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(54) **Easy-assembly domestic electrical plug.**

(57) An electric plug of a type for domestic use consists of a body portion (1) and an insert portion (2) which is enterable into a recess (3) within the body portion (1), the insert portion (2) being adapted for having the conductors of a cable assembled thereto as a first step in the connection of the plug to the cable and then being insertable into the recess (3) where insulation-piercing pins (5) make contact with the cable conductors to complete the connection. The plug body (1) has a projection (7) which is externally screw-threaded and co- operates with an internally screw-threaded drive nut (10) in providing a mechanical advantage to facilitate manual insertion of the insert portion (2) into the recess (3). The plug has the advantage of being connectable to a cable entirely without need for use of any tools.

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Improvements relating to Electrical Plugs

This invention concerns improvements relating to electrical plugs and particularly, though not exclusively, concerns electrical plugs of the type employed for coupling domestic and other electrical appliances to socket outlets of the mains electrical supply.

In International Patent Application No. PCT/GB 81/00141 (International Publication No. WO 82/00387) there is described an electrical plug in which we hold an interest and which comprises a body portion having terminal pins to be inserted into the corresponding openings of a socket outlet and an insert portion enterable into a recess in said body portion, the insert portion comprising a cable clamping arrangement and separate conductor-receiving channels for the separate conductors of the cable to which the plug is to be fitted, each of said channels being configured to receive a conductor end portion therein at a location to be accessed for making electrical contact thereto, and cooperating means being provided in said body portion and in said insert such that when the insert is entered into the recess in the body portion electrical continuity is established between the conductor end portions received

in the channels of the insert and the terminal pins of the body portion; such an electrical plug will hereinafter be called a plug of the kind described.

One of the two embodiments described in WO 82/00387 aforementioned has pins or other electrical contact establishing means projecting into the recess in the body portion, and the insert is arranged to engage with the recess such that the pins enter into electrical contact with the conductor end portions engaged with the insert. In the other embodiment, the insert has contact-making terminal pins projecting therefrom which are adapted to mate with corresponding socket portions formed in an inner end wall of the recess and to enter such socket portions and contact the plug terminals when the insert is entered into the recess. The proposal furthermore in relation to the second embodiment was to spring load the contact-making terminal pins so that as the insert was forced manually into the recess in the plug body, so the contact-making terminal pins would be forced back against their spring bias by virtue of their engagement with the plug terminals and, by virtue of thus being forced back, would be forced into good contact with their respective conductors. As further described in WO 82/00387, in either of the described embodiments insulation displacement techniques could advantageously be utilised so obviating the need to bare the conductor ends of their insulation.

In the course of our further development of the invention described in WO 82/00387 aforementioned, we have found that the force required to drive the insert fully home in the recess and thus complete the requisite connections can, depending inter alia upon the thicknesses of the conductors of the cable being coupled to the plug, be fairly substantial. Whilst this might give rise to no undue difficulties for a young adult male who might be expected to be able fairly readily to manually force home the insert into its accommodating recess, it is envisaged that some women and elderly people might experience some difficulty. The present invention aims to overcome or at least substantially reduce this problem.

According to the present invention therefore, in one of its aspects, an electrical plug of the kind described further comprises means associated with the body portion of the plug for providing a mechanical advantage for facilitating the manual insertion of the insert into its accommodating recess in the plug body.

In the presently preferred embodiment of the present invention, which will hereinafter be described in some detail, the means for providing the required mechanical advantage comprises an internally screw-threaded component adapted for cooperation with an externally screw-threaded portion of the plug body to drive the insert positively into its accommodating recess when the screw threads are engaged with each other and

the internally screw-threaded component is manually screwed down onto the plug body. The use of cooperating screw-threaded parts is considered to be preferable to other mechanical advantage providing arrangements, for example based on levers, on account not only of the widespread familiarity and consumer acceptance of screw-threaded parts, but also of the facility which an internally-screw threaded and thus hollow component provides for accommodating cable clamping parts of the insert within its hollow interior. This latter facility, as will be explained more fully hereinafter, enables an insert of the requisite size to be accommodated within the limited confines of a standard-sized plug body.

More particularly as regards the abovementioned presently preferred embodiment, the plug body has a generally cylindrical hollow protrusion from its rear surface (that is to say the surface where, in a conventional plug of similar terminal configuration and plug body shape, the cable would enter the plug body) and the external surface of such protrusion is screw-threaded. A pair of diametrically opposed slots extend the length of the protrusion through the cylindrical wall thereof for a purpose which will become clear. The recess in the plug body into which the insert is to be inserted aligns with the hollow interior of the protrusion, and the insert has a pair of ears which engage with the aforementioned slots when the insert is introduced into

the protrusion, the ears projecting outwardly beyond the screw-threaded external surface of the protrusion. The arrangement is dimensioned such that the insert can readily be pushed manually into the protrusion and into the recess in the plug body to such an extent that the ears provided on the insert move along their receiving slots at least a distance sufficient to enable the internally screw-threaded component to be engaged with the protrusion and, as the two screw-threaded parts are screwed together, so the insert is positively driven into the plug body by engagement of the internally screw-threaded component with the ears of the insert.

According to another aspect of the present invention, whilst the plug of the kind described in WO 82/00387 aforementioned is particularly intended for use as a plug which is attachable onto a cable end by a user and, as desired, detachable subsequently from that cable and usable with another cable, namely as a rewirable plug, nonetheless the plug in question has attractions as a non-rewirable plug, that is a plug which is adapted to be attached to a cable and, once attached, is not intended to be removable therefrom. A plug of the kind described in which the insert, once inserted, was not removable from the plug body would constitute an advantageous form of non-rewirable plug not subject to problems which have plagued previous non-rewirable plug proposals and including the problem

of loose conductor strands extending to the exterior of the plug body.

In a modification of the aforedescribed presently preferred embodiment adapted for use as a non-rewirable plug, the cooperation between the protrusion from the plug body and the component to be engaged therewith could advantageously be such that once the insert had been firmly engaged in the plug body recess, the component utilised to urge it home could not be removed. For example, instead of providing cooperating screw-threads on the protrusion and on the cooperating component, there could be provided latching teeth for securing the insert-driving component and the protrusion in their fully assembled condition, the assembly being effected with the aid of a press. Alternatively, the cooperating screw threads on the two parts could be retained but with the addition of formations arranged to irremovably interengage once the two parts had been fully screwed together. Yet another possibility would be simply to adhere or ultrasonically weld the insert-driving component onto the plug body protrusion once the insert has been fully driven home into the recess.

The aforementioned ears which are provided on the insert can advantageously be provided at opposite ends of a part of the insert which has a number of apertures therethrough corresponding to the number of

connections to be made by the plug, i.e. generally three insofar as the UK is concerned. The conductors of the cable to which the plug is to be fitted can advantageously be "woven" into these apertures in different directions, as will be explained more fully hereinafter, and by virtue of this arrangement any tension applied to the cable can at least to a substantial degree be prevented from manifesting itself in a force upon the connections made in the plug between the plug terminal pins and the cable conductors.

A preferred form of cable clamping arrangement utilisable with either a rewirable or a non-rewirable plug in accordance with the present invention comprises a pair of spaced-apart limbs which are formed integrally with the insert and extend from the back end thereof, that is to say the end which is not introduced foremost into the insert-accommodating recess in the plug body portion, each of the limbs having at its free end a resilient finger which extends forwardly towards the front end of the insert within the space between the two limbs and is biassed by its resilience away from the respective limb; a cable to be clamped to the insert is passed between the free ends of the two fingers, which are capable of moving apart from one another a distance such as to accommodate different cable diameters, and the arrangement is such that any pull on the cable will cause the ends of the fingers to tend to grasp the cable

and prevent it from being pulled out of their grasp. With this arrangement, there is advantageously also provided at the free end of each of the said limbs an outwardly facing portion having a number of screw thread sections engageable with the screw thread aforementioned which is provided on the interior surface of the hollow cylindrical component provided for driving home the insert. With a rewirable plug, these screw thread sections provided on the limbs serve to provide a deterrent against any tendency for the insert to be pulled out of its accommodating recess in the plug body in the event of the cylindrical insert-driving component becoming partially unscrewed from the screw-threaded protrusion on the body part. When the insert has been fully driven home into the plug body, the screw thread portions on the limbs line up and engage with the internal screw threads of the insert-driving component; if, subsequently, the insert-driving component were to be loosened a number of turns, any tendency for the insert to be pulled out of the plug body would be resisted by the maintained engagement of the screw thread portions on the limbs with the screw threads of the insert-driving component.

Also described hereinafter is a convenient and advantageous fuse holder arrangement wherein a fuse carrier is pivotally mounted in a side wall of the plug

body. A lever connected to the fuse carrier extends across the underside of the plug body so as to be inaccessible when the plug is plugged into a socket outlet. The lever enables the fuse carrier to be pivoted manually between a position where a fuse in the carrier engages fuse contacts within the plug body, and a position where a fuse in the carrier becomes accessible outside of the plug body and can be changed as may be necessary.

Further features and advantages of the present invention will become apparent to those possessed of the relevant skills from a consideration of the following description given with reference to the accompanying drawings wherein:-

Fig. 1 is a side elevation view of a first embodiment of the present invention with the insert shown removed from its accommodating recess in the plug body and with the insert-driving component also detached;

Fig. 2 is a view from beneath of the arrangement of Fig. 1;

Fig. 3 is an enlarged view of the insert of the embodiment of Fig. 1;

Fig. 4 is a sectional view taken on the line IV ... IV in Fig. 3;

Fig. 5 is an end elevational view of the insert of Fig. 3;

Fig. 6 is a partial perspective view of the insert of Fig. 3 showing the cable clamping arrangement utilised;

Fig. 7 is a view similar to that of Fig. 3 but showing an alternative form of insert;

Fig. 8 is a sectional view taken on the line VIII ... VIII of Fig. 7;

Fig. 9 is an end elevational view of the insert of Fig. 7;

Fig. 10 shows yet another form of insert;

Figs 11,12 and 13 show perspective views of still another form of insert having an alternative cable clamping arrangement, the several views illustrating the assembly of a cable to the insert;

Figs. 14,15 and 16 are different sectional views showing the insert of Figs. 11,12 and 13 fully assembled into a plug body with Figs. 17A and 17B indicating the respective section lines whereupon the views of Figs. 14, 15 and 16 are taken;

Figs. 18,19 and 20 are different perspective views showing a fuse holder arrangement in a plug in accordance with the present invention; and

Fig. 21 shows a perspective view of a plug in accordance with the present invention wherein the insert

and its accommodating recess in the plug body are inclined with respect to the plug base.

Referring first to Figs. 1 and 2, an exemplary form of plug according to the present invention is disclosed therein. As with the plug described in WO 82/00387 aforementioned, the illustrated plug comprises a body portion 1 and an insert 2 enterable into a recess 3 in the body portion. As with the arrangement shown in Figs. 1A and 1B of the drawings forming part of WO 82/00387, the body portion 1 and the insert 2 are each formed of high impact, rigid synthetic plastics material and, as is schematically represented, brass terminal pins 4 are secured in the body portion 1 and brass strappings (not shown) couple the terminal pins 4 to conductor piercing pins 5 which project into the recess 3 from its inner end wall. A fuse holder 6 is provided in one side of the plug body 1 and will be described fully hereinafter.

At the rear surface of the plug body 1, there is provided a hollow cylindrical externally screw-threaded boss or projection 7 aligned with the recess 3. As shown in Fig. 1 the boss 7 has a pair of slots 8 formed in its cylindrical wall for receiving a pair of ears 9 formed on the insert 2 when the insert is introduced into the hollow boss and thence into the recess 3, the ears 9 being of such a size as to project outwardly beyond the

screw threads formed on the boss 7 when the insert 2 is inserted. An insert-driving component 10 in the form of an internally screw-threaded screw cap is arranged to thread onto the threads of the boss 7 and to bear upon the ears 9 of the insert 2 for driving the insert into the plug body 1 as the screw cap 10 is screwed down onto the plug body 1. An aperture (not shown) is provided in the end wall of the cap 10 for passage of a cable through the cap.

Referring now more particularly to Figs. 3 to 6, the form of the insert 2 is shown more clearly therein. As shown in Fig. 3, the insert 2 has a portion 11 at its left-hand side (as viewed) which has first and second condcutor-receiving channels 12 and 13 in its upper surface (as viewed) and has a third conductor-receiving channel (not shown) intermediate the channels 12 and 13. Each of the three channels is formed with a shaped through aperture 14 which is designed to be capable of accepting and positively locating a variety of conductors of different sizes, and each of the apertures 14 communicates with a respective one of three conductor-piercing pin receiving bores 15 (see Fig. 4). As shown by Fig. 4, the apertures 14 have a rearwardly inclined profile which serves to assist in the retention of a conductor in the respective aperture, it being appreciated that in use of the insert 2 the conductors

are laid into the channels 12,13 and the not shown under channel and their free ends are inserted into the apertures 14 and bent back upon themselves so as substantially to follow the inclined rear profile of the apertures; in this manner the conductors virtually "hook" onto the insert. With the three conductors of a cable thus assembled into the insert 2, insertion of the insert fully into its accommodating recess 3 in the plug body 1 causes the conductor-piercing pins 5 to enter the bores 15 and pierce through the conductor insulation thereby making electrical contact with the conductor strands.

The generally-elongated, egg-shaped section of the apertures 14 not only enables different conductor sizes to be accommodated with positive centering of the conductors relative to the bores 15 regardless of the conductor size, but also enables the conductor strands to displace as the conductors are pierced by the pins 5 thereby minimising the possibility of conductor strands being severed by the pins 5.

The portion 11 of the insert 2 has a pair of limbs 16 extending from its rear (that is towards the right hand side as viewed in Fig. 3), the limbs 16 carrying the aforementioned ears 9 and also carrying a cable clamping arrangement generally designated 17 (see Fig. 6). The cable clamping arrangement 17 comprises a

pair of fingers 18 formed integrally with the insert and attached to the inner facing surfaces of the limbs 16 at the free ends thereof, the fingers 18 being resiliently biassed towards each other at their free ends so as to define a cable-clamping jaw between their opposed ends (see Fig. 6). As depicted in Figs. 3 and 5, the fingers 18 can move apart from each other to accommodate different sizes of cables. As will be well appreciated by those possessed of the appropriate skills, any pull on the cable in a direction such as to tend to pull it out of engagement with the insert 2 will cause the tips of the fingers 18 to grasp the cable more tightly.

The insert 2 of Figs. 3 to 6 furthermore incorporates a means such as to resist any tendency for the insert to be pulled out of the plug body if the insert-driving component 10 is slightly loosened on the boss 7 and the cable is pulled. At the outer extremities of the limbs 16 there are provided section of screw threads 19 of the same size and pitch as those on the boss 7 and on the component 10. As the component 10 is screwed down fully onto the plug body 1, so these screw thread sections 19 align themselves with the screw threads of the boss 7 and of the component 10. If the component 10 is then slackened off a number of turns, this does not cause the insert 2 to be pulled back out of

its accommodating recess in the plug body 1. Any pull exerted on the cable engaged with the insert would, if it were to dislodge the insert, have to pull the screw thread sections 19 back against their engagement with the screw threads of the insert-driving component 10. The arrangement illustrated thus resists any tendency for the insert 2 to be pulled out of the plug body 1 if the cable is pulled.

In order to attach a cable to the plug of Figs. 1 to 6 it is necessary only to thread the insert-driving component 10 onto the cable, engage the cable end with the cable clamping arrangement and (the external insulation of a length at the end of the cable having been removed to free the conductors) lay the conductors into their respective conductor receiving channels and thread them through the apertures in the insert. The conductors are then pulled tight to ensure that they are well bedded down into their channels and apertures and any excess length trimmed off with a pair of scissors or wire cutters (if available). The insert with the cable thus assembled to it is then inserted into the plug body and manually pushed in as far as possible without use of undue force. The insert-driving component 10 is then engaged with the boss 7 and screwed home, thereby driving the insert into the plug and making the requisite connections to the conductor-piercing pins 5.

Referring now to Figs. 7, 8 and 9, there is shown therein an alternative form of insert usable with the plug body 1 and insert-driving component 10 of Figs. 1 and 2. As with the insert of Figs. 3 to 6 just described, the insert 2 of Figs. 7, 8 and 9 has a portion 11, ears 9 and limbs 16 with screw-thread sections 19. The portion 11 has three conductor-receiving channels 12, 13 and 20, but whereas in the previously described insert each channel had but a single aperture 14, in the current insert three differently sized apertures 14, 14' and 14'' are associated with each channel for accommodating different sizes of conductors. A conductor piercing pin receiving bore 15 is associated with the apertures 14, 14' and 14'' associated with each of the channels 12, 13 and 20. The insert of Figs. 7, 8 and 9 has no cable clamping arrangement as such, but instead has three holes 21 formed in the part extending between the two ears 9. The conductors of a cable are passed through these holes 21 before being laid into their respective channels 12, 13 and 20 and inserted into their respective apertures 14, 14' or 14'' and the consequent "weaving" of the conductors through these holes (see Figs. 12 and 13) serves to attach the conductors more or less firmly to the insert.

Fig. 10 shows an insert similar in many respects to that of Figs. 7 to 9 but with a form of cable

clamping arrangement provided. As shown the limbs 16 are tapered and their inner surfaces are notched in a ratchet-like form to cooperate with corresponding notches formed on packing pieces 22. As the cable is pulled, so the packing pieces 22 ratch back with the cable and, by virtue of the taper in the limbs 16, clamp the cable ever more tightly. A ring 23 is provided at the end of the limbs 16 to reinforce them against the outwards pressure exerted by the packing pieces 22. The screw-threading on the ring 23 performs the same function as the screw thread sections 19 in the previously described inserts.

Figs. 11, 12 and 13 illustrate yet another insert configuration having yet another cable clamping arrangement. The same reference numerals are used in Figs. 11 to 13 as are used for like parts in previously described figures and such parts will not be described any further. The reader should note the manner in which the cable conductors are "woven" into the apertures 21 preparatory to being laid into their respective channels 12, 13, 20. The cable clamping arrangement comprises a pair of arms 24 which are hingedly attached to the insert 2 and each have a cable gripping surface 25 on one side and a screw threaded surface 26 on the other. As shown in Fig. 13 the arms 24 can be brought

together so as to grip a cable between then, and secured by means of an internally screw-threaded locking ring 27.

Figs. 14, 15 and 16 show various sectional views of a plug in accordance with the present invention fitted with an insert as just described with reference to Figs. 11, 12 and 13. The same reference numerals as were used in the earlier Figs. are used in Figs. 14, 15 and 16 to designate like parts, and no further description of Figs. 14, 15 and 16 will be given, other than to direct attention particularly to the form of the fuse holder 6 which, as is shown more clearly in Figs. 18,19 and 20, comprises a pivotally mounted portion 28 of a side wall of the plug body 1 formed with an internal web portion 29 (see Figs. 16 and 20) which is apertured at 30 for holding a fuse 31 which is movable with pivotal movement of the side wall portion 28 into and out of contact with fuse receiving terminals 32 provided within the plug body 1. A lever arm 33 is formed integrally with the side wall portion 28 to enable the same to be opened and closed manually. The lever arm 33, in its closed condition, makes a snap fit within a recess provided in the base of the plug body 1. An aperture 34 enables the fuse to be seen in its holder. The internal construction of the plug preferably is such that when the lever arm 33 is in its open condition, as shown in Fig. 18 for

example, and a cable is wired to the plug, the connections of the live and neutral conductors of the cable to the live and neutral plug pins can be seen at least to the extent necessary to enable a visual check to be made that the correct conductor is connected to the correct plug pin. The lever arm 33 could be apertured to enable this check to be made even when the arm is in its closed condition; such apertures would not constitute any hazard since they would only be accessible to a user when the plug was unplugged, that is to say not plugged into a socket outlet.

Fig. 21 illustrates a variation of the form of the plug designed to be aesthetically more pleasing. The recess in the plug body is inclined relative to the plug base and, as a result, the insert-driving component 10 is more readily available to be grasped and turned relative to the plug body 1. The component 10 furthermore is shown in Fig. 21 as being provided with a pair of opposed wings 40 (only one of which can be seen in Fig. 21) which enable the component to be grasped even more firmly. Although not shown, it is possible that the component 40 could be made in two halves, which may be hingedly connected together, arranged to be snap locked around the cable; such a possibility would avoid the disadvantage which could

arise sometimes that after assembly of the cable end to the insert preparatory to inserting the insert into the plug body, and with an appliance already connected to the other end of the cable, it was found that the insert driving component either had not been threaded onto the cable or had been threaded on the wrong way round.

Although not previously described herein and not illustrated in any of the drawings, the insert and its cooperating recess in the plug body preferably are arranged such that the insert can be inserted into the recess only in a single orientation. This could readily be achieved by giving the insert and the recess a trapezoidal cross-section, for example, or by providing cooperating complementary formations on the two parts. In accordance with one advantageous proposal, a key is provided on the insert for engagement in a keyway formed in a surface of the recess; with such an arrangement the key on the insert could advantageously cooperate with the lever part of the fuse holder to obtain the desirable results that (a) the key lodges behind the fuse holder lever when the insert is driven fully home into the recess so that the lever acts as a physical bar against removal of the insert from the plug so long as the lever is in its closed condition, and (b) that the lever cannot be properly closed until the insert is

driven fully home thereby preventing the plug from being plugged sufficiently far into the receptors of a socket outlet to make electrical connections between the plug pins and the socket outlet (it being recalled that only a small part of a plug pin at the tip thereof actually makes electrical contact with the corresponding socket outlet parts).

Yet another modification not previously described would be to provide the apertures 14 of the insert of the embodiment of Figs. 1 to 6 with means to enhance their grip on the insulation of a conductor received therein. For example, the walls of the apertures could be provided with formations such as ribs or raised dimples to bite into and grip the cable insulation as the conductor is pulled tight in its respective aperture. The upper and/or lower rim(s) of the apertures could be slightly turned in and/or slightly serrated (particularly in the region of their narrower ends), and ribs could be provided on the inner walls of the apertures (again particularly at their narrower ends).

There has thus been described an improved form of the plug described in WO 82/00387 in which the manual insertion of the insert into the plug body should be readily achievable with a minimum of manual strength. Many modifications and variations are available within the

broad ambit of the invention, even beyond those disclosed herein, and it is to be clearly understood that the embodiments of the invention described herein are in all respects examples only. It is particularly to be noted that the present invention, whilst primarily concerned with rewirable (reusable) plugs adapted to be wired to a cable manually, does, as has been mentioned hereinbefore, have application to non-rewirable plugs.

CLAIMS:

1. An electrical plug for use for connecting the power supply lead of a domestic electrical appliance to a socket outlet of a mains electrical distribution system, the said plug comprising a body portion having a plurality of terminal pins to be inserted into the corresponding openings of a socket outlet and an insert portion to which a power supply lead as aforesaid may be assembled as a preliminary step in the connection of the plug to the power supply lead, the said insert portion thereafter being enterable into a recess in said body portion for completing the connection of the plug to the power supply lead, the insert portion comprising a plurality of separate conductor-receiving channels each for receiving a respective one of the conductors of the power supply lead to which the plug is to be connected and each arranged for receiving a conductor end portion therein at a location to be accessed for making electrical contact between the respective conductor and a respective one of said pins when the insert portion is entered into said recess, and a plurality of separate cooperating contact-establishing means being provided in said insert portion and in said recess for establishing electrical contact between each of said terminal pins and a conductor end portion received at a respective one of said locations when said insert portion is entered into said recess, the plug further comprising

means associated with the body portion of the plug for providing a mechanical advantage for facilitating the insertion of the insert portion into the said recess in the plug body portion.

2. An electrical plug as claimed in claim 1 wherein the said means for providing said mechanical advantage comprises an internally screw-threaded component adapted for cooperation with an externally screw-threaded portion of the plug body to drive the insert portion positively into its accommodating recess in the plug body portion when the said screw threads are engaged with each other and the internally screw-threaded component is manually screwed down onto the plug body portion.

3. An electrical plug as claimed in claim 2 wherein the plug body portion has a generally cylindrical hollow protrusion from its rear surface and the external surface of such protrusion is screw-threaded for cooperation with the internally screw-threaded surface of said component, the said recess in the plug body portion aligning with the hollow interior of the protrusion, and the said insert portion and the said component cooperating with each other such that when the insert portion is introduced into the recess and the said component is thereafter screwed onto the said protrusion the said component drives the insert portion into the recess.

4. An electrical plug as claimed in claim 3 wherein said protrusion has a plurality of slots extending the length of the protrusion through the cylindrical wall thereof, and the insert portion comprises a corresponding plurality of formations adapted to engage with the said slots when the insert is introduced into the protrusion, the said formations being dimensioned so as to protrude outwardly beyond the external surface of the protrusion for being drivingly engaged by the said component as it is screwed down onto the protrusion.

5. An electrical plug as claimed in any of claims 2, 3 and 4 wherein the insert portion has at least one partially screw-threaded part which is arranged for engagement with the internal screw thread formed in the said component for resisting any tendency for the insert portion to be pulled out of the said recess in the plug body portion by a tension force applied to a power supply lead coupled thereto.

6. An electrical plug as claimed in any of the preceding claims wherein the arrangement is such that the insert portion having been inserted fully into its accommodating recess in the plug body portion cannot be removed therefrom.

7. An electrical plug as claimed in claim 6 as dependent upon any of claims 2 to 5 wherein the cooperation between the protrusion from the plug body portion and the insert driving component is such that once the insert has been fully engaged in the plug body recess, the insert driving component cannot be removed.

8. An electrical plug as claimed in any of the preceding claims wherein the said insert portion has a part with a plurality of apertures formed therethrough, the said part serving in use of the plug for receiving the conductors of the power supply lead whereby any tension force applied to the power supply lead can at least to a substantial degree be prevented from manifesting itself in a force upon the connections made in the plug between the plug terminal pins and the cable conductors.

9. An electrical plug as claimed in any of the preceding claims wherein the insert portion is additionally formed with a cable clamping arrangement provided at one end of said insert portion which is outermost of said recess when the insert portion is fully entered into said recess, said cable clamping arrangement serving for clamping a power supply lead to the insert portion, and the cooperating contact-establishing means are each provided at the opposite end of said insert portion from the cable clamping arrangement in the direction of

insertion of the insert portion into the recess and at a cooperating surface of said recess.

10. An electrical plug as claimed in any of the preceding claims wherein the insert portion and the recess are arranged such that the insert portion is enterable into the said recess in only a predetermined orientation of the insert portion relative to the plug body portion and is movable within the recess for completing the connection of the plug to a power supply lead only by linear movement of the insert portion relative to the plug body portion without relative rotation therebetween.

11. An electrical plug as claimed in any of the preceding claims wherein said conductor-receiving channels each include a first channel portion and a second channel portion, said first channel portion being formed in a surface of said insert portion and extending generally in the direction of insertion of said insert portion into the recess to a location whereat it communicates with said second channel portion, and said second channel portion comprising an aperture extending into said insert portion transversely to said first channel portion and transversely to the direction of insertion of the insert portion into the recess, said apertures

serving to receive therein and precisely locate the end portion of a respective conductor of a power supply lead, and each of said cooperating contact-establishing means being operative within a respective one of a plurality of further apertures formed in said insert portion and extending in the direction of insertion of the insert portion into the recess and intersecting respective ones of the first-mentioned apertures.

12. An electrical plug as claimed in claim 11 wherein each of said first channel portions communicate with a plurality of spaced-apart second channel portions comprising apertures of different cross-sectional sizes for accommodating different sizes of conductors.

13. An electrical plug as claimed in claim 11 wherein each said aperture constituting a second channel portion has a cross-sectional shape adapted for accommodating different sizes of conductors at different locations therein.

14. An electrical plug as claimed in any of the preceding claims wherein said cooperating contact-establishing means are constituted by said body portion having terminals projecting into said recess from an inner end wall thereof and said insert portion being arranged

such that when, in use of the plug, the insert portion is fully entered into the recess the said terminals enter into electrical contact with conductor end portions received at said locations in said conductor-receiving channels.

15. An electrical plug as claimed in any of the preceding claims wherein the plug body portion is formed with a fuse carrier pivotally mounted in a side wall thereof and having a release lever extending across the underside of the plug body so as to be inaccessible when the plug is plugged into a socket outlet, and wherein the insert portion is arranged to cooperate with the said lever such that the lever acts as a physical restraint against removal of the insert portion from the plug so long as the lever is in its closed condition, and such that the lever cannot be properly closed unless the insert portion is fully inserted into said recess.

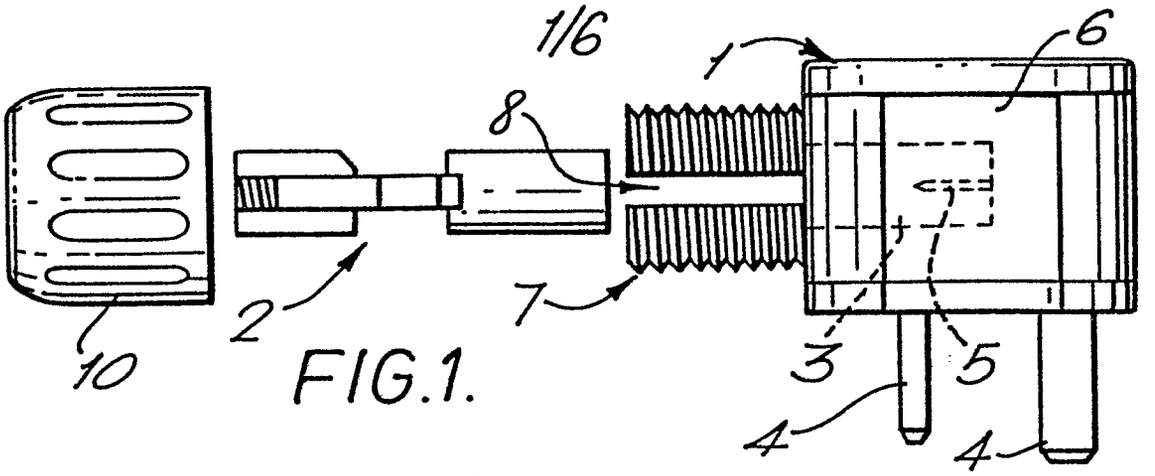


FIG.1.

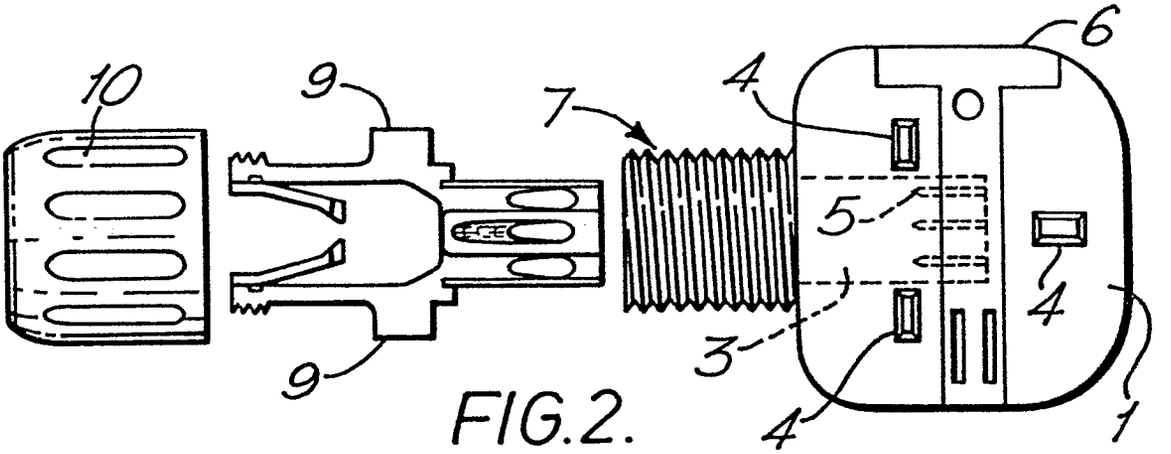
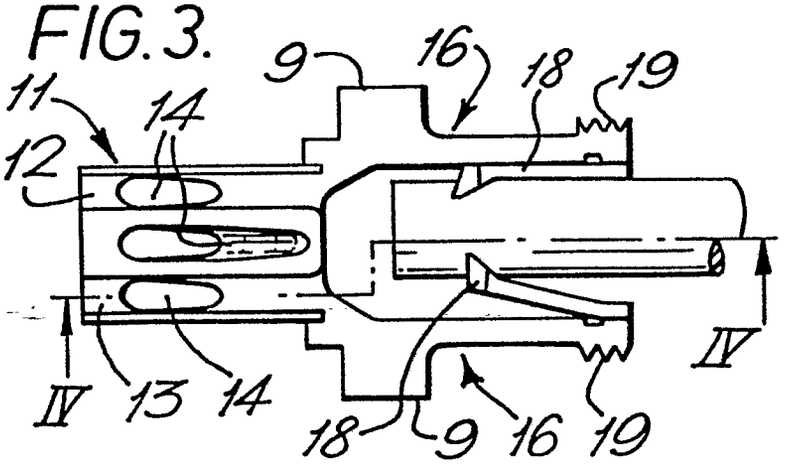


FIG.2.

FIG.3.



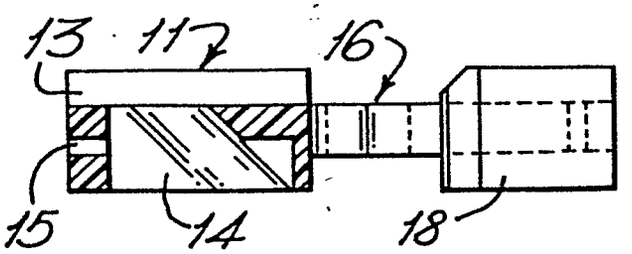
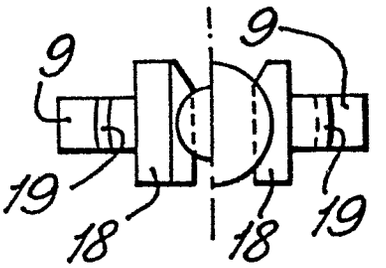


FIG.4.

FIG.5.



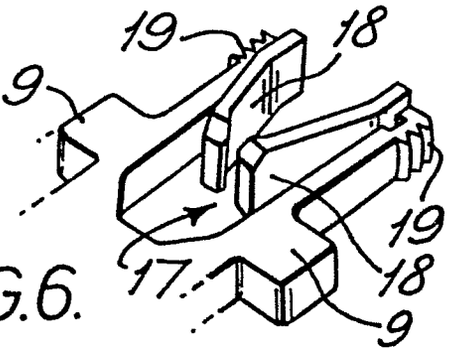


FIG.6.

FIG.7.

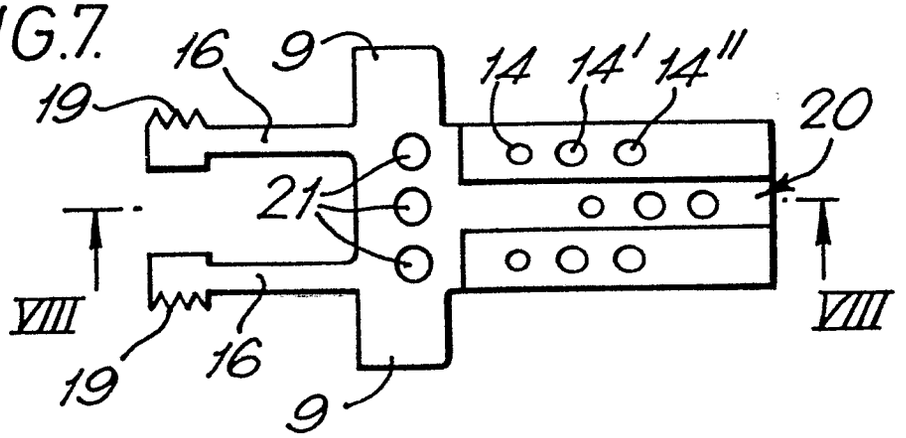


FIG.8.

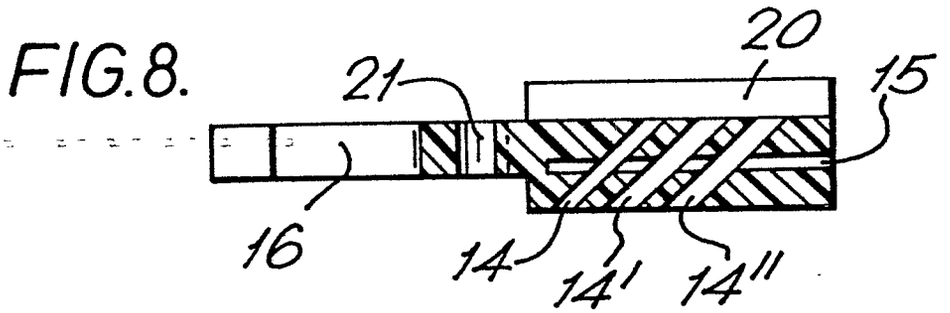


FIG.9.

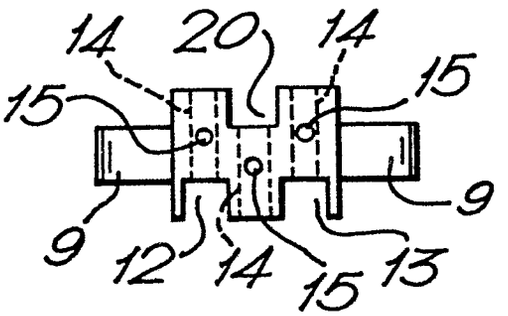
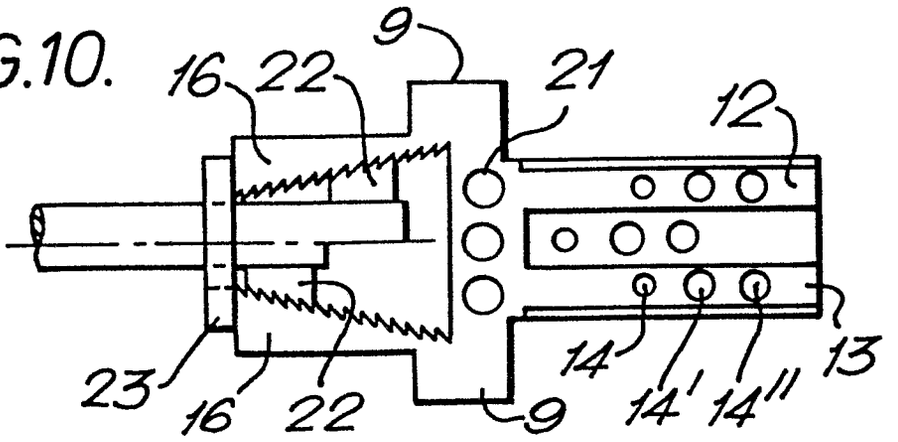


FIG.10.



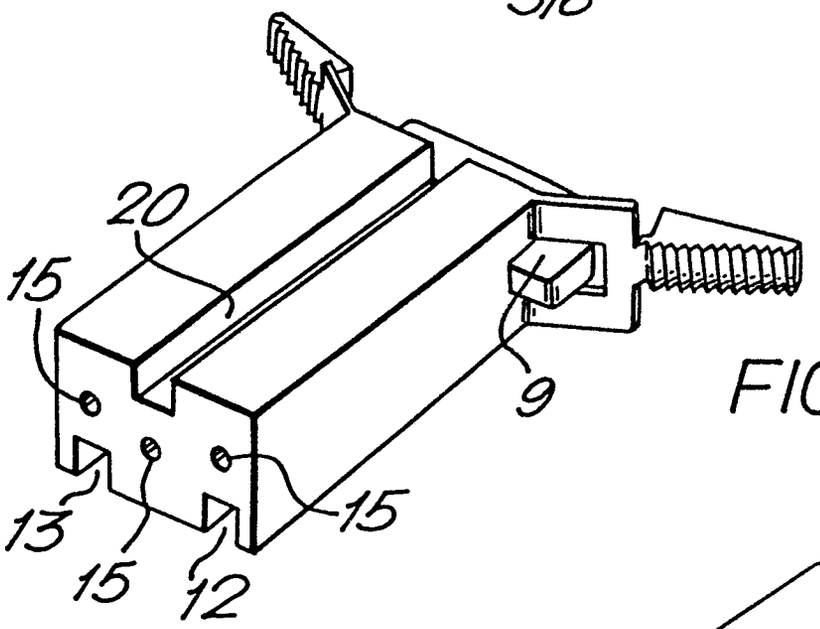


FIG.11.

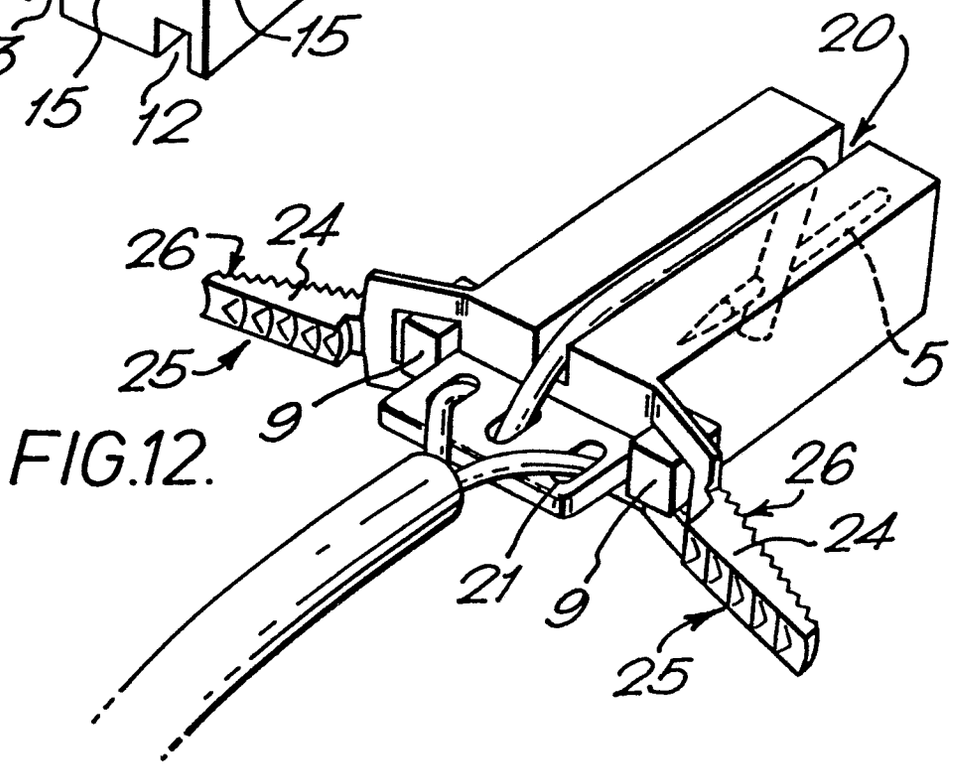


FIG.12.

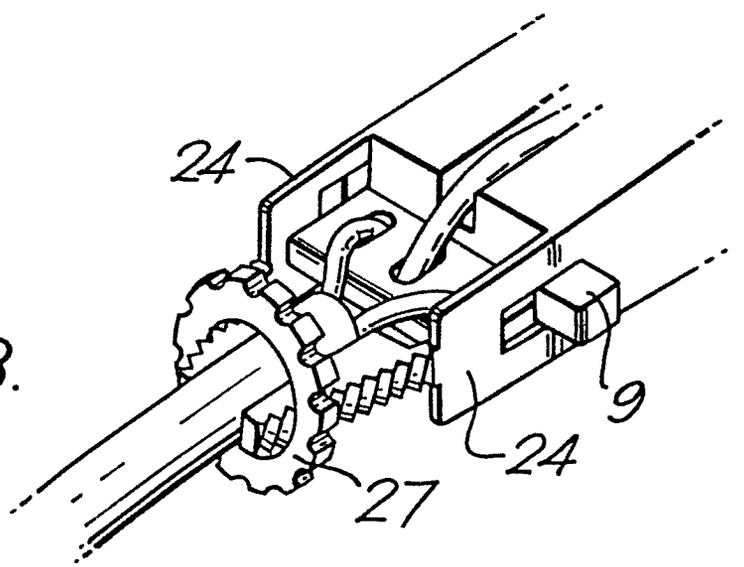


FIG.13.

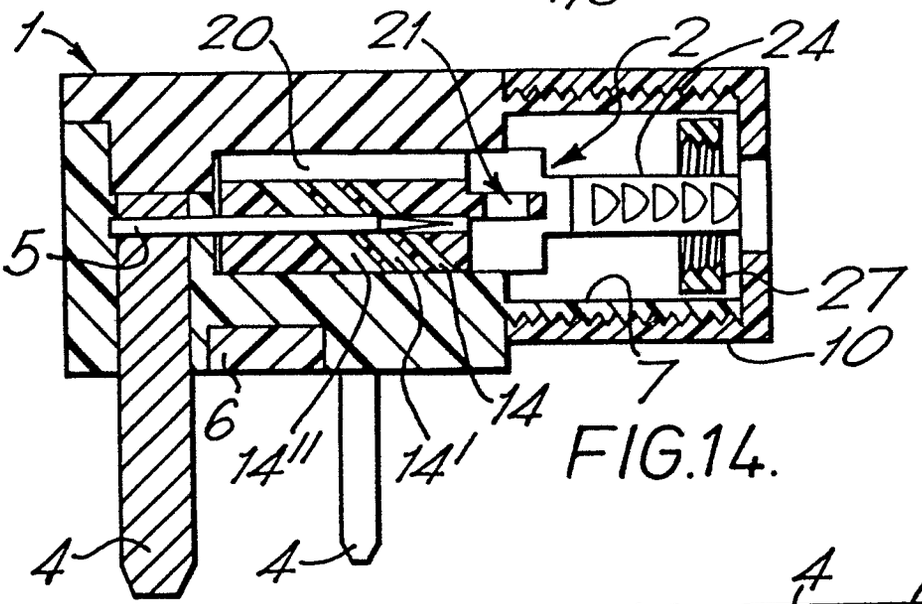


FIG.14.

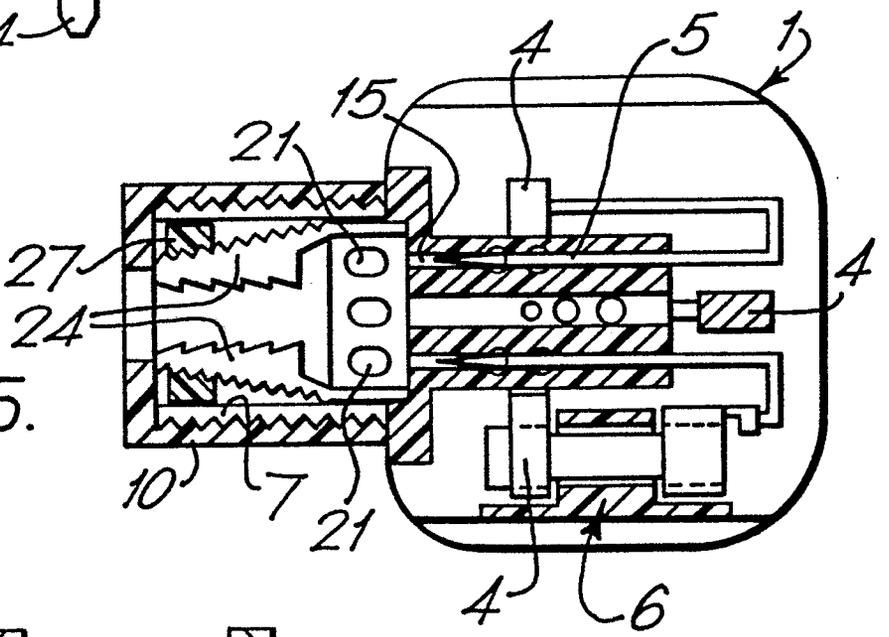


FIG.15.

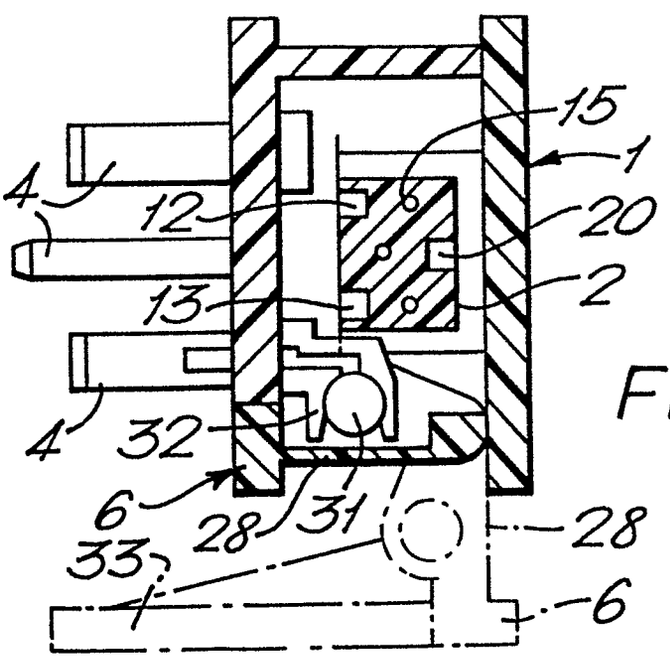


FIG.16.

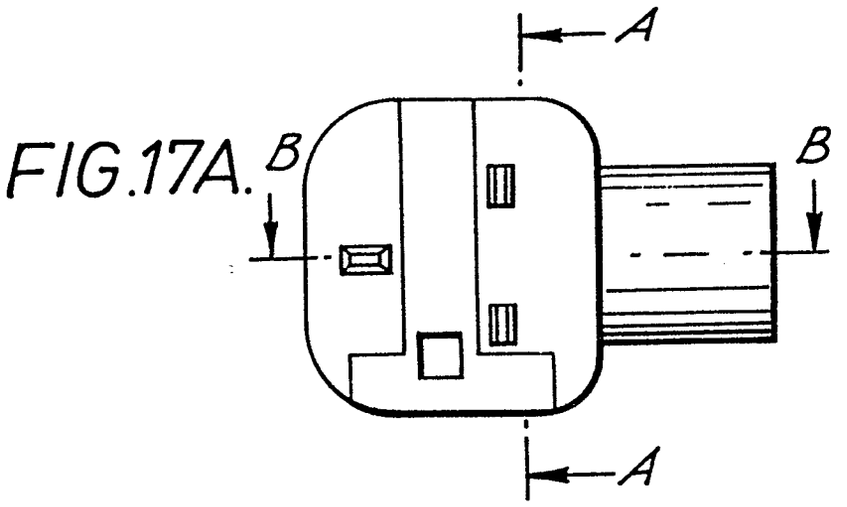


FIG.17A.

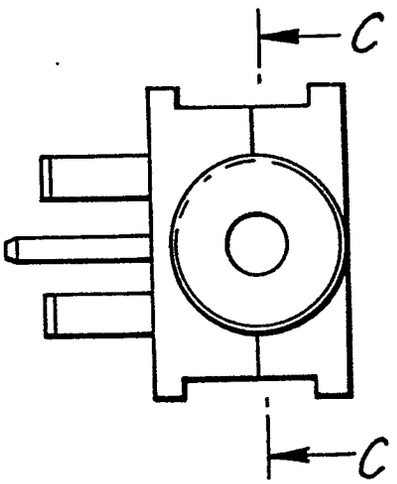


FIG.17B.

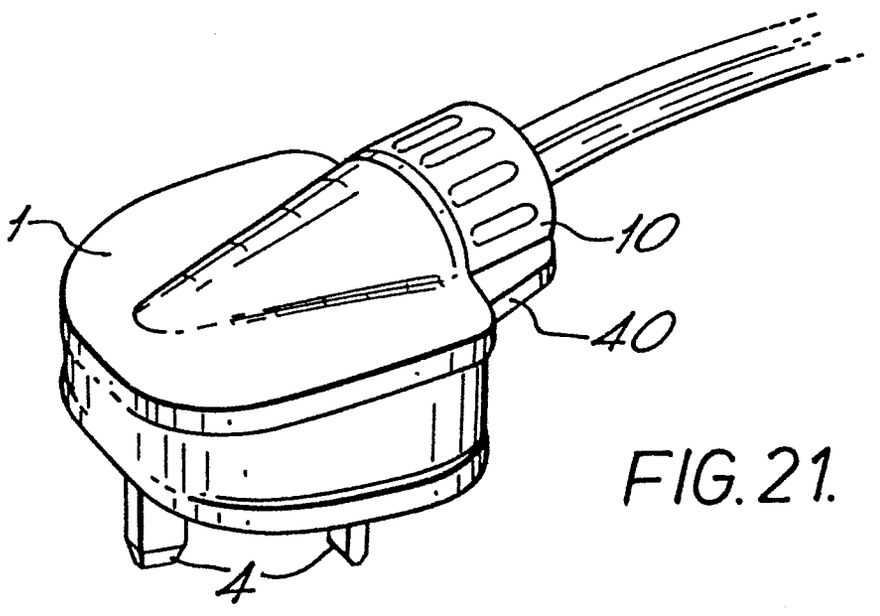


FIG.21.

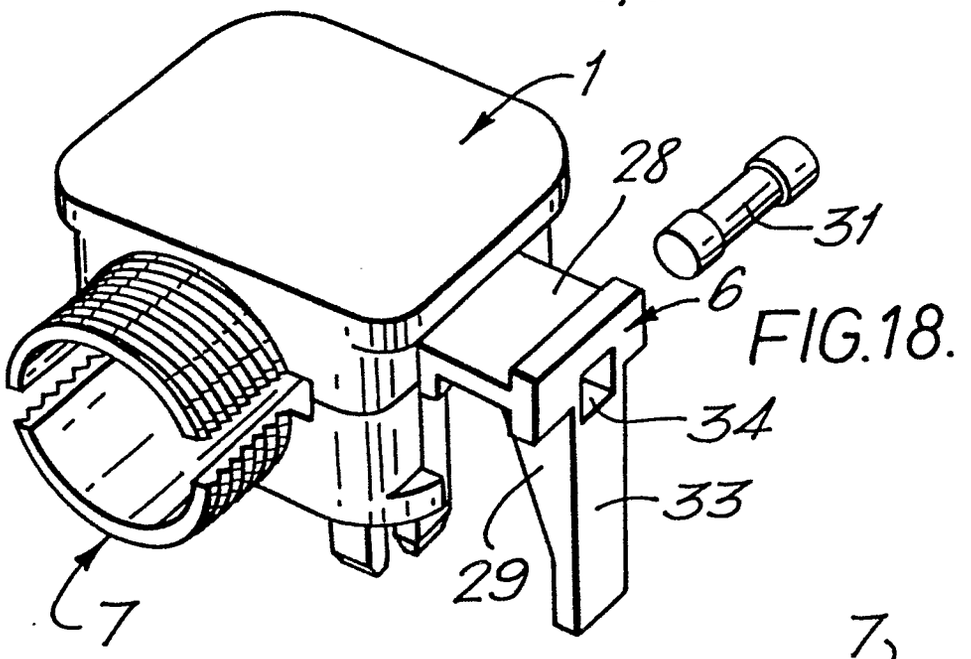


FIG.18.

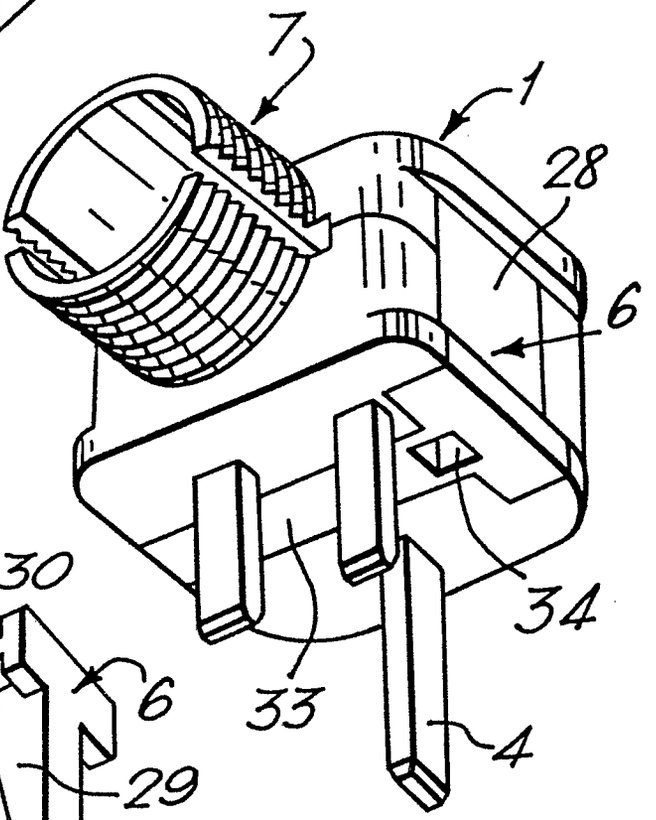


FIG.19.

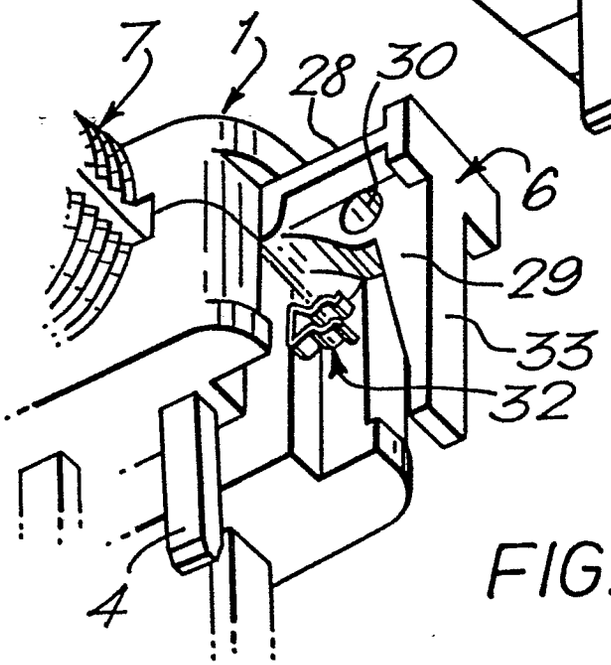


FIG.20.