United States Patent

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[54] **ELECTRICAL CONTACT**
3 Claims, 3 Drawing Figs.

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[51] **Int. Cl.** **H01h 1/02**
[50] **Field of Search** 29/630, 622; 200/166C

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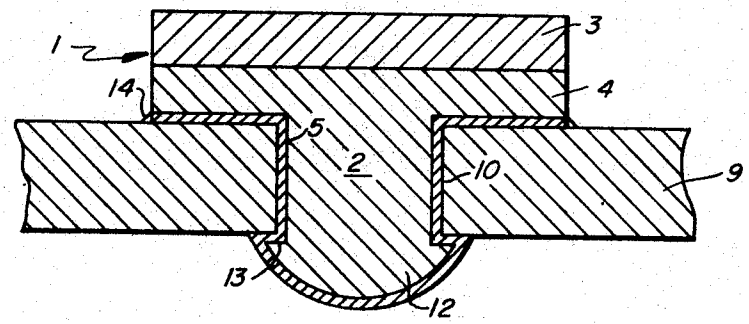
ABSTRACT: An electrical contact of the rivet type comprising a metal head and a metal shank, the head being a bimetallic head composed of a layer of contact metal, e.g. silver, and a backing layer of another metal from which extends the rivet shank and which is preferably of the same metal composition as the metal backing layer, both the shank and the backing layer, including the under surface and the peripheral sides of the backing layer being coated with a layer of metal solder having a lower melting point than the contact metal, the backing layer and the shank.



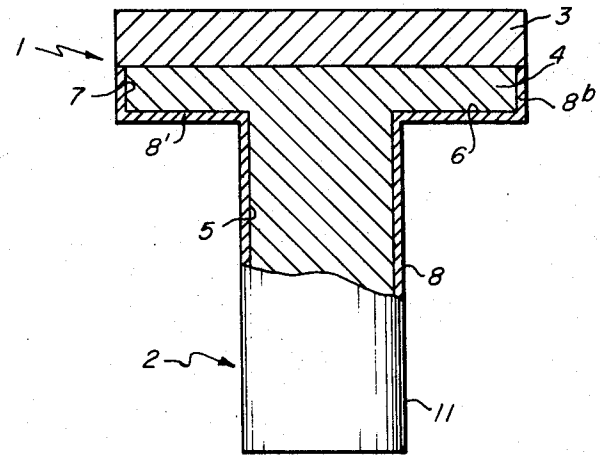


FIG. 1

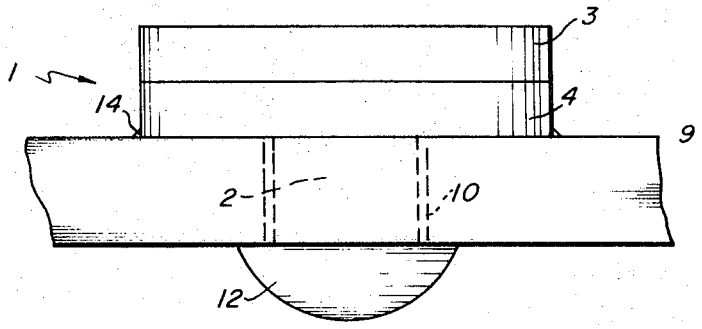


FIG. 2

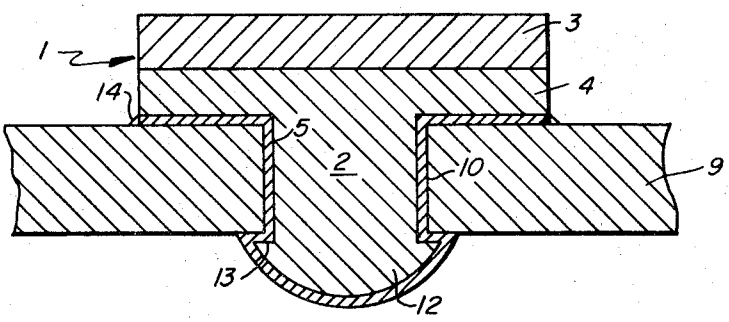


FIG. 3

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ELECTRICAL CONTACT

BACKGROUND OF THE INVENTION

Electrical contacts of the rivet type with the rivet head composed in part of a contact metal selected for its electrical performance, e.g. a bimetallic rivet head having a surface contact layer of silver and the remaining portion, or backing layer, and the shank, composed of a metal different from the contact metal, e.g. copper, are well known as evidenced by U.S. Pat. No. 3,026,603. Such contacts are generally mounted on a contact arm and mechanically secured on the contact arm through an aperture therein by cold staking or hot staking the end portion of the shank passing through the aperture into abutment with the surface of the arm surrounding the aperture. It has been experienced during the operation of such contacts for substantial periods that the mechanical securing of the contact to the contact arm is sometimes subject to loosening with the result that the contact does not operate efficiently and otherwise electrical conductivity is adversely influenced by oxidation of the shank portion which undesirably increases the electrical resistance of the assembly. In addition to such disadvantage, after substantially prolonged usage, the bimetallic head undergoes a distortion such that the peripheral marginal portions of the head adjacent the contact arm separate from the surface of the contact arm at least partly about the circumference of the head effecting a bent distortion, e.g. "curling" of the contact metal layer, which seriously affects the performance of the contact. The present invention contemplates the provision of an electrical contact and contact assembly which obviates such disadvantages.

SUMMARY OF THE INVENTION

In accordance with the invention there is provided an electrical contact of the rivet type comprising a metal head and a metal shank, the head being a bimetallic head composed of a layer of contact metal, e.g. silver, and a backing layer of a different metal, e.g. copper from which extends the rivet shank and which shank is preferably of the same metal composition as the backing layer, both the peripheral surfaces of the shank and the backing layer including the undersurface of an the peripheral sides of the backing layer being coated with a layer of solder having a melting point lower than that of the contact metal, the backing layer and the shank. Specifically, the thickness of the solder coat layer is between the range of 0.005 and 0.0002 inches, preferably between 0.003 and 0.0005 inches. The criticality of the invention lies in the particular thickness of solder coat as well as the combination including such solder thickness and the above-mentioned surfaces coated with the solder layer.

It is not herein regarded as a novel expedient to merely flash coat by electroplating a contact rivet with a metal such as silver within the thickness range of, for example, 0.0001 to less than 0.0002 inches to preserve it against oxidation and corrosion during its shelf life. The silver flash coat could very well be a silver alloy of a solder composition, but unless its thickness is within the range herein contemplated, it cannot operate to provide an effective solder joint. The same applies if the solder is applied to the contact in a thickness exceeding about 0.005 inches. For example, if the solder was applied to a thickness less than about 0.0002 inches, during subsequent heating it diffuses rapidly into the shank and backing metal and also into the surrounding adjacent metal, i.e. the walls of the aperture in the contact arm into which the shank is inserted, so that no solder metal is left to provide a bond layer at the interface between the adjacent metals. If the solder was applied to a thickness exceeding about 0.005 inches, during subsequent heating there would be some solder in the solder layer at the interface in unalloyed condition with the adjacent metals thereby providing an unsatisfactorily weak bond. Otherwise, a lot of the solder would, during melting, exude from between adjacent surfaces and contaminate the contact surface.

DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a partly cross-sectional and partly elevational side view of an electrical contact according to the invention;

FIG. 2 illustrates a fragmentary elevational side view of a contact assembly; and

FIG. 3 illustrates a cross-sectional view of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, the electrical contact of the invention is in the form of a rivet having a rivet head 1 and a rivet shank 2. The rivet head is preferably in the form of a bimetallic head having a surface layer 3 composed of contact metal, e.g. silver, silver alloy, a platinum group metal especially platinum or palladium, gold or a gold alloy, or a tungsten-molybdenum alloy. The contact metal surface layer is mounted on a backing layer 4 composed of a metal different from the contact metal, e.g. a base metal such as copper, bronze, brass, nickel or steel, and the shank 2 extends from the backing layer thereby forming a rivet shape.

The sides 5 of shank 2, the bottom surface 6 of backing layer 4 and the peripheral surface 7 of the backing layer are coated with a layer 8 of solder having a melting point lower than that of the contact metal 3 the backing layer 4 and the core metal of shank 2. Specifically, the thickness of the solder coat layer is preferably between the range of about 0.003 and 0.0005 inch. As stated above, the criticality of the invention lies in the combination of the solder coated surfaces as well as the thickness of the solder coat.

The solder layer 8 is composed of solder alloys such as 15 percent Ag–80 percent Cu–5 percent P; 35 percent Ag–26 percent Cu–21 percent Zn–18 percent Cd; 45 percent Ag–15 percent Cu–16 percent Zn–24 percent Cd; 5 percent Ag–16.6 percent Zn–78.4 percent Cd; 5 percent Ag–95 percent Cd; 56 percent Ag–22 percent Cu–17 percent Zn–5 percent Sn. The selection of a suitable solder composition for the solder layer 8 will depend upon the permissible temperatures to which the contact assembly such as illustrated by FIGS. 2 and 3 will be subjected to during fabrication or use of the contact assembly.

The rivet type contact may be formed in known manner, for example, as disclosed in U.S. Pat. No. 3,208,129, and while the solder layer 8 may be applied as an alloy sheath on a base metal wire core prior to forming the bimetallic head 1, it can also be provided by alternately electroplating layers of different metals such as silver, copper, zinc, tin, etc. on the base metal wire core prior to forming the rivet head and then allowing the solder to be formed from these layers during hot staking onto the contact arm 9 or by passing the cold staked rivet through a controlled temperature as in an oven.

Regarding FIGS. 2 and 3, a metal contact strip or arm 9, e.g. an arm of copper, bronze, brass or steel, is provided with an aperture formed therethrough and defined by aperture wall 10. The rivet of FIG. 1 is inserted into the aperture with the solder layer 8 coating the bottom surface 6 of the backing layer 4 abutting one side of the strip or arm adjacent the aperture and the free end of the shank 2 extending out of the aperture. Thereafter, the free end portion 11 (FIG. 1) of the rivet is deformed into a second retaining head 12 having an inner solder coated face 13 in abutment with the opposite side of the arm adjacent the aperture to form a contact assembly. Preferably, the rivet is mounted in the arm 9 aperture and the end portion 11 is hot staked to form the retaining head 12 by the use of well-known electrically heating electrodes (not shown) having die cavities contoured to contain the head 1 while shaping the head 12 into its headlike convex head.

When the rivet contact is hot staked into arm 9, the solder layer 8, being present in the above-stated critical range of thickness, the solder melts and alloys with the metal of side 5 of shank 2 and the metal of the aperture walls 10, as well as between the metal of the undersurface 6 of back 4 and the portion of the contact arm 9 underlying the head 1 and also

forming a small annular fillet 14 between the periphery of the backing layer 4 and the contact arm due to the flow of solder 8*b* from the peripheral sides of the backing layer.

While the melts and the solder joint is thereby formed by hot staking as described above, the rivets may also be applied by cold staking after which the solder can be melted to form the joint by passing the assembly through an oven under controlled temperature conditions.

With the contact rivet so staked and soldered, it avoids the tendency of the contact head to separate from the contact arm, as by curling, and also insures the rivet shank against loosening in the aperture of the contact arm.

I claim:

1. An electrical contact of the rivet type comprising a metal head and a metal shank extending from one side of the head, the shank, and the side of the head adjacent the shank having coated thereon layer of metal solder having a lower melting point than the metal of the head and the metal of the shank, the metal solder layer having a thickness between about 0.005 to about 0.0002 inch.

2. An electrical contact according to claim 1, wherein the head is a bimetallic head composed of a surface layer of contact metal bonded to a backing layer of a metal different from the contact metal, and said metal solder layer extending over the peripheral surface of the said backing layer.

3. An electrical contact assembly comprising an electrical contact of the rivet type having a metal head and a metal shank joined to the head, the shank, and the side of the head adjacent the shank having coated thereon a layer of metal solder having a lower melting point than the metal of the head and the metal of the shank, the metal solder layer having a thickness between about 0.003 and 0.0005 inch, a metal arm having an aperture therethrough defined by the aperture wall, the shank of the rivet passing through the aperture with the solder-coated side of the head adjacent the shank abutting one side of the arm adjacent the aperture, the free end of the shank being staked in abutment with the opposite side of the arm adjacent the aperture, the solder being in heat alloyed condition as a soldered bond between the head of the rivet and the metal of the arm adjacent the aperture and between the rivet shank and the wall defining the arm aperture.