

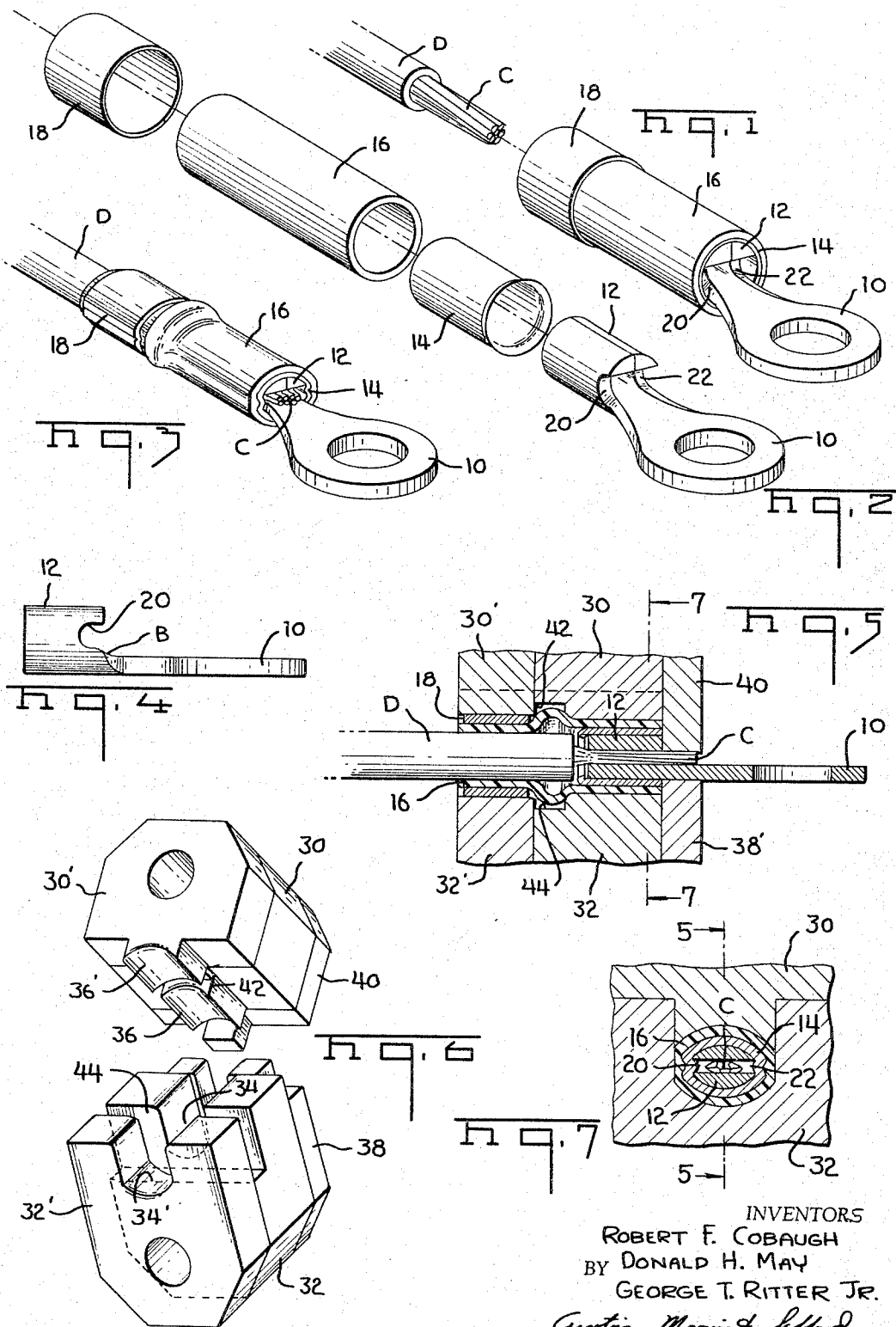
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DIES FOR APPLYING INSULATION TO AN ELECTRICAL CONNECTOR

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DIES FOR APPLYING INSULATION TO AN ELECTRICAL CONNECTOR

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Application Apr. 2, 1965, Ser. No. 445,163, now Patent No. 3,241,098, dated Mar. 15, 1966, which is a continuation of application Ser. No. 122,564, July 7, 1961. Divided and this application Sept. 22, 1965, Ser. No. 489,261

2 Claims. (Cl. 18—36)

This is a division of our prior application, Ser. No. 445,163, filed Apr. 2, 1965, now Patent No. 3,241,098, which is a continuation of Ser. No. 122,564, filed July 7, 1961, now abandoned, for Pre-Insulated Electrical Connector and Dies for Applying Same.

It is frequently desirable to insulate a crimped electrical connection with plastic having operating characteristics in the 500° range. One example of such a plastic is tetrafluoroethylene marketed under the trademark "Teflon" by Du Pont. One of the problems with these plastics is that they have a low compressive strength. As such, if it is attempted to crimp through the plastic to the metal underneath, the plastic may be squeezed out from under the crimping dies. This may cause dielectric failure of the insulating sleeve, rendering it worthless.

It is an object of this invention to provide a means of crimping metal through plastics, particularly useful for plastics having a low compressive strength. It is also an object of this invention to provide such a device to be used with ferrule-type connectors having a rib or "beam" at one end, whereby the required crimping pressure at that end of the insulation sleeve is reduced, thus precluding rupture of the plastic. Also, it is an object of this invention to prevent longitudinal flow at each end of the plastic sleeve whereby the tendency to rupture is reduced. It is a further object of this invention to confine the plastic in all directions and crimp uniformly throughout the entire sleeve of the plastic. It is also an object of this invention to crimp through plastic in the manner designed so as to eliminate sharp corners and thus prevent rupture of the plastic.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there are shown and described illustrative embodiments of the invention; it is to be understood, however, that these embodiments are not intended to be exhaustive nor limiting of the invention but are given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings:

FIGURE 1 illustrates a perspective view of a conductor and a connector made according to the principles of this invention;

FIGURE 2 illustrates an exploded view of the connector shown in FIGURE 1;

FIGURE 3 is a perspective view of the connector of FIGURE 1 crimped onto the conductor;

FIGURE 4 is a side view of a connector body without the insulating sleeve;

FIGURE 5 is a sectional view taken through plane 5—5 of FIGURE 7 and showing the connector and the conductor of FIGURE 1 in a pair of crimping dies;

FIGURE 6 is a perspective view of the dies; and

FIGURE 7 is a section taken through plane 7—7 of FIGURE 5.

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As shown in FIGURE 2, the electrical connector comprises a ring tongue portion 10 which is formed as an integral part of a ferrule member 12. The conductor-receiving portion of the connector may be stamped out of copper and rolled up to form a ferrule. In the preferred, a first metal tubular member 14 surrounds the ferrule 12. A plastic insulating sleeve 16 surrounds the tubular member 14. The sleeve 16 may be of a high temperature plastic such as tetrafluoroethylene, known as "Teflon," even though such material has low compressive strength. An outer metal ring 18 surrounds the free end of the plastic sleeve 16.

As shown in FIGURE 4, the end of the ferrule 12 having the ring tongue 10 emanating therefrom has a relatively high resistance to crimping pressure because of the rib or "beam" formed by the curvature of the metal where it blends from the ferrule into the tongue portion, as indicated by the letter B in FIGURE 4. A pair of recesses 20 and 22 (FIGURES 2 and 4) are formed in each side of the ferrule 12 in the vicinity of the curved portion B. This reduces the crimping pressure needed to be exerted on the ferrule at this point to crimp the ferrule to a conductor C without weakening the crimped connection.

With the connector assembled, a conductor C is inserted into the ferrule 12 with insulation D on the conductor abutting the open end of the ferrule 12 (see FIGURE 5). A pair of crimping dies are then brought to bear on the outer plastic sleeve 16 and metal sleeve 18 so that the pressure required to cold-form or coin the ferrule to the conductor is transmitted through the plastic sleeve to the ferrule 14, thus crimping the ferrule onto the conductor C. The outer sleeve 18 is likewise crimped onto the insulation D of the connector. The insulation 16 is not ruptured or otherwise impaired.

FIGURES 6 and 7 illustrate a pair of dies suitable for crimping plastic having a low compressive strength. The set comprises an indenting die 30 and a nesting die 32. Each die has an insulation support crimping member 30' and 32' adapted to crimp the ferrule 18 on the outside of the connector.

The nesting die 32 is substantially U-shaped and of a length equal to the distance from the free end of the ferrule 12 to the inner end of the ferrule 18. The die surface 34 is slightly longer than the ferrule 12. The bottom surface of the die is arcuate and blends smoothly into a pair of parallel walls to form a U-shaped crimping surface. The indenting die member 30 is of the same length as the die 32 and has an arcuate die crimping surface 36 which has the same radius as the arcuate surface 34. The sides of the indenter die 30 fit snugly within the sidewalls of the die nest 32. The crimping surfaces 34 and 36 have the same radius but reverse curvature so that the combination of the two dies forms an oval in cross-section (see FIGURE 7). The front surface of the lower die 32 contains a plate 38 which is shaped to permit the ring tongue 10 to extend therethrough but precludes lateral extrusion of the plastic sleeve 16. The opposite die 30 has a similar plate 40.

It has been discovered that plastic tends to shrink longitudinally when exposed to extreme temperature conditions. This might tend to expose the end of the ferrule 12 adjacent the ring tongue 10. To preclude this, recessed portions 42 and 44, in each of the dies 30, 32, respectively, permit the insulation 16 to bulge outwardly in this area. The recessed portion is properly radiused to prevent damage to the plastic. When the crimped connection is subjected to extreme heat, the shrinkage will be taken up in the bulge portion, whereby the metal ferrule 12 remains covered with insulation over its entire length.

The insulation support crimping dies 30', 32', resemble

the dies 30, 32, with crimping surfaces 34', 36' corresponding to crimping surfaces 34, 36. However, in closed position (FIGURE 7), the distance between surfaces 34', 36' is slightly greater than between surfaces 34, 36. This accommodates the insulation support ferrule 18. As shown in FIGURE 5, all corners are smoothly radiused to prevent damage to the insulation. When the crimping pressure is applied to the connector, the sleeve or band 18 is crimped to the free end of the plastic sleeve 16. This serves to anchor the plastic in this direction against lateral flow. Continued crimping pressure causes the ferrule 12 to be crimped onto the conductor C. This is accomplished by transmission of crimping pressure through the plastic sleeve 16 to the ferrule 12. The flow plates 38 and 40 preclude extrusion of the plastic in a lateral direction. Furthermore, the notched-out portions 20 and 22 at the front end of the ferrule 12 reduce the required crimping pressure. It also insures that the ferrule begins to collapse in the proper direction when crimping begins.

Crimping is continued until the ferrule 12 snugly is compacted onto the wire C, and the entire terminal is deformed into an oval-shaped, cross-sectional member (see FIGURE 7). The crimping dies are then released and the connector removed therefrom.

It is noted that the final result is a compact, crimped connection having high tensile strength and good operational characteristics at high temperature.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the fore-

going description and accompanying drawings is offered by way of illustration only.

We claim:

1. A pair of dies for crimping a connector having an outer plastic sleeve, a conductor comprising a first die having substantially a U-shaped die surface, a second die disposed to fit within the first die and having an arcuate die surface which is at the same radius but at the reverse curvature to the first die surface, said dies having a length equal to the length of the connector to be crimped, each of said dies having means at one end thereof to prevent longitudinal extrusion of the plastic sleeves on the connector each of said die surfaces having recessed portions located intermediate the ends thereof.

2. The device of claim 1 wherein the means to prevent longitudinal extrusion of the plastic sleeve comprises a plate at one end of each of said dies, said plate adapted to permit the blade-like member to extend out from under the die surfaces but preventing a plastic sleeve on the connector from extruding longitudinally.

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