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Sturm

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[54] **CONTACT SPRING FOR PLUG CONNECTORS**

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[51] **Int. Cl.** **H01r 11/22**

[58] **Field of Search** ..... 339/221 R, 221 L, 221 M, 339/256 R, 258 R, 258 P, 176 MP, 252 R, 252 F, 252 PS, 278 C; 29/629, 630 D, 169.5

[56] **References Cited**

UNITED STATES PATENTS

3,523,273	8/1970	Hammell et al.	339/258 P
3,516,048	6/1970	Scheingold et al.	339/252 R
3,699,505	10/1972	Bruner	339/221 R
3,675,320	7/1972	Watanabe	29/630 D
2,779,011	1/1957	Deakin	339/258 R
3,671,917	6/1972	Ammon et al.	339/221 M X

OTHER PUBLICATIONS

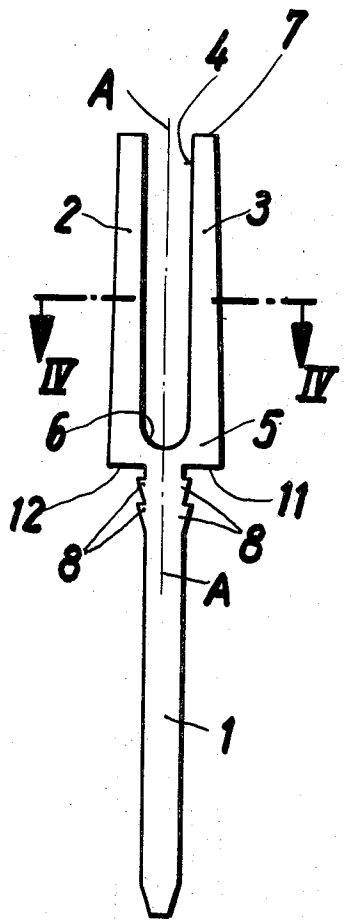
"CONTIP," Specialties Instr. Co. 1-1966.

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[57] **ABSTRACT**

A contact spring for plug connectors stamped out of non-corroding sheet metal and comprising an approximately rectangular shank with a U-shaped head piece connected thereto, which head piece has two arms which face one another and which are spaced equidistant from a plane of symmetry running between them and in the longitudinal direction of the shaft. That width of the arms which is parallel to the plane of symmetry is broadened to a multiple of the thickness of the sheet metal by applying pressure to the arms in a direction transverse to the plane of symmetry.

10 Claims, 5 Drawing Figures



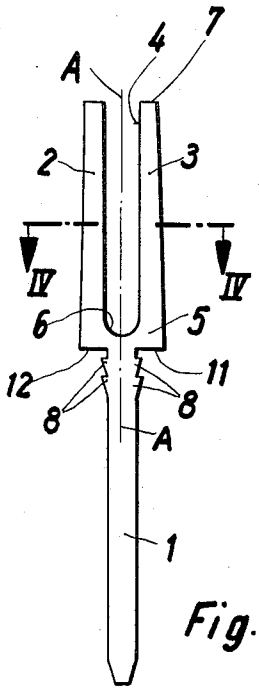


Fig.1

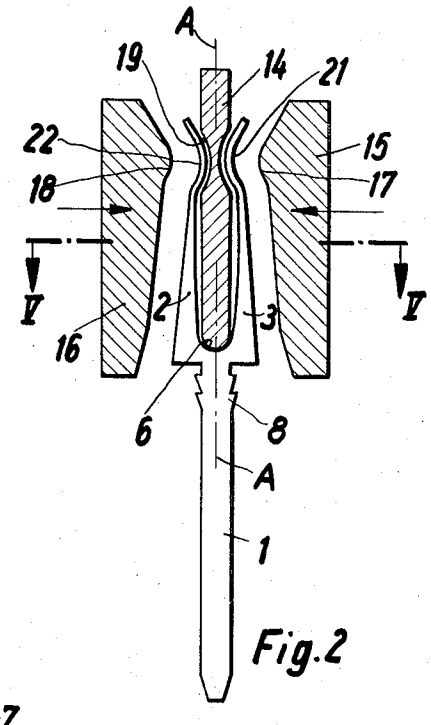


Fig.2

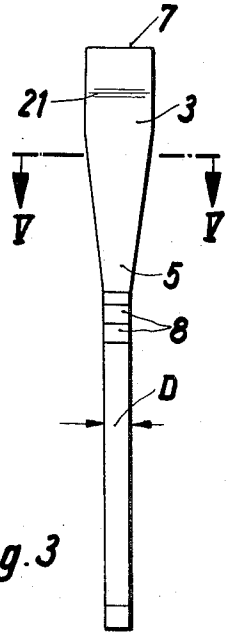


Fig.3

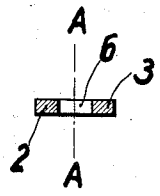


Fig.4

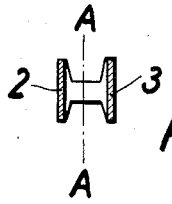


Fig.5

CONTACT SPRING FOR PLUG CONNECTORS

The present invention relates to a contact spring for plug connectors, chiefly for printed circuits, which is punched or stamped out from sheet metal of non-corroding metal and which has two forked contact spring arms facing one another.

It is important above all with the plug connectors provided for the printed circuits, that the contact spring arms be able to exert a sufficient contact pressure even if a contact pin or tongue, insertable between these arms, deviates from the normal state or condition intended for them as a result of unavoidable manufacturing tolerances. It is additionally required with such plug connectors that, in consideration of wire-wrap connection technology, the junction ends of the contact springs should have a cross section of at least 0.6 by 0.6 millimeters.

It is known to punch out contact springs having forked contact spring arms from sheet metal, in which connection the arms are formed together with a connecting zone in a U shape. During the introduction of a contact pin in the form of a tongue or clip, difficulties arise with the heretofore known plug connectors in that the contact spring arms become permanently deformed during assembly at a bending stress beyond the stress or elastic deformation limit. On the other side, the cross section of the contact spring arms can be varied for the realization of an adequate bending flexibility only to such an extent as will still assure a sufficient contact surface for the current flowing through the plug connectors.

It is an object of the present invention to produce a contact spring for plug connectors which assures on the one hand the necessary contact surface for the passage of current and assures on the other hand a sufficient contact pressure of the contact spring arms.

It is a further object of the present invention that the contact spring be insertable into an insulating material plate or panel in a simple manner. The junction ends should be suitable for wire-wrap connection, and should therefore have a minimum cross section of 0.6 by 0.6 millimeters.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing in which:

FIG. 1 shows a view of the breadth of a contact spring according to the invention after the first machining process, namely a stamping or punching operation.

FIG. 2 also shows a view of the breadth of the contact spring shaft according to the invention, this time after the subsequent cold working process.

FIG. 3 is a view of one of the transverse edges of the contact spring shank of the invention in a deformed state.

FIG. 4 is a section taken along the line IV — IV of FIG. 1.

FIG. 5 shows a section taken along the line V — V of FIG. 2 after the cold working of the contact spring.

The invention is characterized primarily in that the contact spring has a rectangular shank and changes or turns into a U-shaped head piece, the arms of which are spaced equidistantly from a plane of symmetry running in the longitudinal direction of the shank. These arms are widened or spread in a direction parallel to the plane of symmetry to a multiple of the sheet metal thickness by means of pressure applied transverse to the plane of symmetry. In a further refinement of the invention, it is especially advantageous if that width or thickness of the contact spring shank measured parallel to the plane of symmetry progressively increases from its connecting zone with the shank up to the free ends of the arms.

In a further development according to the invention, the adhering strength of the contact spring in an insulating material plate or panel serving as a carrier or holder may be improved by providing sawtooth shaped rims or shoulders in the immediate vicinity of the connecting zone of the shank of the contact spring and its two contact spring arms. In order to improve the fit or seat of the contact spring and its strength of adherence in an insulating material plate or panel, it may be provided according to a further refinement of the invention, that the connecting zone of the two contact spring arms be limited or defined in the direction of the shank by at least one shoulder area, which shoulder area, when plugging in the contact spring, will abut the plate or panel of insulating material, thereby limiting the depth of insertion of the contact spring. In view of the chip-less deformation of the contact spring arms according to the invention, it is possible without difficulty to form the press die or stamp in such a way that the contact spring arms obtain or receive contact zones protruding towards one another. These contact zones stand facing each other so closely with regard to each other that during insertion of the counterparts of the plug pins or tongues, which latter form the plug connection, the arms are pressed apart under spring elastic bracing or load. To increase the certainty of the contact, each of these protruding contact zones, according to a further refinement of the invention, may be provided with a coating of precious metal, especially silver or gold, upon the surfaces which face one another. Coatings of this type may be applied by means of pointed or aimed galvanic treatment and require only a small consumption of precious metal. It is especially advantageous according to a further refinement of the invention, if the end sections of the arms, which are connected to the just mentioned contact zones, are obliquely spread or forced away from the plane of symmetry. Due to this, above all with polyphase plug connectors, the introduction of the plug pins or tongues is substantially simplified, and beyond that, the deformation of the contact spring arms beyond their limit of elasticity during untrue attaching or fastening of these contact counterparts is eliminated.

Referring now to the drawing in detail, the contact spring is first produced as a stamped metal part, in the form shown in FIG. 1, out of a sheet metal strip of uniform thickness, which metal strip may be of a relatively soft spring brass or of bronze. In this condition, a U-shaped forked head piece is connected to a slender rectangular or square shaft 1. The inner axial edges 4 of the arms 2, 3 of the forked head piece run parallel to each other and are equidistant from a common plane of symmetry AA. The two inner axial edges 4 turn or change into one another at the connecting zone 5 with a rounding out 6. The breadth of the arms 2, 3 shown in FIG. 1 is insignificantly narrowed or tapered from the connecting zone 5 out to its end edges 7 and, in the processing state shown in FIG. 1, has the same thickness as the shaft 1.

Saw-tooth shaped projections **8** are provided in pairs on both longitudinal or axial edges of the shaft **1** in the immediate vicinity of the connecting zone **5.** The projections **8** assure a secure seating of the shaft **1** and consequently of the entire contact spring when the shaft **1** is inserted into an appropriate recess in a not illustrated insulating material plate or panel. The shaft **1** has the square or rectangular cross section of sufficient thickness necessary for the wire-wrap connection technology. Two shoulder surfaces **11, 12,** which run at right angles to the shaft **1,** are provided on the connecting zone **5** for limiting the depth of the insertion of the shaft **1** and for increasing the stability of the thus arrived at seating of the contact spring in the printed circuit board. The connecting zone **5** is set off from the shaft **1** with the shoulder surfaces **11, 12.**

The punched or stamped out contact spring according to FIG. **1** is then subject to a cold working process indicated in FIG. **2.** In this connection a core part **14** is first interposed between the arms **2, 3.** This core part **14** almost completely fills the available or existing space between the arms **2, 3.** Then each of the two arms **2, 3** are deformed with two instrument jaws or dies **15, 16,** attached or fastened from the transverse or section edges of the arms, by means of pressure exerted transverse to the plane of symmetry AA. The arms **2, 3** are so deformed that each of them, in a manner more clearly visible from FIG. **3,** are spread or broadened to a multiple of the sheet metal thickness, the latter being indicated in FIG. **3** with a D. This spreading or broadening begins from the connecting zone **5** and progresses toward the end edge **7.** The two instrument jaws or dies **15, 16** have protruding prominences or heads **17, 18,** with which they press the contact spring arms **2, 3** into appropriate recesses **19** of the core **14.** In so doing, the two arms **2, 3,** in the vicinity of their end segments, receive contact zones **21, 22** which protrude toward one another. The mutual interval or spacing of the contact zones **21, 22** is substantially smaller than that spacing at the section of the arms extending up to the rounding out **6.** After the pressing and stamping process, these protruding contact zones **21, 22** are provided with a coating, for example out of gold, on those of their surfaces which face one another by means of pointed or aimed galvanic treatment. The end sections of the arms, which are connected to the contact zones **21, 22,** are so deformed during stamping that they are obliquely spread apart or forced away from the plane of symmetry AA; this considerably simplifies the introduction of plug or connector pins or tongues.

The particular advantage of the contact spring according to the invention is characterized primarily in that, by means of the cold working process, the material in the area of the connector tongues is strengthened and thereby the spring or elastic quality is considerably improved. At the same time, the thickness of the material of the connector tongues is narrowed in line with the contact imparting heads **17, 18,** so that a uniform bending stress of the material results over the entire elastic length. This allows attainment of a high contact pressure with high mechanical stability and thereby a reliable contact dose. Complicated and accuracy influencing or affecting bending processes are eliminated with contact springs according to the invention.

It is, of course, to be understood that the present invention is by no means limited to the specific showing in the drawing but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. A contact spring for plug connectors of noncorroding sheet metal and which comprises in combination: a shaft having an approximately rectangular cross section; a U-shaped head piece connected to said shaft and forming a connecting zone; and two contact spring arms connected to said connecting zone, each of said arms having a free end, said arms facing each other and spaced equidistant from a plane of symmetry running between said arms and in the longitudinal direction of said shaft, that width of said contact spring arms which is parallel to said plane of symmetry having been broadened to increase progressively as a multiple of the width of shaft thickness of said sheet metal by compression of said arms in a direction transverse to said plane of symmetry, thickness of material of said contact spring arm respectively decreasing respectively toward the free end thereof.

2. A contact spring in combination according to claim **1,** in which said plug connector is a printed circuit.

3. A contact spring in combination according to claim **1,** in which said connecting zone has at least one shoulder surface, said shoulder surface limiting the depth of insertion of said contact spring.

4. A contact spring in combination according to claim **1,** in which said contact spring arms, in the vicinity of said free ends, have contact zones which protrude toward one another.

5. A contact spring in combination according to claim **1,** in which projections are provided on the longitudinal edge of said shaft in the immediate vicinity of said connecting zone.

6. A contact spring in combination according to claim **4,** in which said protruding contact zones are provided with a layer of precious metal upon those of their surfaces which face one another.

7. A contact spring in combination according to claim **4,** in which said free ends of said contact spring arms are obliquely spread in a direction away from said plane of symmetry.

8. A contact spring in combination according to claim **5,** in which said projections are saw-toothed.

9. A contact spring in combination according to claim **6,** in which said layer is introduced upon said contact zones by means of galvanic treatment.

10. A contact spring in combination according to claim **6,** in which said precious metal is gold.

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