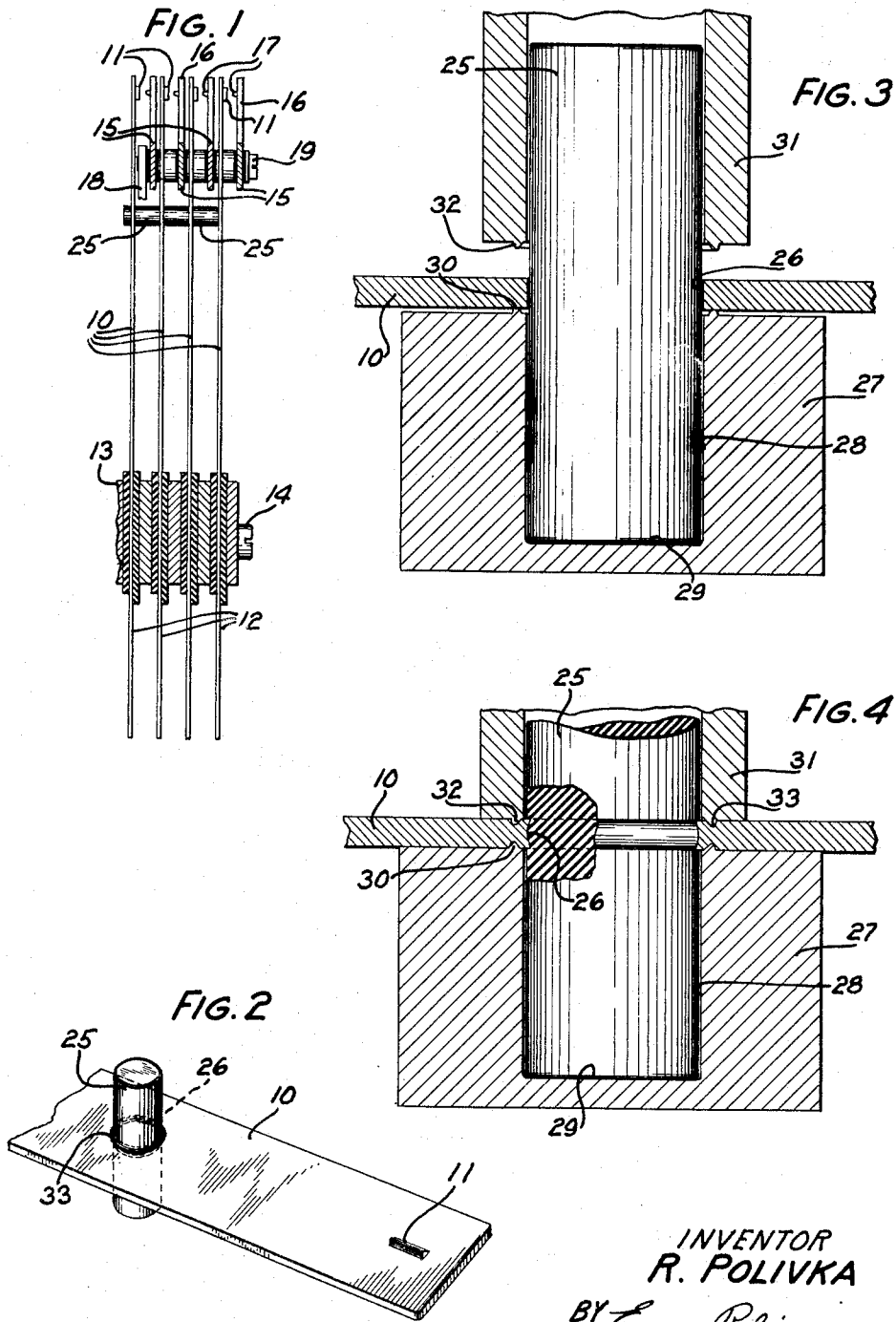


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METHOD OF ATTACHING PARTS

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3 Claims. (Cl. 29—155.55)

This invention relates to methods of attaching parts, and more particularly to a method of securing actuating and separating studs to electrical contact springs.

5 An object of this invention is to provide an expeditious, efficient, and economical method of firmly attaching parts, particularly actuating and separating studs to electrical contact springs.

10 In accordance with the above object, the invention in one embodiment thereof as applied to the attaching of cylindrical hard rubber actuating and separator studs having a uniform diameter throughout their length to flat resilient metallic contact springs of electromagnetic switching devices, contemplates a method wherein the contact spring is provided with an aperture which is slightly larger in diameter than that of the stud. The stud is inserted in the contact spring aperture with its ends extending from opposite sides of the spring and while the parts are predeterminedly positioned relative to each other and maintained the metal of the spring at each side thereof surrounding the stud is contemporaneously pressed annularly and caused to flow inwardly toward the center of and become slightly embedded in the stud by cold pressing the metal by means of a movable hollow annular staking punch and cooperating stationary die upon which the spring is mounted, thus firmly attaching the parts together.

Other objects and advantages of this invention will more clearly appear from the following detailed description, taken in connection with the accompanying drawing, wherein

35 Fig. 1 is a fragmentary vertical sectional view through one type of an electromagnetic switching device having contact springs with actuating and separating studs attached thereto in accordance with the method of this invention;

40 Fig. 2 is a fragmentary side view of an enlarged scale of one of the contact springs with its attached stud;

45 Fig. 3 is a fragmentary diagrammatic view on an enlarged scale, partially in section, of the contact spring and stud shown supported on the stationary lower die ready to be attached together, the movable upper punch being shown approaching the spring to stake the spring and the stud together, and

50 Fig. 4 is a view similar to Fig. 3 after the staking operation has been performed.

Referring now to the drawing, and particularly to Fig. 1, there is fragmentarily shown one type of electromagnetic switching device, comprising an assembly or pile-up of flat resilient metallic

contact springs 10, each having secured at its upper free end a contact 11, the springs at their opposite lower ends having terminal portions 12. The springs 10 are suitably predeterminedly spaced and insulated from each other as well as from a metallic supporting member 13, shown fragmentarily, and secured in parallel positions by means of a screw 14. Associated with the contact ends of the springs 10 is a row of fixed metallic plates 15 having extensions 16 carrying a contact 17, each contact arranged to be engaged by the opposite contact 11 on the spring 10 upon actuation of the springs to close circuits through the contacts 11 and 17. The plates 15 are suitably predeterminedly spaced and insulated from each other as well as from a metallic supporting member 18 and maintained in parallel positions by a screw 19.

The springs 10 near their upper contact ends are maintained in predetermined spaced relation with the contacts 11 carried thereby spaced from the fixed contacts 17 by a plurality of cylindrical hard rubber studs 25 having a uniform diameter throughout their length. In the particular arrangement of contact springs shown one stud 25 is secured to the spring 10 at the extreme left side of the device, and another stud is secured to the third spring from the left side, each stud extending from opposite sides of its spring support. In use all of the springs 10 are simultaneously flexed towards the left upon actuation of means (not shown) engaging and pressing against the short portion of the stud 25 which extends from the spring 10 at the left side of the device. The movement imparted to the springs is sufficient to close each pair of contacts 11 and 17, the studs 25 serving as actuators as well as separators, as above described.

The present invention is directed to a method of securing the cylindrical hard rubber stud 25 to the spring 10. In practicing the method of attaching the parts the spring 10 is provided with an aperture 26 (Fig. 3), the diameter of which is the same, or preferably slightly larger, than the diameter of the stud 25 which has a uniform diameter throughout its length. With the parts ready to be attached they are properly positioned, as shown in Fig. 3, on a stationary lower die 27 formed with a cylindrical depression 28 of such diameter that it freely receives the stud 25, a bottom flat face 29 of the depression serves as a support for the stud 25 while the spring with the stud extending through the aperture 26 thereof rests upon an annular raised wedge-shaped formation 30 formed on the die. A hollow movable

punch 31 into which the stud 25 may freely enter is arranged above and in axial alignment with the die 27 for movement toward and from the die, the movement of the punch being effected by a suitable source of power (not shown). The lower annular surface of the punch 31 is formed with an annular depending wedge-shaped formation 32 which is similar to the formation 30 on the die 27, only reversed, and is accurately aligned therewith. It is to be understood that the distance or depth of the outer surfaces of the ring-shaped or annular formations 30 and 32 from the faces of the punch and die 31 and 27, respectively, which distances determine the degree of their penetration into the opposite sides of the spring 10, are such that the spring is not deleteriously weakened, and further that the depths of the formations as well as the cross-sectional shape thereof will vary with the thickness of the spring and other characteristics of the metal from which they are produced.

Opposite annular side portions of the spring 10 surrounding the stud 25 are now contemporaneously subjected to pressure by the downward movement of the punch 31, the ring and wedge-shaped formation 30 on the punch moving into engagement with the upper surface of the spring, the lower surface of which rests on the ring and wedge-shaped formation 32 on the die 27. In the continued downward movement of the punch 31 the opposite ring formations 30 and 32 are pressed into the opposite surfaces of the spring 10 and the metal of the spring is caused to cold flow toward the center of and completely around the stud 25, filling the slight annular space between the inner and outer peripheries of the spring aperture 26 and the stud 25, respectively, and become slightly embedded throughout the thickness of the spring in the relatively softer material of the hard rubber stud, the points of greatest embedment being at the continuous peripheral edges of the aperture at each side of the spring, as clearly shown in Fig. 4, with the peripheral wall of the aperture being slightly concave between these points. Upon removal of the spring with the attached stud each side of the spring immediately surrounding the stud will have formed therein an annular channel 33 (Figs. 2 and 4) formed during the extruding of the metal inwardly into the stud.

It will be obvious in the particular application of the invention that the extruding of the metal of the spring 10 completely surrounding the aperture 26 inwardly and into the stud 25 at all points therearound in the manner described will

result in a very firm attachment of the parts, thus eliminating loose assemblies while the electromagnetic switching device is in use with consequent interruption to service, and thereby reducing maintenance cost. Furthermore, by practicing the described method an expeditious, efficient and economical assembly and attachment of the parts are effected.

Although the invention herein described and illustrated is particularly well adapted for use in attaching contact springs and hard rubber actuating and separator studs, it will be understood that the invention is capable of many other modifications and applications and is to be limited only by the scope of the appended claims.

What is claimed is:

1. A method of attaching a hard rubber stud to a flat electrical contact spring which comprises forming an aperture of predetermined size in the spring, positioning the stud which is predeterminedly smaller in cross-sectional area than that of the aperture in the aperture with its ends extending from opposite sides of the spring, and then staking the metal of the spring upon a flat side thereof to cause the metal of the contact spring to flow inwardly simultaneously in ring formation around the stud and thereinto and thereby firmly attaching the stud to the spring.

2. A method of attaching a cylindrical hard rubber stud to an electrical contact spring which comprises forming an aperture of predetermined diameter in the spring, inserting the stud which is predeterminedly smaller in diameter than the aperture in the aperture with its ends extending from opposite sides of the spring, and then staking the metal of the spring upon a flat side thereof toward the center of and into the stud simultaneously completely therearound and thereby firmly attaching the stud to the spring.

3. A method of attaching a cylindrical hard rubber stud to an electrical contact spring which comprises forming an aperture of predetermined diameter in the spring, inserting the stud which is predeterminedly smaller in diameter than the aperture in the aperture with its ends extending from opposite sides of the spring, and then cold-pressing the metal of the spring upon opposite flat sides and in opposite directions parallel to the longitudinal axis of the stud to cause the metal to flow inwardly simultaneously at each side of the spring toward the center of and become embedded in the stud completely therearound and thereby firmly attaching the stud to the spring.

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