

Nov. 8, 1966

S. N. BUCHANAN

3,284,754

SNAP-ON TYPE ELECTRICAL WIRE CONNECTOR

Filed Dec. 16, 1963

2 Sheets-Sheet 1

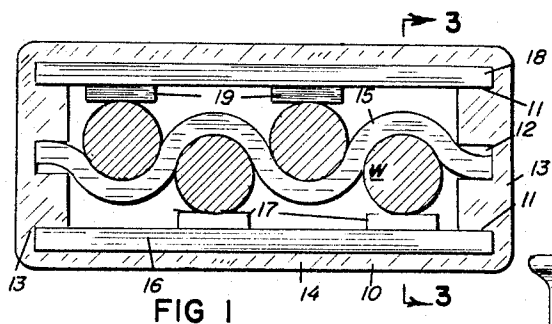


FIG 1

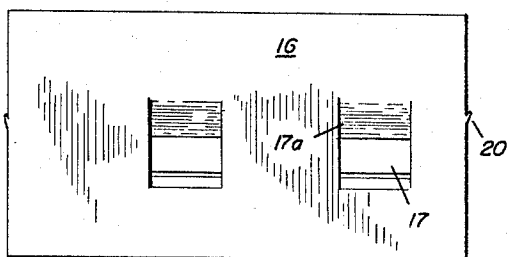


FIG 4

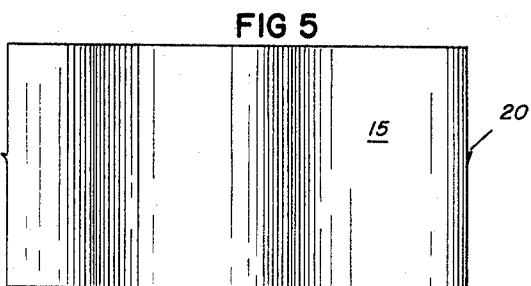


FIG 5

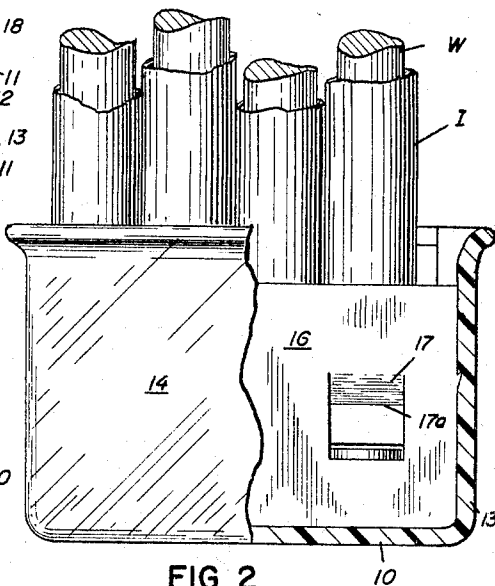


FIG 2

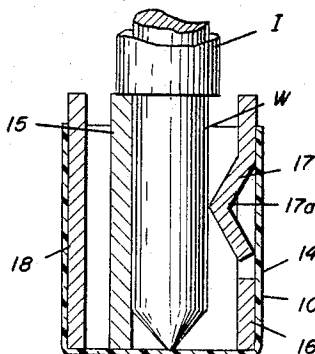


FIG 3

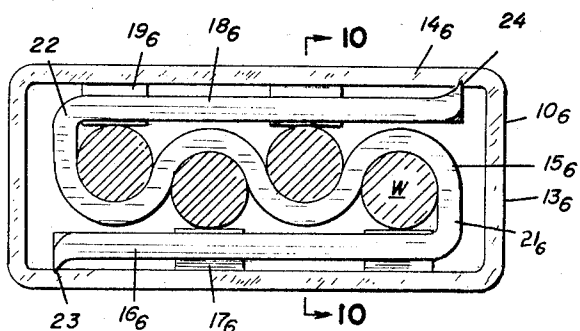


FIG 6

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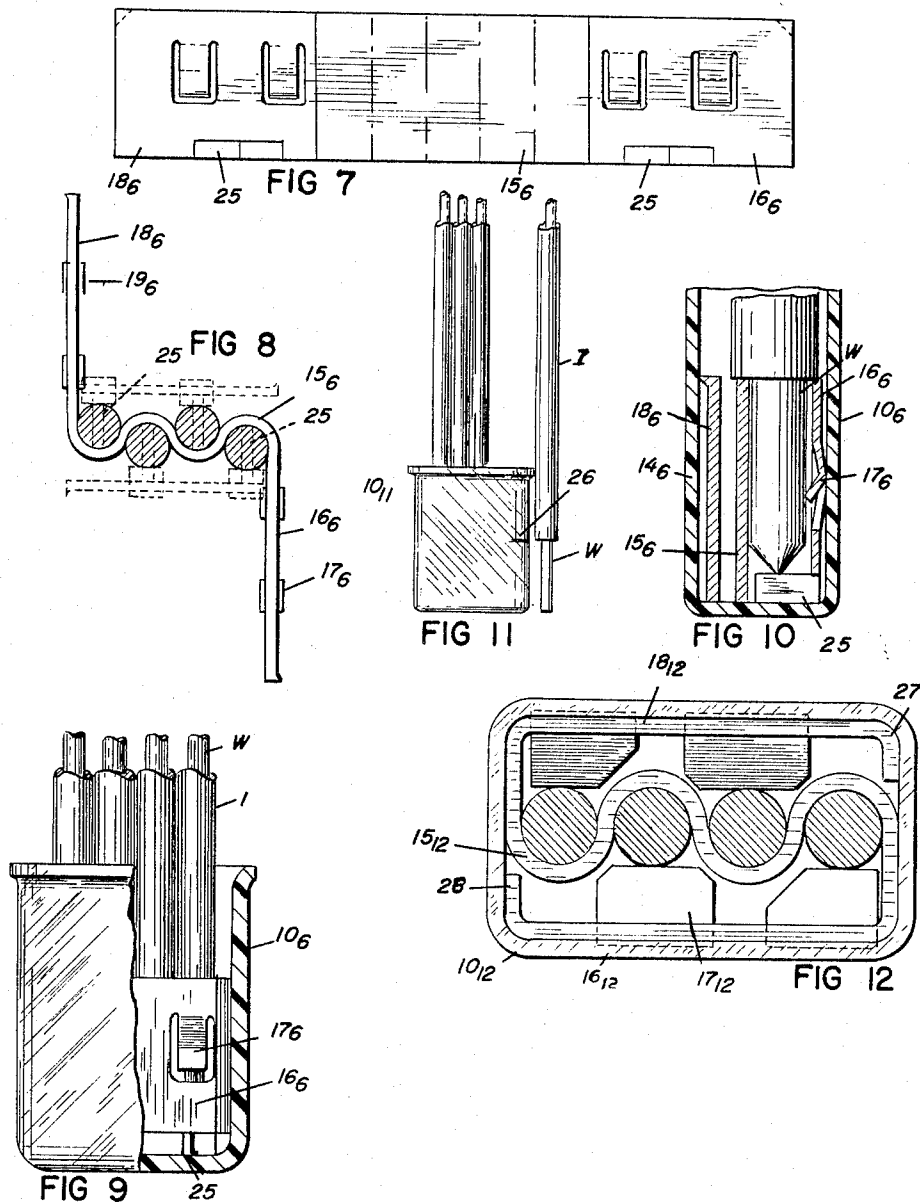
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SNAP-ON TYPE ELECTRICAL WIRE CONNECTOR

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2 Sheets-Sheet 2



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3,284,754

## SNAP-ON TYPE ELECTRICAL WIRE CONNECTOR

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3 Claims. (Cl. 339-95)

The present invention relates to a connector for electrical wires, and more particularly to a connector for connecting the ends of at least two such electrical wires together.

There have been proposals for connectors for connecting the ends of electrical wires, but the ones which are most commonly used, particularly for house wiring, all have several drawbacks. Most prominent among these drawbacks is the fact that once the connector has been applied to the ends of the wires to be joined, the connection is complete and cannot have further wires added to it. In addition, in many such connectors, the wires must be first twisted or otherwise joined together and then the connector is applied, and often the subsequent application of the connector involves a further operation in addition to the application of the connector to the pre-joined wires, such as a bending or a crimping of the connector.

It is an object of the present invention to provide a snap-on type of electrical wire connector which is used simply by inserting the wires to be joined into the connector.

It is a further object of the present invention to provide a snap-on type of electrical wire connector in which wires can be added to a connection after an initial connection between a plurality of wires has been made.

It is a still further object of the present invention to provide a snap-on type of electrical wire connector which has the just mentioned advantages, yet which is simple in its construction and is easy and inexpensive to make.

To this end there is provided a cup of insulating material in which is positioned a plate comprising at least wire positioning means and, spaced from the said plate, a further plate having at least wire retaining means as a part thereof. Ends of wires which are inserted into the space between the two plates are positioned in side by side relationship by the positioning means which comprise the one plate, and are held from being pulled out of the connector by the wire retaining means which comprise the further plate. It is not necessary to twist the wires together prior to their insertion into the connector, and if the connector is made to take, for example, four wires, if only two wires are initially inserted into it, two further wires can later be inserted and added to the connection.

A fuller understanding of the invention will be gained by a reading of the following specification and claims, which describe preferred embodiments of the invention in greater detail, in connection with the accompanying drawings, in which:

FIG. 1 is a sectional plan view through one embodiment of the connector according to the invention;

FIG. 2 is a side elevation view, partly broken away, of the connector of FIG. 1;

FIG. 3 is a sectional view taken on line 3-3 of FIG. 1;

FIG. 4 is a side elevation view of a retaining plate of the connector of FIG. 1;

FIG. 5 is a side elevation view of a wire positioning plate of the connector of FIG. 1;

FIG. 6 is a sectional plan view through a slightly modified form of the embodiment of FIG. 1;

FIG. 7 is a developed view on a smaller scale, of the wire positioning plate and the wire retaining plates of the embodiment of FIG. 6;

FIG. 8 is a diagrammatic plan view showing how the

member shown in FIG. 7 is bent up to properly position the wire positioning plate and the wire retaining plate relative to each other;

FIG. 9 is a side elevation view, partly broken away, of the form of the connector shown in FIG. 6;

FIG. 10 is a sectional view, taken on line 10-10 of FIG. 6;

FIG. 11 is a side elevation view showing a connector according to the invention on a reduced scale and illustrating diagrammatically how a wire is stripped for insertion into the connector; and

FIG. 12 is a sectional plan view of further modification of the embodiment of FIG. 1.

One embodiment of the connector as shown in FIGS. 1-5 comprises a cup 10 of a moldable or extrudable insulating material, such as plastic, for example nylon, or hard rubber. The cup 10 is elongated and has a substantially rectangular cross section. In this embodiment, there are recesses in the form of grooves 11 in the inside surfaces of the end walls 13 of the cup adjacent the side walls 14 of the cup. In addition there is a further recess in the form of groove 12 in the inside surface of the end walls 13 substantially midway between the side walls 14. Inserted into the grooves 12 is a first or wire positioning plate 15 of electrically conducting material preferably copper or a copper alloy, such as brass or bronze, and having undulations formed therein which form recesses in the plate 15 and constitute means for positioning wires W relative to each other. Inserted into the grooves 11 adjacent one side wall of the cup 10 is a second or wire retaining plate 16 having wire retaining means opposite the undulations in plate 15 in the form of inwardly bent retaining fingers 17 which are cut out of the material of the plate 16 and bent inwardly of the cup toward the wire positioning plate 15. The plate 16 is made of spring steel or some equivalent conducting material which is stiff and resilient. In the embodiment shown, the fingers 17 have a bend in them at 17a which is adapted to engage the periphery of the wire W and press it against the wire positioning plate and at the same time retain it in position in the cup 10 against forces tending to withdraw it. Each of the plates 15 and 16 has a notch 20 in each vertical edge thereof which faces in a direction such that the upper edge of the notch digs into the material of the cup 10 so as to prevent withdrawal of the plates from the cup while at the same time permitting them to be inserted into the grooves 11 and 12 easily.

In order to connect a plurality of wires with the connector, the insulation I is first stripped from the ends of the wires W, as is usually done in making a connection. Then the wires W are simply inserted into the cup 10 into the undulations in the wire positioning plate 15. As the wires are forced downwardly into the cup, they spring the wire retaining fingers 17 back toward the wire retaining plate 16. The wires can be moved downwardly into the cup 10 until the ends of the wire abut the bottom of the cup. At this point, the wires will be firmly pressed toward the wire positioning plate 15 by the action of the fingers 17 tending to spring back toward the plate 15, and at the same time the wires will be gripped firmly between the fingers 17 and the plate 15 so that they cannot be removed from the connector. Each wire that is to be connected in the connection is inserted into a separate undulation in the wire positioning plate, the electrical circuit being completed through both the wire positioning plate 15 and the wire retaining plate 16.

In the embodiment of FIGS. 1-5 there is provided a further wire retaining plate 18 which is inserted into the grooves 11 adjacent the other side wall 14 of the cup 10. The further retaining plate 18 has wire retaining means opposite the undulations in the wire positioning plate 15

in the form of fingers 19 in the same manner as does the wire retaining plate 16. Since the undulations in the plate 15 which face toward the further wire retaining plate 18 are between the undulations which face the wire retaining plate 16, the fingers 19 will be offset from the fingers 17. As a result, when wires are inserted into the undulations between plate 15 and fingers 19, the wires retained by the fingers 19 will lie partially between the wires retained by the fingers 17. Since the wire positioning plate 15 is in contact with all of the wires, i.e. the wires on both sides of the wire positioning plate, all of the wires in the connector will be in electrical contact, and all of the wires will therefore be electrically connected to each other.

It will thus be seen that the wires W need not be twisted together, and that they are simply inserted into the connector without any crimping or other deformation being required. Moreover, if after three wires are connected together by the four wire connector of FIGS. 1-5, it is desired to add a fourth wire to the connection, all that is necessary is to insert the fourth wire. It is not necessary to cut the connector off, twist the original three wires together with the fourth wire and then place the joined wires into a connector. Further, the manufacture of the connector is very easy. The cup 10 can be molded or extruded and the plates 15, 16 and 18 can each be cut out and stamped in a single operation. The plates can then be inserted quickly and easily into the cup either by hand or by automatic machinery.

It is of course clear that the size of the connector can be varied, the four wire connector being shown only for the sake of convenience. Connectors for two, three, five, etc. wires can easily be made in exactly the same manner.

In the modified form of the embodiment of the connector of the present invention which is shown in FIGS. 6-10, the wire positioning plate 15<sub>6</sub> and the wire retaining plates 16<sub>6</sub> and 18<sub>6</sub> are joined together into a single piece which is preferably of Phosphor bronze, beryllium copper, or springy brass. The cup 10<sub>6</sub> is the same as in the embodiment of FIGS. 1-5 with the exception that there are no grooves in the end walls. Instead both the end walls 13<sub>6</sub> and the side walls 14<sub>6</sub> are plane. The undulating wire positioning plate 15 has one thereof joined to one end of the wire retaining plate 16<sub>6</sub> by a side plate connecting member 21 and has the other end thereof joined to one end of the wire retaining plate 18<sub>6</sub> by a side plate connecting member 22. The retaining means forming part of the wire retaining plates are fingers 17<sub>6</sub> and 19<sub>6</sub> which are the same as the fingers 17 and 19 of the embodiment of FIGS. 1-5.

As can be seen from FIGS. 7 and 8, the single piece which makes up the wire positioning plate 15<sub>6</sub> and the wire retaining plates 16<sub>6</sub> and 18<sub>6</sub> which are joined to each other by the side plate connecting members 21 and 22 can be stamped out in a single operation and the fingers 17<sub>6</sub> and 19<sub>6</sub> bent out of the plate at the same time. Thereafter, the central portion which is undulated is held in a fixed position and the end portions which forms the wire retaining plates are bent back parallel to the central portion, as seen in FIG. 8. All of the plates can then be inserted into the cup 10<sub>6</sub> in a single inserting operation.

In order to retain the unit in the cup 10<sub>6</sub> the free ends of the retaining plates 16<sub>6</sub> and 18<sub>6</sub> have outwardly pointed projections 23 and 24 thereon pointing away from the wire positioning plate. These projections dig into the material of the cup 10<sub>6</sub> and prevent the unit from being withdrawn.

In addition, in this modification of the embodiment, there are provided wire end stops 25 which are bent out of the bottom edges of the wire retaining plates 16<sub>6</sub> and 18<sub>6</sub> toward the wire positioning plate 15<sub>6</sub> at points directly beneath the fingers 17<sub>6</sub> and 19<sub>6</sub>. As best seen in FIG. 10, these stops 25 act as abutments for the ends of the wires W as they are inserted into the connector. These stops thus protect the bottom of the cup 10<sub>6</sub> from

the ends of the wires which are often pointed or sharp from having been cut by wire cutters or the like.

FIG. 11 shows a connector according to the invention in which a mark 26 has been placed on the outside of the cup 10<sub>11</sub> at a point which is spaced from the outside surface of the bottom of the cup a distance equal to the vertical dimension of the wire positioning and wire retaining plates. This mark is used to determine the amount of insulation I to strip from a wire W so that when the wire is inserted into the connector the insulation will just touch the top of the wire positioning and wire retaining plates.

In a further modification of the embodiment of FIGS. 1-5, as shown in FIG. 12, the free ends of the wire retaining plates 16<sub>12</sub> and 18<sub>12</sub> are bent inwardly toward the wire positioning plate 15<sub>12</sub> and the inwardly bent ends 27 and 28 press against the end walls 13<sub>12</sub> of the cup 10<sub>12</sub> to retain the unit made up of the wire positioning plate and the wire retaining plates in position in the cup.

There has thus been provided an electrical connector which is used simply by inserting the wires into the cup between the wire positioning means and the wire retaining means. The connector functions to retain the wires in the connector without the necessity of any further operation, such as crimping or bending. For embodiments of the connector where there are provided positions for more than two wires, wires can be added to the connection between the first two wires simply by inserting the additional wires into the connector without it being necessary to remove the connector from the first two wires.

Since the connector is made of only a few parts, the cup and the wire positioning and wire retaining plates, it is simple and easy to make. The cups can be easily molded or even extruded, and the plates can be cut and stamped and even bent up into the single units in a single operation. There only remains the insertion of the unit containing the plates into the cup to complete the connector.

It is thought that the invention and its advantages will be understood from the foregoing description and it is apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing its material advantages, the forms hereinbefore described and illustrated in the drawings being merely preferred embodiments thereof.

What is claimed is:

1. An electrical wire connector, comprising a cup of insulating material and having a cup opening, a wire positioning plate of conducting material positioned in said cup and being undulated to define recesses in staggered positions on opposite sides of said wire positioning plate which form wire positioning means, a first wire retaining plate positioned in said cup on one side of said wire positioning plate and having wire retaining means projecting therefrom and being spaced from said wire positioning plate to define a space between said plates opening out of the cup opening and into which the ends of wires to be connected are inserted, and a second wire retaining plate positioned in said cup on the other side of said wire positioning plate and having a wire retaining means projecting therefrom and being spaced from said wire positioning plate to define a space between said plates opening out of the cup opening and into which the ends of wires to be connected are inserted, the wire retaining means projecting from the respective wire retaining plates being opposite recesses in said undulating wire positioning plate which open toward the respective wire retaining plates.

2. An electrical wire connector as claimed in claim 1 in which said cup is substantially rectangular in cross section and has end walls having grooves therein opening into the interior of said cup, said plates being separate

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from each other and having the edges thereof in said grooves to position the plates in said cup.

3. An electrical wire connector as claimed in claim 1 in which said cup is substantially rectangular in cross section, and said wire positioning plate has one end joined to the corresponding end of said first wire retaining plate and has the other end joined to the corresponding end of said second wire retaining plate, said wire positioning plate and said wire retaining plates being a single piece of conducting material bent in a shape having the retaining

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plate portions parallel to the undulated wire positioning plate portion.

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