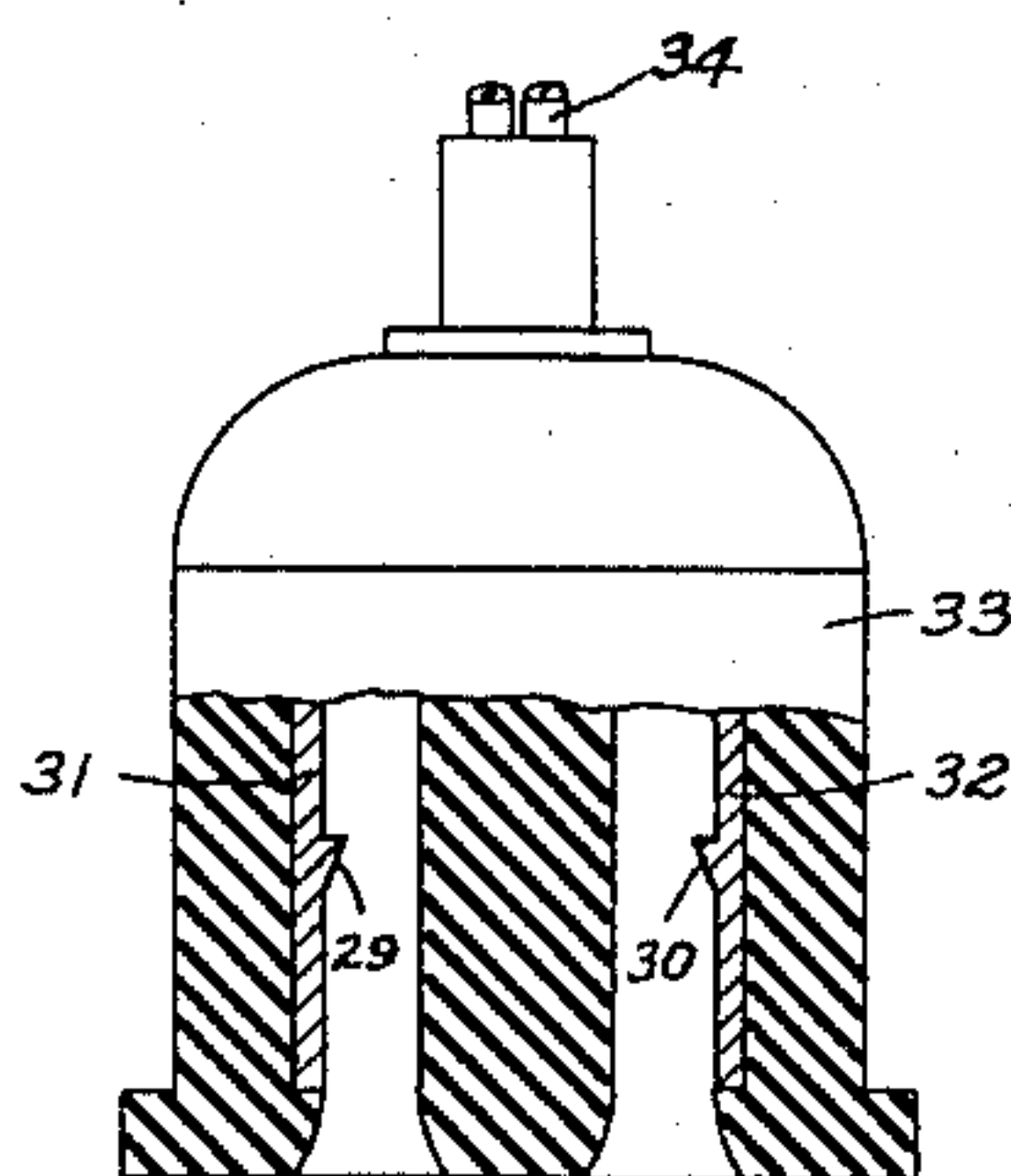


Fig. 5.

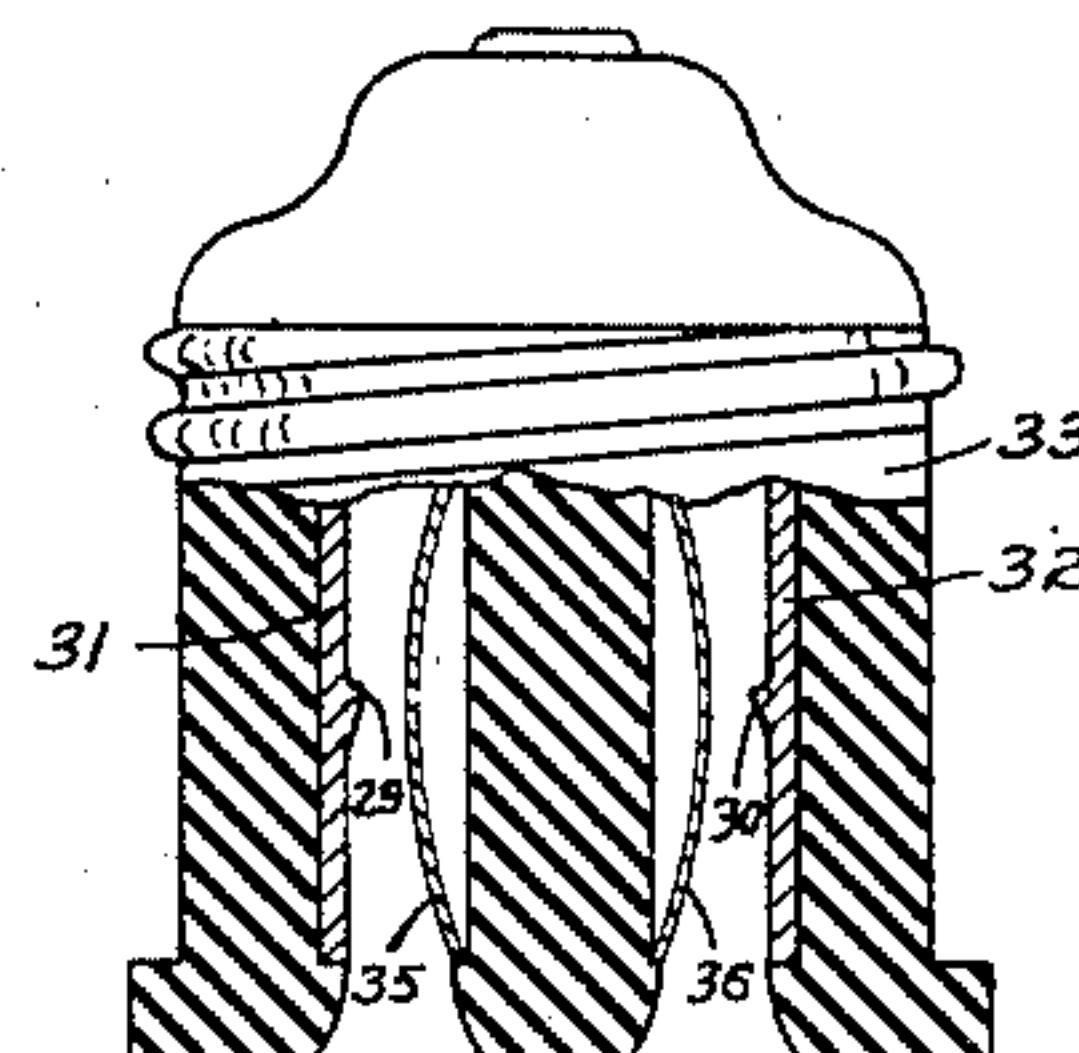


Fig. 6.

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ELECTRIC CONNECTOR

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4 Claims. (Cl. 173—343)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government of the United States for governmental purposes without the payment to me of any royalty thereon.

This invention relates to separable connectors for electrical conductors and more specifically to plug and socket connectors, such, for example, as attachment plugs as are used on lead wires from portable devices and sockets on feed conductors, as wall plugs, for supplying power to portable devices from a more or less permanent wiring system.

In the use of attachment plugs of this character, the contact elements or projecting prongs thereof are frequently held so tightly by the elements of the socket that the plug can only be withdrawn or disconnected with difficulty and force. In such instances, the user, when desiring to disconnect or uncouple the attachment, usually pulls on the feed conductors with the result that binding screws and the wires are often broken or disconnected. In other cases the reverse is often the situation, namely, that the plug and socket contact elements engage so loosely that the attachment plug is often accidentally pulled or jarred out of its operative position during the use of an electrical device connected thereto.

An object of my invention is to provide an attachment plug and a cooperative socket embodying simple cooperative latching means which operate efficiently to lock the plug in connected relation with a socket or wall plug. A further object is to provide an attachment plug of the type that embodies a pair of prong-like terminals, projecting from the plug and adapted to be inserted into a socket of a type that embodies contact elements that may be contacted by the plug prongs through slots.

A further object is the provision of connecting elements which may be easily engaged and yet readily disconnected from each other without difficulty. It is an object of this invention to provide connectors of this type which when connected will not be readily uncoupled without manual operation.

A further object is to provide an attachment plug in which the connections between the conductors and the terminals thereof are entirely enclosed within the plug and to provide a plug which is entirely devoid of screws, plates, pins, rivets and the like which are commonly used for the purpose of rigidly fixing the contact prongs to the body of the plug. By the elimination of the same, breakage and short-circuiting is

avoided, and the construction of the connector is greatly simplified.

Other objects, purposes, and functions of my invention will be set forth in the following description, it being understood that the above general statements of the objects of my invention are intended to generally explain the same without limiting it in any manner.

In the accompanying drawing, illustrating embodiments of my invention,—

Figure 1 illustrates a base-end view of an attachment plug, the projecting contact prongs being shown in cross-section, while—

Figure 2 illustrates the reverse end of a plug through which the conductors are intended to pass.

Figure 3 is a central horizontal section through one of the plugs.

Figure 4 is a view similar to Figure 3 but taken at right angles thereto.

Figure 5 is a combined section and elevation of the cooperative socket for the plug, and—

Figure 6 is a view similar to that of Figure 5 except that it illustrates a screw-type of socket and a modified form of latching means.

Several embodiments and modifications within the scope of my invention are known to me, but according to that by which I have illustrated the invention and by which it may be practiced, I provide (Figure 3) an attachment plug having a body portion 10 composed of distortable or resilient insulating material and formed with an enlarged front-end or head portion 11 and a shank portion 12 through which shank portion a conductor aperture 13 is provided. The aperture 13 extends into the head portion 11 where it is preferably enlarged, as at 14, so as to provide space for connecting conductors (not shown) to contact elements 15 and 16 and also to provide sufficient space to allow a predetermined amount of distortion to the plug (the purpose of which is described hereinafter) without forming a contact between the contact elements or between the conductor couplings. The contact elements 15 and 16 terminate into prongs 17 and 18 which protrude from the base of the plug when installed therein.

The prongs 17 and 18 are arranged in the usual parallel relation and are of the usual rectangular cross-section in order to fit the more or less standard socket.

The cavity forming walls of the plug are provided with an oblate annular shoulder or an oblate annular groove or recess 19 at a point inward

of the base end of the plug walls, the purpose of which is described hereinafter.

Recesses 20 and 21 are provided within the walls of the plug into which the contact elements 15 and 16 are inserted by compressing or distorting the resilient plug. The contact elements may be, however, incorporated or molded directly within the insulating walls of the plug. It is to be considered that this latter method of installation is within the scope of my invention, but the former method is preferred in order that the contact elements may be replaced or repaired if necessary.

In either type the contact elements are firmly held in their normal position with respect to the plug by the action of the resilient material on the faces of the off-set portions.

The recesses 20 and 21 enter the body portion of the plug from opposite sides of the cavity 14, preferably at right angles to the walls thereof, at a point inwardly adjacent the oblate annular shoulder, groove, or recess 19 and extend midway into the walls where they assume the angular shape or contour of the plug walls. The recesses 20 and 21 preferably terminate short of the end of the shank 12 to prevent exposure of, or contact with, the contact element at the shank end of the plug.

Thus it will be seen that the shape of the recesses 20 and 21 and the conforming shapes of the contact elements 15 and 16 serve as means for retaining the elements 15 and 16 within the plug without rigid fixing means such as screws, rivets and the like, which are subject to breakage and short circuits.

I further provide an insulating plate or washer 22 having apertures 23 and 24 disposed substantially diametrically opposite each other (see Fig. 1). This plate is of such size and shape as to be interlocked with the body portion of the plug when inserted within the oblate annular recess, groove, or shoulder 19.

As stated heretofore, the contact elements 15 and 16 are of such shape as to conform to the angles and curvatures of the recesses provided therefor within the walls of the plug. The contact elements 15 and 16 are further provided with shoulders or offset jogs 25 and 26 where they converge into the projecting prongs 17 and 18 thereof. These shouldered or offset portions of the contact elements are adapted to abut the inner face of the plate 22 and thereby the plate serves as further means for locking and retaining the elements within the plug. The jogs in turn permit the prongs to project through the plate apertures 23 and 24 and in a direction substantially parallel. The contact elements 15 and 16 are provided with means, such as illustrated at 25, Figure 4, preferably located on portions thereof within the housing or cavity 14, to which conductors (not shown), lead into the plug through aperture 13, may be attached by means 26 such as a screw.

The prong portions 17 and 18 of the contact elements 15 and 16 are provided with means such as notches, catches or eyelets 27 and 28 for engaging cooperative means 29 and 30 such as lugs, notches or catches, provided on the contact elements 31 and 32, within the socket 33, to which the lead wires 34 are attached. In addition to the cooperating engaging means of the plug and socket, the socket may, if desired be provided with further means 35 and 36, such as an arcuate spring, for retaining the respective contact elements in a locked position. The en-

gaging elements 29 and 30 are preferably formed with outwardly flared termini to provide for slipping engagement with the means 27 and 28. The notches while of sufficient depth to insure against ordinary accidental separation of the plug and socket may, of course, be designed to permit forceful separation without injury to either plug or socket such as by a person tripping over the conductors.

Figure 5 illustrates a socket similar to that shown in Figure 6 except for the modified form of contact engaging elements and except that Figure 6 illustrates the type of socket that may be screwed into another socket such as an ordinary light bulb socket.

The apertures 23 and 24 of disc 22 are guide-ways for the prongs 17 and 18 and serve to maintain the prongs in alignment. These apertures are of such size and shape as to permit sufficient lateral movement of the ends of the prongs 17 and 18 to disengage the locking means 27 and 28 of the plug from the cooperative means 29 and 30 of the socket when manually operated. Another purpose of the disc 22 and the apertures 23 and 24 therein is to maintain proper and fixed distance between the prongs 17 and 18, that is, to prevent a spreading thereof beyond a predetermined maximum and to prevent a compression thereof beyond a predetermined amount. By the latter prevention the prongs cannot form a short circuit, that is, be compressed into contact with each other, but still are afforded sufficient lateral movement, under compressions, to release the locking means.

The conductor passage 13, provided in the shank 12 of the plug is preferably of such size and shape as to provide a relatively close fit with the conductor when installed.

In the operation of structures described it will be seen that the prongs 17 and 18 are normally retained in a predetermined spaced relation but may be urged toward each other a predetermined distance by compressing the resilient body portion for releasing as described. By the relatively close fit of the shank 12 with the conductor it will be seen that the prongs 17 and 18, upon compression of the body of the plug at 11, will move as though the contact elements were pivoted at the ends opposite the prongs, yet without the employment of a rigidly fixed pivot as heretofore employed.

The plug is provided, on the sides thereof in which the contact elements are incorporated, with substantially flat faces 37 and 38 (Figures 1 and 2) to readily indicate the sides to be compressed in order to release the cooperative latching means.

By the foregoing description it will be seen that I provide a plug and socket having cooperative latching means to limit accidental disengagement; a plug which is devoid of metallic or other means for rigidly fixing or retaining the contact elements; a plug in which connections between conductors and contact elements are shielded from exposure; a plug provided with means for preventing short circuiting between conductors and/or contact elements; a plug in which the contact elements are capable of relative movement to and from each other, of being distended, dilated, expanded and contracted in order to engage and disengage latching elements and yet devoid of any pivotal connecting means; and a plug which is simple in construction.

Having thus described means by which my invention may be practiced what I claim is:

1. In combination an electrical plug having a relatively thin resilient off-set wall with elongated off-set recesses therein substantially parallel to the faces of said wall and electrical contact elements having off-set portions of substantially the same configuration as said wall and positioned within said recesses whereby said contact elements are retained in said plug by the action of the resilient material of said wall upon the faces of said off-set portions and in a predetermined spaced relation to each other, and a socket having orifices adapted to receive the contact elements of said plug, additional contact elements within said orifices, said contact elements being provided with cooperating interlocking means disengagement of which is accomplished by compression of the wall of said plug whereby said contact elements are moved from the position determined by said plug.

2. An electrical plug comprising a hollow body portion having a conductor passage therein, contact elements having a portion retained within the walls of said body portion and having ends extending free from the base of said body portion in spaced relation, said free ends being provided with means for assuring contact with a socket, a disc, means within said hollow body portion whereby said disc is retained transversely therein, said body portion being of resilient material normally retaining the contact elements thereof in a predetermined spaced relation but capable of being compressed at a point in close proximity to the transverse disc and capable of inherently returning to its normal position, whereby the contact elements and their free ends may be urged toward each other, said disc having means whereby transverse movements of the contact elements to and from each other are prohibited beyond predetermined distances and whereby said contact elements are retained in alignment.

3. An electrical plug comprising an inherently resilient hollow body portion having a conductor passage therein, a disc frictionally held in said hollow body portion, contact elements one end of each of which is of curvilinear configuration and retained thereby within said body substantially the full length thereof with their other ends extending from said body normally in spaced relation, said disc being formed with openings for guiding said extending ends toward each other upon compression, means between said disc openings to prevent a contact of said extending ends, said contact elements also having jogged portions whereby said disc abuttingly assists in the retention of the elements within the plug, and means whereby when the embedded ends of the elements are pressed toward each other, their extending free ends will be correspondingly moved relative to each other.

4. An electrical connector including a manually compressible hollow body portion, consisting of a relatively thin resilient wall, contact elements having off-set portions of curvilinear configuration interlocked within complementary longitudinal recesses in said body portion, an oblate annular recess within said body portion, and a disc within said oblate annular recess, said disc having means for guiding said contact elements in alignment toward each other upon compression of said body portion, means for limiting the separation of said elements beyond a predetermined position, and means for preventing a contact between said contact elements upon the compression of said body portion, in combination with a socket adapted to receive the ends of said contact elements and having means within said socket for locking and releasably retaining said contact element ends therein.

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