

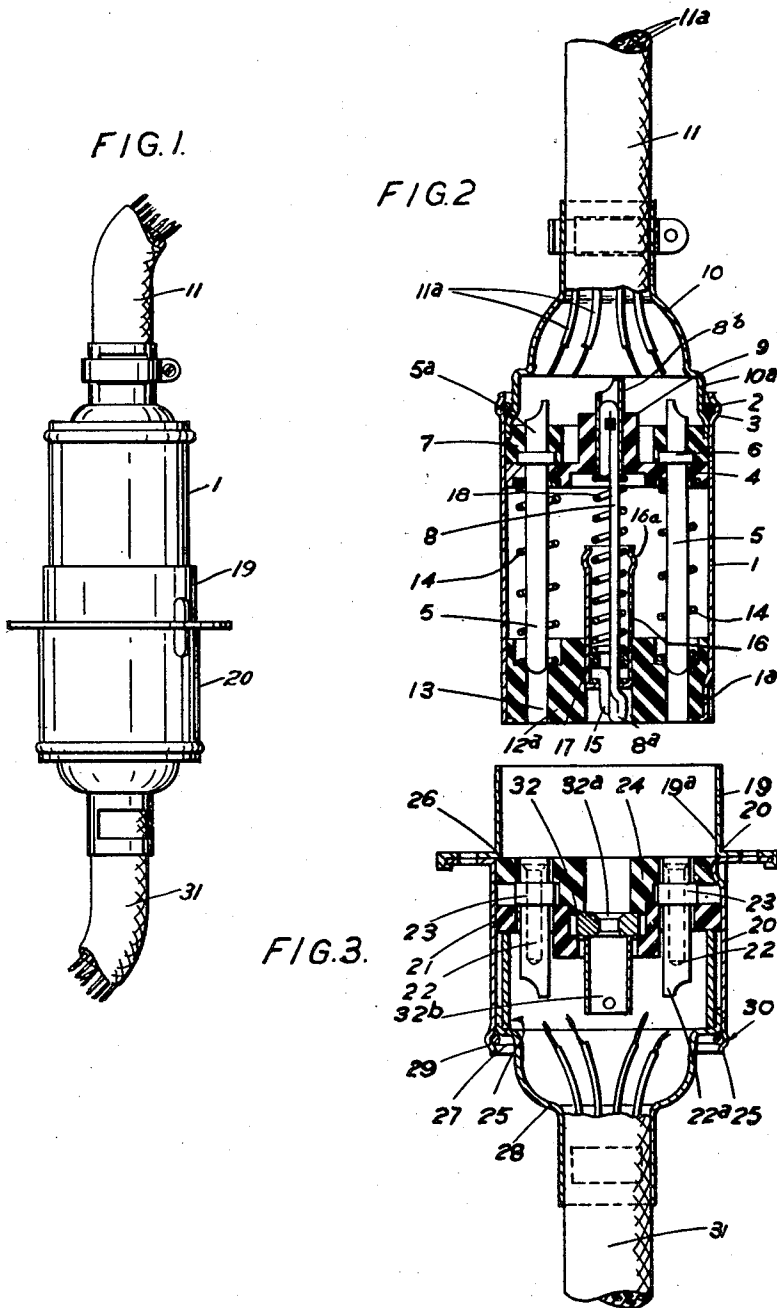
July 6, 1948.

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ELECTRICAL PLUG AND SOCKET CONNECTOR  
WITH RETRACTABLE CONTACTS

2,444,843

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2 Sheets-Sheet 1



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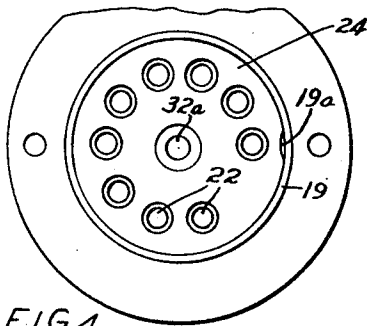


FIG. 4.

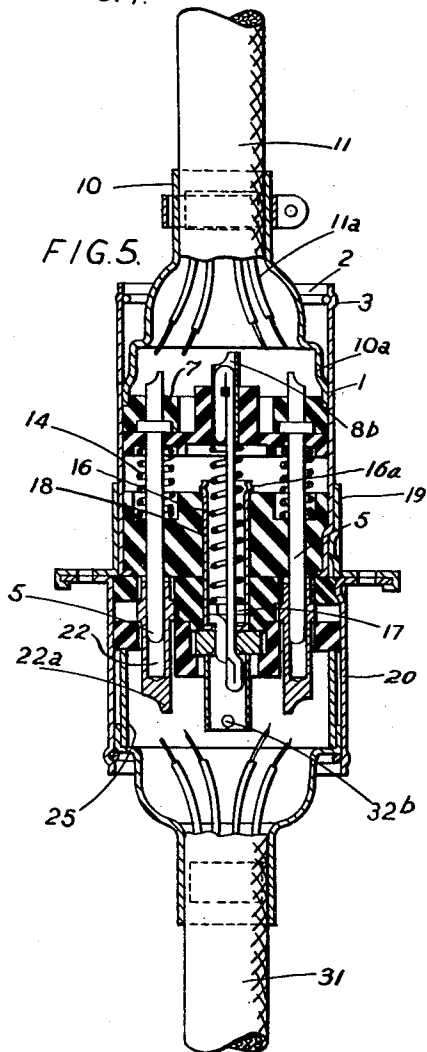


FIG. 5.

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# UNITED STATES PATENT OFFICE

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## ELECTRICAL PLUG AND SOCKET CONNECTOR WITH RETRACTABLE CONTACTS

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8 Claims. (Cl. 173—328)

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This invention relates to electrical plug and socket connectors and has for its object to provide self-locking electric plug and socket connectors with retractable contact elements. The invention is applicable to plugs and sockets of many kinds including plugs and sockets for domestic use, and is especially applicable to connectors having a multiplicity of contact elements adapted to be engaged in or with corresponding elements carried in a common moulding so as to establish a number of separate circuits.

The main characteristic of plugs in accordance with the present invention is that the contact elements such as for instance contact pins or tubular sockets are normally housed in retracted positions in the moulding or casing and are thus protected from damage and cannot be tampered with, but when the plug and socket are connected all the contact elements of one series, i. e., either the plug pins or the socket elements, are first advanced so that they enter or engage the corresponding connection elements, the further pressing home of the plug into the socket or vice-versa, locking the plug to socket with plug and socket contact elements in connected position. One convenient way of effecting this locking action is that disclosed in my prior application Ser. No. 487,761, filed May 20, 1943, now Patent 2,423,250, issued May 22, 1947, where a clamping rod engages and locks itself to a socket element. This clamping rod may itself be one of the contact elements of the plug, or several small clamping rods may be employed as contact elements, or alternatively all contact elements may consist of such clamping rods.

The invention may therefore be said to consist broadly of an electrical plug and socket connector, wherein the plug or socket contact elements are, when the plug is disconnected from the socket, held in retracted position within a casing until the plug and socket are applied one to the other, whereupon the plug or socket contact elements are projected by the plugging action into engagement with their corresponding socket or plug contact elements, the final movement establishing connection of the plug and socket ensuring the positive locking or securing of the plug to the socket with all the contact elements engaged in circuit establishing relation.

The characteristics in use of the plug and socket connector according to this invention are that no current carrying parts are or can be exposed whilst the connector is disengaged, being inserted, locked or being separated.

In order that the invention may be more

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clearly understood and carried into practice reference is hereby made to the accompanying drawings, wherein an example of a plug and socket connector in accordance with the invention is illustrated.

In these drawings

Figure 1 is an elevational view of a plug and socket in engaged or connected relationship;

Figure 2 is a longitudinal section of the plug;

Figure 3 is a longitudinal view of the socket;

Figure 4 is a plan view of the socket; and

Figure 5 is a longitudinal section showing the plug and socket in connected position.

Referring to these drawings the numeral 1 designates the outer casing of the plug which is provided at its outer end with a retaining ring 2 which is sprung into a grooved ridge 3 formed in the casing. Within the casing 1 a slidable disc 4, of insulating material, is provided for carrying the pins or plug contact elements 5. These pins 5 pass through holes in the disc 4 and have flanges 6 which seat upon the disc 4 and a retaining ring 7, through holes in which the upper ends or terminal 5a of the pins 5 pass, serves to retain the pins in position. Centrally of the disc 4 the clamping rod 8, which may be a current conductor or an earthing pin, is carried by and secured to an insulating block 9 integrally formed with disc 4. The numeral 10 indicates a cable casing in which the end of the cable 11 is secured. The cable 11 contains the separate electrical conductors 11a, each of which is connected, for example by soldering, to a terminal 5a of its appropriate pin 5. Within the enlarged inner end 10a of the cable casing 10 a waterproofing packing 12 may be provided so as to prevent the entry of moisture to the wires and terminals. The outer end of the casing 1 is closed by an insulating disc 12a provided with holes 13 through which the pins 5 can pass, the forward ends of the pins being just engaged in these holes when the pins 5 are in retracted position. A compression spring 14 surrounds several or each of the pins 5 and these springs normally act between the closure disc 12a and the disc 4 to hold the disc 4, and consequently all the pins 5 in the retracted position. Centrally of the plug the device for locking the plug in the socket is provided.

This device operates on the same principles as disclosed in my prior application before alluded to. It consists, in this example, of a wedging stud 15 located in the bottom of a casing 16 and held in position by a ring 17 upon which the spring 18 bears, this spring surrounding the

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clamping bar 8 and acting between the ring 17 and the disc 4. Casing 16 has a collar or ridge 16a limiting the axial forward movement of the casing relative to disk 12a.

Referring to Figure 3, the socket part of the device consists of the connected casing parts 19 and 20 in which the insulating block 21 supporting the socket contact elements 22 is mounted. The socket elements 22 are flanged at 23 and are held in position on the block 21 by the superimposed retaining block 24, the composite fitments 21-24 being secured in position between the upper end of a retaining barrel 25 and a shoulder 26 of the casing part 19. The other outer end of the barrel 25 bears upon the flanged part 27 of the socket cable carrier 28 which is held in position by a spring retaining ring 29 sprung into a groove 30 formed in the casing part 20. The separate conductors of the cable 31 are, of course, electrically connected, as by soldering, to the terminals 22a of the socket contact elements 22.

Centrally of the socket and loosely held in a recess between the blocks 21 and 24 a floating bush 32 is provided for co-operation with the clamping rod 8.

The manner in which the device operates is as follows:

When it is desired to make connection the plug casing 1 is inserted into the socket casing part 19 and is adjusted so that the recess 1a on the outside of casing 1 registers with the projection 19a of the casing part 19. This positions the pins 5 in alignment with the socket contact elements 22. Pressure is now applied to the plug casing 10, which forces the disc 7 and its attachments, including the pins 5 and the clamping rod 8, together with casing 16 forward and the pins 5 enter the socket elements 22 and the circuits are established. When collar or ridge 16a of casing 16 abuts against disc 12a, further forward movement of the casing and with it of wedging stud 15 are arrested while the forward movement of clamping rod 8 continues and the clamping head 8a of the clamping rod 8 is forced forward beyond the tip of the wedging stud 15 and enters the hole 32a of the floating bush 32 and passes through it. In this relative position of clamping head 8a and wedging stud 15, further pressure will serve to displace slightly the floating bush 32 sideways thus permitting the wedging stud 15 to enter the hole 32a, the amount of such sideways movement being referred to hereinafter as the "displacement distance." Once the pressure on the cable casing 10 is released, the spring 18 surrounding the clamping rod 8 will retract the clamping rod. Owing to the presence in the hole 32a of the wedging stud 15, retraction is only possible until the clamping head 8a bears against the edge of the hole 32a which it cannot pass. Plug and socket are thus secured in the connected position shown in Figure 5 with the ridge 16a of the casing 16 resting on the top of the plug closure disc 12a.

As before mentioned, the clamping rod 8 may be used as a current conductor or may be used solely as the means for locking the plug and socket together. When used for conducting current its upper end will be provided with a terminal indicated at 8b, and the floating bush 32 can be of conducting material and be provided with an extension 32b to which a conductor can be soldered or otherwise electrically connected.

To disconnect the plug from the socket pulling force is applied to the casing 1 (which when the connector is in use, is not subject to cable pull)

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which causes the locking wedge 15 to be withdrawn from the floating bush 32, which then is displaced sideways sufficiently to permit the clamping head 8a of the clamping rod 8 to pass through the hole 32a in the bush 32.

From the foregoing description of the unlocking action, it will be obvious that unlocking takes place very suddenly, namely when the pull applied to the casing 1 has withdrawn the wedging stud 15 sufficiently so that the clamping rod 8c may enter the hole 32a. Unlocking of the clamping mechanism is a spring operated snap action, followed instantly by the spring driven withdrawal of all plug contact members. Thus, the connector according to this invention will always break its circuit suddenly thus tending to prevent arcing and the like action.

I claim:

1. An electrical plug and socket connector comprising plug and socket contact elements and casings therefor, the plug element being retractable relative to its casing and held in the retracted position when the elements are out of engagement, said elements being so arranged and constructed that when they are applied one to the other the plug element is projected from its casing into circuit establishing engagement with the socket element, and locking means positioned within and separated from the plug casing for locking the plug to the socket when the elements are in circuit establishing engagement, said locking means comprising a clamping rod with a clamping head, a wedging stud in slidable engagement with the clamping rod, yieldable means tending to press the wedging stud towards the clamping head, and a co-operating socket plate with an opening substantially of the joint cross-section of the operative portions of the clamping rod and the wedging stud.

2. An electrical plug and socket connector comprising plug and socket contact elements and casings therefor, the plug element being retractable relative to its casing and held in the retracted position when the elements are out of engagement, said elements being so arranged and constructed that when they are applied one to the other the plug element is projected from its casing into circuit establishing engagement with the socket element, and locking means positioned within and separated from the plug casing for locking the plug to the socket when the elements are in circuit establishing engagement, said locking means comprising a clamping rod with a clamping head, a wedging stud in slidable engagement with the clamping rod, a spring tending to bias the wedging stud toward the clamping head, and a laterally slidably mounted cooperating socket plate with an opening substantially of the joint cross-section of the operative portions of the clamping rod and the wedging stud, said clamping rod, clamping head, wedging stud and cooperating socket plate being arranged to cause relative lateral movement between clamping head and clamping plate substantially equal to the cross-sectional width of the wedging stud in the direction of the lateral plate movement.

3. An electrical plug and socket connector comprising plug and socket contact elements and casings therefor, the plug element being retractable relative to its casing and held in the retracted position when the elements are out of engagement, said elements being so arranged and constructed that when they are applied one to the other the plug element is projected from its cas-

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ing into circuit establishing engagement with the socket element, and locking means positioned within and separated from the plug casing for locking the plug to the socket when the elements are in circuit establishing engagement, said locking means comprising a clamping rod with a clamping head, a wedging stud in slidable engagement with the clamping rod, yieldable means tending to press the wedging stud towards the clamping head, a co-operating socket plate with an opening substantially of the joint cross-section of the operative portions of the clamping rod and the wedging stud, and a shield member in the plug casing, said shield member having openings therethrough, through which the plug contact element, the clamping rod with the clamping head and the wedging stud are passed, and which shield conceals the plug contact element when retracted into the plug casing.

4. An electrical plug comprising a plug contact element and a casing therefor, a clamping rod with a clamping head, a wedging stud slidably connected with the clamping rod for conjoint movement therewith, a member slidable in the plug casing and supporting the clamping rod and the plug contact element, an end wall member fastened to the plug casing and having openings therethrough for the passage of the plug contact element and the clamping rod together with the wedging stud, yieldable means tending to separate the end wall member and the slidable member for retracting the plug contact element relative to the casing and also biasing the wedging stud toward the clamping head, whereby, upon the application of pressure on the slidable member against the action of the yieldable means, the plug contact element and the clamping rod together with the wedging stud are projected from the end wall member, and limit means for arresting the forward movement of the wedging stud after a predetermined distance of travel thereof.

5. An electrical plug and socket connector comprising plug and socket contact elements and casings therefor, the plug contact element being retractable relative to its casing and arranged to be held in the retracted position when the elements are out of engagement and in the projected position when the contact elements are applied one to the other, and means positioned within and separated from the plug casing for retracting and projecting the plug contact element and for locking the said element to the socket, said means including a clamping rod with a clamping head, a wedging stud slidably connected with the clamping rod for conjoint movement therewith, a member slidable in the plug casing and supporting the clamping rod and the plug contact element, an end wall member fastened to the plug casing and having openings thereto for the passage of the plug contact element and the clamping rod together with the wedging stud, yieldable means between the slidable member and the end wall member tending to separate the end wall member and the slidable member for retracting the plug contact element relative to its casing, and biasing the wedging stud toward the clamping head, whereby, upon application of pressure on the slidable member against the action of the yieldable means, the plug contact element and the clamping rod together with the wedging stud are projected from the end wall member, limit means for arresting the forward movement of the wedging stud after a predetermined distance of travel thereof, and a cooper-

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ating socket plate having openings therethrough for receiving the plug contact element, the clamping rod with the clamping head and the wedging stud, the opening for receiving the clamping rod with the clamping head and the wedging stud being substantially of the joint cross-section of the clamping rod and the wedging stud, said wedging stud, upon application of the elements one to the other preventing a withdrawal of the clamping head through the respective socket plate opening when the compressed yieldable means are released, thereby latching the plug and socket elements together.

6. An electrical plug and socket connector comprising plug and socket contact elements and casings therefor, the plug contact element being retractable relative to its casing and arranged to be held in the retracted position when the elements are out of engagement and in the projected position when the contact elements are applied one to the other, and means positioned within and separated from the plug casing for retracting and projecting the plug contact element and for locking the said element to the socket, said means including a clamping rod, a member slidable in the plug casing and supporting the clamping rod and the plug contact element, an end wall member fastened to the plug casing, a wedging stud, means for supporting said wedging stud slidably relative to the clamping rod, said wall member having openings therethrough for the passage of the plug element and the clamping rod and for slidably mounting said support means, yieldable means between the end wall member and the slidable member tending to separate said members for retracting the plug contact element relative to its casing, and biasing the wedging stud toward the clamping head, whereby, upon application of pressure on the slidable member against the action of the yieldable means, the plug contact element and the clamping rod together with the wedging stud are projected from the end wall member, limit means at said support means positioned to engage a corresponding abutment within the plug casing for arresting forward movement of the wedging stud after a predetermined distance of travel thereof while the plug contact element and the clamping rod continue their forward travel in response to a continued compression of the yieldable means, and a co-operating socket plate having openings therethrough for receiving the plug contact element, the clamping rod with the clamping head and the wedging stud, the opening for receiving the clamping rod with the clamping head and the wedging stud being substantially of the joint cross-section of the clamping rod and the wedging stud, said wedging stud, upon application of the elements one to the other, preventing a withdrawal of the clamping head through the respective plate opening when the compressed yieldable means are released, thereby latching the plug and socket elements together.

7. An electrical plug and socket connector comprising plug and socket contact elements and casings therefor, the plug contact element being retractable relative to its casing and arranged to be held in the retracted position when the elements are out of engagement and in the projected position when the contact elements are applied one to the other, and means positioned within and separated from the plug casing for retracting and projecting the plug contact element and for locking the said element to the socket, said means

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including a clamping rod, a member slidable in the plug casing and supporting the clamping rod and the plug contact element, an end wall member fastened to the plug casing, a wedging stud, a sleeve member surrounding the clamping rod and supporting said wedging stud slidably relative to the clamping rod, said wall member having openings therethrough for the passage of the plug contact element and for slidably mounting the sleeve member with the clamping rod and the wedging stud therein, spring means between the end wall member and the slidable member tending to separate the said members for retracting the plug contact element relative to its casing, and to bias the wedging stud toward the clamping head, whereby, upon application of pressure on the slidable member against the action of the spring means, the plug contact element and the clamping rod are projected from the end wall member, said sleeve member being positioned to be engaged by the slidable member after a predetermined forward displacement thereof and to be moved forward together with the wedging stud, a projection at the sleeve member positioned to abut against the end wall member after a predetermined distance of travel of the sleeve member for arresting further movement thereof and also of the wedging stud while the plug contact element and the clamping rod continue their forward travel in response to continued forward displacement of the slidable member, and a laterally slidably mounted co-operating socket plate having openings therethrough for receiving the plug contact element, the clamping rod with the clamping head and the wedging stud, the opening for receiving the clamping rod with the clamping head and the wedging stud being substantially of the joint cross-section of the operative portions of the clamping rod and the wedging stud, said clamping rod, clamping head and wedging stud and

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co-operating socket plate being arranged to cause relative lateral movement between clamping head and socket plate substantially equal to the cross-sectional width of the wedging stud in the direction of the lateral plate movement, said wedging stud, upon application of the elements one to the other, preventing a withdrawal of the clamping head through the respective socket plate opening when the compressed spring means are released, thereby latching the plug socket and elements together.

8. An electrical plug and socket connector as described in claim 7, wherein said spring means and said projection of the sleeve member are constructed and positioned to provide for a lifting of the sleeve member together with the wedging stud in response to a lifting of the plug casing with the end wall member fastened thereto for removing the wedging stud from its latching position, thereby releasing the latch connection between plug and socket elements.

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