Aug. 8, 1967 C. E. CAMPBELL, JR 3,335,397

PLUG WIRE CONTACTOR

Filed Nov. 19, 1964

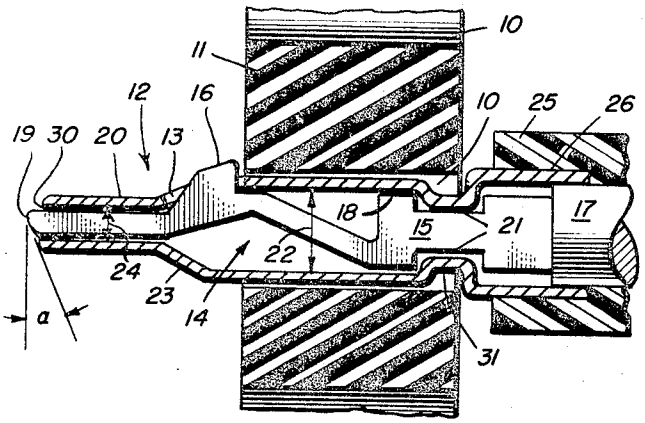


FIG. 1

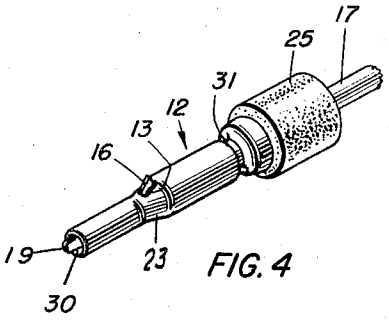


FIG. 4

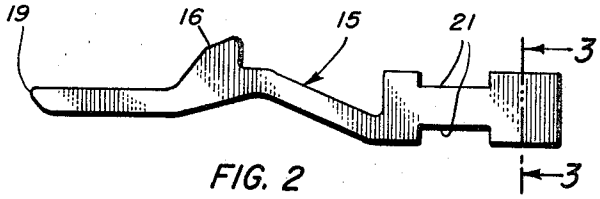


FIG. 2

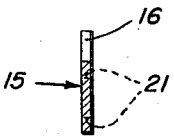


FIG. 3

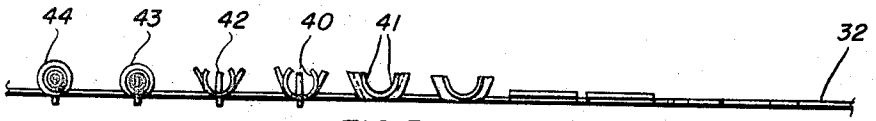


FIG. 5

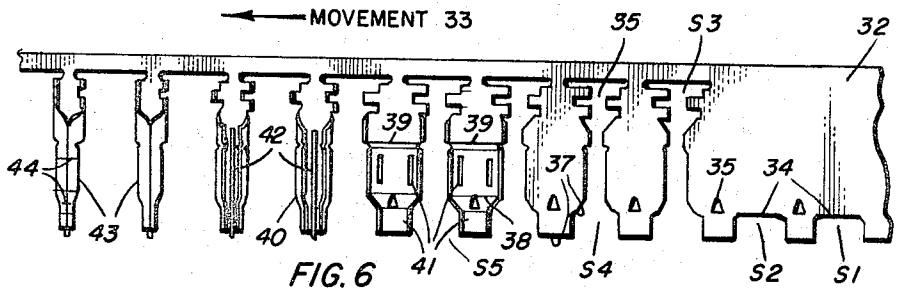


FIG. 6

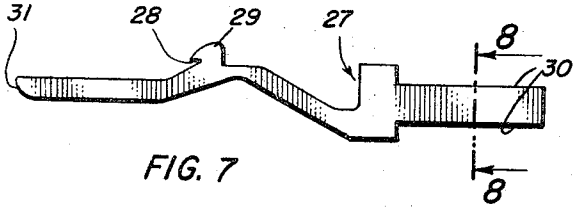


FIG. 7

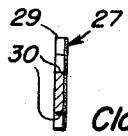


FIG. 8

INVENTOR.
Clayton E. Campbell, Jr.

BY

David Rabin

ATTORNEY

United States Patent Office 3,335,397 Patented Aug. 8, 1967

3,335,397

PLUG WIRE CONTACTOR

Clayton E. Campbell, Jr., Greensboro, N.C., assignor, by mesne assignments, to AMP Incorporated, Harrisburg, Pa., a corporation of New Jersey

Filed Nov. 19, 1964, Ser. No. 412,447
5 Claims. (Cl. 339—217)

This invention relates to electrical plug wire contactors and more particularly to spring latch plug wires that hold against pressure on the head but are readily withdrawn by a pull from the rear, and are of the type used, for example, in plugboards for automatic computers, tabulators and the like, for completing selected electrical circuits to control the operation of the machine as desired.

A primary object of this invention is to provide in a plug wire contactor of the type wherein a pull on the wire to which the plug wire contactor is attached or on the sheath which encases the rear portion of the plug acts directly to withdraw the latch and allow removal of the plug, a more rugged and simpler latch mechanism than has heretofore been available.

A further object is to provide a positively acting latch which will not itself be damaged by a force applied to the plug or the wire and which will not damage the plugboard or panel during its normal life when being inserted and withdrawn.

Still a further object is to provide a superior spring latch plug wire contactor that is simple, inexpensive and easy to mass produce and assemble.

Still a further object is to provide a method for producing plug wire contactors that hold against pressure on the head but are readily withdrawn by a pull from the rear.

Other objects of the present invention will become apparent to those skilled in the art from the following detailed description when taken in conjunction with the drawings in which there is shown and described an illustrative embodiment of the invention; it is to be understood, however, that this embodiment is not intended to be exhaustive nor limiting of the invention, but is given for purposes of illustration of the invention, the principles thereof and the manner of applying it in practical use so that one may modify it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings:

FIG. 1 is a sectional view in elevation of the plug wire contactor in a freely inserted position in the plugboard;

FIG. 2 is a fragmentary sectional view of the flat spring making up the inner portion of the plug wire contactor of FIG. 1;

FIG. 3 is a sectional view taken at lines 3—3 of FIG. 2;

FIG. 4 is a perspective view of an embodiment of a plug wire contactor incorporating features of the present invention;

FIG. 5 is an end view of a strip of plug contactors in various stages of production illustrating the steps of the progressive die operation for stamping and forming the contactors;

FIG. 6 is a top view of the metal strip illustrated in FIG. 5;

FIG. 7 is a view similar to FIG. 2 illustrating a modified form of the flat spring making up the inner portion of the plug wire contactor of FIG. 1; and

FIG. 8 is a sectional view taken at lines 7—7 of FIG. 3.

Referring now to FIGS. 1 through 8, a plurality of apertures 10 of plugboard 11 receives a plurality of plug wire contactors, such as the plug wire contactor generally designated at 12.

Cylindrical chamber 14 has its main body portion of a fixed diameter 22. Toward the nose of plug contactor 12

cylindrical chamber 14 tapers at a portion 23 to a forward projecting portion or nose portion 20 having a smaller fixed diameter 24. A small substantially rectangular opening 13 is permitted in the tapered portion 23 of cylindrical chamber 14. A rearwardly projecting terminal 26 for crimping extends from the body portion of fixed diameter 22 and surrounds wire conductor 17. A longitudinally fashioned linearly tensioned flat spring 15 is positioned within the cylindrical chamber 14 so that latching tip 16, which is formed on the leading edge and as an integral part of flat spring 15, will project through substantially rectangular opening 13 to engage plugboard 11. Flat spring 15 has notched indentures 21 which enable the spring to be secured within cylindrical chamber 14 by engaging an indented and interior shoulder 21 of the body of contactor 12 to prevent its displacement therefrom when plug wire contactor 12 is removed from plugboard 11. The forward end 19 of flap spring 15 projects through the open end 30 of the forward projecting portion 20 of cylindrical chamber 14, this open end 30 having a smaller fixed diameter 24 than the diameter 22 of the main body of plug wire contactor 12. The other end of flat spring 15 is positioned adjacent to wire conductor 17. Flat spring 15 in its relaxed position rests on the bottom of cylindrical chamber 14. As the plug wire contactor 12 is placed into plugboard 11, the tip 16 protruding through rectangular opening 13 in cylindrical chamber 14 depresses, permitting the passage of plug wire contactor 12 through aperture 10 of plugboard 11. The same action takes place with the normal removal of plug wire contactor 12 from aperture 10 of plugboard 11 by pulling from the rear of the plug either on the wire to which the plug wire contactor 12 is attached or on the sheath 25 which encases the rear portion of plug wire contactor 12.

As shown in FIG. 1, there is clearance 18 between the top edge of flat spring 15 and cylindrical chamber 14. There is also an angle a on projecting tip 19 of flat spring 15, this tip extending through and beyond forward projection portion 20 of cylindrical chamber 14. Any pressure directly against projecting tip 19 causes flat spring 15 to be loaded longitudinally, move up and lock cylindrical chamber 14 into plugboard 11. Releasing the pressure against projecting tip 19 of flat spring 15 will permit latching tip 16 to drop and return to its normal and relaxed position, thus permitting the removal of plug wire contactor 12 from aperture 10 of plugboard 11.

Plug contactor 12 has its cylindrical chamber 14 and flat spring 15 made of a resilient conductive metal such as phosphor, bronze or brass.

An insulating sheath 25 of a suitable synthetic resin such as polyvinyl chloride is molded around the crimped end of plug wire contactor 12 and the adjacent portion of wire conductor 17. Insulating sheath 25 insulates and supports the junction between the rearwardly projecting terminal 26 of cylindrical chamber 14, flat spring 15 of plug contactor 12 and wire conductor 17 to increase its resistance to bending fatigue while conveniently serving as a handle for manipulating the plug wire contactor 12.

FIG. 7 is a view similar to FIG. 2 illustrating a modified or semipermanent form 27 of longitudinally fashioned flat spring 15. Instead of a manually operated apparatus as is spring 15 of FIG. 2 modified spring 27 of FIG. 7 represents a fixed device. There is a spring locking notch 28 in the forward edge of latching tip 29 of modified spring 27 and the rear portion of the spring which forms notched indentures 21 of FIG. 2 have been removed. This permits modified spring 27 to slide forward and be secured against cylindrical chamber 14 in an extended position by engagement of the locking notch 28 of the latching tip 29. Since latching tip 29 of modified spring 27 extends through rectangular opening 13 to engage

plugboard 11 with locking notch 28, this prevents the removal of plug wire contactor 12 from aperture 10 of plugboard 11 by pulling from the rear, thus making it necessary to depress locking tip 29 with a tool not claimed as a part of this invention before plug wire contactor 12 can be withdrawn.

It will, therefore, be understood that the plug wire contactor 12 shown in FIGS. 1, 2, 3 and 4 may be inserted into or withdrawn from the plugboard 11 by movement of cylindrical chamber 14; however, the plug wire contactor 12 may not be pushed from plugboard 11 by rearward pressure on the projecting tip 19 of flat spring 15. It will also be understood that the modified flat spring 27 shown in FIGS. 7 and 8 for use with cylindrical chamber 14, wire conductor 17, and insulating sheath 25 is a variation of flat spring 15 shown as being used in FIGS. 1, 2, 3 and 4, and the plug wire contactor utilizing this modified flat spring 27 may neither be pushed from aperture 10 of plugboard 11 by rearward pressure on the projecting tip 31 of modified flat spring 27, nor may it be pulled from the plugboard by a pull on the wire conductor to which it is attached. It will also be seen that the plug wire contactor 12, as shown in FIGS. 1 and 4, is formed of only three basic parts; the cylindrical chamber 14 and its embellishments which can be stamped by a progressive die operation from a flat conductive metal, such as brass, and rolled to the configuration shown; the flat spring 15 and its modification 27, which can also be made from a flat stamping; and the insulating and supporting sheath or shroud 25, which is molded onto the assembled plug wire contactor after the wire conductor 17 is crimped thereto.

The method for forming the shaped plug shell 14 of plug wire contactor 12 and the insertion of flat spring 15 therein is illustrated in FIGS. 5 and 6, both figures showing a strip of resilient conductive metal being fashioned into plug shells for plug wire contactors, these shells shown at various stages of the progressive die stamping operation.

The flat sheath of resilient conductive material 32 is fed along a directed path of travel 33 to an initial stamping station S1 where a first profile defining the connector nose end 34 is formed. The conductive strip then progresses to a second stamping station S2 where a second profile defining a lug receiving aperture 35 is formed. As the conductive strip continues to move along its directed path of travel 33, it reaches a third punching station S3 where a third profile composed of a conductor receiving means 36 at the end of the connector opposite the nose end is formed. A fourth punching station S4 yields a fourth profile shaping the nose and diameter portions of 37 of plug shell 14. The following station S5 indents the flat bell portion to form an angle between the barrel and nose end 38, while simultaneously indenting the barrel portion near the rear to form a shoulder receiving means 39. Shell 14 is then indented along both edges of the barrel and nose portions 41 to anticipate the subsequent rolling operations so as to avoid subjecting these portions to the severe and sudden strain that would occur should such rolling be done entirely in a single step. The partial rolling operation then follows forming a U-shaped cradle 40 and flat spring 15 is then inserted at 42. The spring latching tip or lug 16 integral with spring 15 engages aperture 13 upon insertion 42, this engagement correctly aligning and positioning the spring within U-shaped cradle 40. The plug shell 14 is then closed entirely 43 by a further pressing operation and the barrel and nose diameters exactly established by a final pressing operation 44. The crimping operation whereby the rear conductor receiving portion of the contactor 12 is clamped around a conductor 17 is a separate operation unrelated to the progressive die stamping process as is the shrouding and molding operation described previously.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims

What is claimed is:

1. A plug wire contactor comprising a conductive shell having a forward nose end of a fixed diameter, a rear wire engaging end and a cylindrical intermediate portion of a diameter larger than that of said nose end, said shell having a substantially rectangular lug receiving aperture proximate the forward nose end, a circumferentially indented shoulder proximate said rear end, a flat spring locking member having a forwardly projecting portion extending through and projecting at least partially out of said nose end, a rear section notched to receive said shoulder by a notch dimensioned to permit a slight amount of axial movement of said locking member relative to said shell, and a forwardly sloping intermediate spring portion having a locking lug for projecting through said lug receiving aperture, said intermediate portion being offset from the axis of the forwardly projecting portion and rear section whereby a rearward force on the forwardly projecting portion biases the locking lug outwardly through said aperture thereby providing means for resisting removal of a plug wire contactor from a plugboard socket when seated therein.

2. In a plug contactor for use with plugboards having apertures therein, a hollow conductive shell member including a forward contact portion and a center support portion, a slot in said shell member between said contact portion and said support portion and an indentation formed in said support portion at a point axially removed from said slot to form a shoulder extending interiorly of said shell member, a flat spring member including a forward portion extending through said contact portion and a lug portion extending through said slot and biased out of said slot, the said forward portion upon receiving forces applied to the end of said contactor operating to lock said lug portion radially outward and lock said contactor within a board aperture, the said spring member including a rear portion having a slot therein forming abutments disposed on each side of said shoulder captivating said spring member, the axial distance between said abutments being sufficient to permit a slight movement of said spring member relative to said shell member in a forward or rearward sense whereby to facilitate axial expansion and contraction of said spring member during use of said contactor.

3. The contactor of claim 2 wherein said spring member includes an intermediate portion extending from said lug portion diagonally across the center longitudinal axis of said contactor to, in part, provide a spring action for said spring member and, in part, assure a locking of said lug outwardly responsive to forces applied to the forward portion of said spring member.

4. In a plug contactor for use with plugboards having apertures therein a shell member including a forward portion of reduced diameter, a center portion of a diameter to slidingly fit within a board aperture and a rearward portion adapted to be terminated to a conductive lead, a transition portion in said shell between said forward and center portions, said transition portion having a slot therein extending between said portions, a flat spring member positioned within said shell member for axial movement relative to said shell member, said flat spring member including a lug biased to protrude out of said slot to a position radially outwardly of said center portion to engage the edge of a board aperture, said spring member including a portion extending within and through said shell forward portion to receive forces applied to the end of said contactor, said lug including a slot positioned to engage the forward edge of the slot in said transition

portion, the said spring member operating to lock said contactor in a plugboard responsive to forces applied to said shell to extract the contactor and operating responsive to forces applied to the forward end of said contactor tending to push said contactor out of said plugboard.

5. In a method of forming a plug wire contactor, the steps comprising feeding a flat sheet of conductive metal along a directed path of travel, blanking a first profile to define a contact nose end at one edge of said sheet, blanking a second profile to define a lug receiving aperture removed from said contactor nose end and lying along the center axis thereof transverse of said sheet, blanking a third profile to define barrel portions of said contactor, forming said third profile into a fourth profile having a generally U-shaped configuration, inserting a flat strip spring member having a single lug thereon within said fourth profile with the lug extending through said aperture, forming said fourth profile as loaded with said spring into a rounded configuration with the seam thereof closed and then again forming said contactor by a further

die having the exact dimensions of desirable barrel and nose diameters.

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MARVIN A. CHAMPION, *Primary Examiner.*

PATRICK A. CLIFFORD, EDWARD C. ALLEN, *Examiners.*