Jan. 23, 1951 H. G. CRAIG 2,539,230

ELECTRICAL POWER OUTLET AND POWER PLUG

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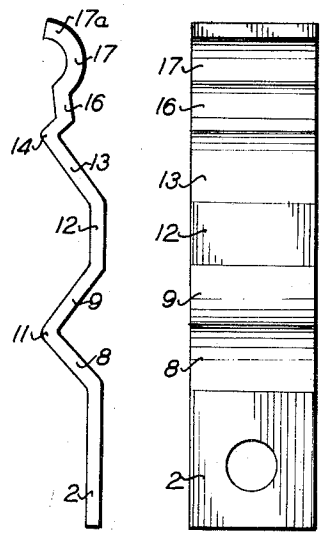

Fig. 1

Fig. 2

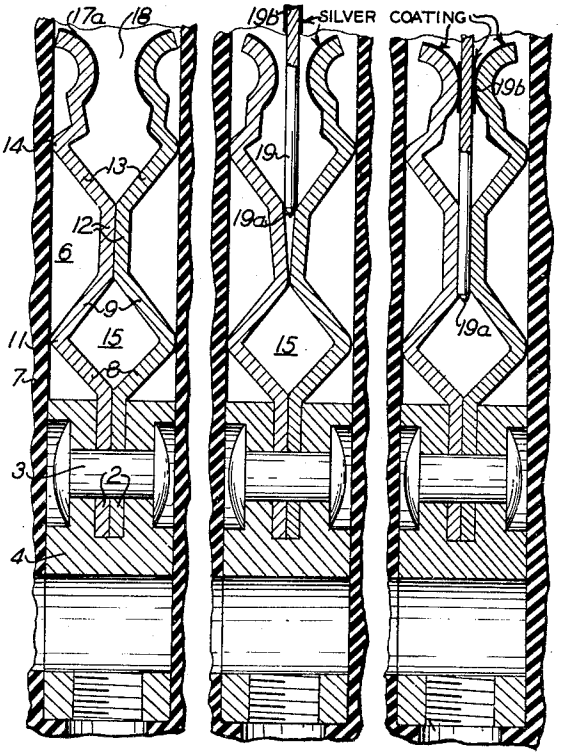

Fig. 3A Fig. 3B Fig. 3C

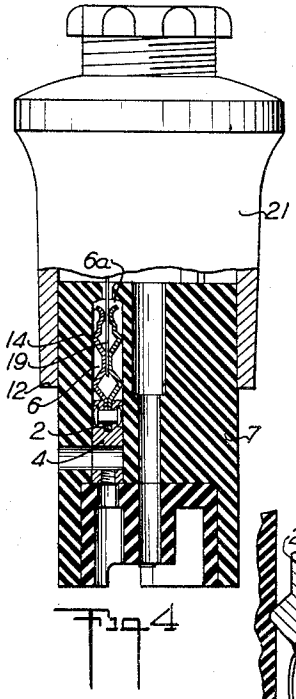

Fig. 4

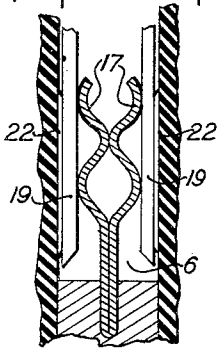

Fig. 5

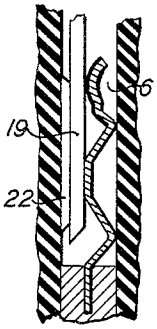

Fig. 6

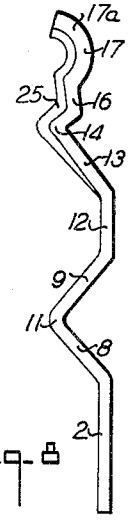

Fig. 8

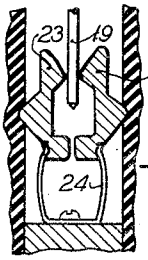

Fig. 7

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ELECTRICAL POWER OUTLET AND POWER PLUG

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5 Claims. (Cl. 173—363)

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This invention relates to electrical power outlets and power plugs and other electrical devices such, for instance, as switches, radio valve bases, telephone jacks, and is especially concerned with such devices when equipped with blade or flat pin contacts, as distinct from round pin contacts.

In certain respects blade contacts are greatly to be preferred to those of the round pin type, but previous designs and constructions of such blade type contacts and of the cooperating contacts, leave much to be desired in the way of making satisfactory mechanical and electrical connection. Very often, through faulty electrical connections, the devices become grossly overheated while the contact members themselves become unsuitable for carrying the current which is passing through them.

In general these faulty connections are due primarily to the formation and continued presence of copper oxide despite the wiping action usually associated with the contacts of this type; secondarily to the deterioration of spring pressure associated with the excessive heat generated by the passage of alternating electrical current through the resistance of this copper oxide film. In certain types which are known, the contacts have been silver plated to provide an improved electrical connection due to the excellence of silver oxide and/or silver as a conductor. A deposit of silver by such means is, however, only a temporary expedient as it is subject to the whole of the wiping action and is removed rapidly, being very soft compared with the non-ferrous alloys, e. g. brass, Phosphor bronze usually employed in such contacts. Furthermore, a silver plating deposit is limited to a few thousandths of an inch in thickness (usually 2 or 3) and thus cannot withstand repeated wiping or abrasive actions.

The present invention is more especially concerned with the design, construction and arrangement of the contact members and their cooperation with the contact blades, the primary object of the invention being to provide for connections between the respective contacts which are of the highest efficiency and reliability both from a mechanical and an electrical point of view.

According to the invention, each contact member is pressed, stamped or similarly formed from a strip or blank of thin sheet metal so that one portion constitutes a lever system, or provides a lever action, whereby a positive electrical and mechanical contact is assured, while the other

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portion provides for a desirable degree of resiliency. These two functions, i. e. the lever action to obtain a positive pressure contact and the resiliency to provide necessary spring accommodation, are to a certain extent, independent of each other but on the other hand are coupled in that they are both inherent in the design and construction of the contact member.

For the purpose of more ready explanation, the invention will be hereinafter described with particular reference to the contact members of electric power outlets and sockets but it is to be understood that this by way of example and that precisely the same or closely similar features of design and construction may be applied to a wide range of electrical devices.

Dealing firstly with the contact members of the power outlet themselves, each contact member will usually comprise a pair of metallic strips of Phosphor bronze or other suitable material, the free ends of which are spaced apart but are caused by insertion of a power plug blade contact, to make and to maintain exceptionally good contact, both electrically and mechanically, with opposite sides of the blade when the latter has been inserted to its full extent. This desirable contact is brought about primarily by a leverage or compound leverage action which arises from the design and construction of the power outlet contact members, as will be described hereinafter.

It is also a feature of the invention that the free end portions of the power outlet contact members and opposite side faces of the power plug blade are given inlays or coatings of silver or other appropriate substance which ensure low electrical resistance at the zones of contact. At the same time, the extent of sliding movement between the respective silver inlay or coated surfaces is relatively slight so that such surfaces will not become abraded or otherwise adversely affected by repeated insertion and withdrawal of the power plug blades.

Another object of the present invention is to provide a means whereby such silver contacts may be employed but of substantially greater thickness (say from twenty to thirty thousandths of an inch) than may be achieved by plating, whilst still achieving a sealed bond between the silver and the non-ferrous base, thus preventing the formation of copper oxide between the silver and the contacts.

The above and various other objects, advantages and features of the invention will however, be more readily understood from the following

description aided by reference to the accompanying drawings in which:

Figure 1 is a side view of a contact member according to one form of the invention.

Figure 2 is a face view of the contact member.

Figures 3A, 3B and 3C are sectional views of a series of similar views, showing two contact members, operatively assembled and the manner 10 in which they operate when a contact blade is inserted between them.

Figure 4 is a part sectional elevation of portions of a power outlet and plug, and showing contact members according to the invention assembled in the power outlet.

Figures 5, 6 and 7 are longitudinal sections illustrating certain modifications.

Figure 8 is a side view of a modified contact member.

Each contact member is formed from a metal strip which may be said to have an inner end portion 2 which is straight and flat so that two of such end portions may lie in face to face engagement and be clamped together by a rivet or the like 3 to a contact holder 4 adapted for insertion and retention in a passageway 6 formed in the base interior or like member 7 of a power outlet or other such device.

Above its inner end portion, each strip is inclined outwardly or sidewardly, as at 8, at an angle of say 45° for an appropriate distance and is then inclined inwardly, as at 9, from a resulting elbow 11 at a preferably smaller angle, say about 40°. At the outer end of the last mentioned inclined portion 9, the strip continues lengthwise in the form of an intermediate flat portion 12 in alignment with the aforesaid inner end portion 2 for a suitable distance and is then given another outward or sideward inclination, as at 13, at an angle in the region of say 40°. At the outer end of the last mentioned inclined portion, the strip is bent inwardly for a relatively slight distance and at a comparatively abrupt angle say of the order of 60°. By this relatively acute and short bend, there is formed what may be termed a hump 14 which constitutes a fulcrum point as will be hereinafter described.

From the aforesaid relatively acute inward bend the strip continues forwardly and slightly outwardly, as at 16, at a angle of say 10° and then merges into the outer or free end portion or contact jaw 17 which is given an outward bowing or curvature, being somewhat less than a semicircle. The inner or convex side of this curved extremity provides the contact face of the strip.

Where two strips as aforesaid are employed in conjunction they are assembled with the inner end portions 2 and, also if desired, the intermediate straight portions 12 in contact with each other as in Figures 3 and 4 so that viewed from the side, there is a somewhat diamond shaped space 15 between the inner ends 2 and the intermediate straight portions 12, while an entrance gap 18 for the associated power plug blade 19 is formed between those portions of the two strips projecting outwardly from the intermediate straight 12. The two inclined portions 13 immediately below the humps 14 provide a tapered "lead-in" for the contact blade 19, the outer end 19a of which may also be tapered, thus reducing wear and facilitating the entry of the contact blade between the two intermediate straight portions.

The two humps 14 and 14 of the contact strips engage opposite sides of the passages 6 in the base interior or like member 7 and thus assist in providing fulcrum points about which curved outer ends 17 of the two strips are caused to pivot or swing as will be apparent hereinafter.

The aforesaid elbows 11 also engage opposite sides of the said passages 6.

In applying a power plug to a power outlet, each of the power plug blades 19 initially enters freely, in a lengthwise direction into the gap 18 between the two curved ends 17 of the contact strips as will appear from Figure 3B. As the blade continues to be moved inwardly it forces a way between the intermediate straight portions 12 of the two strips causing them to yield outwardly. The tapered "lead in" 13 and the tapered end 19a of the contact blade facilitate this action. The first, second and third mentioned sidewardly inclined portions 8, 9 and 13 of the two strips, on account of their moderate resiliency, permit of such movement and there may be a slight lengthwise travel of the two strips from the inner straight portions 2 which are securely clamped in the aforesaid holders 4.

However, the relatively acute bends between the third mentioned inclined portions 13 and portions 16 have the effect of rendering the lever system comparatively rigid. To ensure sufficient rigidity portions 13, 14 and 16 and 17 may have one or more expressed ribs 25, Fig. 8. Thus a strong leverage action is created about the fulcrum points provided by the aforesaid humps 14 with the result that the curved outer ends of the strips are swung inwardly into close engagement with opposite sides of the power plug blade at about the time when the silver inlay or coated surfaces 19b thereof comes opposite the similarly inlayed or coated convex surfaces 17a of the curved ends of the two contact strips.

The engagement of the aforesaid elbows 11 with the opposite sides of the passages 6 produces spring pressure by compression, and the resulting friction assists the curved outer ends to securely retain the contact blade in position.

In this way a very positive electrical and mechanical contact is established and maintained, and only a minimum sliding of the silvered surfaces 19b, 17a, against each other takes place.

It will be understood that, while the lower or outer end portion of the blade 19 will be closely engaged at opposite sides of the two intermediate straight portions 12 of the strips, the primary and essential electrical contact is made between the curved ends 17 of the two strips and the adjacent part of the blade.

It will also be understood that in withdrawing the plug, the aforesaid actions are reversed and that, here again, there is comparatively little, if any, sliding or wiping of the silvered parts of the blade against the silvered parts of the contact strips.

The silver inlays or coatings 19b, 17a, may be applied in any suitable manner. For example they may be applied by a process of reduction rolling of a chemically clean inlay.

Furthermore, in order to economize in manufacture, it is preferred that such inlays or coatings should be applied to bodies of stock material from which each individual blade and contact strip may be blanked or punched as an initial operation in forming the blades and strips.

The lower portion of the contact holder may be of greater cross sectional dimensions than the contact strips which are attached to it. Hence the contact holder is prevented from moving, and the contact strips are not displaced by the frictional drag associated with the withdrawal of the contact blade. The clearance provided between the upper ends of the contact strips

and the ceiling 6a of the passage 6 in the contact holder is maintained by this means, so permitting the lever action to operate freely at any stage of the insertion or withdrawal of the contact blade.

An additional advantage arising from the invention is that the spring contacts are self-aligning. The separation of the two intermediate straight portions 12 when the contact blade is inserted represents the operating condition minimum. Tilting of the contact blade 19 by side thrust or pull upon the plug top 21 or even permanent bending or distortion of any or all of the contact blades (which is insufficient to prevent insertion of the plug top) will cause the contact blade to assume a non-central or tilted position between the straight portions 12 of the contact strips thereby increasing their separation which correspondingly increases the magnitude of the leverage and so maintains the electrical contact between the silvered faces 19b, 17a.

It is to be understood that the shape of the contact strips as previously described and illustrated is given primarily by way of example and may be departed from in various respects without sacrificing efficiency. Furthermore, although the strips may have been stated to be separate, they could be joined by an integral return bend at the straight inner portions.

Referring to Figure 5, two contact blades 19 may be provided and arranged to extend one each at the outer sides of the contact strips, the jaws 17 of which would be of reversed formation to those previously described. In this case the contact strips are shown as being integrally united by a return bend.

Referring to Figure 6, a single contact member may make contact with one side only of the blade 19, the other side of which bears against a rib 22 in the passage 6.

Referring to Figure 7, each lever system 23 may be formed as a casting or stamping and be acted upon by a separate spring 24 which may be formed from a strip which may be of U shape as shown for co-operating with two of the lever systems. Alternatively a separate coiled or other suitable spring could be associated with the lower or inner end of each lever 23.

In all cases contact buttons of superior contact material may be riveted or otherwise secured to the jaws 17 or the levers 23 while flexible conductors may lead from the buttons to wire holders.

Notwithstanding the foregoing description, the improved contact members or parts of them may in appropriate cases be in the form of castings, instead of being fashioned from strips or blanks of sheet metal, and have pigtail or like connections for the conductor wires sweated or moulded thereon.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An electric connector comprising a body member having a wall portion, and a contact member comprising an integral metal strip having at least one fulcrum point on one side bearing against the wall portion of the body member and a pair of contact surfaces on the other side of which one contact surface is flat and the other is a curved portion, said fulcrum point and contact surfaces being interconnected by portions of the strip, and said strip having a securing portion at one end secured in the body member and the curved portion at the other end forming one of the contact surfaces and the fulcrum point being arranged between the two contact surfaces, and the convex portion abutting the wall portion in the non-contacting position but when in electrical contact the fulcrum point will force the curved portion away from the wall portion when contact is completed with the flat contact surface.

2. An electric connector comprising a body member having a wall portion and a contact member comprising an integral metal strip having at least one fulcrum point on one side in direct contact with the wall portion of the body member and a pair of contact surfaces on the other side, said fulcrum point and contact surfaces being interconnected by portions of the strip, and said strip having a securing portion at one end secured in the body member and a free contact portion at the other end forming one of the contact surfaces, the fulcrum point being arranged so that it is between the two contact surfaces and is comparatively rigid with the free contact portion so that the latter will be forced away from the connector when a contact blade is forced against the other contact surface to thereby rock the free contact portion against the blade around the fulcrum point.

3. An electric connector according to claim 2, in which two metal strips are mounted in the body member normally with the said other contact surfaces in contact with each other and the free contact portions spaced from each other.

4. An electric connector comprising a body member having a wall portion, and a contact member comprising a contact strip having a comparatively rigid portion and a resilient portion interconnected and mounted in the body member, said rigid portion comprising a contact portion normally in contact with the wall portion of the body member and a fulcrum portion which at all times bears again the wall portion, said contact strip having a second contact portion which when contacted by a contact blade will cause the rigid portion to rock around the fulcrum portion on the wall portion to shift the first-mentioned contact portion from the wall portion to and against the contact blade.

5. An electrical connector according to claim 4, in which the rigid portion of the contact strip is provided with at least one rib portion to increase the rigidity thereof.

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