Jan. 18, 1938. J. T. GORDON ET AL 2,105,812

BEAD WIRE DIE

Filed Aug. 29, 1935 2 Sheets-Sheet 1

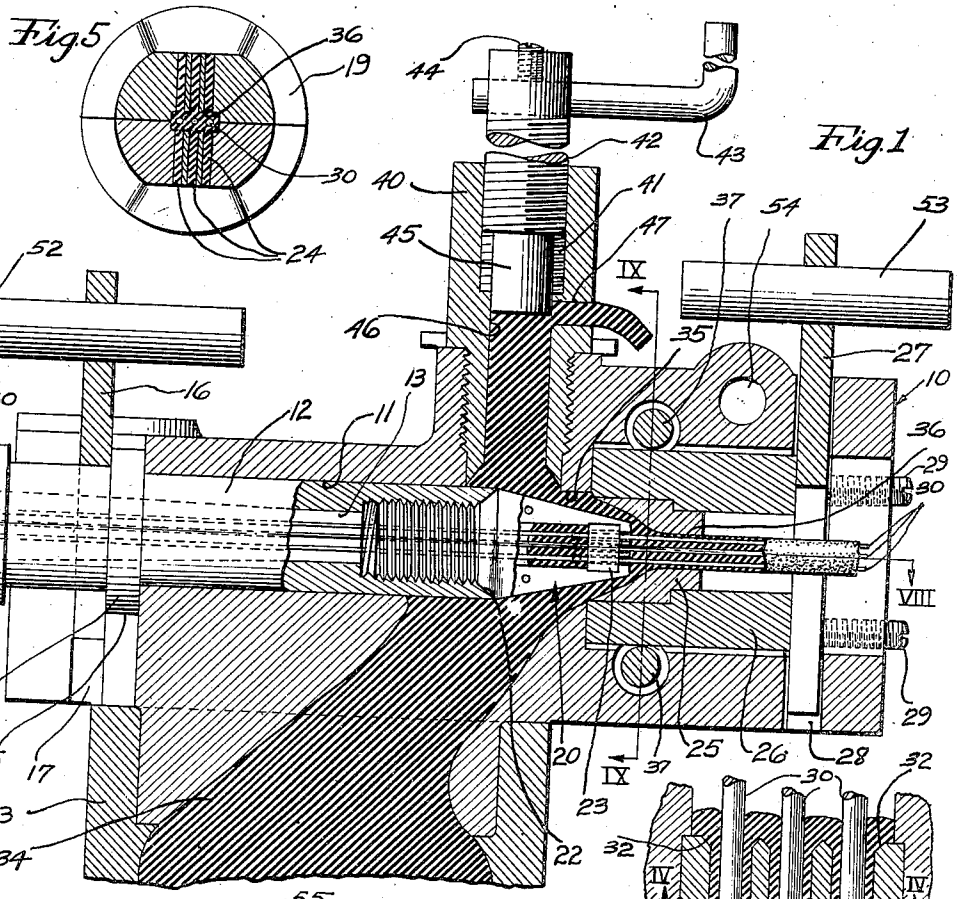

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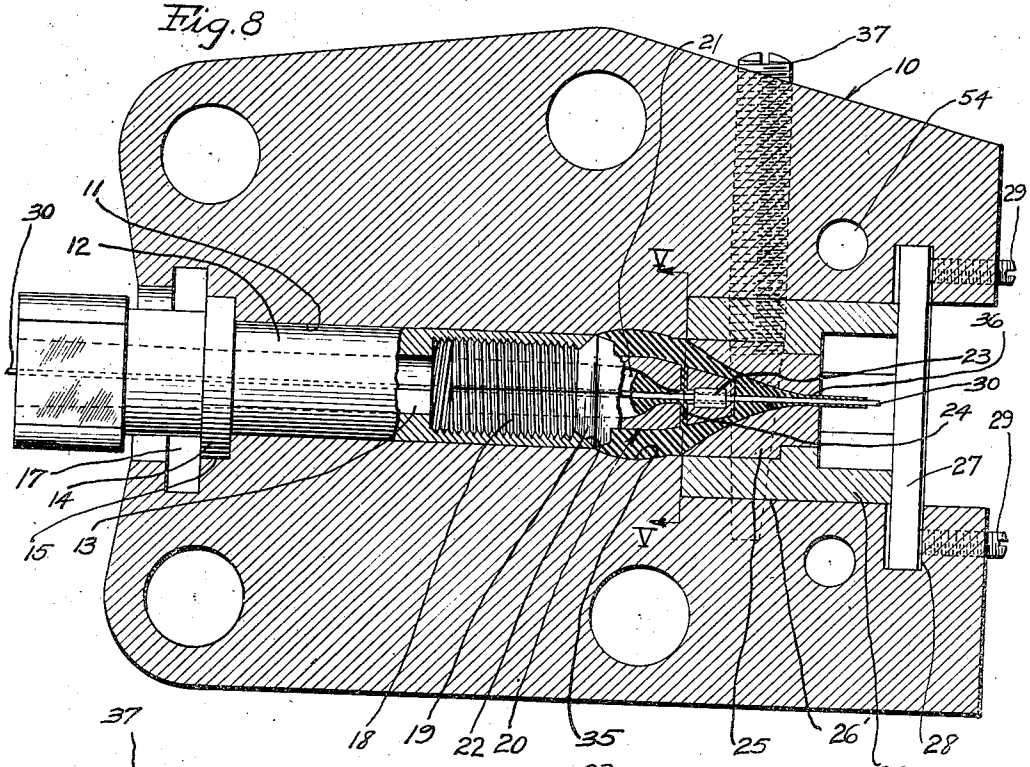
Fig. 8



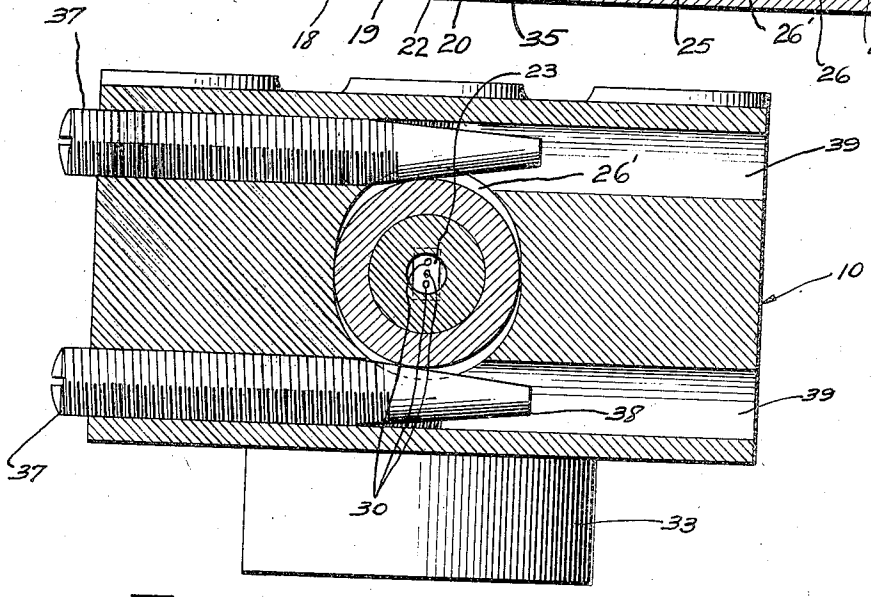


Fig. 9

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BEAD WIRE DIE

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9 Claims. (Cl. 18—13)

The present invention relates to dies for insulating bead wires for automobile tires and the like and forming said bead wires into a ribbon prior to being formed into the bead.

An important object of this invention is to provide means for lubricating the bead wires as they pass through the wire-guiding die which determines relative positions of the wires in the completed ribbon which is later shaped into a bead for a tire.

Another object of this invention is to provide a die member for coating bead wires individually with a coating of rubber prior to coating a group of the wires as a unit.

Another object of this invention is to provide a novel form of die that will withstand the excessive pressures developed in this type of machine. Rubber under high pressure is extruded through the die to coat the wire as the wire passes through the die. In carrying out this part of the invention the die is so arranged and constructed as to be quickly assembled and disassembled for cleaning purposes so as to save time.

Another object of this invention is to provide means for aligning the wires properly as they pass through the dies to insure a uniform coating on the individual wires and also the assembled wires.

A still further object of this invention is to prevent "scaling off" of portions of the surfaces of the bead wires as they pass thru the guiding die, whereby to reduce the amount of metal which is scaled off the wires. During the "scaling off", the flakes formed accumulate and will tend to pack up in advance of the die until a solid mass is formed which bears on the wires and retards their movement thru the die and the proper distribution of the rubber about the wires. Some loose portions on the surface of the wires may scale off, but very little in proportion to that which ordinarily scales off when following prior-art practices.

Other objects of this invention will appear hereinafter as the description of the invention proceeds, the novel features, arrangements and combinations being clearly set forth in the specification and claims hereto appended.

In the drawings:

Fig. 1 represents a horizontal cross-section thru a device embodying our invention, the section being taken substantially centrally of the bead wire dies;

Fig. 2 is a fragmentary portion of the mechanism shown in Fig. 1 but on a larger scale to illustrate the invention more clearly;

Fig. 3 is a horizontal cross-section on a greatly enlarged scale through the guiding die for the wires, the clearances being exaggerated for the sake of clearness;

Fig. 4 is a section taken along the line IV—IV of Fig. 3;

Fig. 5 is a cross-section taken along the line V—V of Fig. 8;

Fig. 6 is a plan view of a modified die to be used with a device such as disclosed in Fig. 1, parts thereof being broken away for the sake of clearness;

Fig. 7 is an end view of the device shown in Fig. 6;

Fig. 8 is a cross-section taken substantially along the line VIII—VIII of Fig. 1; and

Fig. 9 is a cross-section taken along the line IX—IX of Fig. 1.

In forming beads for tires, individual wires are fed through a die and rubber extruded into the die from a suitable extruding mechanism which forms about the wires and coats the same on all sides, the groups of wires passing through a single opening of substantially the same cross-section as the ribbon desired, the cross-section being such as to leave a small coating of rubber on all sides of the wires. In such a device the wires are guided through a suitable guiding die having openings therethrough of such a size as to permit free movement of the wires therethrough while guiding them along a path such that they occupy their desired relation with respect to each other before being coated with the rubber, whereby in the finished ribbon, the wires are properly spaced from each other and from the outer surfaces of the ribbon.

Obviously, such guiding means should clear the wires only slightly if there is to be proper guiding of the wires. These wires when being fed to the guiding die, have some transverse vibration and are not always generally aligned before reaching the guiding die and the edges of the openings to which the wires are first presented in their passage through the die frequently contact the surfaces of the wires and small portions of the wires are scraped off the wires by said edges of the openings. These small portions or flakes accumulate at the entrance edges of the openings in the die and tend to wedge themselves between the wire and the openings. This results eventually in closing the clearance spaces between the wires and the openings to such an extent that considerable friction is operating on the wires to cause more and more material to be scraped off the wires and to retard their move-

ment through the die. This may result in the wires breaking or slowing down to such an extent that the machine will not operate properly and the apparatus must be taken apart and the assembled flakes removed before the apparatus will again operate properly.

The present invention contemplates doing away with the objections to the prior construction by lubricating the individual wires by a quantity of the rubber as the wires pass into and through the openings in the guiding die to prevent the wires from contacting the edges of the openings and thus reducing the amount of scaling off of the wire. Thus, fewer shutdowns of the apparatus are necessary and if the wire is of the proper consistency so as not to readily scale off, no shutdowns will be necessary, for the wires, as they pass through the die, are lubricated by the rubber coating thereon.

After passing through the guiding die, the wires are in their proper spaced relation to each other and have a thin rubber coating thereon. They then pass through a chamber filled with rubber under pressure from the extruding means and receive a unified coating of rubber to hold them together, the thickness of which is determined by a second die having substantially the same cross-section as desired for the final ribbon.

In the drawings, the reference numeral **10** indicates generally the casting which houses the die and this has a longitudinal bore **11** for the reception of a tube **12** having a central opening **13** which is slightly tapered at the outer end thereof as is shown at the left in Figs. 1 and 8. This tube **12** has a collar **14** which fits within a recess **15** concentric with the bore **11**. This prevents longitudinal movement of the tube to the right, and movement in the opposite direction is prevented by means of a U-shaped latch member **16** which is guided horizontally in the guide slots **17**, the inner face of which abuts against the collar **14**, thus holding the tube **12** in the indicated position.

The inner or right-hand portion of the tube **12** is threaded internally to receive the threaded portions **18** of the two halves **19** of a die holder indicated generally by the reference character **20**. These two portions **19** are similarly shaped and when placed together form a tubular body having an internal bore **21** which is in alignment with the central opening **13** of the tubular member **12**. The die holder **20** is provided with a conical slot **22** seating against a similar seat at the right-hand end of tube **12** whereby, when the die holder is threaded into position, the seat **22** and its cooperating seat on the tube **12** cooperate to wedge the two halves of the holder firmly together. Relative shifting movement between the two halves **19** of the die holder is prevented by the pins **55** secured in one of the halves **19** and snugly fitting aligned openings in the other half.

The forward or right-hand end of the die holder **20** is tapered on the outside to form a nose and is recessed internally to receive the rectangular guiding die **23** to be described more in detail presently. Transverse openings **24** communicate with the bore **21** and the outer surface of the die holder at a point slightly to the rear or left of the die **23**.

A second die **25** is arranged within a bushing **26** and forms a unit which is held in place within the opening **26'** at the right-hand side of the casting **10** by a U-shaped latch or holding member **27** slidable in the horizontally arranged guiding slots **28**. In order to clamp the bushing **26** firmly in position, we provide additionally the screws **29** which are threaded in the casting **10** and engage the latch **27** to force the same inwardly or to the left into clamping engagement with the bushing **26** to hold it firmly seated within the recess **27**. Note that there is a small clearance between the latch **27** and sides of the slots **28** to permit the latch **27** to be moved firmly against the bushing **26**. The positive clamping of the member **26** is necessary due to the high pressures which are used for forcing the rubber into and through the dies.

The bead wires **30**, of which three are shown in the present embodiment of our invention, are fed through the tube **12** and guiding die **23** and then through die **25** emerging at the right-hand end in proper spaced relation and completely coated with rubber as well as being connected by rubber. The guiding die **23** insures the proper alignment of the wires in the finished ribbon.

Referring now particularly to Figs. 2, 3 and 4, it will be noted that the die **23** is provided with a plurality of openings **31** tapered slightly at their entrance ends **32**, and these openings are of such a size as to provide clearance between the side walls of the openings and the wires passing therethrough. The shape of these openings in cross-section is best illustrated in Fig. 4 wherein it will be noted that they have a greater diameter in a vertical direction than in a horizontal direction. Thus, more movement of the wires is permitted in a vertical direction than in a horizontal direction.

The clearance illustrated between the openings and the wires in Figs. 3 and 4 is somewhat exaggerated as the wires are only slightly smaller in diameter than the smallest diameter of the openings. Therefore, in normal use if the wires are not properly aligned the openings will place them in alignment within rather narrow limits but, in so doing, if it were not for the invention herein described the wires would contact the entrance edges of the openings and portions of the wire would scale off and clog the openings and make it difficult, and at times impossible, for the wires to move longitudinally therethru. In order to avoid this unsatisfactory feature of prior devices, the lubricating openings **24** have been provided for coating each of the wires with a small amount of rubber before it passes into the openings **31**, whereby the rubber keeps the wires spaced from the sides of the openings and prevents their engagement with the edges thereof to prevent scaling off of portions of the wire. The openings **24** are relatively small to restrict the flow of rubber into said holder, whereby the pressure on the rubber in said holder is less than outside the same. Thus, the rubber is under a great enough pressure to retard the movement of the wire appreciably, but is sufficient to coat the wires with rubber as desired. Also the lower pressure prevents the rubber from flowing out of the tubular member **12** which is open to the atmosphere at the left-hand end thereof.

The casting **10** is connected to the hollow exit end **33** of an extruding member thru which the rubber is extruded by means of a screw or the like into the opening **34** in the casting **10**. The opening **34** communicates with the internal recess **35** in the casting in which the die-holding member **20** is arranged, with the result that rubber completely fills the space around the nose of the die-holding member **20** and portions of the rubber are forced thru the relatively small lubricating openings **24** into the bore **21**. Thus, rubber entirely surrounds the wires before they enter the guiding die **23** and portions of the rubber are carried

along with the wire into the openings 31. The rubber forms a lubricating means for the wires and prevents the scaling off of portions thereof, with the result that there are no flakes to accumulate except that occasionally pieces may scale off either by accidental contact with the edges of the openings or due to the pressure within the bore 21 which may cause loose portions on the wire to scale off.

Therefore, as the wires emerge from the guiding die into the recess 35, they are lubricated by a thin layer of rubber and are in proper spaced relation, the layer of rubber also operating to better center the wires as they pass through the openings 31.

The die 25 is provided with a single, substantially rectangular opening 36 and, since there is rubber under pressure in the recess 35, the wires are completely coated as a unit with the rubber and the die 25 determines, by the shape of the opening therethrough, the cross-section of the assembled wires and rubber. The wires and rubber, therefore, emerge as a ribbon of uniform cross-section with the wires properly aligned and centered within the ribbon.

It is sometimes necessary to shift the die 25 in order to make the thickness of the rubber at the opposite edges of the ribbon uniform and for this purpose we provide the following mechanism: The bushing 26 which holds the die 25 is arranged within the recess 26' which, in a horizontal direction, has a small amount of clearance with the bushing whereby the latter may be moved laterally to adjust its position. In order to adjust this bushing laterally and to hold the same in position after it is adjusted, we provide the mechanism illustrated in Fig. 9. This mechanism comprises a pair of screws 37 tapered at their inner ends as at 38 and threaded in the openings 39, which have screw threads at least at the left ends thereof and for a sufficient distance to provide for the proper adjustment of the screws 37 longitudinally of the openings 39. The tapered ends 38 engage the sides of the bushing 26 and by loosening up on one screw and tightening on the other a lateral adjustment of the bushing and die results. Before making this adjustment, however, the screws 29 should be loosened sufficiently to permit easy movement of the bushing, the movement of which would otherwise be resisted by its frictional engagement with the latch 27.

Threaded into one side of the casting 10 is a hollow bushing 40 which in turn is threaded internally at its upper end as at 41 and provided with a longitudinally adjustable screw 42 operated by a crank 43 arranged within a transverse opening in said screw and held in place by a set screw 44. The lower end 45 of this screw is reduced in cross-section and cylindrical in shape and on movement of the screw 42 longitudinally the portion 45 moves into or out of the bore 46 in the lower end of the hollow bushing 40. The reduced portion 45 has a close sliding fit with the bore 46. A lateral opening 47 in the bushing communicates with the atmosphere and the bore 46 and the reduced portion 45 is utilized to vary the amount of communication between said opening and bore. The reduced portion 45 can be moved sufficiently to cut off any communication between the opening 47 and bore 46.

This device is utilized for the purpose of removing the dead rubber which tends to pile up in portions of the recess 35 and is also utilized to regulate the pressure within the recess 35. In other words, by moving the screw 42 upwardly in Fig. 1 more rubber can escape, and consequently the internal pressure on the rubber is reduced. At the same time the rubber which tends to remain pocketed within the recess 35 can escape and this is used over again.

Thus, it will be seen that with my invention I have provided means whereby apparatus of this character can be operated for a greater period of time, without having to be disassembled for cleaning purposes, than could prior devices of this nature. Furthermore, there is a better centering of the wires in the openings due to the rubber surrounding the same and as a result the finished ribbon to be used for the bead is more uniform in character and, consequently, gives better results, for the amount of rubber around the wires and between the same is more uniform. Also the dies last longer where the rubber lubricant is provided, thus greatly reducing replacement cost. The die is made of hardened steel and of course this increases the cost of replacement.

By having the guiding die 23 a single unit, the openings have smooth walls and no joints as in a split die such as shown in Figs. 6 and 7. Consequently, there is less friction and the rubber-coated wire moves thru the die more readily.

In Figs. 6 and 7 there is shown another form of the invention in which, instead of using a die member separate from the holder, the die member is formed as a part of the holder. The holder 48 is formed by the two similar portions 49 and 50 which are provided internally with wire-guiding grooves 50, each of which is substantially semi-cylindrical in shape so that when the two portions are placed together they form substantially cylindrical recesses that are preferably not exactly cylindrical but of the shape shown for the recesses in Fig. 4. Lubricating openings 51 communicate with these grooves at their inner ends and lubricate the wire as the same is fed to the openings formed by the grooves 50. Pins 56 provent lateral shifting movement in a manner similar to pins 55 previously described. The action is the same, as in the form of the invention previously described, but there is a possibility of the two halves becoming accidentally separated if the member 48 is unthreaded from the tube, such as 12, in Figs. 1 and 8, with the disadvantage that the rubber spreads between the grooves and causes a frictional retardation and improper coating of the wires. However, this is not a serious disadvantage, especially since the two halves will not separate if properly assembled and threaded into the tube, but will remain in close contact with each other.

The form of the invention first described has the advantage of lower maintenance cost for, with the device of Figs. 6 and 7, the entire device 48 must be discarded when the grooves become worn, as they will during use, and a new unit made to take its place, whereas, with the device first described it is only necessary to replace the die member 23 and several of the die members may be made up in advance and substituted quickly in the holder for the die member which is worn out.

In both of these constructions it will be noted that some of the rubber which is forced through the lateral passageway 24 or 51 is moved to the left away from the openings 31 in the first embodiment and openings 50 in the second embodiment. This rubber, in moving away from these openings, will carry with it at least some of the flakes which may be taken off of the wire in its

passage through the device and prevents the same from accumulating near the entrance ends of the openings to clog the latter, thus insuring that the device will remain in operation longer than with a device in which this feature is not present.

The latches 16 and 27 have pins 52 and 53, respectively, extending therethrough to form handles by which the latch members may be inserted and withdrawn.

The member 10 is provided with a cooling passage 54 surrounding the bushing 26 to reduce the temperature of the bushing and die 25 for better operation of the apparatus. The cooling passage 54 is substantially circular in shape but is not illustrated in detail here. The entrance and exit passageways for the cooling fluid have been omitted, although it is obvious that it is only necessary to connect the passage 54 at the opposite ends thereof to supply and discharge conduits by passages extending to the exterior surfaces of the member 10.

Obviously, those skilled in the art to which this invention pertains may make various changes in the particular arrangement and construction of the parts illustrated in the drawings without departing from the scope of the invention and, therefore, I do not wish to be limited except as may be hereinafter set forth in the claims.

Having thus fully described my invention, what I claim and desire to secure by Letters Patent of the United States is:

1. A device of the class described comprising a one-piece guiding die having a plurality of openings extending therethru, a split holding member recessed to receive said die and hold it in fixed position with respect to said holding member and means for holding said split holding member together to clamp the die member in position, comprising a tubular member threaded internally to receive the threaded portion on the said split holder and cooperating wedging means on said holder and tubular member for clamping said holding members together when the said holder is threaded into said tubular member a given distance.

2. In a device of the class described the combination with a casing member having a longitudinal bore, a tubular member arranged within said bore and having means therein for preventing longitudinal movement of the same in said bore in one direction, removable latch means for preventing movement of said tubular member in the opposite direction, said casing member having a second bore aligned with said first bore and having a removable die member arranged therein, means for holding said die member in operative position within said second bore, a second die member connected to said tubular member and having a plurality of openings communicating with the interior of said tubular member for receiving single ones of a plurality of wires to be fed thru said tubular member, said casing member having a chamber formed therein surrounding said second die member, restricted openings in said die member communicating with said chamber and with said openings in said second die member for supplying rubber from said chamber to said openings to lubricate the wire passing therethru, and said first die member having a forming opening for forming a unitary coating of rubber supplied from said chamber about said plurality of wires after they emerge from said second die member.

3. The method of continuously forming insulated bead wires which comprises the steps of moving each of a plurality of wires to be insulated through separate guide openings of slightly larger all-around cross-section than said wires, whereby the wires may be moved through said openings with a clearance space entirely around same, the wires being moved to and through said openings in straight lines substantially coincident with the axes of the respective openings, continuously supplying a coating compound to said wires immediately in advance of said openings to coat the wires on all sides to thereby maintain the wires spaced from the walls of the openings as they pass through said openings, thereafter passing said coated wires through a single opening spaced from the first-mentioned openings and of greater cross-section than the combined cross-section of the wires and supplying a coating compound under pressure to said wires in the space between the first- and second-mentioned opening, to form an integral coating embracing all of said wires.

4. The method of continuously forming insulated bead wires which comprises the steps of moving each of a plurality of wires to be insulated through separate guide openings of slightly larger all-around cross-section than said wires, whereby the wires may be moved through said openings with a clearance space entirely around same, the wires being moved to and through said openings in straight lines substantially coincident with the axes of the respective openings, continuously supplying rubber to said wires immediately in advance of said openings to coat the wires on all sides to thereby maintain the wires spaced from the walls of the openings as they pass through said openings, thereafter passing said rubber-coated wires through a single opening spaced from the first-mentioned openings and of greater cross-section than the combined cross-section of the wires and supplying rubber under pressure to said wires in the space between the first- and second-mentioned opening, to form an integral coating embracing all of said wires.

5. The method of continuously forming insulated bead wires which comprises the steps of moving each of a plurality of wires to be insulated through separate guide openings of slightly larger all-around cross-section than said wires, whereby the wires may be moved through said openings with a clearance space entirely around same, the wires being moved to and through said openings in straight lines substantially coincident with the axes of the respective openings, continuously supplying rubber to said wires immediately in advance of said openings to coat the wires on all sides to thereby maintain the wires spaced from the walls of the openings as they pass through said openings, thereafter passing said coated wires through a single opening spaced from the first-mentioned openings and of greater cross-section than the combined cross-section of the wires and supplying rubber to said wires in the space between the first- and second-mentioned opening under greater pressure than that rubber used to first coat the wire to form an integral coating embracing all of said wires.

6. In a wire-coating device in which the wires are fed to and through said device in substantially a straight line, the combination with a guiding die, of a shaping die, of means for supplying a coating compound to each of said dies in advance thereof and under pressure, said guiding die having a plurality of openings therethrough for the passage of the wires to be coated,

said openings being so positioned that the respective wires will pass coaxially therethrough and each opening being of such all-around cross-sectional area as to permit the respective wire to pass therethrough in all-around spaced relation to the wall of the opening, the coating compound in advance of said guiding die coating each wire and filling the space between each wire and the walls of its respective opening as the wire passes therethrough to lubricate the wire in its passage through said guiding opening and maintain the wire spaced from the walls of the opening, the shaping die being spaced from said guiding die and positioned to receive the wires after said wires have passed through the guiding die, and having a single opening therethrough of a cross-section sufficiently great to permit all of the wires to pass therethrough at one time in all-around spaced relation to the wall thereof, whereby an integral coating about all of said wires may be formed as said wires pass through said single opening.

7. In a wire-coating device in which the wires are fed to and through said device in substantially a straight line, the combination with a one-piece guiding die, of a shaping die, of means for supplying a coating compound to each of said dies in advance thereof and under pressure, said guiding die having a plurality of openings therethrough for the passage of the wires to be coated, said openings being so positioned that the respective wires will pass coaxially therethrough and each opening being of such all-around cross-sectional area as to permit the respective wire to pass therethrough in all-around spaced relation to the wall of the opening, the coating compound in advance of said guiding die coating each wire and filling the space between each wire and the walls of its respective opening as the wire passes therethrough to lubricate the wire in its passage through said guiding opening and maintain the wire spaced from the walls of the opening, the shaping die being spaced from said guiding die and positioned to receive the wires after said wires have passed through the guiding die, and having a single opening therethrough of a cross-section sufficiently great to permit all of the wires to pass therethrough at one time in all-around spaced relation to the wall thereof, whereby an integral coating about all of said wires may be formed as said wires pass through said single opening.

8. In a wire-coating device in which the wires are fed to and through said device in substantially a straight line, the combination with a guiding die, of a shaping die, of means for supplying a coating compound to each of said dies in advance thereof and under pressure, said guiding die having a plurality of openings therethrough for the passage of the wires to be coated, said openings being so positioned that the respective wires will pass coaxially therethrough and each opening being of such all-around cross-sectional area as to permit the respective wire to pass therethrough in all-around spaced relation to the wall of the opening, the coating compound in advance of said guiding die coating each wire and filling the space between each wire and the walls of its respective opening as the wire passes therethrough to lubricate the wire in its passage through said guiding opening and maintain the wire spaced from the walls of the opening, the shaping die being spaced from said guiding die and positioned to receive the wires after said wires have passed through the guiding die, and having a single opening therethrough of a cross-section sufficiently great to permit all of the wires to pass therethrough at one time in all-around spaced relation to the wall thereof, whereby an integral coating about all of said wires may be formed as said wires pass through said single opening, said means for supplying said dies comprising pressure means for forcing rubber to said dies, a relatively large passage for permitting substantially restricted flow of said rubber to said shaping die and a relatively small passage for greatly restricting the flow of rubber to said forming die.

9. In a wire-coating device in which the wires are fed to and through said device in substantially a straight line, the combination with a guiding die, of a shaping die, of means for supplying a coating compound to each of said dies in advance thereof and under pressure, said guiding die having a plurality of openings therethrough for the passage of the wires to be coated, said openings being so positioned that the respective wires will pass coaxially therethrough and each opening being of such all-around cross-sectional area as to permit the respective wire to pass therethrough in all-around spaced relation to the wall of the opening, the coating compound in advance of said guiding die coating each wire and filling the space between each wire and the walls of its respective opening as the wire passes therethrough to lubricate the wire in its passage through said guiding opening and maintain the wire spaced from the walls of the opening, the shaping die being spaced from said guiding die and positioned to receive the wires after said wires have passed through the guiding die, and having a single opening therethrough of a cross-section sufficiently great to permit all of the wires to pass therethrough at one time in all-around spaced relation to the wall thereof whereby an integral coating about all of said wires may be formed as said wires pass through said single opening, said guiding openings being wider in one direction normal to its axes than in a direction at substantially right angles thereto for the purposes set forth.

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