Feb. 27, 1968 J. W. MASTON 3,371,308

SOCKET CONTACT C SPRING

Filed Dec. 30, 1965 2 Sheets-Sheet 1

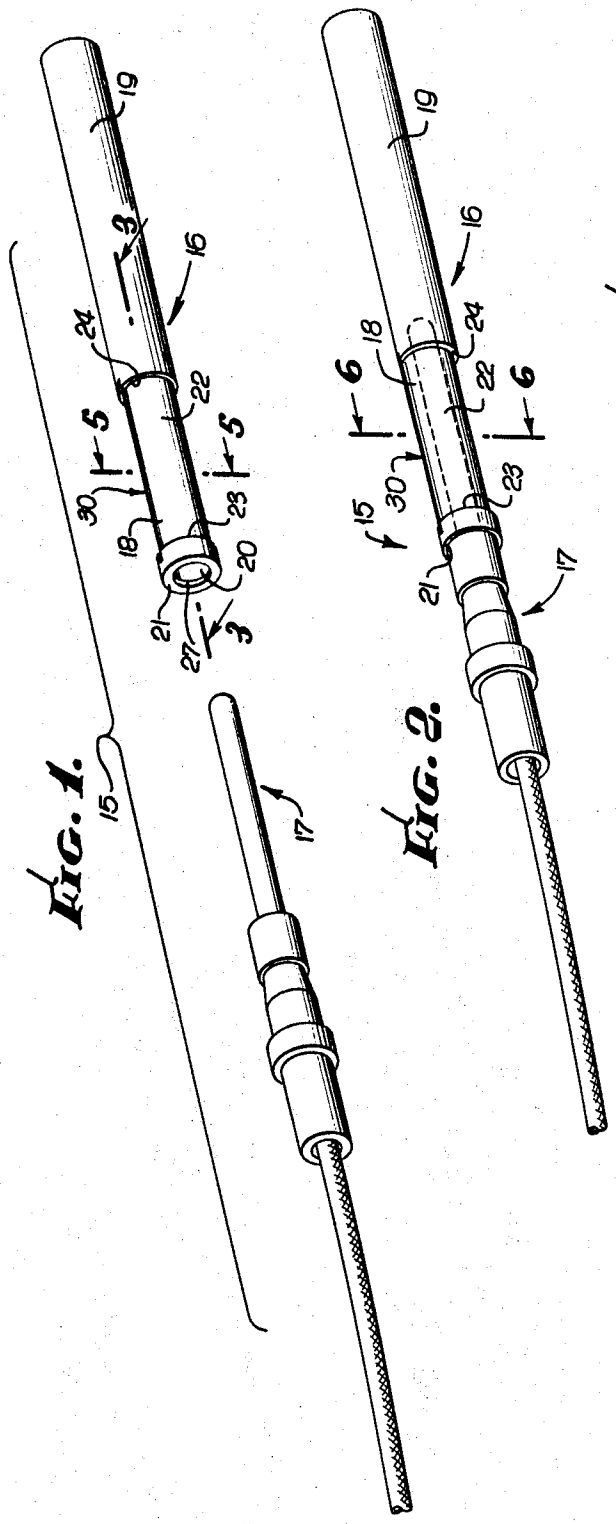


FIG. 1.

FIG. 2.

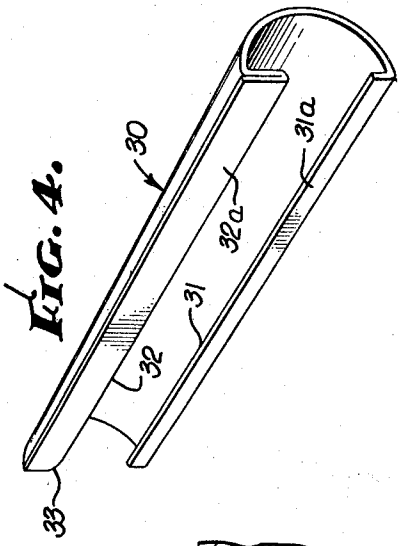


FIG. 4.

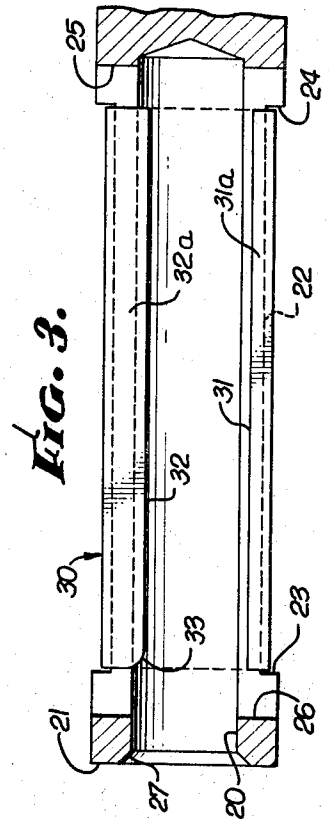


FIG. 3.

INVENTOR
JAMES W. MASTON

Feb. 27, 1968 J. W. MASTON 3,371,308

SOCKET CONTACT C SPRING

Filed Dec. 30, 1965 2 Sheets-Sheet 2

FIG. 5.

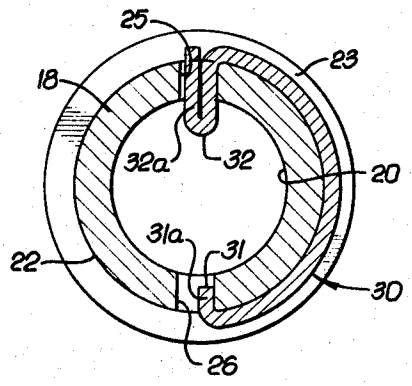


FIG. 6.

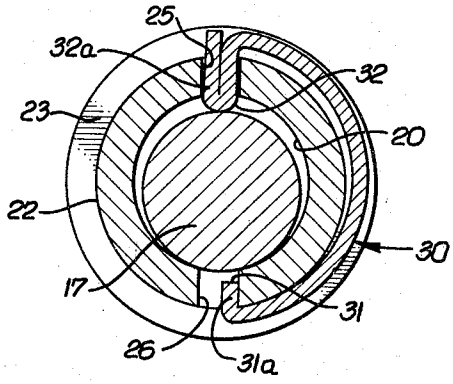


FIG. 8.

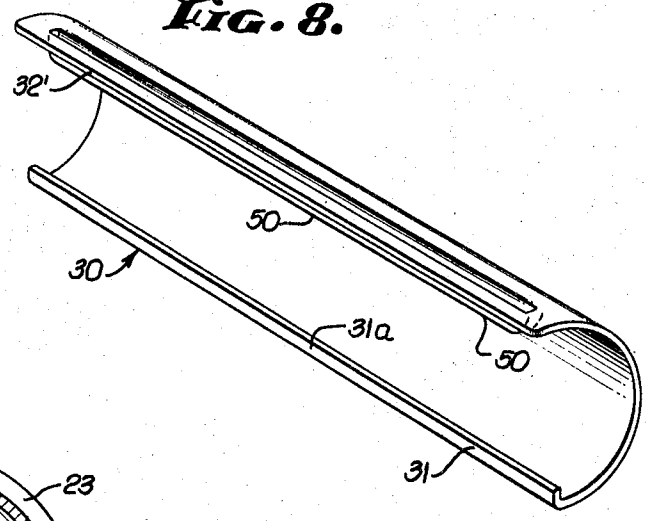
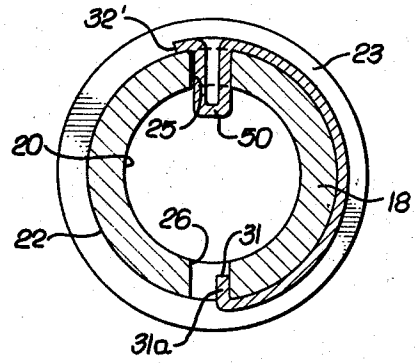


FIG. 7.



INVENTOR
JAMES W. MASTON

United States Patent Office 3,371,308 Patented Feb. 27, 1968

3,371,308

SOCKET CONTACT C SPRING

James W. Maston, Altadena, Calif., assignor to International Telephone and Telegraph Corporation, New York, N.Y., a corporation of Maryland

Filed Dec. 30, 1965, Ser. No. 517,641
4 Claims. (Cl. 339—256)

ABSTRACT OF THE DISCLOSURE

A tubular connector for receiving a male connector therein has a pair of longitudinally extending slits located at opposite sides of the connector and passing completely through the connector body. An elongated spring of generally C-shape cross section fits over the tubular connector with its longitudinal edges received within the slits, one of the edges extending into the tubular cavity for resiliently urging the male connector into contact with the tube wall.

This invention relates to electrical connectors and in particular to an improvement in a connector wherein a socket contact element is characterized by a C spring which biases a contact pin inserted in the socket against the wall of the socket.

Objects of the invention are to provide a connector socket featureing a spring resiliently protruding into the bore of the socket for the function indicated, and which is not damaged or rendered ineffective by an oversize probe or careless use thereof, the parts of which socket are easy to manufacture and relatively inexpensive to assemble, which affords redundant electrical paths, and which, once assembled, remains intact.

The invention in general comprises an electrical connector socket for reception of a pin contact terminal wherein the socket embodies a bored tubular member open at its forward end and having circumferentially separated longitudinal slots through the wall of the tubular member, and a spring member generally C-shaped in cross section and conforming generally to the external surface of the tubular member embodying one end projection or flange seating in one of the slots, this end flange having a radial dimension less than the thickness of the wall of the tubular member so that it does not protrude into the bore of the same, and the spring is formed with a second end projection or flange which seats in the other one of the slots, this second end flange having a radial dimension greater than the thickness of the wall of the tubular member so that the second end flange protrudes into the bore of the tubular member, the spring being snapped into place and being retained on the tubular member by engagement of the flanges in the respective slots, and the second flange being adapted resiliently to urge a pin contact member inserted in the tubular member toward the surface of the bore generally diametrically opposite the position of the second flange.

The foregoing objects and general features of the invention, and others, will more fully appear from the drawings and the description which follows.

In the drawings:

FIGURE 1 is a perspective view of the connector with the pin and socket separated.

FIGURE 2 is a view of the connector with the pin and socket joined.

FIGURE 3 is an enlarged longitudinal section of the socket.

FIGURE 4 is a perspective view of the C spring employed in the socket of the previous figures.

FIGURE 5 is a magnified cross section of the socket taken on the line 5—5 of FIGURE 1.

FIGURE 6 is a similar view taken on the line 6—6 of FIGURE 2 showing the pin inserted.

FIGURE 7 is a view of the same general character as FIGURE 5 illustrating a C spring with a modification over the form of FIGURE 4.

FIGURE 8 is a perspective view of the C spring illustrated in FIGURE 7.

The connector 15 shown in FIGURES 1 and 2 comprises a socket 16 and a pin 17 adapted to be inserted in the socket. The socket embodies a tubular member or section 18 and a termination section 19, the latter being either hollow or solid depending upon the desired termination thereof in conjunction with an electrical conductor not shown. The means of termination is not a part of the present invention nor is an insulation block or member in which the socket may be mounted in any part of the present invention. It is obvious to anyone skilled in the art that while the socket and pin can be employed individually for making an electrical connection, in ordinary practice, especially in miniaturization, these respective parts are mounted in insulator members usually in plural arrangement for effecting a multiplicity of independent connections in a small, compact arrangement.

The tubular member has a bore 20 open at the forward end 21 and extending rearwardly at least a sufficient distance to receive the pin 17. The outside diameter of the pin is sufficiently less than the diameter of the bore for easy insertion fo the pin inasmuch as no tight friction fit between the two parts is required, other than that imparted by the C spring as later described.

Preferably, although it is not absolutely essential, the exterior of the tubular member is formed with an intermediate annular undercut 22 providing shoulders 23 and 24 at each end.

Through the wall of the reduced section of the tubular member defined by the undercut 22 are provided slots 25 and 26 which preferably are disposed 180° apart and which are elongated and extend parallel to the axis of the bore and are generally coextensive with the length of the undercut 22, although it is preferable that the slots extend beyond the shoulders 23 and 24 for a short distance. It is important, however, that the forward end 21 provides a circularly uninterrupted closed entry, which should be chamfered as shown at 27, and that an uninterrupted annular section at the rear end of the bore be incorporated, so that the tubular member does not spread when the pin is inserted.

A spring 30 is employed, this spring having the overall general form of a semi-cylinder preferably elongated relative to its diameter and in cross section generally resembling the letter C. The shape and size of the spring is such that in retraction it snugly conforms to the outer surface of the undercut 22 or if there be no undercut to the outer surface of the tubular member in the region of the slots 25 and 26, and that its axial dimension be no greater than the length of the undercut portion if that be present. In such case, the shoulders 23 and 24 restrict the spring against axial movement. Otherwise, such restriction would be provided by the ends of the slots. The spring embodies what may be designated a non-working end 31 and a working end 32. These ends are disposed diametrically opposite one another at a circumferential separation approximately 180° and they are illustrated as including projections or flanges 31*a* and 32*a* extending radially inwardly toward the axis of the spring, being angled in from the cylindrical plane of the main body 33 of the spring.

The radial dimensions of the flange 31*a* is less than the thickness of the tubular member at the section where insertion occurs, to be described. The radial measurement of the flange 32*a* is greater than the thickness of the

section of the tubular member where the flange **32***a* is inserted, so that when the spring is assembled on the tubular member this flange will protrude into the bore of the tubular member. The spring may be formed whereby the flange **32***a* is made of a fold-back of the spring material to contribute a greater surface contact with the pin when inserted, and this flange also preferably is radiused or chamfered as at **33** to provide a lead-in.

The spring and tubular member are assembled by inserting the flange **31***a* of the non-working end into one of the slots in the tubular member, and by exerting a radial pressure on the spring moving the flange **32***a* into alignment with the opposite slot whereupon the spring will snap into place and will be permanently retained on the tubular member by the cooperation of the two flanges.

The spring may be made of any suitable spring material, various metals being suitable for such purpose, and inasmuch as the spring does not have to function as a conductor, certain plastic materials are also usable.

When the spring and tubular member are assembled the socket is complete and ready for use. The pin **17** is inserted into the socket and encounters the chamfered end **33** of the spring flange **32***a*, riding against this flange as the insertion is completed. Thus, upon insertion, the spring bearing upon the pin biases it resiliently against the diametrically opposite wall of the bore. Inasmuch as the opposite wall of the bore is divided to considerable extent by the slot in which the flange **31***a* of the spring reposes, redundant electrical paths are afforded which contribute to the efficiency of the electrical connection. The diametric limitations of the bore **20** prevent the pin from pushing the flange **32***a* out of the slot in which it rides, and consequently the spring remains in place irrespective of repeated insertions of the pin.

The fold-back illustrated for the working end **32** of the spring can be eliminated, and this working end can be a single thickness similar to the non-working end **31** except that it extends through the wall of the tubular member. A rounded edge on the flange **32***a*, as illustrated, is preferable to a flat sharp edge because it operates more smoothly and has less tendency to scratch or abrade the pin. If desired the edge may be liquid-honed or Teflon coated to reduce friction when the pin is inserted or withdrawn.

Another form of working end on the spring is shown in FIGURES 7 and 8. In this one the non-working end **31** is the same as in the form previously described. The working end **32'**, however, utilizes a projection or flange in the form of a dimple **50**, preferably elongated as shown, which can be drawn or stamped if the spring is made of sheet spring material, or molded if plastic, and either left relatively open as illustrated in FIGURE 7 or the sidewalls pinched together after the general formation of the form first described as seen in FIGURE 5. Instead of a single dimple it is obvious that a series of dimples in straight alignment (not illustrated) could be substituted.

Whichever form is employed, the spring cannot be damaged by use of an oversized probe or careless use of a probe when testing circuits, because if the probe is oversized, yet of sufficiently small diameter to be inserted into the socket it will simply push the spring through the slot to the wall of the bore, and upon withdrawal of the probe the spring will return to its working position protruding into the bore.

While it is preferred that the slots be circumferentially spaced approximately 180° both for optimum retention of the spring in its assembly with the tubular member and also for a truly diametric pressure of the working end of the spring against the pin of the connector yet there may be a workable variation in the respective locations of the slots and consequently in the shape and ends of the spring. The thickness of the spring preferably is slightly less than the depth of the undercut **22** so that if the socket is mounted in a bore of the insulation block which

tightly houses the ends of the tubular member, there will be room within the bore of the insulation block for the working end of the spring to move outwardly under the influence of a pin being inserted. An alternative would be to provide a relief in the bore of the insulation block.

The connector has been described with the tubular element of the spring and the contact portion of the pin all in circular cylindrical form. While this probably is the most common form in which the connector will be embodied, the principles of the invention are applicable to a socket with a square or other polygonal cross section in which case the cross section of the spring would define a block letter C or a modification conforming generally to the outside contour of the tubular member, and the flanges of the spring would be angled from the main body of the letter C radially inwardly toward each other.

Although I have herein shown and described my invention in which I have conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

What I claim as new and desire to secure by Letters Patent is:

1. An electrical connector comprising: a socket including a hollow tube having diametrically opposite first and second longitudinally extending slots therethrough; a generally C-shaped spring surrounding approximately one-half of the external surface of said tube, said spring having first and second ends bent towards each other to extend radially into said slots, said first end being shorter than the thickness of said tube from the bend at said first end so as not to project beyond internal surface of said tube, said second end being longer than the thickness of said tube from the bend at said second end so as to project beyond internal surface of said tube, said second slot having side walls parallel to a plane through the axis of said tube, said second spring end having a width such that it substantially fills the space between said second slot side walls wherein said second spring end is in sliding engagement with said second slot side walls, said side walls thereby firmly guiding radial movement of said second spring end in said second slot; and a pin slidable into said socket, said second spring end being engageable with said pin for resiliently urging said pin into contact with the internal surface of said tube.

2. The invention as defined in claim **1**, wherein said second spring end has parallel side walls for secure sliding engagement with said second slot side walls.

3. The invention as defined in claim **1**, wherein said tube has a cylindrical internal surface and said pin has an uninterrupted cylindrical external surface of a diameter only slightly smaller than that of said tube internal surface.

4. The invention as defined in claim **3**, wherein said second spring end has parallel side walls for secure sliding engagement with said second slot side walls.

References Cited

UNITED STATES PATENTS

3,123,119	3/1964	Maloof	151—11
3,169,817	2/1965	McKee	339—256
3,205,474	9/1965	Culver et al.	339—256 X

FOREIGN PATENTS

232,573	2/1961	Australia.
20,458	1911	Great Britain.

OTHER REFERENCES

German printed application 1,128,500, April 1962.

MARVIN A. CHAMPION, *Primary Examiner.*

P. TEITELBAUM, *Assistant Examiner.*