June 3, 1969 C. ADRIEN 3,448,431

CONTACT CARRIER STRIP

Filed March 17, 1966

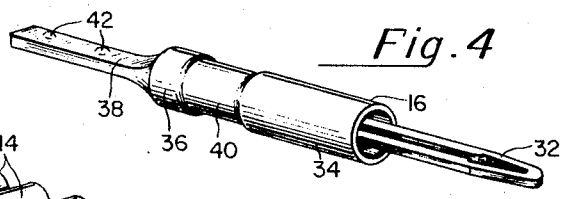

Fig. 4

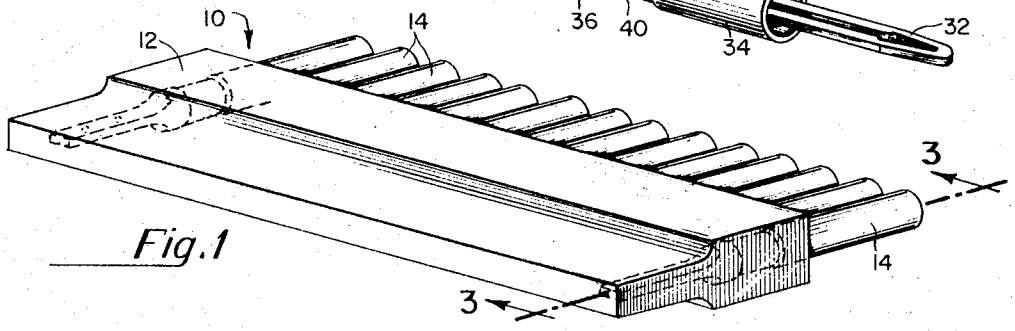

Fig. 1

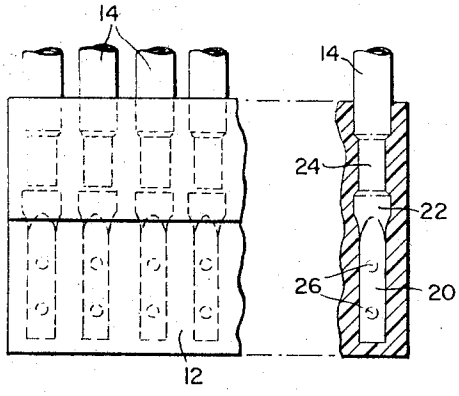

Fig. 5

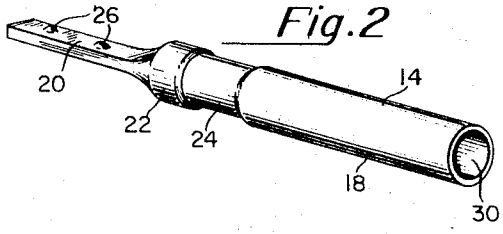

Fig. 2

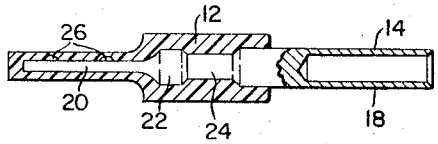

Fig. 3

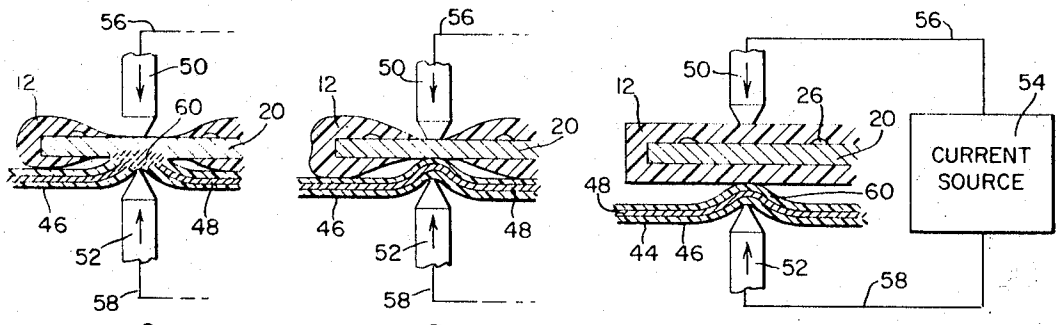

Fig. 6

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United States Patent Office 3,448,431
Patented June 3, 1969

3,448,431

CONTACT CARRIER STRIP

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Filed Mar. 17, 1966, Ser. No. 535,379
Int. Cl. H01r 5/04, 13/50, 11/16
U.S. Cl. 339—176 8 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to a thermoplastic contact carrier strip with a plurality of contacts embedded therein. The contact carrier strip is mated to a conductor carrying ribbon by means of welding electrodes which expose the conductors and contacts for electrical conduction by melting the thermoplastic.

This invention relates to a contact carrier strip and has as its objective the provision of a contact carrier strip which holds contacts in such a way that the contacts can be welded directly to the conductors of the ribbon cable.

The handling of a large number of contacts or connectors presents problems of movement and proper orientation. Towards this end it has been suggested to secure, mount or otherwise attach contacts to holding pieces or other retention devices, either temporarily or permanently. As the miniaturization of the electronics industry has proceeded, the size of contacts, terminals and other components has proportionately decreased, and thereby intensified the problem of handling the contacts.

The desirability of welding contacts and terminals to other conductors has added even more importance to the necessity to achieve handling of contacts and connectors. A novel welding technique is disclosed and claimed in co-pending application Ser. No. 317,617, filed Oct. 21, 1963, now abandoned, entitled Method of Securing Connector Terminals to a Ribbon Cable (inventer—Herbert E. Ruehlemann).

In said application the terminals were positioned in the desired relationship with respect to the conductors of a ribbon cable prior to the initiation of the welding process. While this could be satisfactorily accomplished through the appropriate use of jigging machinery with larger contact surfaces, the inherent difficulties in handling smaller contacts have made for a complicated industrial problem should it be desired to weld the smaller contacts to the conductor of a ribbon cable.

It is, therefore, an object of the present invention to provide a novel means for holding a plurality of contacts in desired relationship with respect to the conductors of a ribbon cable or other electrical device in order to permit the application of welding techniques.

Yet another object of the present invention is to provide a contact carrier strip which will hold small size contacts in desired relationship with respect to conductors of other devices, such as a ribbon cable in order to allow for the efficient application of welding techniques.

Still another object of the present invention is to provide a contact carrier strip of relatively low cost which is simple in use and of high reliability.

The foregoing as well as other objects of the invention are achieved by providing a somewhat elongated plastic strip having contacts secured therein in precise relationship or spacing with respect to each other. The tail sections of the contact are sufficiently accessible to receive a welding current in order that the tail section may be welded to the conductor of a ribbon cable or other electrical device. In the preferred embodiment of the invention the tail section is incapsulated in the carrier strip which is of a thermoplastic material.

Thus, when heat is applied to the carrier strip, the thermoplastic insulation will be flowed away as a result of the combination effects of heat and pressure so that the tail section will be moved in actual contact with the conductor of a ribbon cable whose insulation has been similarly flowed away. Once mechanical contact has been established between the tail section and the ribbon cable conductor, a welding current can be applied in order to complete the connection.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a perspective view of a contact carrier strip of the present invention having female contacts secured therein;

FIG. 2 is a perspective view of one of the female contacts of FIG. 1;

FIG. 3 is a sectional view taken along the lines 3—3 of FIG. 1;

FIG. 4 is a perspective view of a male contact which can be secured within a carrier strip in the manner of FIG. 1;

FIG. 5 is a plan view of the carrier strip of FIG. 1 with portions broken away for the sake of clarity; and

FIG. 6 is a sequential view illustrating the welding of a contact of the carrier strip of FIG. 1 to a conductor of a ribbon cable.

Referring now in greater detail to the various figures of the drawings wherein like reference characters refer to similar parts, there is shown at **10** in FIG. 1 a contact carrier strip embodying the present invention. The carrier strip **10** basically comprises thermoplastic holding portion **12** from which female contacts **14** extend. The contact carrier strip is preferably formed simultaneously or integrally so that the contacts **14** are embedded in the holding strip **12** upon discharge from the molding area. It is conceivable that other manufacturing techniques may be employed, such as separately forming the holding strip, heating the contacts and inserting the heating contacts under pressure so that they penetrate within the holding strip **12**.

A typical female contact **14** is shown in perspective in FIG. 2 and a typical male contact **16** is shown in FIG. 4. The female and male contacts **14** and **16** indicated here illustrate the operation of the present invention. However, the present invention is in no way limited to the precise structure of the female and male contacts described herein. It will be readily apparent to those skilled in the art that contacts, both male and female or hermaphroditic may be utilized.

The female and male contacts **14** and **16** of FIGS. 2 and 4 are constructed generally along the lines of certain contacts disclosed and claimed in co-pending application Ser. No. 501,407, filed Oct. 22, 1965, entitled Cylindrical Connector Contact (inventor—Herbert E. Ruehlemann), and the disclosure of said patent application is hereby incorporated in reference.

As generally shown in FIG. 2 the female contact **14** basically comprises a cylindrical mating section **18** and a relatively flat or uniplanar tail section **20**. The contact **14** further includes cylindrical shoulder **22** from which the tail section **20** extends. A recess **24** is provided which separates shoulder **22** from mating section **18**. As further shown in FIG. 2 the tail section **20** includes convex points **26** which strengthen the connection between the contacts **14** and the holding strip **12**.

The disposition of the contacts **14** in the holding strip **12** is illustrated in FIG. 3 which indicates that the entire

tail section **20**, together with shoulder **22** and recess **24** is completely incapsulated within the holding strip **12** which terminates forwardly in edge **28** along a portion of the length of mating section **18**. It will readily occur to those skilled in the art that the actual width of the holding strip **12** may be narrowed or may be broader, depending upon the needs of a particular situation.

It is conceivable that the holding strip **12** will encompass only middle portions of the contacts, thereby leaving substantial portions of the mating section and the tail section exposed. However, the holding strip **12** does have a protective function, since it prevents oxidation of the tail section **20** as well as lending some mechanical support.

The female contact further includes a central bore **30** which is adapted to receive the spring member **32** of the male contact **16**, the details of which are shown in FIG. 4. The male contact **16** as well as the female contact **14** may be both comprised of maximum hardness beryllium copper, although softer materials may be used, depending upon the needs of a particular situation.

The male contact **16** basically comprises in addition to spring member **32** a body section **34** and cylindrical shoulder **36** from which tail section **38** extends. A recess **40** is provided which separates shoulder **36** from body setction **34**. As further shown in FIG. 4 the tail section **38** includes convex points **42** which strengthen the connection between the contacts **16** and the holding strip **12**.

The disposition of the contacts **16** in a holding strip is substantially identical to the FIGS. 1 and 3 disposition of female contacts **14** in the holding strip **12**. Thus, the entire tail section **38**, together with shoulder **36** and recess **40** may be completely incapsulated within the holding strip **12** that will terminate in a manner substantially identical to the showing of FIG. 3. As previously indicated, it will readily occur to those skilled in the art that the actual width of the holding strip **12** in conjunction with either female contacts **14** or male contacts **16** may be narrowed or may be broader depending upon the needs of a particular situation.

It is thus seen that the contact carrier strip of the present invention facilitates the handling of a plurality of female contacts **14** or male contacts **16**. It is preferred that the female contacts or male contacts be integrally molded within the holding strip **12** at the time of the formation of the holding strip **12** as previously described. At times, it may be desirable to initially heat the contacts and then force them into a thermoplastic holding strip as described in Ruehlemann Patent No. 3,182,276.

Yet another advantage of the contact carrier strip of the present invention is to achieve the welding of a large number of contacts to the conductive members of a ribbon cable. This is shown in detail in FIG. 6. A ribbon cable is basically an elongated strip of plastic having conductive wires or members embedded or printed therein. In order to be usable with the present invention, the insulation of the ribbon cable should be thermoplastic or exhibit thermoplastic characteristics in the manner of a vinyl plastic or polyethylene.

A ribbon cable as known in the art is extremely thin and possesses a series of parallel conductive members which run lengthwise of the ribbon cable. However, the term "ribbon cable" is broad enough to include intersecting conductors or conductive matrices.

As shown in FIG. 6 the ribbon cable **44** comprises thermoplastic insulation **46** and at least one embedded conductor **48**. As further shown in FIG. 6 the tail **20** of a female terminal as embedded in holding strip **12** is placed closely above the ribbon cable **44** in such a manner that the tail **20** is superimposed upon the conductor **40**.

The details of a process involving the welding of a terminal to a conductor of a ribbon cable are disclosed in pending application Ser. No. 317,617, filed Oct. 21, 1963, entitled Method of Securing Connector Terminals to a Ribbon Cable (inventor—Herbert E. Ruehlemann), and said details are herein incorporated in reference.

In order to carry out the welding process of FIG. 6, electrically heated electrodes **50** and **52** are employed in conjunction with current source **54** and leads **56** and **58**. A condenser discharge circuit (not shown) as described in said application Ser. No. 317,617 may also be utilized in a switch or timer arrangement.

As shown in FIG. 6–A, pressure is applied to the hot electrodes in the direction of the respective arrows in order to urge the hot electrodes **50** and **52** toward each other. Where the ribbon cable **44** is quite thin as shown in FIG. 6–A, the ribbon cable adjacent hot electrode **52** will immediately flow into a bulge **60**. Thereafter, the insulation adjacent electrode **50** is melted away as shown in FIG. 6–B. Under continued heat and pressure as shown in FIG. 6–C, the insulation is flowed away not only from the top surface of contact tail **20**, but also the heat passing from electrode **50** through tail section **20** as well as the heat emitted by lower electrode **52** passes through the ribbon cable and melts away the insulation adjacent the lower face of the tail **20**.

It may be desirable to form the holding strip **12** from a thermoplastic material that will melt at a lower temperature than the thermoplastic material of the ribbon cable **44**. In this way, the holding strip insulation will be more quickly flowed away than the ribbon cable insulation. Thus, the tail **20** will be rather quickly exposed to top electrode **50**.

As shown in FIG. 6–C the combination of pressure and heat as applied by the electrodes **50** and **52** flows away the holding portion **12** and the ribbon cable insulation so that the tail section **20** is in actual contact with a conductor of the ribbon cable. A welding current can now be passed through the actuation of switch means, either manually or through a timer in order to form weld **60** of FIG. 6–C. This process may be duplicated simultaneously or successively in order to weld a series of tail sections in the holding strip **12** to corresponding conductors of ribbon cable. It follows that the same process will apply when male contacts are present in the holding strip **12**.

It is thus seen that the contact carrier strip of the present invention not only facilitates the handling of contacts, but is also well suited to expedite the holding of contacts to the conductors of a ribbon cable. The present invention is also well suited where the contacts are of small size. After the welding operation has been completed, a protective insulation coating or layer may be applied about the welded area for insulating as well as protective purposes.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed as the invention is:

1. A contact carrier strip comprising an elongated, relatively thin thermoplastic strip having a narrow edge; and a plurality of contacts secured in said strip in precise relationship to each other; said contacts including a mating section and a tail section, the mating sections of the contacts projecting beyond said narrow edge of the thermoplastic strip, and the tail sections of the contacts being encapsulated within said narrow edge by said thermoplastic strip whereby the tail sections of the contacts are protected by upper and lower thin thermoplastic layers.

2. The invention of claim **1** wherein said tail sections include convex points which strengthen the connection between the thermoplastic strip and the tail sections.

3. The invention of claim **1** wherein said mating sections are female.

4. The invention of claim **1** wherein said mating sections are male.

5. The combination of a ribbon cable and a contact carrier strip; said ribbon being relatively flat and having

a plurality of spaced conductors encapsulated side-by-side in thermoplastic insulation; said contact carrier strip comprising an elongated, relatively thin thermoplastic strip having a narrow edge, and having a plurality of contacts secured therein with a spacing matching that of said conductors; each contact having a mating section extending beyond said thermoplastic strip and a tail secion initially encapsulated by said thermoplastic strip and being welded to a different one of the plurality of conductors within the insulation of said ribbon cable, and portions of said thermoplastic strip being removed to achieve actual contact between the tail section of a contact and a conductor in said ribbon cable.

6. The invention of claim 5 wherein said tail section includes convex points which strengthen the connection between the thermoplastic strip and the tail section.

7. The invention of claim 5 wherein said mating section is female.

8. The invention of claim 5 wherein said mating section is male.

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U.S. Cl. X.R.

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