June 12, 1962 J. R. AYMAR 3,039,076

ELECTRICAL CONTACT

Filed Feb. 17, 1959

Fig. 1

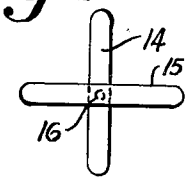


Fig. 2

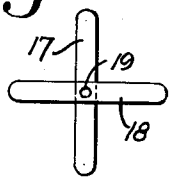


Fig. 3

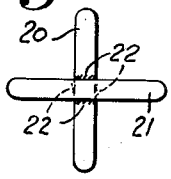


Fig. 4

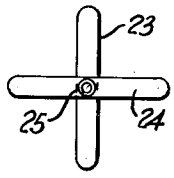


Fig. 5

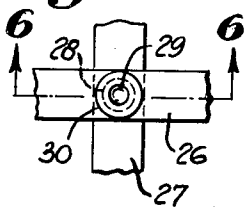


Fig. 6

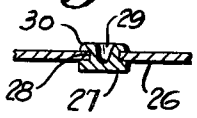


Fig. 7

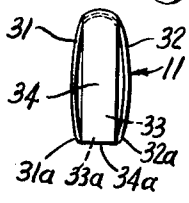


Fig. 8

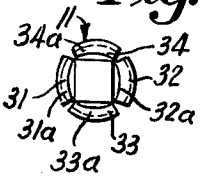


Fig. 10

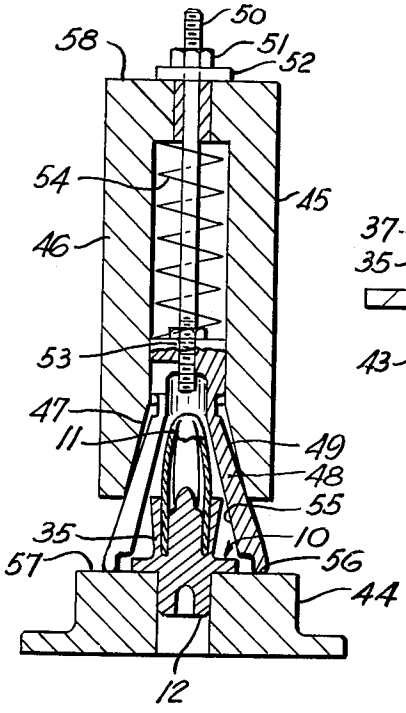


Fig. 11

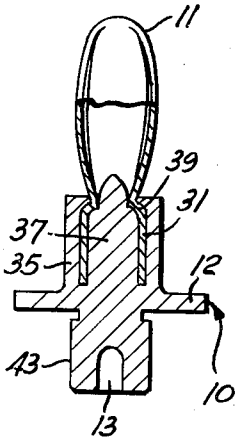
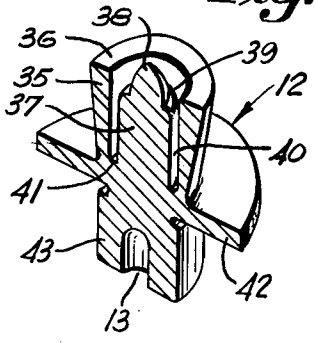


Fig. 9



INVENTOR.
JULIAN ROBERT AYMAR
BY
Richards & Geier
ATTORNEYS

United States Patent Office 3,039,076 Patented June 12, 1962

3,039,076

ELECTRICAL CONTACT

Julian Robert Aymar, 2018 E. 67th St., Brooklyn 34, N.Y.

Filed Feb. 17, 1959, Ser. No. 793,821
1 Claim. (Cl. 339—252)

This invention relates to an electrical contact of the banana plug variety, and apparatus and method for manufacturing the same.

There is a great need for easily manufactured banana plug electrical contacts which can be readily connected and disconnected from an electrical receptacle or mating part. Prior art does not fulfill the need because there are no easily manufactured electrical contacts of this type known in prior art. All previous attempts to fulfill the need have required numerous and varied machine processes to make and assemble the electrical contact, and even then the resulting contact was not always operationally efficient.

One object of the present invention is the provision of a device providing a secure contact between the banana plug electrical contact and an electrical receptacle or mating part, yet allowing for the easy connecting and disconnecting of the electrical contact.

A second object is the provision of a banana plug electrical contact having a large contact area with the mating part.

Another object is the provision of a banana plug electrical contact, wherein the spring legs of the electrical contact are securely anchored in the electrical contact base.

Yet another object is an easy, simplified and inexpensive method of manufacturing the electrical contact spring legs.

A further object is a simplified and efficient method of securely assembling the spring legs with the base.

A still further object is the provision of an apparatus for efficiently manufacturing the banana plug electrical contact.

Other objects of the present invention will become apparent in the course of the following specification.

In accomplishing the objects of the present invention it was found desirable to provide a banana plug electrical contact comprised of a base and resilient conductive spring legs which serve to form the electrical contact with any suitable electrical mating part. The legs which form the banana shaped spring are securely anchored in the base by the action of a specially designed collet device which during assembly exerts uniform pressure on the base in a manner securely anchoring one end of the resilient legs in the base. The legs themselves are made from conductive laminar material, are easily formed into the banana shape, and by means of the collet device are easily, efficiently and inexpensively anchored in the base.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawings, showing, by way of example, preferred embodiments of the inventive idea.

FIGURE 1 shows the spring legs prior to shaping, comprising, two strips of conductive material fastened together by ultra-sonic spot welding.

FIGURE 2 shows the spring legs prior to shaping fastened together by electric spot welding.

FIGURE 3 shows the spring legs prior to shaping fastened together by soldering.

FIGURE 4 shows the spring legs prior to shaping fastened together by a rivet.

FIGURE 5 shows a top view of the spring legs prior to shaping, fastened together by means of an extrusion on one strip extending through a hole in the other strip.

FIGURE 6 is a section through the center of the strip of FIGURE 5 having the extrusion.

FIGURE 7 is a side view of the spring legs.

FIGURE 8 is an end view of the spring legs as seen from the base end of the legs.

FIGURE 9 is a perspective view of the base of the banana plug electrical contact with a section through the center of the base.

FIGURE 10 is a sectional view through the center of the banana plug electrical contact and the collet device, showing the collet device in position to fasten the spring legs in the base of the electrical contact.

FIGURE 11 is a sectional view through the center of the completely assembled banana plug electrical contact.

The banana plug electrical contact **10** is shown in FIGURE 11 and comprises a spring member **11** and a base member **12**. The base **12** or the opening **13**, may be connected to an electrical connection (not shown). The spring **11** is connected to any suitable electrical mating part (not shown), and since the spring **11** and base **12** are both made of electrically conductive material an electrical connection results.

The spring **11** is made by taking two strips of resilient, electrically conductive material (such as a nickel-silver alloy), which are slightly curved both in the lateral and longitudinal directions (FIGS. 7 and 8) and fastening them together at right angles to one another.

Various methods may be used for joining the two strips. For example, FIGURE 1 shows two such strips **14** and **15** fastened together by an ultra-sonic weld **16**.

FIGURE 2 shows two strips **17** and **18** fastened together by an electrical spot weld **19**.

FIGURE 3 shows two strips **20** and **21** fastened together by solder **22**.

FIGURE 4 shows two strips **23** and **24** fastened together by a rivet **25**.

As is indicated in FIGURES 5 and 6, the two strips **26** and **27** may be fastened together by extending a hollow cylindrical extrusion **28** on strip **27** through a hole **29** in strip **26** and then peening down the extruded upper portion **30**.

Using the embodiment of FIGURES 5 and 6 as an example, after being fastened together strips **26** and **27** are bent by any known means into the form of the banana shaped spring **11** indicated in FIGURES 7 and 8. The spring legs **31**, **32** and **33**, **34** are formed from strips **26** and **27**, respectively. FIGURE 7 shows in side view the spring **11**, wherein the original longitudinal curvature of the strips **26**, **27** may be seen, while FIGURE 8 is an end view of the spring **11**, wherein may be seen the original lateral curvature of the strips **26** and **27**. Both FIGURES 7 and 8 indicate that after being bent to shape the full end portions **31***a*, **32***a*, **33***a*, and **34***a* of spring **11** are adjacent to one another, thus forming a continuous curved equi-sided section.

Being shaped in this manner, and being made out of resilient material, the spring **11** possesses the necessary springiness for being easily connected and disconnected from mating electrical parts (not shown), for making electrical contact within the mating parts, and for securely fastening the legs **31**, **32**, **33**, **34** in the base **12**.

The base **12** shown in FIGURE 9 comprises a hollow cylindrical outer portion **35** having an upper surface **36**, a post **37**, an upper portion of the post **38**, a ledge **39** located below the level of surface **36**, and a circular recess groove **40** having a bottom **41** separating the post **37** and the outer portion **35**. A wing portion **42**, connects the post **37** and outer portion **35** with the connector portion **43** which connects to any suitable electrical connection (not shown).

To securely fasten the spring **11** to the base **12**, the

spring legs **31**, **32**, **33**, **34** are placed in the recess groove **40** until the end portions **31***a*, **32***a*, **33***a*, **34***a*, touch the bottom portion **41** of recess grooves **40**. (FIGS. 7, 9, and 10.) The spring **11** is so designed that when placed in the recess groove **40** the leg end portions **31***a*, **32***a*, **33***a*, **34***a* touch one another and completely cover the bottom portion **41** of the recess groove **40** (FIGS. 8 and 10). The banana plug electrical contact **10** is then placed in fixture **44** and is ready for the fastening operation to be carried out.

The collet device **45**, as shown in FIGURE 10, includes a cylindrical tool body **46** having an inner tapered surface **47**, and a collet **48** having an outer tapered surface **49**. The slope of surface **49** is less than the slope of surface **47** when the collet **48** is in the open position, but the slopes are identical when the collet **48** is in the closed position. A threaded stud **50** is supported near one end by the tool body **46** by means of a nut **51** and washer **52**, and at the other end it is connected to collet **48** by means of the threaded collet hole **53**. The stud **50** passes through a heavy spring **54** which is pre-compressed between the tool body **46** and the collet **48** to any desired degree by tightening the nut **51**.

FIGURE 10 shows the relative positions of the holding fixture **44**, the banana plug electrical contact **10**, and the collet device **45** as the fastening operation is begun. When the collet **48** is fully open the collet bore or inner surface **55** is tapered and has a diameter sufficiently great so that the collet **48** may be slipped over the outer portion **35**. The entire collet device **45** is then lowered until the bottom surface **56** of the collet **48** contacts the upper surface **57** of the fixture **44**. This is the position shown in FIGURE 10. To complete the fastening operation a downward force is applied on the upper surface **58** of the tool body **46**. Since the slope of the collet surface **49** in the open position is less than the slope of the tool body surface **47** the collet **48** is compressed inwardly forcing the collet inner surface **55** against the outer portion **35** of the base **12**. During this operation the collet bore or inner surface **55** changes from a tapered bore to a cylindrical bore thus forcing the thickened metal upper portion of the outer portion **35** to flow inwardly, and to securely hold the spring **11** against the post **37** and ledge **39**. The spring **54**, stud **50**, and nut **51** can be adjusted to determine the diameter of the collet opening **55** in the open position. The slopes of surfaces **47** and **49** are selected such that the slope of surface **49** will become equal to the slope of surface **47** when the outer portion **35** has forced the spring **11** against the post **37** the desired amount. When the slope of surface **49** becomes equal to the slope of surface **47** no further increment of inward force can be applied by tool body **46** on the collet **48**, nor, consequently, can any further increment of force be applied by collet **48** on the outer portion **35** of base **12**. When the downward force on the tool body **46** is released the collet **48** reopens and the electrical contact **10** can be removed.

The resulting banana plug electrical contact is shown in FIGURE 11, where it can be seen how the leg **31** is held securely between the outer portion **35** and the post **37**, and especially how the leg **31** is held against the ledge **39**.

Among the advantages of this invention are:

The ease of connecting and disconnecting the electrical contact from a mating part, the large area of contact with the mating part, the large contact area between the spring legs and the base, the simplified method of manufacture of the spring, and the novel method of securely fastening the spring legs to the base.

It is apparent that the described examples are capable of various variations and modifications within the scope of the present invention. All such variations and modifications are to be included within the scope of the present invention.

What is claimed is:

An electrical contact of the banana plug type, comprising in combination with a spring member consisting of two strips having central overlapping portions wherein said strips are firmly joined together at right angles to each other, said overlapping portions being curved and constituting the projecting tip of said spring member, said strips further having spring legs extending side by side and curved in the lateral and longitudinal directions; a base member comprising a cylindrical outer portion, a wing portion integral with said cylindrical outer portion and extending transversely thereto, a post integral with said wing portion and located within said cylindrical outer portion, said base member having formed therein an annular recess groove separating said post from said outer portion, the spring legs of said strips having end portions located in said groove and contacting each other and the bottom of the groove and being in tight engagement with the adjacent surfaces of said post and said cylindrical outer portion to provide frictional securement of said leg end portions, said cylindrical outer portion having an annular upper surface, said post having a narrow upper portion extending above said upper surface and an annular ledge surrounding said upper portion and located below said upper surface, said strips having intermediate portions engaged tightly by said cylindrical outer portion against said ledge to prevent withdrawal of the spring member, the diameter of said intermediate portions being smaller than the diameter of the end portions located in said annular groove, whereby said intermediate portions provide an abutment preventing the withdrawal of the spring member.

References Cited in the file of this patent

UNITED STATES PATENTS

2,377,912	Way	June 12, 1945
2,398,684	Woodward	Apr. 16, 1946
2,508,770	Oshinsky	May 23, 1950
2,548,773	Chirelstein	Apr. 10, 1951
2,563,561	Stanley	Aug. 7, 1951
2,563,713	Frei et al.	Aug. 7, 1951
2,593,081	Wilmot	Apr. 15, 1952
2,610,390	Locke	Sept. 16, 1952
2,671,205	Wermine	Mar. 2, 1954
2,794,963	Hess et al.	June 4, 1957
2,821,011	Sanders et al.	Jan. 28, 1958
2,846,563	Cronin	Aug. 5, 1958

FOREIGN PATENTS

458,969	Germany	Apr. 26, 1928
460,448	Great Britain	Jan. 27, 1937
809,169	France	Dec. 3, 1936