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APPARATUS FOR EXTRUDING ORGANIC PLASTIC MATERIAL

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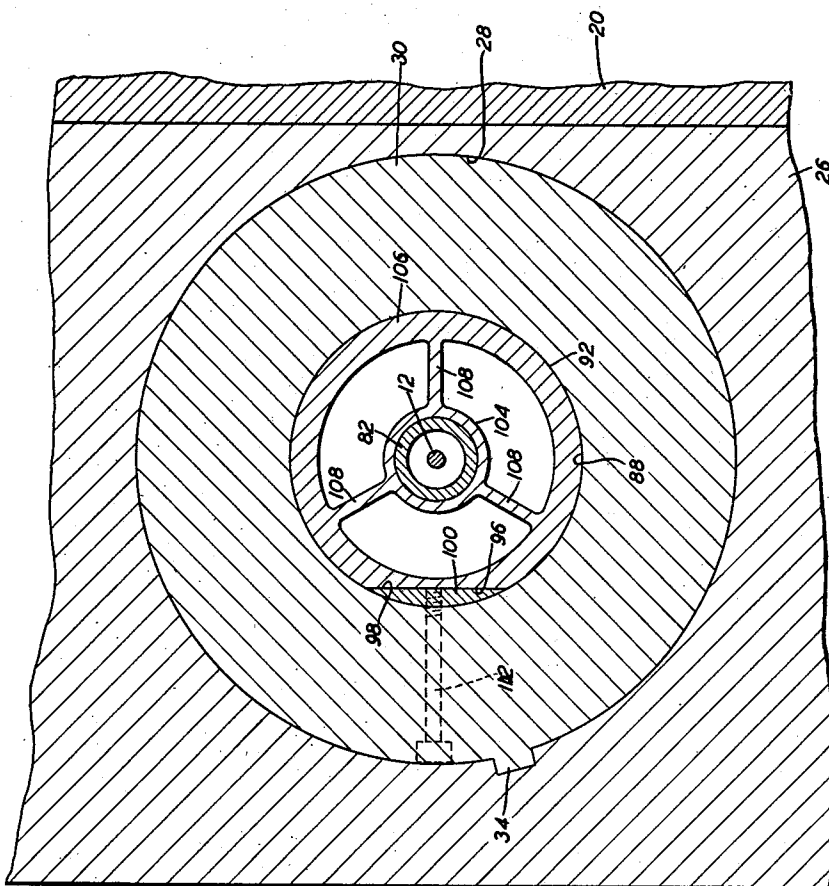


FIG. 2

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APPARATUS FOR EXTRUDING ORGANIC
PLASTIC MATERIAL

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This invention relates to apparatus for extruding organic, plastic material, and particularly to apparatus for extruding insulating or jacketing material on conductors or other cores.

An object of the invention is to provide new and improved apparatus for extruding organic, plastic material.

In utilizing much of the rubber and plastics insulating and jacketing equipment available today, the centering of a conductor with respect to the material extruded therearound sometimes is accomplished by adjusting the components of the extruding head manually at each setup for a given combination of conductor and material. Even when skilled operators are employed, a considerable amount of operating time is lost in making the adjustments necessary to produce commercially acceptable products.

Much of this time may be saved by the use of a so-called "self-centering" extruding head, which essentially is a head in which the component parts are designed to be assembled in a given position for each setup without any adjustment of the parts. With the use of self-centering heads, the relative positions of the several parts of the head are fixed and the extruding tools are placed in their proper operating position each time the head is assembled. One type of self-centering head is shown in G. L. Cherry et al. Patent 1,862,005, granted June 7, 1932.

The quantity of flow of an extrudable material through extruding heads should be balanced, and one of the principal causes of eccentricity in coverings applied to conductors is the presence of unbalanced flow conditions in different portions of the extruding heads. This is especially true when stranded conductors or cabled cores are covered, and the need for balanced flow conditions is increased when such articles are to be covered with an extruded covering.

In accordance with this invention, a balanced flow of covering materials in extruding heads is obtained by spacing the extrusion orifice far enough from the deflector of the core guide that the pressures at all points in the extrusion orifice are equal. As a result, the coverings on covered conductors made with extruding apparatus embodying the invention are substantially concentric with the conductors, whether the conductors are solid or stranded, and the covered conductors meet the standards for commercially acceptable products.

The invention will be clearly understood from the following detailed description of a preferred embodiment of the invention, when read in con-

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junction with the accompanying drawings, in which:

Fig. 1 is a fragmentary, horizontal, sectional view of an extruding apparatus illustrating certain features of the invention, and

Fig. 2 is an enlarged, fragmentary, vertical, sectional view taken on line 2-2 of Fig. 1.

Referring now in detail to the drawings, an extrusion cylinder 20 has formed therein a cylindrical bore 21, in which a stock screw 22 rotated by a suitable source of power (not shown) is mounted for the purpose of forcing an insulating material 24 through an extruding head, designated generally by the numeral 25. The extruding head 25 comprises a body member 26 provided with an opening 27, which forms a continuation of the bore 21 and which communicates with a cylindrical bore 23 formed in the head transversely of the opening 27.

Slidably mounted within the bore 28 is a cylindrical tool holder 30 having a central cylindrical bore 31 extending coaxially with the bore 28. A plug 32 and an annular cap 33 secure the tool holder against endwise movement in the bore 28, and a key 34 prevents rotation of the tool holder in the bore 28. The tool holder 30 is provided with a tapered opening 40 leading transversely into the bore 31, and also has a tapered socket 42 formed in one end thereof. The tool holder may be inserted longitudinally into the bore 28 through a tapped portion 44 of the bore 28 and secured therein by the plug 32. A tubular deflector 48 fits in the bore 31 and is secured therein in an oriented position by a pin 50 fitting into a notch 52 formed radially in the tool holder. The deflector is provided with deflecting surfaces 54, 55 and 56, which deflect material forced into the opening 40 to the left, as viewed in Fig. 1. A wire-guiding tube 60 having a threaded end portion 62 and a frustoconical end socket 64 fits closely but slidably in the tubular deflector. A tubular spacer 72 is provided with a tapped portion 74 designed to be screwed over the threaded end portion 62 of the tube 60 to lock the tube 60 to the spacer 72. The spacer 72 has a threaded portion 76 designed to be threaded into a tapped portion 78 of a lock nut 79 to force the tube 60 tightly against a frustoconical end 80 of a core tube 82, which end fits into the socket 64.

The annular cap 33 having a tapped bore 86 therein is bolted to the body member 26, and holds the cylindrical tool holder 30 in the bore 28. A generally cylindrical spider 92 having a tapered end 94 complementary to the socket 42 in the tool holder is mounted in a counterbore

88 with a flat side face 96 of the spider in contact with a flat face 98 of an arcuate aligning plate 100 fastened to the tool holder by studs 102—102. The spider is provided with a hub 104 supported coaxially with respect to an outer ring 106 thereof by equally spaced radial arms 108—108. Each of the arms 108—108 is streamlined, and has a rounded forward edge 110 and a sharp rear edge 112.

The core tube 82 has a tapered nose 116 and a core passage 118, and fits into the hub 104. A shoulder 120 formed on the core tube is designed to abut an end of the hub.

A generally cylindrical die 124 fits into the tool holder 30, and has a flat side face 126 which fits against the aligning plate 100. The die is provided with a passage 128 of which a portion 130 is cylindrical and a portion 132 is tapered. A threaded plug 134 provided with sockets 136—136 designed to receive a prong wrench (not shown) is screwed into the tapped bore 86 in the cap 33, and holds a tapered end portion 138 of the die against a complementarily tapered portion 140 of the spider. This holds the frustoconical end portion 94 of the spider in the socket 42 formed in the tool holder. The spacer 72 holds the tube 60 tightly against the frustoconical end 80 of the core tube 82, and holds the shoulder 120 of the core tube against the end of the hub 104 of the spider, which locates the tapered end 116 of the core tube in a predetermined position longitudinally with respect to the die 124 and aligned with the die.

Operation

An insulating compound including as its essential constituent an organic, plastic material, such as a thermoplastic or a thermosetting insulating or jacketing material, is forced by the stock screw 22 through the extrusion cylinder 20 into the tapered opening 40 in the tool holder 30 and into the open portions of the bore 31 in the tool holder 30. The deflector 48 deflects the compound toward the left, as viewed in Fig. 1, through an angle of 90°, and the material flows to the left through the bore 31 around the tube 60, through the spider 92 between the streamlined arms 108—108, through the tapered annular space between the core tube 82 and a portion of the tapered portion 132 of the passage 128 in the die 124, and then through the rest of the tapered portion 132 and the cylindrical portion 130 of the passage 128. The die forms the compound into a covering 150 over the conductor 12 as the compound flows therethrough.

As the compound 24 is forced from the opening 40 into the bore 31 in the tool holder 30, around the wire-guiding tube 60, and is deflected to the left, as viewed in Fig. 1, the pressure of the compound in the area generally below the tube 60 is less than that of the compound in the rest of the area around the tube 60. However, as the compound is forced the long distance between the deflector 48 and the left hand end of the core tube 82, the pressures on the compound in all portions of the cross-sectional area of the passage of flow are equalized by the time the compound reaches that end of the core tube, at which end the point of critical clearance between the core tube and the passage 128 in the die 124 is located. Hence, there is no eccentricity in the covering 150. The core tube 82 is held rigidly by the spider 92 and the wire-guiding tube 60, and the die 124 and the spider are locked in oriented positions with respect to each other by the cap 33 and the aligning

plate 100 so that their orientation is not affected by the high extrusion pressures.

The apparatus is simple in construction and operation, and may be assembled and disassembled easily. The tool holder 30 and all the tools held therein may be easily slid out of the head 25 for cleaning or other purposes, another tool holder identical with the tool holder 30 and containing tools like those in the tool holder 30 may be substituted therefor with a minimum interruption of the extrusion operation, and the tools may be removed from the holder 30 easily and cleaned leisurely.

What is claimed is:

1. An extrusion apparatus, which comprises an extrusion cylinder, an extrusion head connected to one end of the extrusion cylinder and having a passage extending therethrough transversely to the extrusion head, the extrusion head also being provided with an opening aligned axially with respect to the extrusion cylinder and extending through the head to the passage, said opening joining the passage at a point intermediate to the ends of the passage, a tubular tool holder having a passage extending therethrough and also being provided with an opening extending transversely to the passage and intersecting the passage in the tubular holder at a point intermediate the ends thereof, said tool holder being insertable in the passage in the head to a position in which the opening therein is aligned with the extrusion cylinder and the passage therein is aligned with the passage in the head, means for locking the tubular holder in that position, a tubular deflector positioned in one end of the passage in the tubular holder, a bushing having a tapped end portion positioned in the last-mentioned end of the passage in the extruding head and held therein against longitudinal movement in said passage for holding the plug against movement in the passage, a die mounted in the other end of said passage, a core tube positioned in the passage and extending toward the die, the core tube being provided with a shoulder to limit the movement of the core tube toward the die, a spider mounted slidably between the die and the plug for supporting the core tube, means for aligning the spider in the die axially, means for holding the die in the tool holder, and a wire guiding tube provided with a threaded portion for engaging the tapped end portion in the bushing and extending through the bushing and the tubular plug for engaging one end of the core tube and for forcing the shoulder on the core tube against the spider.

2. An extrusion apparatus, which comprises an extruding head having a passage therethrough and a counterbore at one end of the passage, a die held in the open end of the counterbore, a spider positioned in the passage in a position abutting the die and the other end of the counterbore, a core tube having a shoulder thereon supportable by the spider in a position in which the core tube extends toward the die and the shoulder abuts the spider, a tubular deflector mounted in the other end of the passage, a guide tube extending through the tubular deflector to the core tube, and means for locking the guide tube against the core tube to hold the shoulder on the core tube against the spider.

3. An extrusion apparatus, which comprises an extruding head having a passage therethrough, a die held in one end of the passage, a spider positioned in the passage in a position abutting the die, a core tube having a shoulder thereon sup-

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portable by the spider in a position in which the core tube extends toward the die and the shoulder abuts the spider, a tubular deflector mounted in the other end of the passage, a guide tube extending through the tubular deflector to the core tube, and means for locking the guide tube against the core tube to hold the shoulder on the core tube against the spider.

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