Dec. 24, 1963 T. E. HANNER ET AL 3,115,541

ELECTRICAL WIRING CONNECTOR

Filed May 21, 1962 2 Sheets-Sheet 1

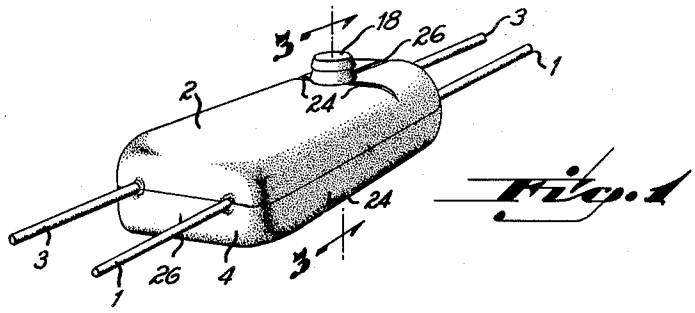

Fig. 1

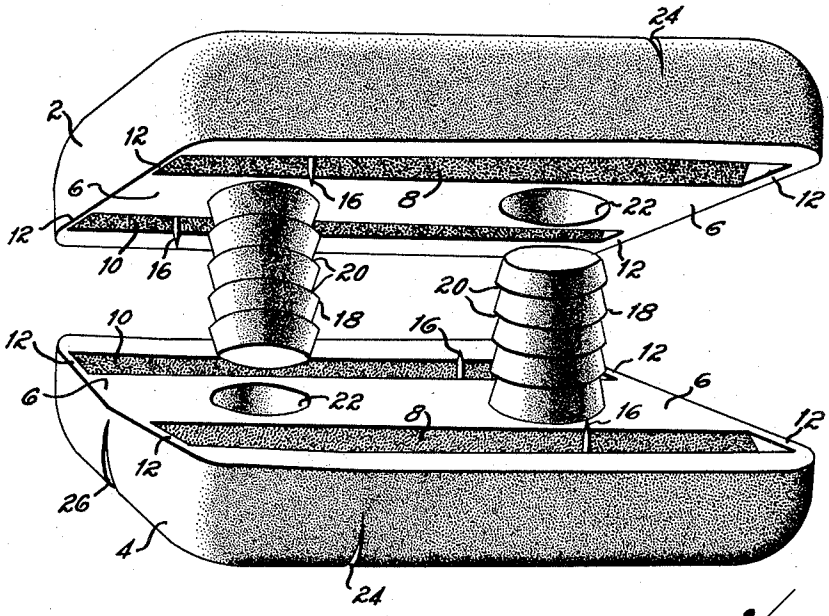

Fig. 2

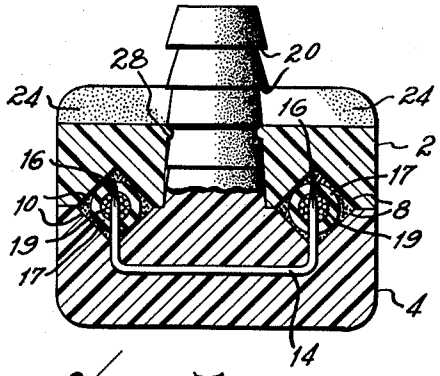

Fig. 3

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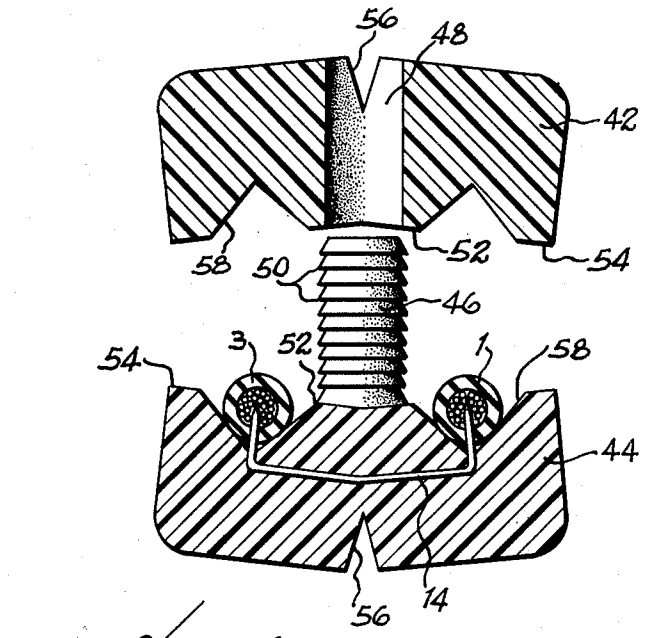

Fig. 4

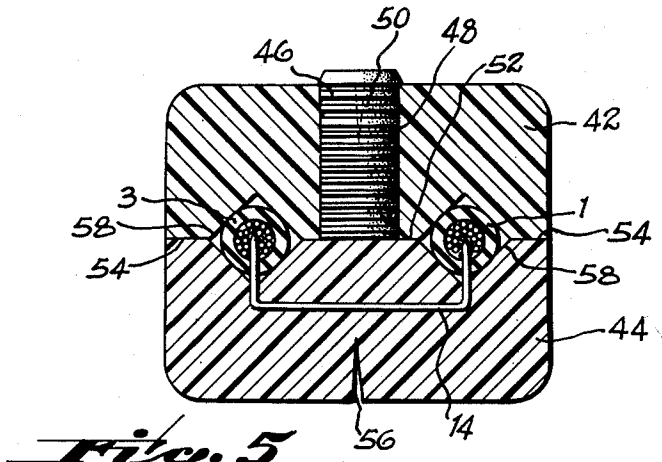

Fig. 5

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ELECTRICAL WIRING CONNECTOR

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This invention relates to wiring connectors and more particularly, to a wiring connector for electrically connecting two insulated wires without the necessity of removing the insulation from the wires.

In many industries, such as the automobile manufacturing industry where there is a large amount of wiring involved in the finished product, it has been found desirable to tap into a wire and electrically connect it to another without removing the insulation from the wires. There has been a need for along time in the electrical wiring industry for an inexpensive, uncomplicated wiring connector for electrically connecting two insulated wires without removing the insulation from the wires. While prior attempts have been made to supply such a wiring connector, these earlier attempts have involved relatively complex structures which were difficult to handle and which did not positively and permanently electrically lock the wires together.

This invention arose out of the need for an inexpensive connector to electrically engage two wires of very small diameter, as for example, ⅛" in diameter including the electrical insulation. In order to conserve space, the connectors are usually not more than ½" in length and ½" or less in width. These small wires and the small connectors used to electrically connect them present handling problems for a person in a production type industry who must handle these parts in a minimum of time without errors. It is imperative that an electrical connector designed for this type of use be easy to handle and positive in operation so as to minimize assembly time. Because of the small size of many of these connectors, it is also imperative that the connector have a minimum of parts and not require a great effort to align and assemble the parts in their proper relationship.

It has therefore been an objective of this invention to provide an electrical connector which has a minimum of parts and is easily and positively placed in position to lock insulated wires in electrical engagement.

Another objective of this invention has been to provide an electrical connector made from two identical parts so as to minimize the cost of manufacture and maximize the ease of handling of small connectors for the workmen using the connectors.

Still another objective of this invention has been to provide an electrical connector which is easily snapfit into positive locked engagement.

Very briefly, this invention comprises an electrical wiring connector made from a non-conducting semi-flexible plastic material. The connector is made from two identical halves, each of which is provided with two long longitudinally extending V-shaped grooves in the opposing faces. A Phosphor bronze, or any conductive material staple is embedded in each half in such a fashion that one prong protrudes upwardly from the base into the two longitudinally extending grooves. Located between the grooves in each half is a stud or post which is generally in the shape of a right circular cylinder except that the peripheral surface has a plurality of concentric ribs whose cross sections are tapered giving the impression that the right circular cylinder is composed of a series of identical truncated cones superimposed one on top of another. The stud or post is located near one end of each half. Also located between the grooves but at the other end

from the protrusion or stud is a hole sized to receive the stud or post.

When the two halves are opposed, face to face, and end for end, the stud on one half is forced into the hole of the other with a certain pressure, depending upon the plasticity of the material. Thus the ribs on the post are forced through the hole in the opposing mating half so as to snap-fit and positively lock the two halves into engagement with the wires in the grooves sandwiched therebetween and connected electrically by the staples in each half.

This combination provides a wiring connector which is made from two identical symmetrical halves so that only one mold must be utilized to manufacture the die-cast halves of the connector. In addition, because the halves are symmetrical, the workman assembling the wires and connectors need not concern himself with properly selecting the parts of the connector in order to correctly assemble them.

In addition, this connector has the advantage of providing an efficient snap-fit lock mechanism which may be easily and inexpensively molded onto a die-cast connector.

The invention can best be further described with reference to the drawings in which:

FIGURE 1 is a perspective view of the assembled wiring connector,

FIGURE 2 is an exploded perspective view of the connector in unassembled position,

FIGURE 3 is a cross-sectional view taken along the line 3—3 of FIGURE 1,

FIGURE 4 is a cross-sectional view of a modified form of connector shown in an unassembled position,

FIGURE 5 is a cross-sectional view of the connector shown in FIGURE 4 in the assembled position.

The wiring connector of this invention consists of two identical halves 2, 4, which are adapted to be snap-fit into locked engagement. The two identical symmetrical halves are molded from a non-conducting semi-flexible plastic material such as high-density polyethylene or polypropylene. Each of the halves is in the form of a generally rectangular block having a flat inner surface which is adapted, when the connector is assembled, to be located adjacent the flat surface of the mating block. Each of the blocks has a pair of longitudinally extending V-shaped recesses 8 and 10 in the flat inside surface 6. These recesses extend from a point near one end of the block to a point near the other end. Because the recesses do not extend the full length of the block, a small lip 12 of resilient plastic material is left between the end of the recess and the outer surface of the block. When wires 1, 3 are placed in the recesses and the two blocks are fitted together with the wires sandwiched therebetween, the lips 12 are caused to deform and form a resilient moisture seal around the wires.

A U-shaped staple 14 made from Phosphor bronze or any other electrically conductive material is embedded in the plastic block with its ends extending up into each of the recesses of the block. The ends 16 of the staples are pointed and extend into the recesses a sufficient distance so that when a wire is placed in the recess, the pointed ends of the staples penetrate the insulation 17 of the wires in the recess and project into engagement with the conductive material 19 of the wire.

In the modification shown in FIGURES 1 to 3, a stud or protrusion 18 extends outwardly normal to the plane of the flat inner surface 6. The protrusion 18 is located between the two recesses 8 and 10 at a point offset from the center of the block. The stud has the general shape of a right circular cylinder except that the peripheral surface has a plurality of concentric ribs 20 thereon whose cross sections are tapered so as to give the appearance that the stud or post is composed of a series of

identical truncated cones superimposed one on top of the other.

Located between the recesses 8, 10 and offset from the transversely disposed center line of the block the same distance as the stud is offset but in the opposite direction from the center of the block, is a conical aperture 22 which extends through the block and is tapered outwardly and toward the axis of the aperture from the flat surface 6. As an alternative or added locking feature, each block may have a rib 23 which extends inwardly into the aperture 22 and serves as a locking ring when the stud 18 of the opposite half is forced into the aperture 22. The locking rib 28 may be used as an alternative to the conical shape of the aperture 22 to aid in locking the two halves of the connector together.

A V-shaped recess 24 extends inwardly from the outer surface of the block and across its width in the plane of the axis of the aperture 22. A similar V-shaped recess 26 in the outer surface of the block extends along the longitudinal axis of the block in the plane of the axis of the aperture 22. Because of the resiliency of the material of which the block is constructed, these slots cooperate with the studs and apertures to permanently lock the blocks in assembled engagement when the studs are forced into the apertures.

Referring to FIGURES 1 and 2, it will be seen that in order to assemble the blocks with the wires 1 and 3 locked in electrical connection, the blocks are placed in opposing relationship with the stud 18 of one block 4 opposing the aperture 22 of the opposite block 2. The wires which are to be electrically connected, are placed in the recesses 8, 10 of one block and the studs 18 of the opposing blocks are forced into the apertures in the opposite blocks. When the two blocks are forced together so as to sandwich the wires in the recesses, the staples 14 puncture the insulation of the wires so as to connect the two wires electrically. As should be readily obvious, two staples are not necessary to make the electrical contact between the two wires. However by utilizing two staples, the two blocks may be made identical and a good electrical contact is doubly assured.

The cylindrical studs 18, on entering the conical apertures 22 force them to assume a cylindrical shape, thereby springing open the recesses 24, 26 in the opposite block and bowing both blocks in both the longitudinal and the transverse directions.

When the bowed blocks meet, with the wires between them, pressure exerted so as to squeeze them together tends to straighten out the bow which in turn tends to close the recesses 24, 26 and make the apertures 22 grip the studs 18 more tightly in their attempt to resume their original conical shape. It is in this manner that the grooves 24, 26 in the outer surface of the blocks cooperate with the studs 18 and apertures 22 to lock the blocks in assembled relation.

As the stud 18 of the block is passed through the aperture 22 of the opposing block, the ribs formed by grooves 20 on the periphery of the stud 18 compress until the stud passes through the outer surface of the opposing block at which time the ribs expand against the outer surface of the opposing block and lock the two blocks in engagement with the wires sandwiched therebetween.

Referring to FIGURES 4 and 5, there is shown a slightly modified form of locking arrangement between the identical halves 42, 44 of the connector. Aside from this modification in the snap-fit lock of this embodiment, the connector of FIGURES 4 and 5 is similar to the connector of FIGURES 1–3.

In this embodiment, the studs 46 and apertures 48 are cylindrical in shape rather than tapered. The studs have concentric ribs 50 on their periphery similar to the connector of FIGURES 1–3. These ribs are adapted to compress as the stud is forced through the aperture and those ribs which are on the end of the stud resume their original shape after passing through the aperture. Because the ribs are tapered outwardly and downwardly toward the half of the connector up which the studs are mounted, these ribs are easily forced into the aperture and after passing through the aperture, hook over the top surface of the opposite block to lock the halves of the connector in assembled relationship. Of course, the aperture 48 could be counterbored so that the ribs would hook over the edge of the smaller portion of the counterbored aperture and with this arrangement, the studs would not have to protrude completely through the opposite block to achieve the same type of locking action between the studs and apertures.

In the embodiment illustrated in FIGURES 4 and 5, the inner surfaces 52 of the symmetrical halves of the connector are slightly concave so that as the halves of the connector are forced together into locked engagement, the abutting lateral edges 54 of the halves force each half of the connector to fulcrum about the lateral edges 54 so as to bow the center portion of each half downwardly into the plane of the lateral edges. As the center portion of each half is bowed downwardly, the outer portion of the aperture constricts around the stud to lock the two halves of the connector in engagement. To facilitate this fulcruming action, each half of the connector shown in this embodiment has a longitudinal V-shaped recess 56 in its outer surface. As the halves are forced together and the upper portion of the aperture constricts, the V-shaped recesses are forced to partially close.

It should be noted that in the embodiment illustrated in FIGURES 4 and 5, the lateral edges 54 of the halves need not be forced into abutting relation in order to cause constriction of the apertures. If the connector is used to electrically connect large wires which do not permit the inner surfaces 52 of the halves to abut, the halves still fulcrum about the wires because of the engagement of the wires with the wire receiving V-shaped recesses 58 which are laterally displaced from the longitudinal axis.

The snap-fit lock arrangement illustrated in the two embodiments has the advantage of providing an inexpensive lock which is very easily assembled by a workman and which has absolutely no tendency to release or become inadvertently displaced. In addition, this lock arrangement has the advantage of interconnecting two wires at any point along their length with a connector which is made of two identical parts. Even if the connector is very small the halves of the connector are easily handled by a workman and may be quickly snapped over the wires to lock the two wires in electrical connection.

While preferred embodiments of the invention have been illustrated and described in this application, numerous modifications of the invention will be readily apparent to those skilled in this art. For example, the particular snap-fit lock illustrated in these embodiments could be utilized in different and other typs of connectors than those illustrated. We do not wish to be limited to the particular structure shown in the drawings but intend that the invention be limited only by the scope of the appended claims.

Having described our invention, we claim:

1. A wiring connector for electrically connecting two insulated wires, said connector comprising two halves adapted to be fitted together into locked engagement, at least one of said halves having electrically conductive means mounted thereon adapted to puncture the insulation of wires placed between said connectors when said halves are placed in locked engagement, and snap-fit means on said halves for locking them in engaged relation with a face on one half adjacent and parallel to a face of the other half when said connector is assembled, said snap-fit means comprising a post extending outwardly from said face of said one half and an aperture in the face of the other half, said post having concentric resilient ribs on the periphery thereof, said post being adapted to be received in said aperture and extend through said aperture to lock the halves into engagement.

2. A wiring connector for electrically connecting two insulated wires, said connector comprising two halves adapted to be fitted together into locked engagement, at least one of said halves having electrically conductive means mounted thereon adapted to puncture the insulation of wires placed between said connectors when said halves are placed in locked engagement, and snap-fit means on said halves for locking them in engaged relation with a face on one half adjacent and parallel to a face of the other half when said connector is assembled, said snap-fit means comprising a post extending outwardly from said face of said one half and a tapered aperture in the face of the other half, said post being adapted to be received in said aperture to lock the halves into engagement.

3. A wiring connector for electrically connecting two insulated wires, said connector comprising two halves made from semi-resilient material and adapted to be fitted together into locked engagement, at least one of said halves having electrically conductive means mounted thereon adapted to puncture the insulation of wires placed between said connectors when said halves are placed in locked engagement, and snap-fit means on said halves for locking them in engaged relation with a face on one half adjacent and parallel to a face of the second half when said connector is assembled, said snap-fit means comprising a post extending outwardly from said face of said one half and an aperture in the face of said second half, said second half having a recess in a surface opposite said planar surface, said recess being in a plane intersecting the axis of said aperture whereby the sides of said recess are forced apart when said post is forced into said aperture and are subsequently forced together when said connector is completely assembled to lock said halves in engagement.

4. A wiring connector for electrically connecting two insulated wires, said connector comprising two halves made from semi-resilient material and adapted to be fitted together into locked engagement, at least one of said halves having electrically conductive means mounted thereon adapted to puncture the insulation of wires placed between said connectors when said halves are placed in locked engagement, and snap-fit means on said halves for locking them in engaged relation with a face on one half adjacent and parallel to a face of the second half, said snap-fit means comprising a post extending outwardly from said face of said one half and an aperture in the face of the second half, said post having concentric ribs on the periphery thereof, said second half having a recess in a surface opposite said planar surface, said recess being in a plane intersecting the axis of said aperture whereby the sides of said recess are forced apart when said post is forced into said aperture and are subsequently forced together when said connector is completely assembled to lock said halves in engagement.

5. A wiring connector for electrically connecting two insulated wires, said connector comprising two halves of symmetrical configuration, at least one of said halves having means thereon adapted to electrically connect said wires, each of said halves having cooperating symmetrical snap-fit locking means thereon, said snap-fit locking means comprising a protrusion and aperture on each of said halves whereby the protrusion on one half will be received in aperture of the other half when the halves are placed in locking engagement.

6. A wiring connector for electrically connecting two insulated wires, said connector comprising two halves of identical configuration, each of said halves being made integral of semi-resilient material, at least one of said halves having means thereon adapted to electrically connect said wires, each of said halves having cooperating snap-fit locking means thereon adapted to lock said halves in engagement.

7. A wiring connector for electrically connecting two insulated wires, said connector comprising two halves of symmetrical configuration, each of said halves having an inner face, at least one of said halves having electrically conductive means protruding from said face and adapted to puncture the insulation of said wires to electrically connect said wires, each of said halves having cooperating symmetrical snap-fit means thereon, said snap-fit means comprising a protrusion on the inner face of each half and an aperture in the inner face of each half, said protrusions being adapted to be received in said apertures to lock said halves in engagement with said wires located between said planar faces.

8. A wiring connector for electrically connecting two insulated wires, said connector comprising two halves adapted to be fitted together into locked engagement, at least one of said halves having electrically conductive means mounted thereon adapted to puncture the insulation of wires placed between said connectors when said halves are placed in locked engagement, and snap-fit means on said halves for locking them in engaged relation with a substantially concave face on a first half adjacent a substantially concave face of a second half, said snap-fit means comprising a post extending outwardly from said concave face of said first half and an aperture in the concave face of the second half, said post being adapted to be received in said aperture to lock the halves into engagement, said second half having a recess in a surface opposite said concave face, said recess being in a plane intersecting the axis of said aperture whereby the recess will be caused to narrow and constrict a portion of said aperture when said halves are forced together into locked engagement.

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