Feb. 23, 1965 B. GAIZAUSKAS 3,170,230

TOOL FOR REMOVING CONTACTS FROM CONNECTORS

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FIG. 1

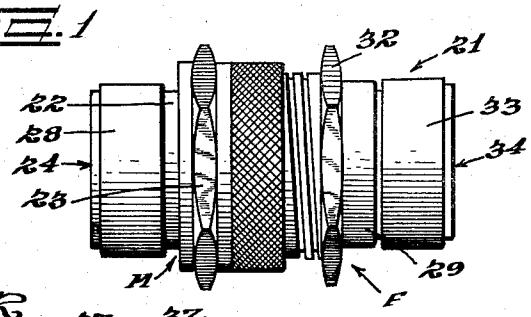


FIG. 2

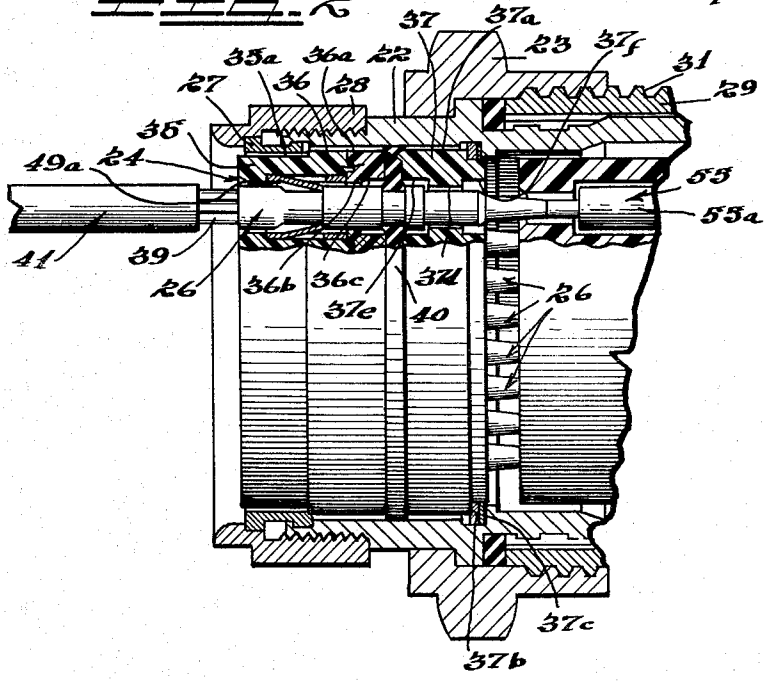
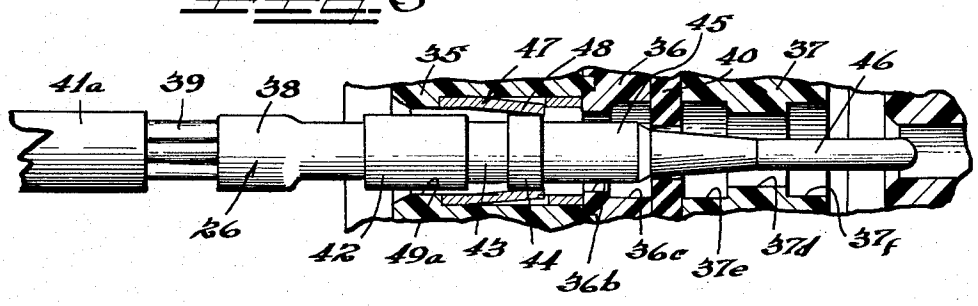


FIG. 3



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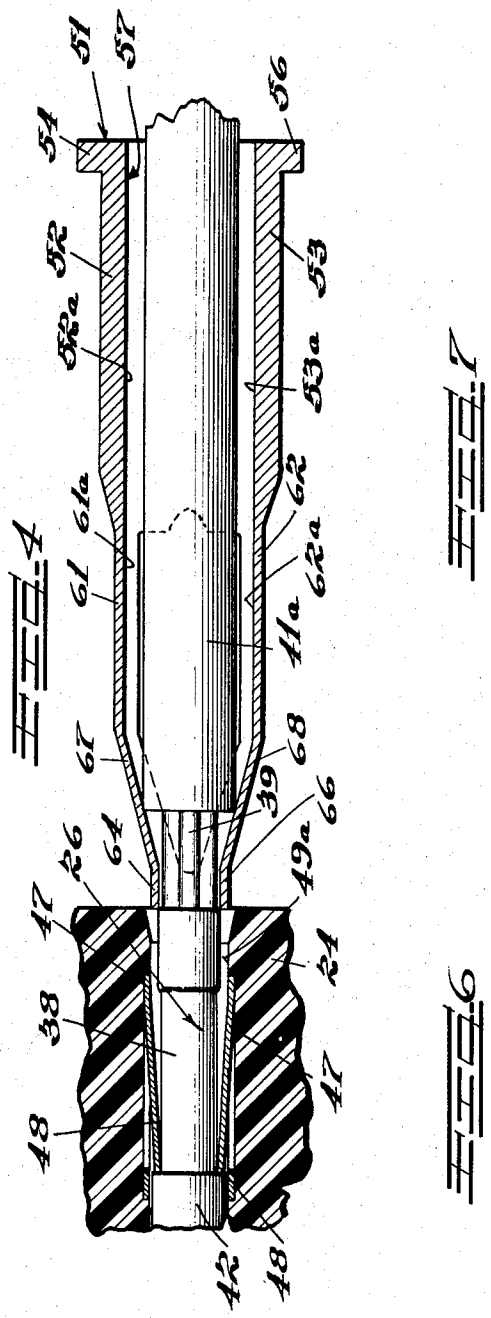


FIG. 4

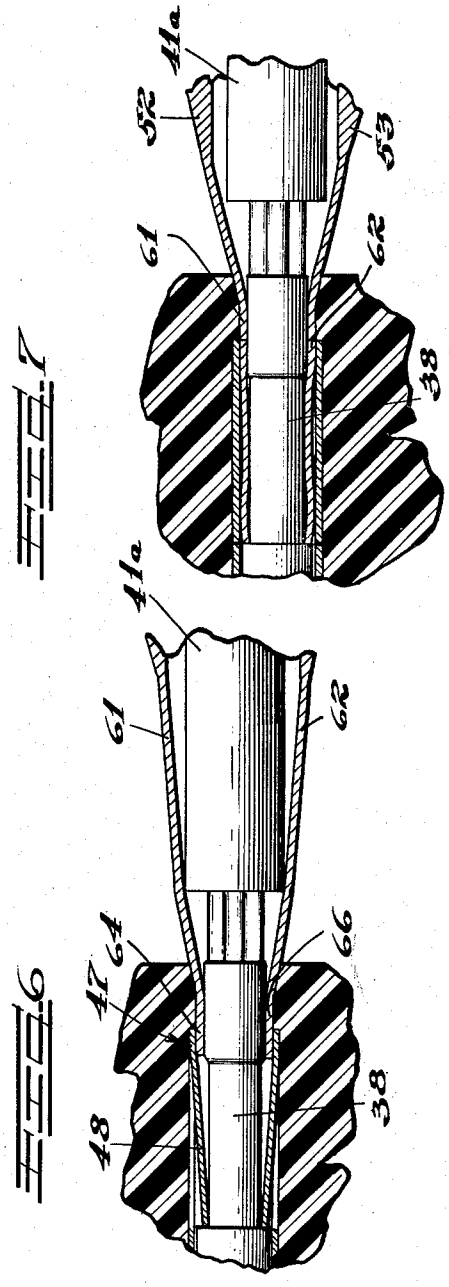


FIG. 7

FIG. 9

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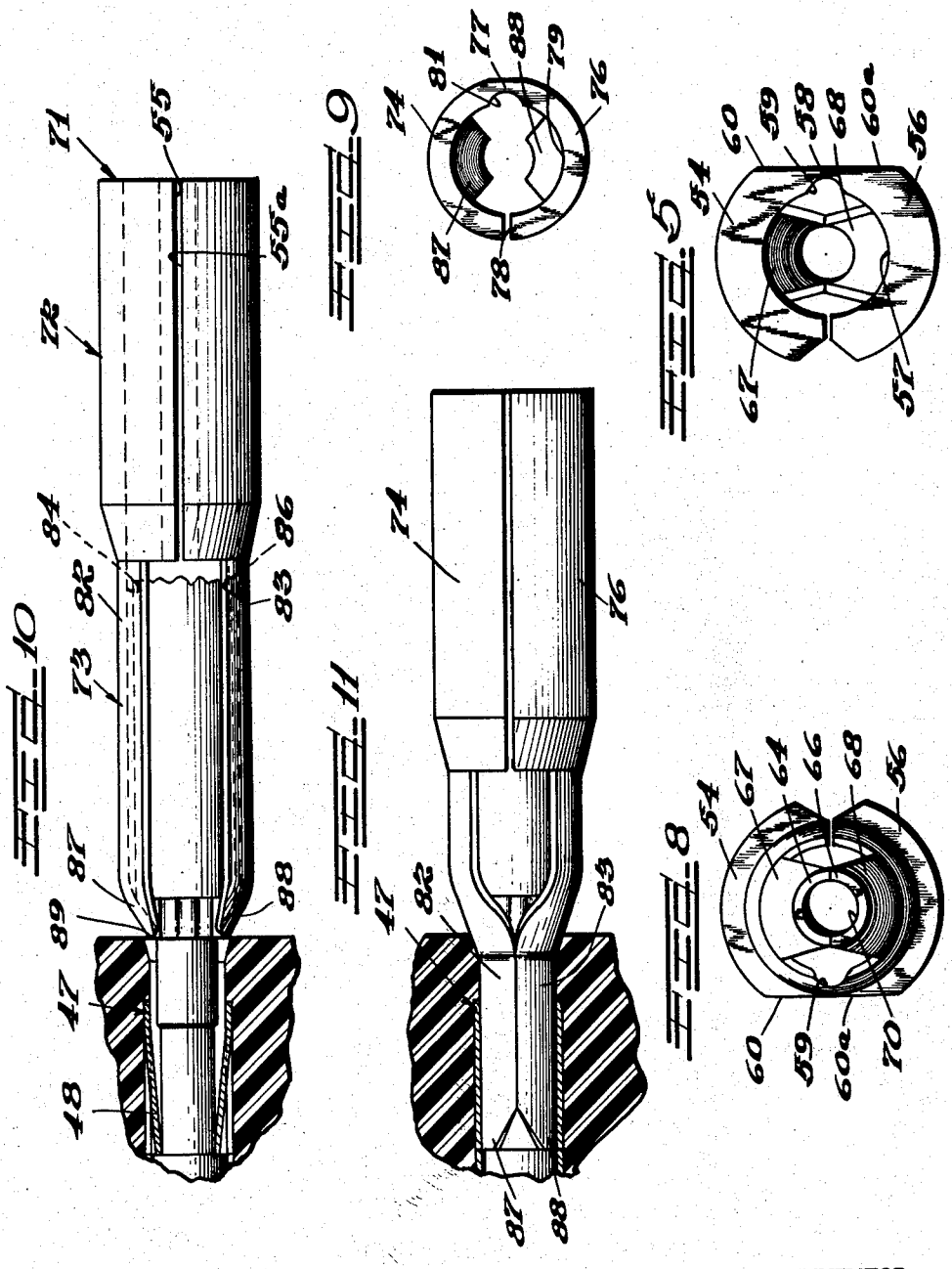
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TOOL FOR REMOVING CONTACTS FROM CONNECTORS

Filed July 11, 1963 3 Sheets-Sheet 3



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3,170,230
TOOL FOR REMOVING CONTACTS FROM CONNECTORS

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5 Claims. (Cl. 29—203)

The present invention relates to a tool for removing contacts from a connector having the capability of radial compression from a diameter large enough to encircle a wire to a smaller diameter compatible with the contact for entry into the cavity of the contact.

Electrical multi-contact connectors contain a plurality of male and female electrical contacts which must be removed from the electrical connector whenever it is desired to replace the contacts.

According to the present invention a flat molded plastic part is provided which consists of two half round sections tied together with a flexible section which can be flexed in the manner of a hinge. Thus, the tool can be effectively used with wires of different diameters without injuring any strains on the tool. Further, the tool can be wrapped around the insulation, thereby eliminating the possibility of wire insulation damage caused by snapping the tool over the wire.

It is therefore an object of the present invention to provide a contact removal tool that will accept a range of wire insulation diameters and contact sizes without damaging the wire insulation and effectively removing the contact from the multi-contact connector.

It is another object of the present invention to provide a radially compressible contact remover that will safely remove a contact from an electrical connector without injuring the wire insulation of the wire connected to the contact.

It is another object of the present invention to provide an improved electrical contact remover having two hinged half sections to accommodate wires having various diameters.

It is still another object of the present invention to provide a molded one-piece contact remover having two hinged half sections with semi-circular grooves therein that are utilized to engage the electrical contact and the wire insulation of the wire connected to the electrical contact.

It is still further another object of the present invention to provide an electrical contact remover made of a single molded plastic piece having two hinged-together half formed with semi-circular grooves therein and with the portion of the contact remover that engages the electrical contact having a converging end portion.

These and other objects, features and advantages of the present invention will become more apparent from a careful consideration of the following detailed description when considered in conjunction with the accompanying drawings illustrating a preferred embodiment of the present invention and wherein like reference numerals and characters refer to like and corresponding parts throughout the several views.

On the drawings:

FIGURE 1 is an elevational view of a multi-contact electrical connector that may utilize the contact removal tool of the present invention;

FIGURE 2 is a partial longitudinal cross-sectional view of the electrical connector illustrated in FIGURE 1 illustrating the position of an electrical contact in the electrical connector with corresponding wire means suitably attached to one contact for illustrative purposes.

FIGURE 3 is an illustrative step showing the partial

removal of the electrical contact from its insulative mounting means;

FIGURE 4 is a partial longitudinal cross-sectional view with parts in elevation, illustrating the electrical contact remover of the present invention being placed in the initial stage of removing an electrical contact from a multi-contact connector;

FIGURE 5 is a front view of the electrical contact remover illustrated in FIGURE 4;

FIGURE 6 is a partial cross-sectional view with parts in elevation of the contact remover of the present invention partially inserted into an electrical connector to remove an electrical contact therefrom;

FIGURE 7 is a partial longitudinal cross-sectional view with parts in elevation, illustrating the contact remover of the present invention being completely inserted in a connector to remove an electrical contact from the connector;

FIGURE 8 is a rear view of the contact remover of the present invention illustrated in FIGURE 4;

FIGURE 9 is an end view of another electrical contact remover manufactured in accordance to the principles of the present invention;

FIGURE 10 is a longitudinal cross-sectional view with parts in elevation of the electrical contact remover of the present invention illustrated in FIGURE 9 being in an initial position to remove an electrical contact from an electrical connector; and

FIGURE 11 is a partial longitudinal cross-sectional view with parts in elevation of the electrical contact remover illustrated in FIGURE 10, being in position to withdraw an electrical contact from an electrical connector.

As shown on the drawings:

The present invention is concerned with an electrical contact removing tool that may be utilized to remove electrical contacts from the rear of an electrical connector. The removing tool of the present invention is preferably a one-piece molded plastic tool having two substantially equal semi-circular half sections. Each semi-circular half section has a rear flat surface so that they may be folded at their hinged section to form a substantially cylindrical passageway therethrough with said passageway converging to form a contact mouth at the open end of a contact engaging portion. Also, the contact remover is preferably made with the contact engaging portion thereof having a lesser thickness than the wire insulation engaging portion thereof and formed only of arcuate sections.

The contact remover of the present invention may be utilized with contacts and corresponding wire insulations having various diameters. The removal tool is wrapped around the contact wire with its contact mouth end adjacent the electrical contact socket portion. The remover contact portion is inserted around the end of the contact and is radially compressible for entry into the contact cavity. The removal tool of the present invention securely grasps the contact socket portion and removes the contact from the connector with its longitudinal axis substantially parallel to the other contacts in the connector and without injuring the connector contact, or its corresponding wire insulation.

Referring to FIGURE 1 there is illustrated an electrical connector 21 having a male component indicated at M and a female component indicated at F. The two components M and F constituting separable members of a multi-pin or a multi-contact connector assembly. The male component M has a cylindrical housing 22 internally structured to receive a mounting means 24 retaining male contact members 26 and a rigid thin wall sleeve or tube 27 around the end of the mounting means 24. The

sleeve 27 is retained in position by a nut member 28 which is internally threaded for engagement with an external threaded portion of the housing 22.

The female component F has a housing 29 sized to receive in telescoping relation, in the end thereof, housing 22 and is externally threaded as at 31 for engagement with an internally threaded nut member 23.

A tool engaging flange 32 is formed on the female housing 29 and the outer end thereof is externally threaded for cooperation with a nut member 33 similar to the nut member 28. A mounting means 34 is retained within the housing 29 by means of said nut 33 and associated structure such as a thin wall rigid sleeve or tube corresponding to the sleeve or tube 27. Desirably, the mounting means 34 also corresponds structurally to the mounting means 24, has a plurality of rigid cylindrical plastic insulating members 35, 36 and 37 and a cylindrical resilient rubber seal member 40 sandwiched between insulating members 36 and 37.

Referring to FIGURES 2 through 4, a typical male contact member indicated generally by the reference numeral 26 is provided with a socket portion 38 having a recess in which the bared end 39 of a sheathed conductor wire 41 may be inserted. The socket portion 38 is crimped to the wire end 39 and is inserted therewith. The socket portion of the contact member 26 terminates in a radially large circumferentially continuous rib 42. Spaced from the rib 42 is a second rib 44 with a reduced medial section 43 connecting said first and second ribs to define a contact groove. Extending forwardly from the rib 44 on the male current-continuing means is a generally circular contact body portion 45 which converges into a reduced diameter cylindrical male insertion portion 46.

The mounting means 24 has a plurality of cylindrical contact openings 49*a* formed through the back insulation means 35 with the openings 49*a* having a diameter larger than the diameter of the first male contact rib 42 and has an outer surface 35*a* that has a stepped configuration so as to be spaced approximately an equal distance from the inner walls of the tube 27 and inner housing walls 22. The back insulation member 35 is suitably connected to intermediate insulation member 36 and has a collet 47 mounted in each passage 49*a* flush with the inner walls thereof. The collets 47 have tines 48 that engage the back shoulder of the rib 42 to retain the male contact in the connector.

The intermediate insulation member 36 has an outer surface 36*a* having a diameter slightly less than the diameter of the housing wall 22 and being continuous with the outer surface of the back insulation member 35. The intermediate member 36 is counterbored so as to form a cylindrical passage 36*b* having a diameter slightly larger than the diameter of the rib 42 adjacent the back member 35 and a counterbored contact bore 36*c* adjacent the back face of the sealing member 40.

The forward insulation member 37 has an outer surface 37*a* with a stepped configuration that is spaced from the housing wall 22 and has a shoulder 37*b* for bottoming a biasing means 37*c*. The forward insulation members are counterbored at each end to form a cylindrical passage 37*d* having a diameter slightly larger than the diameter of the contact body 45; a back counterbored cylindrical contact bore 37*e* having a diameter equal to the diameter of the intermediate insulation member contact bore 36*c* and in contact with the forward face of the rubber seal 40 and a forward counterbored passage 37*f*.

The rubber seal means 40 is sandwiched between the intermediate insulation member 36 and the forward insulation member 37. Both of the insulation members 36 and 37 have protrusions on their facing end walls to pinch and securely grasp the rubber seal as illustrated in FIGURE 2. The outer diameter of the rubber seal is larger than the inner diameter of the housing 22. Therefore, when the mounting means 24 is inserted in the housing 22, the outer periphery of the seal 40 is compressed to seal the housing 22.

A plurality of holes are formed through the rubber seal and are set to be concentric with respective insulator passages 36*b* and 37*b*. The seal holes have a diameter smaller than the diameter of the male contact groove 43 and a thickness smaller than the distance between the ribs 42 and 44. Also, the amount of protrusion of the rubber seal is such that the rubber seal will be compressed and present pressure surfaces in abutting sealing relation against the respective rib shoulders 42 and 44 in a low pressure system illustrated in FIGURE 2 or in flapper sealing arrangement.

It is of course understood that the plurality of female contacts 55 (FIGURE 2) in the mounting means 34 are similar to the male contacts except they have a female receiving portion 55*a* for receiving the male insertion portion 46. Sheathed conductor wires 41 are press fitted into the female contact socket portion which is similar to the male contact socket portion 38.

Referring to FIGURES 4 through 8 there is illustrated one embodiment of the present invention. An electrical connector having electrical contacts therein with the bare portion 39 of the sheathed wire 41 in the socket portion thereof and said electrical wire having an insulating covering 41*a*. The contact is held in the electrical connector by a cylindrical rubber seal 40 and collet means 47 having tines 48 contacting the shoulder of the rib 42.

The tool of the present invention is a one-piece molded plastic tool 51. The tool 51 has two substantially semi-cylindrical wire engaging end walls 52 and 53 with shoulders 54 and 56 radially extending from one end thereof to provide a means for grasping said tool 51. The walls 52 and 53 have substantially concave semi-cylindrical inner surfaces 52*a* and 53*a* that are to be wrapped around the wire insulation 41*a*. A portion of the outer surface of each end wall is segmented from one edge to form contiguous flat walls 60 and 60*a* respectively.

The end walls 52 and 53 are integrally hinged together at said one edge to form hinge 58 extending substantially the length of the end walls, and when the other edges 55 and 55*a* of each wall 52 and 53 are joined together as illustrated in FIGURES 4 through 8, the inner surfaces 52*a* and 53*a* form a substantially cylindrical opening 57.

Along the interior of the hinge is formed a semi-cylindrical groove 59 extending the length of the passageway 57 to allow the tool to be opened and closed to accommodate various sizes of wires and contacts without putting undue stresses and strains on the hinge that would cause the hinge to rupture prematurely.

Longitudinally and integrally extending from the other end of the walls 52 and 53 are two arcuate contact engaging walls 61 and 62 having facing concave inner surfaces 61*a* and 62*a* respectively. The arcuate walls extend for a predetermined distance and have their inner surfaces that are continuous with the surface of the passage 57. The ends of the arcuate walls are reduced substantially semi-cylindrical passage 70 when joined together, as illustrated in FIGURE 4. The thickness of the arcuate walls 61 and 62, converging arcuate walls 67 and 68, and the semi-cylindrical end walls 64 and 66 are substantially equal and a predetermined amount less than the thickness of the wire end walls 52 and 53.

The tool member 51 of the present invention is placed around the wire 41 with its semi-cylindrical end walls 64 and 66 adjacent the mouth of the mounting member opening 49*a*. The tool is then urged into the connector opening 49*a* between the walls of the opening 49*a* and the contact socket portion 38. As the removing tool 51 is urged into the opening 49 (FIGURES 6 and 7), it is radially compressed and surrounds the contact socket portion 38 and urges the collet tines 48 upwardly into the mounting member 24 to prevent them from interfering with the sliding of the contact 26 in the opening 49*a*.

The final position of the removing tool in conjunction with the contact and collet members is illustrated in FIGURE 7. The tool portion formed by the walls **52** and **53** surrounds the wire insulation **41***a* while the tool portion formed by the walls **61, 62, 64, 66, 67** and **68** engages the contact socket portion **38**. The portion of the tool engaging the contact has a sufficient flexibility and column strength to develop enough force to expand the collet **47** when it is restrained between the outer diameter of the contact and the inner bore of the rigid plastic insulating member **35**.

The removing tool of the present invention, with its hinge features, allows the tool to be used with a plurality of varied diameter wires without imposing any strains on the tool. This feature also allows the tool to be wrapped around the wire insulation and thereby eliminating the possibility of wire insulation damage caused by snapping the tool over the wire.

Referring to FIGURES 9 through 11, there is illustrated another embodiment of the present invention utilizing a one-piece hinged molded plastic electrical contact remover **71** having a wire insulation wrap portion **72** and a contact wrap portion **73**. The insulation wrap portion comprises two semi-cylindrical walls **74** and **76** being integrally hinged together at one edge thereof forming a hinge **77** and the other edges thereof forming a slot **78** opposite said hinge portion and extending the length thereof. The facing concave inner surfaces of said walls **74** and **76** form a substantially cylindrical passageway **79** when said tool is in a substantially closed position as illustrated in FIGURES 9 through 11. The cylindrical passageway has a semi-cylindrical groove **81** formed therein opposite the hinge **77** and extending the length thereof that allows the contact removing tool **71** to open and close without undue strain on the tool hinge.

Extending concentrically with the wire portion **72** is the contact portion **73**. The contact engaging portion has longitudinally extending arcuate walls **82** and **83** having a smaller outer diameter than the diameter of the walls **74** and **76** and extend respectively therefrom. The inner surfaces **84** and **86** of the walls **82** and **83** respectively are concentric and contiguous with the cylindrical passage **79**. The ends **87** and **88** of the walls **82** and **83** respectively converge inwardly to form a contact mouth **89** having an inner diameter smaller than the opening **79**.

The contact removing tool **71** is positioned at the mouth of the connector passageway **49***a*, as illustrated in FIGURE 10, with the tool surrounding the wire insulation **41**. The tool is urged into the passage between the contact socket portion **38** and the walls of the passage **49***a*. The contact portion **73** is radially compressed and substantially surrounds the contact socket portion **38** and is of such flexibility and column strength that it develops enough force to expand the collet **47** to raise the collet tines **48** into the insulation contact mounting means and out of engagement with said electrical contact socket portion to allow the contact to slide in the passageway **49***a*, as is illustrated in FIGURE 11.

When the contact tool of the present invention is in the positions illustrated in FIGURES 7 and 11, the tool may be pulled away from the connector. The tool is in engagement with the contact and fixedly and forcefully engages the socket portion thereof. When the tool is urged backward, the contact is removed from the sealing means and the insulating members to a position illustrated by FIGURE 3. The thickness of the tool contact portion **73** is a predetermined amount smaller than the thickness of the tool insulation portion **72**. The two thicknesses insure the removing tool with sufficient strength for proper removal of varied diameter wires and contacts without undue strain on the tool and without damage to said wires and contacts.

The contact tool remover of the present invention is manufactured of a plastic material i.e. polypropylene.

It is seen where I have provided an electrical contact removing tool which may be utilized with contacts having wire connected therewith of varying diameters. Said contact tool effectively removes an electrical contact from an electrical connector without injuring the electrical contact or its corresponding wire.

Although minor modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

1. A one-piece molded plastic remover tool adapted to remove an article from a container comprising:
   - a pair of substantially semi-cylindrical walls each forming a substantially concave semi-cylindrical inner surface,
   - a segmented portion of the outer surface beginning at one edge of each of the semi-cylindrical walls forming a flat outer surface thereon,
   - an integral hinge extending the length of the semi-cylindrical wall and formed by joining together the one edge of each semi-cylindrical wall so that the flat surfaces of each semi-cylindrical wall are substantially contiguous,
   - a substantially cylindrical passage formed by substantially contacting the other edges of said semi-cylindrical walls,
   - a substantially semi-cylindrical groove formed on the inner surface of said hinge and extending the length thereof providing said tool with flexibility and preventing undue strain thereon,
   - an arcuate wall integrally and longitudinally extending from one end of each of said semi-cylindrical walls with their longitudinal centers spaced approximately 180° apart,
   - the inner surface of said arcuate wall being concentric and contiguous with the inner surfaces of the semi-cylindrical walls to form engaging surfaces, said arcuate walls converging at their ends, and the thickness of the arcuate walls being less than the thickness of the semi-cylindrical walls whereby said remover wraps the arcuate walls around a portion of the article to grasp the article for removal from the container without injuring the article and said tool being capable of extracting more than one size article from the container.

2. A tool for removing contacts from a contact carrier in an electrical connector comprising
   - a pair of conductor wire engaging walls having
   - an integral hinge interconnecting said walls,
   - and said hinge having a groove formed in its inner surface coextensive in length with said hinge and said walls,

   whereby said tool may be opened and closed to accommodate wires and contacts of varying size,
   - said walls having portions of different thickness along the length thereof to form a thicker wire insulating wrap portion at one end of the tool and a thinner contact wrap portion at the other end of the tool,
   - said contact wrap portion terminating in a contact mouth at the end thereof for insertion into a contact carrier of an electrical connector in surrounding relation to a contact connected to a conductor wire and retained in the carrier by the tines of a collet,
   - said tool being made of a material having sufficient flexibility and column strength to expand the collet tines retaining the contact in the connector while extracting the contact from the connector carrier.

3. A tool as defined in claim 2, and further characterized by
   - shoulders extending radially outwardly of said wire insulation wrap portion to facilitate manipulation of the tool.

4. A tool as defined in claim 2, and further characterized by

said contact wrap portion having ends converging inwardly to form a said contact mouth with a diameter of reduced dimension.

5. A tool as defined in claim 2, and further characterized by

said walls being preformed to form inner concave surfaces of semi-cylindrical configuration and arcuate walls of converging configuration longitudinally inwardly of the contact mouth of the tool.

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