Sept. 15, 1964 W. H. STUART 3,149,211

ELECTRICAL OUTLET SOCKET CONNECTORS

Filed March 16, 1962

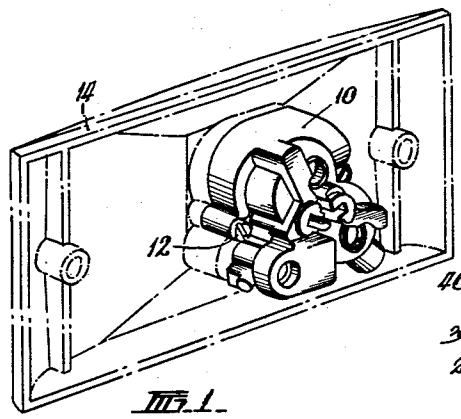

FIG. 1

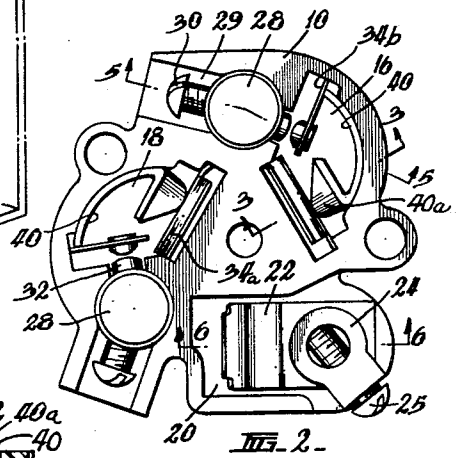

FIG. 2

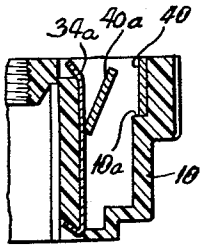

FIG. 3

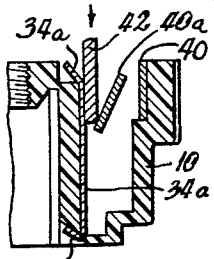

FIG. 4

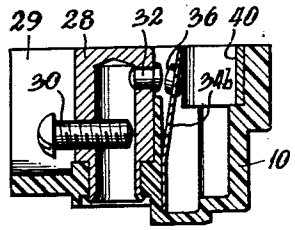

FIG. 5

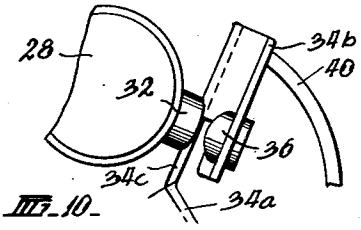

FIG. 10

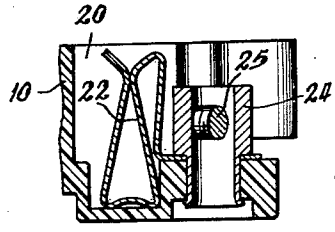

FIG. 6

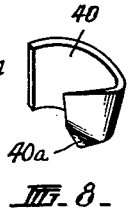

FIG. 8

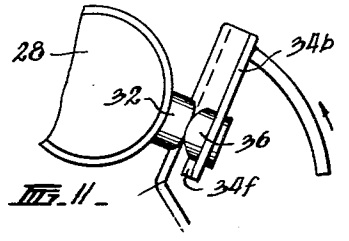

FIG. 11

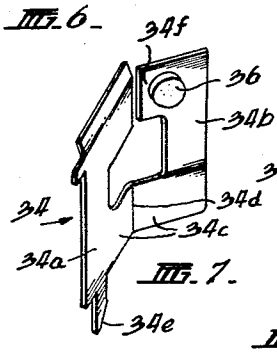

FIG. 7

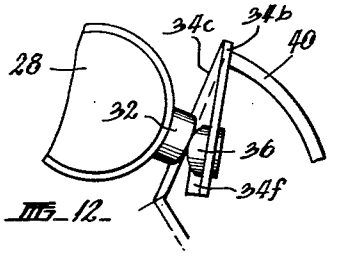

FIG. 12

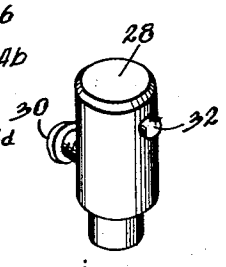

FIG. 9

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ELECTRICAL OUTLET SOCKET CONNECTORS

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9 Claims. (Cl. 200—51.09)

This invention relates to outlet sockets adapted for the attachment thereto of multi-pin electrical connector plugs, particularly but not necessarily three-pin plugs of the kind in common use for domestic appliances and the like. Such outlet sockets are usually combined with a manually operable switch by which one at least of the socket contacts is connected in circuit, but it is also known to provide an outlet socket with a switch which is operated by one of the plug pins, whereby the respective socket contact is automatically connected in circuit when the plug is attached and is automatically disconnected when the plug is detached.

More particularly, in such automatic outlet sockets, the switch is positively closed by the respective pin of the connector plug and is opened by spring pressure when the plug is removed. It is well known however, that when the coacting switch contacts are small in area, they commonly become lightly welded together when the switch is closed, this effect being due to the momentary flow of a surge current of considerably higher value than the rated current-carrying capacity of the switch. In such circumstances, a switch of the aforesaid kind does not open in the normal manner, if the force required to separate the welded contacts is greater than that exerted by the switch opening spring.

A feature of this invention resides in an outlet socket connector provided with at least one switch which is automatically closed by the attachment thereto of a connector plug and vice versa and characterised in that the switch contacts engage and disengage with a relative sliding and/or rolling action. More particularly, the switch contacts, while in engagement during the operation of closing and opening the switch, are caused to move relatively with a sliding and/or rolling action.

In a preferred form of the invention, the movable contact is mounted near the free end of a resilient conducting arm and the latter is eccentrically loaded in order to close the switch, whereby the said resilient arm is twisted to some extent to cause the said movable contact to move relatively to the coacting contact after engaging the latter.

For this purpose, the said resilient switch arm is preferably displaced to close the switch by means of an angularly movable member having one of its ends arranged for engagement by the respective pin of the connector plug and having its opposite end arranged to engage the resilient switch arm at a position which is spaced from the axis of the movable contact carried thereby. The said angularly movable member preferably comprises a metal strip of arcuate shape having one of its ends engaging the switch arm and having its opposite end arranged for engagement and displacement by the plug pin, the said member being accommodated within a recess having an arcuate wall which forms a guide therefor.

In the following more detailed description of a preferred construction according to the invention:

FIGURE 1 is a perspective view from the back of an outlet socket connector,

FIGURE 2 is a front view of the socket connector with the cover plate removed and is drawn to a larger scale,

FIGURE 3 is a view in sectional elevation taken on the line 3—3 of FIGURE 2 and shows a coacting pair

of jaw contacts before a plug pin is inserted between them,

FIGURE 4 is a view similar to FIGURE 3 and shows the plug pin entering the space between the jaw contacts,

FIGURES 5 and 6 are views in sectional elevation taken respectively on the lines 5—5 and 6—6 of FIGURE 2,

FIGURES 7, 8 and 9 are perspective views respectively of an integral plug contact and switch arm, an angularly movable switch actuating member, and a terminal, and

FIGURES 10, 11 and 12 are similar plan views to a considerably enlarged scale showing different stages in the operation of closing a switch.

The outlet socket shown in the drawings is adapted for engagement by a connector plug of the common type having three angularly spaced flat-sided contact pins projecting from its front face, viz. two current carrying or "power" pins and an earth pin, the said "power" pins usually being designated as the "active" and "neutral" pins.

The illustrated outlet socket comprises a moulded body 10 of insulating material detachably connected by screws 12 to the back of a suitable front plate 14 provided in the usual way with suitable slots through which the plug pins may be inserted to engage coacting socket contacts in the body 10.

As shown in FIGURES 2, 3, 4 and 5, the forward end of the body 10 is formed with spaced cavities 16, 18 and 20 in which the respective socket contacts are arranged, the cavities 16 and 18 for the two "power" contacts being similar while the cavity 20 for the "earth" contact is open at one side.

The "earth" contact 22 is generally of a common type and comprises as shown in FIGURES 2 and 6, a strip of resilient metal which is bent to form upstanding opposed jaws between which the earth pin of the plug is insertable and this strip is secured to the body 10 by a tubular terminal 24 mounted on the outer end of the contact strip and having a reduced inner end projecting through a hole in the body and riveted thereto. The earth conductor may thus be inserted into the terminal 24 from the back of the body and is secured thereto by a radial clamping screw 25.

Each of the similar cavities 16 and 18 which accommodate the contacts for the power pins of the plug is of sector shape when viewed from the front, as in FIGURE 2, so that it has an arcuate wall and two flat walls and one of the latter is disposed radially with respect to the longitudinal axis of the body while the other or innermost wall is disposed at right angles to the radius through its midpoint.

An upstanding "power" terminal post 28 of cylindrical shape is arranged adjacent to, but outwardly of, the radial wall of each of the cavities 16 and 18 and each of these terminals is arranged within the adjacent closed inner end of a corresponding cavity 29 provided in the body as shown in FIGURES 2 and 5.

These cavities 29 are open at their outer ends to permit of free access to radial clamping screws 30 fitted to the respective terminals. These terminals are also riveted to the body and have holes extending thereinto from their rear ends so that the corresponding conductors are also inserted from the back of the body.

Each terminal 28 is provided near its closed forward end with a radially arranged silver contact 32 which projects into the adjacent end of the corresponding cavity 16 or 18 through an opening in the intervening wall of the body.

Each of the cavities 16 and 18 accommodates a contact member 34 formed of Phosphor bronze or other stiffly resilient thin sheet metal. As shown best in FIGURE 7, this contact member comprises two spaced up-

standing arms 34*a* and 34*b* which are integrally connected at their lower ends by a transverse portion 34*c* of the strip and this portion 34*c* is bent at an intermediate position 34*d* so that the arms 34*a* and 34*b* are angularly disposed when viewed in plan as in FIGURE 2.

An integral lug 34*e* projects downwardly from the bottom of the arm 34*a* and this lug extends through a hole at the bottom of the respective cavity in the body and is bent laterally behind the latter in order to secure the strip thereto. The said arm 34*a* forms the fixed jaw of a coacting pair of contact jaws and for this purpose, it is arranged in contact with the innermost side of the respective cavity 16 or 18 and its upper edge is bent outwardly to provide a "lead-in" for the free end of the respective pin of a connector plug as shown in FIGURES 3 and 4.

The transverse connecting portion 34*c* of the strip 34 bears constantly against the corresponding wall of the cavity as shown in FIGURE 5, but the upstanding switch arm 34*b* thereon is bent outwardly from that wall as shown in the same figure and its upper end is formed with an integral lateral extension 34*f* provided on its outer face with a projecting silver contact 36. This contact is disposed in alignment with, but is normally spaced from, the radial contact 32 on the respective terminal 28 as shown in FIGURES 2, 5 and 10.

An angularly movable arcuate member 40 comprising a strip of metal arranged on edge and bent to the required shape is arranged in contact with the concave outer wall of each of the cavities 16 and 18 and has its lower edge resting on a ledge 10*a* formed on the respective wall. The upper edge of each member 40 is approximately flush with the front face of the body 10 and with the upper edge of the contact strip 34 and the outer end of said member 40 bears against the inner face of the arm 34*b* adjacent to the outer edge thereof as shown in FIGURES 2, 10, 11 and 12 while the inner end 40*a* of the said member is obliquely bent inwardly and forms a movable jaw contact which is normally maintained in abutting contact with the coacting fixed jaw 34*a* by the resilience of the switch arm 34*b*. Due to the oblique disposition of the inwardly bent movable jaw, it provides a tapered lead-in for the coacting contact pin 42 of the connector plug.

Thus when the plug is being attached to the socket, each "power" pin 42 of the plug enters the downwardly converging space between the upper portions of the corresponding fixed and movable jaws 34*a* and 40*a* respectively so that as this entry movement of the pins is continued, the arcuate member 40 is displaced outwardly and transversely with respect to the contact pin 42 whereby it slides along the concave outer wall of the respective recess in the body. Thus the member 40 is moved angularly about an axis disposed parallel to the contact pin and passing through the centre of curvature of the guide wall so that the outer end of the member pushes the respective switch arm towards the respective terminal 28 (FIGURE 11). However, before each member 40 is fully displaced by the respective plug pin, the moving contact 36 engages the corresponding contact 32 on the respective terminal 28 as shown in FIGURE 11. Consequently, when the member 40 is further displaced as the plug pin is inserted to its full extent, the outer edge of the switch arm 34*b* undergoes a further outward movement while the contact 36 being already in engagement with the terminal contact 32, is unable to participate in this movement. Consequently the arm 34*b* is twisted by the continued movement of the member 40 as shown in FIGURE 12 whereby the contact 36 is caused to undergo a rolling and sliding movement on the fixed contact 32 as illustrated in FIGURE 12. If, therefore, the surge current which passes at the time of initial engagement of the contacts 32 and 36 causes them to be fused together, the subsequent rolling and sliding movement of the contact 36 breaks the weld.

It will be evident that these operations are repeated in the reverse order as the connector plug is being detached so that the switch arm is untwisted accompanied by a relative rolling and sliding movement of the engaged contacts 32 and 36 before these contacts are separated to open the switch.

I claim:

1. An electrical outlet socket connector comprising a body, a plurality of spaced socket contacts supported on the body for engagement by corresponding pins on a connector plug, a switch arm electrically connected to one of said spaced contacts, a fixed contact carried by said body and engageable by said switch arm and an angularly movable actuating member supported by the body and arranged to be displaced by the insertion of the plug pin thereby to move the said switch arm into engagement with said fixed contact and wherein said actuating member engages said switch arm at a position disposed out of alignment with said fixed contact whereby the arm is twisted after engaging the fixed contact due to the further insertion of the respective plug pin thereby to cause said arm to move relatively to the fixed contact with a sliding and/or rolling action.

2. An electrical outlet socket connector according to claim 1, wherein said switch arm and said contact electrically connected thereto comprise spaced portions of a resilient metal strip.

3. An electrical outlet socket connector according to claim 2, wherein said resilient metal strip comprises spaced upstanding arms integrally connected at their lower ends by a transverse portion and wherein one of said upstanding arms forms a fixed contact jaw for engagement by the plug pin while the other upstanding arm constitutes the said switch arm.

4. An electrical outlet socket connector according to claim 3, wherein said transverse connecting portion of the metal strip is bent between the said upstanding arms thereon whereby the latter are angularly displaced.

5. An electrical outlet socket connector according to claim 1, wherein said angularly movable actuating member is formed of conducting metal and is arcuate in shape, said actuating member being slidably mounted in contact with a curved guide surface on said body, and having its opposite ends engaging said switch arm and the spaced contact electrically connected thereto whereby the last-mentioned contact and the adjacent end of said arcuate actuating member form coacting jaws between which the respective plug pin is insertible.

6. An electrical outlet socket connector according to claim 1 including a further switch arm similarly associated with another one of said spaced contacts.

7. An electrical outlet socket connector according to claim 1 wherein said fixed contact for engagement by the switch arm projects from the side of a terminal post on the body.

8. An electrical socket connector comprising an insulating body, a socket contact mounted thereon for engagement by a contact pin on a detachable connector plug, a fixed contact on the body at a position spaced from said socket contact, a resilient switch arm electrically connected to said socket contact, said switch arm having a free end portion engageable with but normally separated from said fixed contact, and a switch actuating member slidably supported on the body so as to move substantially transversely with respect to the length of said contact pin, said actuating member extending between said socket contact and a portion of said switch arm which is disposed out of alignment with said fixed contact, said actuating member being normally pressed resiliently against said socket contact, said contact pin being insertable between the socket contact and the actuating member whereby the latter is progressively displaced as said pin is being inserted to its full extent, and wherein during an initial stage of the displacement of said actuating member, said switch arm is moved thereby into engagement with said fixed contact whereby to connect said socket contact to a

source of power while during the further movement of said actuating member, said switch arm is twisted whereby it moves on the fixed contact with a sliding and/or rolling action.

9. An electrical socket connector comprising an insulating body, a socket contact arranged therein for engagement by a contact pin on a detachable connector plug, a fixed contact on the body at a position spaced from said socket contact, a resilient switch arm electrically connected to said socket contact, said switch arm having a free end portion engageable with but normally separated from said fixed contact, and an electrically conductive switch actuating member of arcuate shape slidably supported on and guided by the body so as to move angularly about an axis disposed substantially parallel to the length of said contact pin, said actuating member being arranged between said socket contact and said switch arm and being normally pressed against said socket contact by said switch arm, said contact pin being insertable between said socket contact and said actuating member whereby the latter is

progressively displaced as said pin is being inserted to its full extent whereby during an initial stage of the displacement of said actuating member by the contact pin said switch arm is moved into engagement with said fixed contact and wherein said actuating member bears against the switch arm at such a position disposed out of alignment with said fixed contact that during the further movement of said actuating member, said switch arm is twisted so that it moves on the fixed contact with a sliding and/or rolling action.

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