FORMING DEVICE FOR INSULATED WIRE

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This invention relates to dies used in the formation of insulated wiring having a plurality of conductors insulated by a surrounding sheath of rubber or plastic material. More particularly, this invention relates to a die for extruding and forming the insulating material about the conductors, wherein the insulating material may be demarked or adhesively joined between the conductors in such a manner that the conductors may be readily separated at the terminal ends of the wire.

Accordingly, it is an object of this invention to provide a novel extruding die including a retainer and slitter assembly positioned across the discharge orifice of the die body; Figure 4 is a view of the die body taken along the line 4—4 of Figure 2;

Figure 3 is an elevation section similar to that of Figure 2, but showing a second form of retainer and slitter assembly positioned across the discharge orifice of the die body;

Figure 4 is a face view of the die body seen in Figure 2 taken along the line 4—4 of Figure 2;

Figure 5 is a face view of the die body taken along the line 5—5 of Figure 2 and showing the slitter elements and associated knife members correctly positioned on dowel pins 12 and the face of the die body, the retainer element being removed;

Figure 6 is a view of the face of the die when taken along line 6—6 of Figure 3 with the retainer and knife elements shown in Figure 3 positioned on the dowel pins 12 and the face of the die body and across the discharge orifice thereof;

Figure 7 is a view of the retainer element taken along the line 7—7 of Figure 2;

Figure 8 is a view of the retainer element taken along the line 8—8 of Figure 3;

Figure 9 is a perspective view of the knife element used in the embodiment of the invention disclosed in Figure 3;

Figure 10 is a perspective view of one of the knife holders used in the embodiment of the invention as shown in particular in Figure 5;

Figure 11 is a view similar to Figure 10 showing the form of the knife holder used in the embodiment of the invention disclosed in Figure 3.

With particular reference to the drawings and particularly Figs. 1, 2, 3 and Figure 4 thereof, the device of the instant invention includes an extrusion tip 1, an associated die body member 2, these members being supported in the usual spaced relation to one another in a conventional extruding machine die body chamber designated generally as 3'. This space is provided between the die body member 2 and the nozzle of the tip member 1, the latter of which has suitable apertures 5 and 6 through which are passed the several conductor members 20 and 21. The entry of insulating material is by way of the chamber-like portion 3' of the conventional extrusion machine 3 including the usual screw means, not shown. The passage of the insulating material is through the relatively constricted passages of the associated members 1 and 2 which force it to flow in compact adhesion relation around the conductor members 20 and 21. The extruding nozzle 1 may be of a conventional design wherein the conductor members 20 and 21 pass through an open end disposed outside the chamber and are guided by apertures 5 and 6 in spaced parallel relation and in alignment with an orifice in the die body for the purposes which will be hereinafter described.

In an advantageous embodiment of the invention, the die body 2 comprises a smoothly machined, generally cylindrical-like member, which is anchored by any suitable means in the wall 8 of the extruding machine 3. This cylindrical member has generally funnel-shaped bore 11 as seen in Figs. 1, 2 and 3 extending from its inner face toward its discharge end as viewed in these figures. The bore 11 terminates at its smaller end, hereinafter called the discharge end, in an orifice 7, which may be clearly seen in Fig. 4, said discharge orifice being generally oval in configuration and being aligned with the small end of the extruding nozzle or tip 1 as is clearly shown in Figs. 1, 2 and 3.
The outer or discharge face 2' of the die body 2, as viewed in Fig. 4, is generally a plane surface having horizontally extending axially aligned recesses as shown by reference numerals 15 and 16, these recesses being of considerable width relative to the sides of the oval aperture or orifice 7 and extending from the edges of the aperture laterally outwardly to either side thereof across the entire face of the die body to the marginal edges thereof. Located within the region embraced by the recesses are suitable dowel pins 12 which are used for a purpose to be hereinafter described. The die body 2 is also provided with other apertures 14 which receive machine screws 45 for a purpose which will also be hereinafter described. As may be seen in Figs. 1 and 2, the recess portions 15 and 16 of the die face 2' extend generally parallel with respect to a horizontal plane when the die body 2 is properly positioned in the end wall 8 of the extruding machine 3.

Referring in particular to Figs. 1, 2, 5 and 7, along with Fig. 10, there are shown the removable components which make up one form of replaceable retainer and slitter assembly for producing the type of covered conductor wire shown in cross-section in Fig. 5A. These components comprise a retainer member 30, said member being also preferably cylindrical in form and having parallel faces or ends, the retainer member 30 having a central aperture 31 of rightly figure 8 outline and adapted to be fixed to the die body with the orifice 7 of the die body 2 aligned with the aperture 31 in the retainer member 30. Retainer member 30 is bored as at 35 with apertures adapted to receive machine screws 45 which pass through these apertures as shown in Figs. 1 and 2, and are threadedly engaged with the die body 2 to maintain the retainer member 30 in fixed relation with respect thereto.

Referring now to Fig. 5 in particular the die body 2 is shown with one form of slitter assembly attached to the face thereof. As may be seen from Fig. 5, in this form the slitter assembly comprises a pair of similarly constructed knife holders 70 and 71 installed in the recesses 15, 16 provided in the face 2' of the die body 2. Holders 70 and 71 have apertures 75 therein which are adapted to be placed in alignment with the dowel pins 12 on the face of die body 2, such that the dowel pins will pass through the apertures 75 so as to maintain these elements in proper relation with respect to each other. The knife holders 70, 71 include pointed portions 78, 79 respectively, which extend inwardly of and across the area 57 including and projecting from the edge thereof located centrally of the discharge bore 47 of the die body 2. As shown in Figs. 3, 4, 6 and 7, as well as Fig. 11, a second embodiment of the novel insulation forming and cutting device of the instant invention is disclosed. As will be seen from a review of these figures, the elements comprising the retainer member, knives and knife holders, previously described, are completely removed from the face of the die body 2. In place thereof there is substituted a novel knife element 50 as clearly shown in Figs. 9 and 11 of generally shallow T-shaped form having its base leg or stem 50' of substantially the same horizontal width as the lateral edges of the aperture 7 in die body 2. A pair of knife holders 55 of identical character and having substantially the same construction and apertures 54 to coincide with the dowel pins 12 in the face 2' of the die body 2 are inserted in the recesses 15, 16 previously described. As shown in Fig. 11, these elements are also provided with generally longitudinal elongated slots 52 similar to the slots 72 in holders 70, 71. As may be seen from an inspection of Figs. 6 and 3, the knife holders 55 are placed in the recesses 15 and 16 provided in the face 2' of the die body 2 such that the slotted portions 52 thereof are in alignment across the face 2' of the die body 2. The wings of the spring steel knife element 50 are then inserted in the slots 52 of the knife holders and extends across the aperture 7 substantially mid-way between the upper and lower walls thereof, with the arms or wings of the T extending into the slots 52 of the aligned holder elements 55. The stem 50' of the T-shaped knife is provided with a cutting edge 51'. Thus, it may be seen that when installed in proper relation with respect to the die body 2, the knife element 50 will serve to slit or separate any material which is passed through the aperture.

A suitable retainer member 40 for the above described knife and knife holders is disclosed in Figs. 3 and 8 for use with the form of knife now under consideration. This retainer member 40 has apertures 41 and having a generally figure 8-shaped outline. A pair of spring steel knives 60 and 61 are in turn inserted in the slots 72 which extend longitudinally of the knife holders 70 and 71. Thus, it may be seen that with the slitter assembly in place on the face of the die body 2, the retainer member as shown in Fig. 7 and identified as member 30 is aligned with the knife holders 70 and 71 in such a way that it bears against the forward edge of the knife elements 60 and 61 while the knife holders 70 and 71 receive the rearward edges of the knives 60 and 61 and the entire slitter assembly is fixed in non-relative relationship with respect to the die body 2. Machine screws 45 are then inserted in apertures 35 in the retainer 40 from whence they pass into the threaded apertures 14 in the die body so as to securely lock the retainer member 30, knife holders 70 and 71, and knife elements 60 and 61 in place on the face 2' of the die body 2. Thus, it may be seen from a comparison of Fig. 5 with Fig. 4, that the generally elongated oval aperture 7 has now assumed a generally figure 8 outline. As the insulated or covered conductors pass through the aperture 7, and between knife holders 70, 71 and knives 60 and 61, the insulating material extruded in close adjacency with the conductors 20, 21 will contact the knife elements 60 and 61 and retainers 70 and 71. As a result, the extruded insulation or covering for the conductors will be shaped into the cross-section illustrated in Fig. 5A. It is to be noted that in an advantageous embodiment of the invention, the knife elements 60 and 61 may be longitudinally displaced with respect to the die body 2 and in more or less abutting relation in the slots provided in the knife holders 70 and 71 by simple manual adjustment and by merely locating to a minor degree the machine screws 45. Thus, it may be seen that the connecting web 100 for the conductor covering 100' as shown in Fig. 5 may be varied in thickness in such a manner that any desired amount of insulating material may be retained between the two conductor members 20 and 21 by the use of only one set of knife elements.
this slot may be vented to the outside air whereby as the insulating material passes thereover, air will be introduced between the strips of insulating material cut by the knife 50 so as to form a pocket of air between the strips after they are again brought together in a manner to be described hereinafter. This pocket of air in turn aids in helping to pry the two pieces of insulated cable covering apart to permit usage of the same. With reference to the form of the invention now under consideration, attention is directed to Figs. 6 and 6A which show the insulated material formed into what is known as double “D” insulated wiring when the material appears as it would immediately after its passage over the knife member 50 and also that the discharge aperture 47 in retainer 49 is identical with the bore 7 in die body 2.

With reference to Fig. 3, the natural tension induced in the conductors as they pass beyond the slitter is sufficient to cause the separated surfaces of the insulation to touch in adhesive relation, and due to the tacky nature of the insulating material, they will remain in this position. Upon subsequent curing, by steam or other heating medium, as is conventional in the art, a very weak bond is formed between the conductors. Alternatively, press rollers or other means may be used, as is also conventional in the art, to positively force or press the separated conductors and the insulation together to form the adhesive union.

Referring in particular to Figs. 1, 2 and 3, it may be seen that in either case the retainer elements 30 and 40 are clamped by screws 45 into firmly abutting relation to the face of the die body 2. The recesses 15 and 16 in die body 2 are of sufficient depth and the knife holders 55, 70 and 74 of sufficient thickness that a substantially flush surface is presented to the abutting face of either retainer when positioned on the die body.

While the mode of device for the formation of readily separable insulation between the conductors has been described, it is to be noted that conventional, oval type insulated wire may also be formed with the same basic die body and proper choice of interchangeable parts.

Referring in particular to Figs. 3, 6, 8 and 11, the die body 2 may be provided with the knife holders 55 properly positioned on dowel pins 12. The knife element 50 is omitted and retainer element 40 is positioned in its proper relation with respect to discharge orifice 7. Machine screws 45 are then passed through apertures 41 and threadedly engaged in the internally threaded bosses 14 in die body 2 to clamp the retainer and the knife holders in fixed relation to the die body 2 and orifice 7. As the insulating material is forced around the conductor, no shifting or other disturbance of the insulators results and conventional plural strand insulated wire is formed.

Thus, it may be seen, that the invention contemplates the formation of a standard die body having a face so arranged that it may be adapted for use with cooperating interchangeable retainer and slitter or cutting elements or retainer members alone, which in turn, may be used selectively and interchangeably to produce, by means of the same die body, more than one type of insulated or covered conductor product. In this respect, it is to be noted that the change from one type of production to another may be conveniently and easily accomplished by the simple act of selectively substituting the desired retainer in combination with the desired interchangeable elements on the face of the die body. Thus, the necessity for dismantling of the die and its removal from the extruding machine is obviated.

While this invention has been described and illustrated hereinabove with special reference to preferred embodiments thereof, it is to be understood that changes and modifications may be made therein without departing from the spirit or scope thereof as defined by the appended claims.
on said discharge face, and said knife-like element in said slotted blocks.

6. An extrusion apparatus as defined in claim 4 wherein said retainer means bears against said planar discharge face, said slotted blocks and said knife-like elements so as to clamp the blocks in said recesses provided on the discharge face of said die body and said knife-like elements in said slotted blocks.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Inventor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,957,212</td>
<td>Hinsky</td>
<td>May 1, 1934</td>
</tr>
<tr>
<td>2,089,774</td>
<td>Wachstein</td>
<td>Aug. 10, 1934</td>
</tr>
<tr>
<td>2,514,211</td>
<td>Carlson</td>
<td>July 4, 1950</td>
</tr>
<tr>
<td>2,524,829</td>
<td>Perzel</td>
<td>Oct. 10, 1950</td>
</tr>
<tr>
<td>2,626,302</td>
<td>Cox</td>
<td>Jan. 20, 1953</td>
</tr>
</tbody>
</table>