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SPINNING FUNNEL

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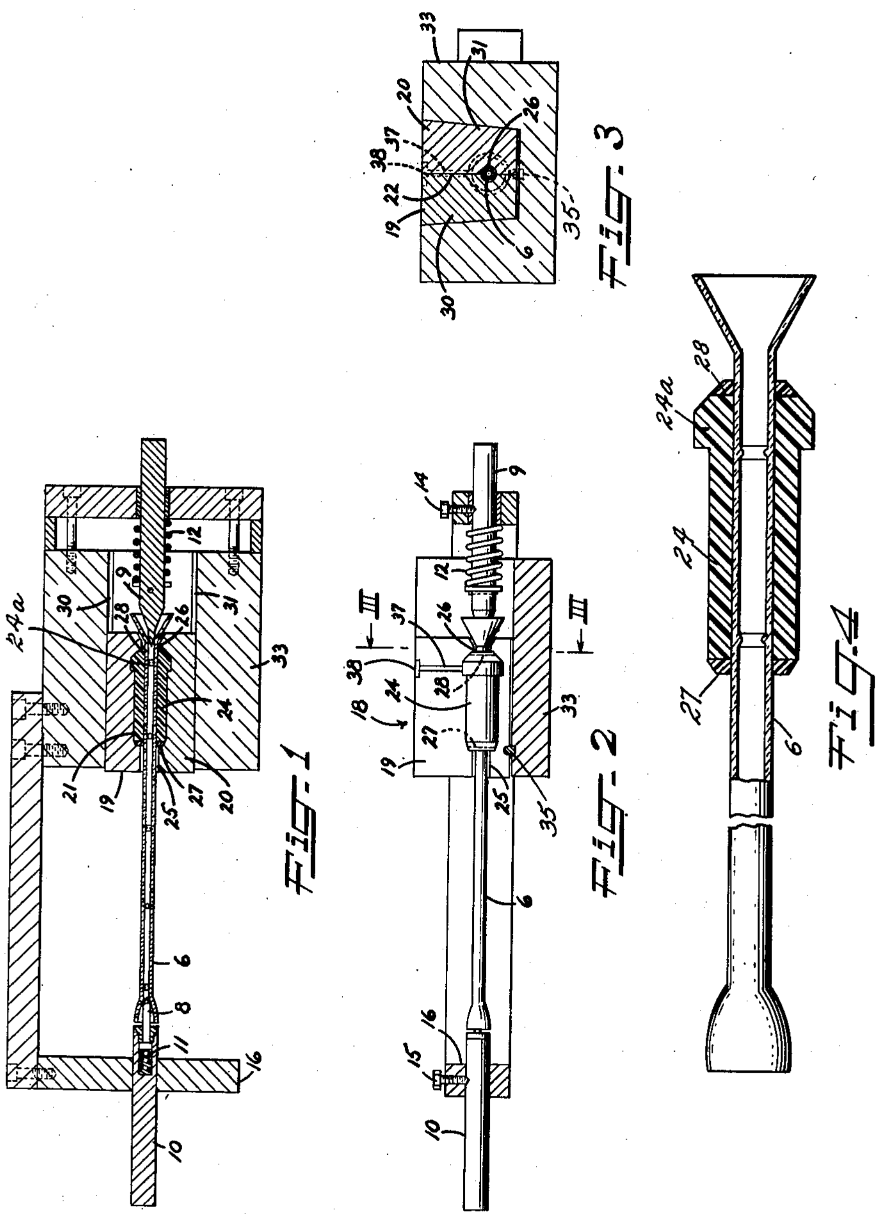

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SPINNING FUNNEL

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This invention relates to funnel guides of the type found in equipment used in spinning viscose rayon yarn in centrifugal pots and, more specifically, to guides of unitary construction and to apparatus for making them.

A spinning funnel guide of the prevalent type presently used in spinning yarn comprises a glass funnel having a stem of approximately uniform outer diameter except for its end sections, and a lead ferrule supported concentrically on the stem near the bell-shaped or outwardly flared upper section of the glass funnel. The ferrule is molded independent of the glass portion with an appreciably larger inside diameter than the outer diameter of the stem. The ferrule is affixed to the glass stem by supporting the ferrule and the glass funnel in a clamping fixture in the relationship desired in the finished spinning funnel guide and then pouring molten sulphur into the annular space between the ferrule and the glass stem. When the molten sulphur solidifies, the spinning funnel guide may be removed from the fixture and attached to spinning equipment which supports the guide in the usual manner occurring in a conventional spinning machine wherein a portion of the machine engages the exterior surface of the ferrule.

Forming of the spinning funnel by this procedure is necessarily a multiple-step operation because the thermodynamic properties of the lead are such that the stem of the glass funnel generally cracks or breaks when the molten lead is poured into direct contact with the glass. Sulphur, having a melting point and a heat transfer rate sufficiently low to avoid injury to the glass, is a satisfactory material for bonding the premolded lead ferrule to the glass stem. Lead and sulphur, because of the ease with which they are molded and their chemical inertness to the materials used in the manufacturing of rayon and particularly viscose rayon, have been preferred materials for forming and attaching the ferrule to the glass funnel. However, the multiple-step procedure in manufacturing the spinning funnel from these materials is obviously more costly than a method involving less steps if the material costs are comparable. The weight of the lead ferrule is the major portion of the total weight of the spinning funnel and accounts to a large extent for the considerable breakage which occurs in commercial spinning operations.

It is an object of the invention to employ a one-step process in forming the ferrules about the stem of spinning funnels. It is another object to provide spinning funnels which are lighter

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in weight and less susceptible to breakage. Still another object is to provide spinning funnels of greater durability and lower manufacturing cost. Other objects, features and advantages of the invention will become apparent in the following description of the invention and the drawing relating thereto in which:

Fig. 1 is a longitudinal sectional view of apparatus for forming a ferrule on the stem of a spinning funnel showing the funnel in place;

Fig. 2 is a longitudinal side elevation with some parts sectioned and other parts removed;

Fig. 3 is a lateral sectional view taken along line III—III of Fig. 2; and

Fig. 4 is an enlarged foreshortened view partly in section of the funnel guide illustrated in Fig. 1.

Briefly, the invention comprises a spinning funnel of unitary structure and apparatus for building it in which the funnel is supported on centering means insertable into each end of the stem, said centering means and the ends of the stems having a common axis with a mold cavity for forming the ferrule, said cavity being disposed between the centering means; and while the funnel is so supported, filling the cavity with a thermosensitive plastic material having a low heat transfer coefficient, said material becoming rigid when cooled to temperatures which are substantially above room temperature.

Figs. 1 to 3 illustrate a stem portion 6 of a glass spinning funnel supported on centering pins 8 and 9 which extend into the opposite ends of the tubular stem of the spinning funnel. By using a stronger spring 12 to urge the pin 9 into the flared strand-receiving portion of the funnel than the spring 11 provided for the pin 8, the glass funnel is forced lengthwise so that its annular strand-discharging end-surface seats against the annular end-portion of the pin-supporting member 10. The desired longitudinal position of the funnel may be obtained by loosening a set-screw 15 (Fig. 2) and moving the element 10 lengthwise with respect to an aperture therefor in the frame member 16 to the proper position and then tightening the set-screw.

A mold 18 comprising two members 19 and 20 which are mirror images of each other is supported so that a mold cavity 21 is axially aligned with the centering pins 8 and 9. The cavity 21, which may be generally cylindrical as shown, is equally distributed between the two members of the mold by a separation plane 22 shown in Fig. 3 extending in a vertical direction and containing the axis of the cavity. Apertures 25 and 26, extending from each end of the cavity to the exterior of the mold are centered with respect to the axis of the cavity and the pins and accommodate the funnel stem 6 when the stem is supported between the centering pins. To provide sufficient clearance for minor inaccuracies in the construction of the stem of the funnel, the holes 25 and 26 provided at the ends of the cavity for the stem are large enough to permit extension therethrough of a funnel stem having a small degree of curvature or misalignment without placing any lateral springing or tension in the stem. Consequently, the outer annular surface of a ferrule 24 which is molded around the glass stem is centered with respect to the axis of the centering pins 8 and 9 even though there may be some curvature in the stem of the funnel which causes the portion extending through the mold cavity to be out of alignment.

In the simple molding device shown, the two-membered mold obtains lateral support from the tapered walls 30 and 31 of the support member 33. The walls 30 and 31 and the side surfaces of the mold members 19 and 20 are complementarily tapered so that as an injection nozzle is brought to bear on the members 19 and 20 at the entrance of a sprue 37, lateral compressive forces normal to the plane of separation are produced which hold the members tightly together during the molding operation. The mold members 19 and 20 are prevented from movement in the direction lengthwise of the funnel stem by a dowel pin 35 extending upwardly into a complementary recess having portions in both halves along the bottom of the mold 18. The sprue 37 which extends from the mold cavity to the upper surfaces of the mold members is bisected by the separation plane 22. A small annular recess 38 is provided in the mold around the exterior end of the sprue to facilitate bringing the nozzle of an injection molding or other extrusion machine (not shown) into the proper alignment with the sprue.

To form a ferrule on the glass stem of a spinning funnel, such as shown in enlarged view in Fig. 4, the glass funnel portion 6 is inserted through the holes 25 and 26 or the separated mold members 19 and 20 are placed around the stem while they are out of the frame member 33. The set screws 14 and 15 are loosened so that the members 10 and 9 may be retracted and the glass funnel inserted longitudinally between the members. The mold 18 with the stem extending therethrough is placed within the frame member in the position shown in the figures of the drawings. The centering member 10 is then moved to the position corresponding to a desired longitudinal position of the funnel and the set screw 15 is tightened. The center pin 9 is inserted into the end of the funnel and by action of the spring 12 allowed to urge the funnel endwise against the member 10. The entire apparatus shown is then placed under the nozzle of an injection machine (not shown), and after proper alignment and engagement of the nozzle with the recess 38 a heated plastic material may be forced into the cavity under pressure to produce a ferrule in accordance with the contour of the mold cavity. A sudden rise in the injection pressure of the material passing into the mold, as the cavity becomes filled, is utilized in the conventional extrusion or injection machine to terminate the transfer of the material into the cavity by automatic means. Immediately thereafter, the nozzle of the injection machine may be retracted. By retracting the centering members 8 and 9 from the ends of the funnel, the mold 18 containing the spinning funnel is removed from the frame 33. The mold members 19 and 20 are then separated and the spinning funnel of the invention, i. e., the glass funnel and the ferrule 24 formed thereon, is removed. The ferrule thus formed consists of a single sleeve comprising throughout its entire body the material extruded into the mold cavity 21 in adherent relationship with the exterior surface of the tube. In the embodiment herein illustrated and described, the cavity 21 comprises an outwardly extending circular groove such as needed to form a shoulder 24*a* on the ferrule.

In selecting a suitable plastic material for forming the ferrule, at least two characteristics of the material are essential for a satisfactory molding procedure. They are: the viscosity of the plastic material and the rate of heat transfer from the material into the glass. The rate of heat transfer is dependent upon such factors as the elevation of temperature necessary to obtain a suitable viscosity of the plastic material, the specific heat capacity of the material, and the heat transfer coefficient of the material. For example, molten lead is unsuitable, not because the melting point is too high but because of a very high rate of heat transfer which permits the heat to pass from the lead into the glass so rapidly that cracking results from the strains produced as the outer and inner layers or longitudinally disposed sections of the glass tube are heated non-uniformly. On the other hand, polystyrene may be heated to as high a temperature as the melting point of the lead and forced into the cavity of the mold to produce a satisfactory ferrule without cracking the glass because polystyrene has a much lower specific heat capacity and a heat transfer coefficient than lead.

However, the thermoplastic organic linear-type resins commonly used as a major ingredient in compositions for extrusion molding have relatively low specific heat capacities and heat transfer coefficients, and may be successfully extruded or molded in direct contact with glass. These resins include polyethylene; polystyrene; vinyl resins including copolymers of vinyl-chloride and vinyl-acetate, vinyl-chloride and acrylonitrile, vinylidene-chloride and vinyl-chloride; the acrylate resins; and the polyamide resins. In general, these materials may be heated to obtain any satisfactory molding viscosity, their heat capacities and rates of heat transfer being sufficiently low to avoid the danger of breaking the glass tube.

Since the apertures to the mold cavity provided for the glass stem are preferably larger than the cross-section of the stem, the stem is unsupported except at the exterior centering pins 8 and 9. Consequently, the tubular stem may undergo lateral flexing until forced into contact with the peripheries of the holes 25 and 26 when subjected to lateral pressure such as when the plastic material is so viscous that it does not flow readily about the mold cavity. Strain is thus produced which, in addition to the strain in the glass imposed by the sudden heating, may produce cracks in the glass tube. It is highly undesirable to form the ferrule about the tube while it is flexed since the stem will return to its original alignment when removed from the mold and the ferrule will be off-center with respect to the axis passing through the ends of the tube.

It is essential therefore that the viscosity of the resin be reduced to such a degree that the cavity may be filled quickly without excessive strain on the glass. It is a further advantage to fill the cavity quickly so that the material which first enters the cavity does not cool and shrink appreciably before it is forced into conformity with the cavity wall when the cavity becomes filled, along with the less cooled and therefore less shrunk material which enters later during the cavity-filling operation. By maintaining the differences in shrinkage between the various portions of the ferrule within acceptable standards, machining of the outer surfaces of the ferrule, such as applied to lead ferrules to obtain a close fit with a supporting bracket of the spinning equipment, may be eliminated.

As the holes **25** and **26** permit considerable clearance with the glass stem and therefore permit the formation of flash particularly when the viscosity of melted resin is low, the mold procedure may be limited to suitable ranges of temperature and viscosity with respect to a specific resinous material. However, flash which is extruded from the mold along the stem may be prevented by placing annular elements such as washers **27** and **28** on the portion of the stem of the funnel which is to extend through the mold, before the mold is assembled around the glass stem. The washers or other apertured articles used to prevent flash are spaced along the stem so that they are adjacent the junction of the cavity with the holes provided in the mold for the stem. If the funnel stem lacks the uniformity in diameter which permits the installing of accurately fitting washers by inserting the end of the stem through the washers, the washers may be split and slipped laterally onto the stem. To accomplish satisfactory bonding of the washers to the rest of the ferrule, the washers are preferably formed from the resin from which the ferrule is formed.

A simple apparatus and method for forming spinning funnels has been described which may be readily modified to obtain production in commercial quantity. For example, apparatus may be provided in which hydraulically-operated opposed platens provided with suitable mold cavities may replace the mold members **30** and **31**. Their movement may be readily synchronized with automatically retractable centering devices substituted for the centering means **10** and **9** of the device described and illustrated. Such an apparatus would operate in synchronism with an automatically retractable nozzle for engaging the entrance of a sprue when the platens were in position to receive the molding material. Other arrangements for automatic operation will be indicated by specific production requirements.

While a preferred embodiment of the invention has been shown and described, it is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A funnel guide comprising an elongate glass stem having a passageway for the movement of a strand therethrough and a flared end-portion, said stem terminating at its other end in an annular strand-discharging surface, and a ferrule consisting solely of a sleeve comprising substantially throughout its entire body a synthetic linear-type resin having a low heat transfer coefficient, said ferrule extending lengthwise of, and enclosing, a relatively short length of the stem adjacent said flared end-portion with the resin in adherent relationship with the external surface of the stem, said ferrule having an external surface adapting it to be engaged and supported by a portion of a spinning machine.

2. A funnel guide as defined in claim 1 wherein the heat transfer coefficient of the material constituting the ferrule is substantially lower than that of lead.

3. A funnel guide as defined in claim 1 wherein the resin is polystyrene.

4. A funnel guide as defined in claim 1 wherein the resin is polyethylene.

5. A funnel guide as defined in claim 1 wherein the resin is one selected from the group consisting of copolymers of vinyl chloride and vinyl acetate, vinyl chloride and acrylonitrile, and vinylidene chloride and vinyl chloride.

6. A funnel guide comprising an elongate glass stem having a passageway for the movement of strand therethrough and a flared end-portion at one end, said stem terminating at its other end in an annular strand-discharging surface, and a ferrule consisting solely of a sleeve comprising throughout its entire body portion a synthetic linear-type resin having a low heat transfer coefficient, said ferrule extending lengthwise of, and enclosing, a relatively short length of the stem adjacent said flared end-portion with the resin in adherent relationship with the external surface of the stem, said ferrule having a generally cylindrical external surface in coaxial relationship with the flared end-portion and the annular strand discharging surface and having a shoulder extending radially from the end of the cylindrical surface nearer the flared end-portion.

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