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COOLING PLUG FOR CONTINUOUSLY EXTRUDED HOT TUBULAR PLASTIC MATERIAL

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FIG. 1

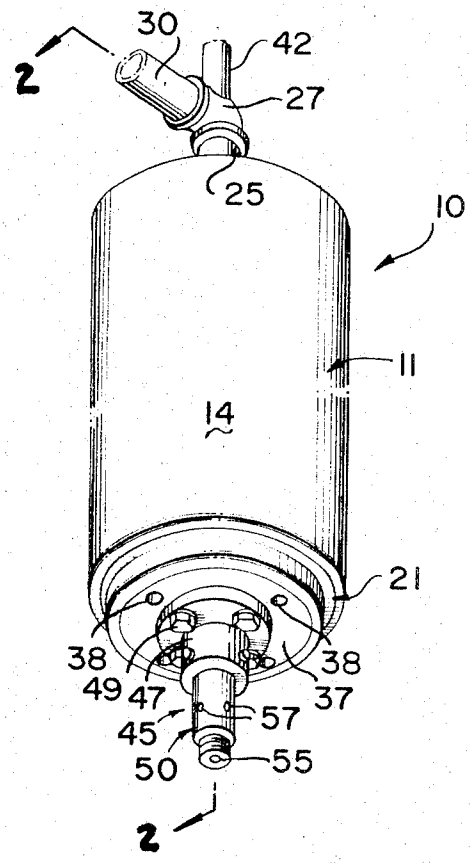
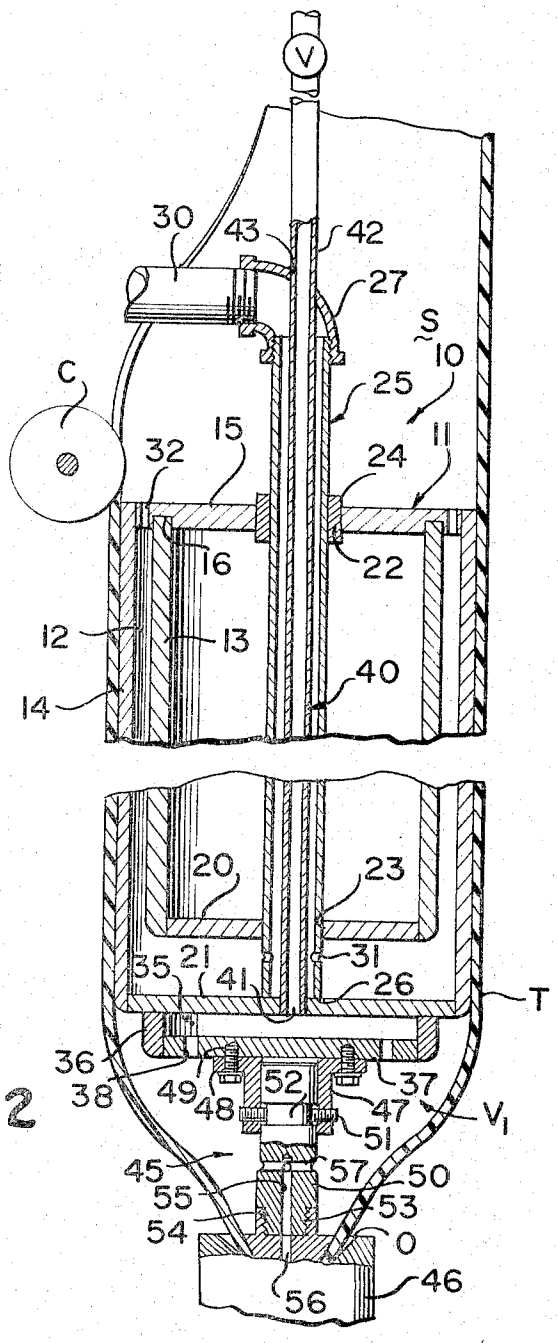


FIG. 2



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COOLING PLUG FOR CONTINUOUSLY EXTRUDED HOT TUBULAR PLASTIC MATERIAL

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ABSTRACT OF THE DISCLOSURE

This invention is directed to a cooling plug having upper and lower chambers closed at opposite ends by respective first and second end walls. The upper chamber is generally U-shaped in axial section and means are provided for introducing and removing coolant therefrom. Means are provided for introducing a fluid media into an area between the exterior of the lower chamber and a plastic tube extruded thereabout, while valve regulator means are provided for directing the fluid media into the lower chamber and then to the exterior thereof through the partition and the first wall.

An object of this invention is to provide a novel cooling plug including a jacket defining a cooling chamber closed at first and second end portions thereof by respective first and second end walls, means for introducing coolant into the chamber, means for exhausting coolant from the chamber, and means passing completely through the jacket for conducting fluid media, such as condensible gases or water vapor, from a side of the jacket which is adapted to be connected to an extrusion machine to an opposite side of the jacket exposed to atmosphere thereby preventing the interruption of a continuous extrusion operation which might otherwise occur in the absence of the removal of the fluid media.

A further object of this invention is to provide a novel cooling plug comprising first and second chambers, the first and second chambers being closed at opposite ends thereof by respective first and second end walls, a partition separating the first and second chambers, means passing through the first end wall for introducing coolant into the first chamber, means passing through the second end wall for introducing a fluid media from the exterior of the second chamber to the interior thereof, means for directing the fluid media from the second chamber to the exterior of the jacket adjacent the first end wall, and means for coupling the cooling plug to an extrusion machine.

Still another object of this invention is to provide a novel cooling plug of the type immediately above described in which the coupling means includes passage means for directing the fluid media from a source of fluid media to an area adjacent the second end wall of the second chamber.

A further object of this invention is to provide a novel cooling plug including a jacket, the jacket including a cooling chamber closed at first and second end portions thereof by respective first and second end walls, a first conduit passing longitudinally through the cooling chamber and opening outwardly thereof through the first and second end walls whereby a fluid media externally of the jacket adjacent the second end wall is bypassed to the exterior of the jacket adjacent the first end wall, a second conduit passing through the first end wall into the interior of the cooling chamber for introducing coolant therein, means in the first end wall for exhausting circulated coolant from the cooling chamber, a second chamber adjacent the cooling chamber, the second chamber being separated from the cooling chamber by the

second end wall, the second conduit opening into the interior of the second chamber, a wall portion of the second chamber being provided with aperture means for placing the interior of the second chamber in fluid communication with the exterior thereof, and the first and second conduits being in telescopic relationship.

Another object of this invention is to provide a novel cooling plug of the type described wherein the jacket includes an external surface, and the external surface of the jacket is provided with a coating of polytetrafluoroethylene.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawing.

In the drawing:

FIGURE 1 is a bottom perspective view of a cooling plug constructed in accordance with this invention, and illustrates a pair of conduits connected to a jacket of the cooling plug and coupling means for securing the cooling plug to an extrusion machine.

FIGURE 2 is an enlarged fragmentary sectional view taken generally along line 2—2 of FIGURE 1, and illustrates the cooling plug attached to an extrusion machine and a tube of hot plastic material being cooled by the cooling plug.

A novel cooling plug constructed in accordance with this invention is generally referred to by the reference numeral 10 and comprises a jacket 11 which is of a substantially cylindrical configuration. The jacket 11 includes a substantially annular cooling chamber 12 (FIGURE 2) defined by an iner body wall 13 and an outer body wall 14. Each of the walls 13, 14 is generally cylindrical in shape and is enclosed at upper end portions (unnumbered) by a generally circular end wall 15. The inner wall 13 is received in a downwardly opening annular groove 16 of the end wall 15. The walls 13 and 15 are preferably welded or otherwise conventionally secured to each other to maintain the walls 13, 15 in fixed relationship. The end wall 15 is similarly welded (not shown) to the outer wall 14 of the jacket 11.

A bottom end portion (unnumbered) of the jacket 11 is provided with a pair of axially spaced generally circular end walls 20, 21. The end wall 20 is welded or otherwise secured to the cylindrical wall 13 while the end wall 21 is similarly welded to the cylindrical wall 14.

The walls 15, 20 are provided with respective circular openings 22, 23, and a bushing or sleeve 24 is fixed to the end wall 15 in the opening 22. A pipe or conduit 25 is positioned in the bushing 24 and the opening 23, and a bottom edge 26 of the pipe 25 seats upon the wall 21 of the jacket 11. The pipe or conduit 25 is fixed to the bushing 24, the wall 20 and the wall 21 by welding. An elbow 27 connects the conduit 25 to a conduit 30 which is in turn connected to a conventional source of liquid coolant, such as water. A lower end portion of the pipe 25 is provided with a plurality of identical radially directed circumferentially spaced openings or ports 31 positioned substantially midway between the walls 20, 21.

Coolant from the coolant source (not shown) is introduced through the conduit 30, the elbow 27, the pipe 25 and the plurality of openings 31 into the lower portion of the cooling chamber 12. The coolant is exhausted from the chamber 12 by means of a plurality of circumferentially spaced apertures or openings 32 formed in the end wall 15 of the jacket 11. Suitable conduits (not shown) can be connected to each of the openings 32 for returning the coolant to a conventional reservoir (also not shown), or a manifold (not shown) having a single return conduit can be secured in spaced overlying relationship to the

end wall 15 for accumulating the exhausted coolant and returning the same to the coolant reservoir.

The jacket 11 of the cooling plug 10 includes a second chamber 35 defined by the end wall 21, a cylindrical body wall 36 and a generally circular end wall 37 provided with a plurality of circumferentially spaced openings or apertures 38. A conduit or pipe 40 is arranged in coaxial internally telescopic relationship to the conduit 25. The conduit 40 has a bottom end portion 41 opening into the interior of the second chamber 35. The bottom end portion 41 of the conduit 40 is fixed in an opening (unnumbered) of the end wall 21. An upper end portion 42 of the conduit 40 passes through an opening 43 in the elbow 27. A valve V of a conventional construction is located in the conduit 42 remote from the cooling plug 10. The purpose of the second chamber 35, the conduit 40 and the valve V is to bypass fluid media, such as condensible gases or water vapor, from an exterior area adjacent the bottom of the cooling plug 10 to an area above and remote from an upper portion of the cooling plug, as will appear more fully hereafter.

Coupling means45 are provided for coupling the cooling plug 10 to an extrusion nozzle 46 of a conventional extrusion machine or extruder (not shown). The coupling means 45 comprises a generally cylindrical collar 47 having a radially outwardly directed flange 48. A plurality of screws 49 passed through openings (unnumbered) in the flange 48 secure the collar 47 to the end wall 37 of the jacket 11. A connector 50 is partially positioned in and secured to the collar 47 by means of a plurality of set screws 51 bottoming in a circumferential groove 52 of the connector 50 as is readily apparent from FIGURE 2 of the drawing. A reduced threaded end portion 53 of the connector 50 is threadably secured to an internally threaded socket 54 of the extrusion nozzle 46. The connector 50 also includes an axial passage or port 55 in aligned relationship with a passage or port 56 of the extrusion nozzle 46. The passage 55 is connected to a plurality of radially outwardly directed passages or ports 57 opening outwardly through a surface (unnumbered) of the connector 50.

Referring to FIGURE 2 of the drawing in particular, a tube T of hot solid or foam plastic material, such as polyethylene or polystyrene, is extruded outwardly from an extrusion orifice O of the extrusion nozzle 46. The tube T is drawn upwardly by conventional draw or pull rolls (not shown) during which time an inner surface S externally surrounds and contacts an outer surface (unnumbered) of the cylindrical wall 14. Heat is transferred from the tube T to and through the cylindrical wall 14 and to the coolant in the chamber 12 of the cooling plug 10, thus cooling or chilling the tube T. During this cooling operation, the coolant is continually introduced into and exhausted from the chamber 12 in the manner heretofore described.

After the tube T has been sufficiently cooled a conventional cutter C longitudinally severs or slices the tube in the manner clearly illustrated in FIGURE 2 of the drawing. The severed tube is thereafter progressively opened and formed into a generally flat web which is wound into a roll by a suitable mechanism (not shown).

During the extrusion of the tube T air, an inert gas, or a similar gaseous media is introduced into a volume V1 of the tube T through the passage 56 of the extrusion nozzle 46 and the passages 55, 57 of the connector 50. In the case of air, the moisture in the air introduced in the volume V1 tends to condense and form water vapor due to the differential temperature between the hot tube T and the relatively cooler plug 10. Unless otherwise provided for the accumulation of water vapor in the volume V1 would interrupt the continuous extrusion process, as would the build-up of any other type of condensible gas at the bottom of the cooling plug 10. However, such build-up is prevented by the cooling plug 10 which effectively bypasses a gaseous media from the volume V1 to atmosphere along a fluid path defined by the apertures 38, the interior of the housing 35, the conduit 40 and the valve V. The valve V is regulated to control the rate of flow of the gaseous media from the volume V1 to atmosphere. This bypassing of the gaseous media prevents objectionable accumulation of a condensible gas or water vapor in the volume V1 and insures continuous and uninterrupted extrusion of the tube T.

From the foregoing description, numerous changes in the cooling plug 10 will be apparent to those skilled in the art and are considered to be a part of this invention. For example, in order to insure the free movement of the extruded tube T along the outer surface (unnumbered) of the cylindrical wall 14, the wall 14 is preferably provided with a coating of polytetrafluoroethylene. In addition, the portion of the conduit 40 upstream from the valve V can be connected to a conventional source of vacuum (not shown) to increase the flow rate of the gaseous media from the volume V1.

From the foregoing, it will be seen that novel and advantageous provisions have been made for carrying out the desired end. However, attention is again directed to the fact that additional variations may be made in this invention without departing from the spirit and scope thereof as defined in the appended claims.

I claim:

1. A cooling plug in combination with an extrusion nozzle wherein the extrusion nozzle includes an extrusion orifice for continuously extruding hot tubular plastic material in an upward direction in external telescopic relationship to said cooling plug, said cooling plug including respective upper and lower chambers, said upper and lower chambers being closed at opposite ends thereof by respective first and second end walls, a partition between and separating said upper and lower chambers, means passing through said first end wall for introducing coolant into said upper chamber, means for removing coolant from said upper chamber, means for introducing a fluid media to an area between said lower chamber and said tube, means passing through said second end wall for introducing the fluid media from the exterior of said lower chamber into the interior thereof, means for directing the fluid media from said lower chamber to the exterior thereof through said partition and said first end wall, and means for regulating the flow of said fluid media from said area exteriorly of said cooling plug.

2. The combination as defined in claim 1 wherein said upper chamber is of a generally U-shaped configuration in axial section.

3. The combination as defined in claim 1 wherein said coolant introducing means and said fluid media directing means are conduits disposed in coaxial telescopic relationship.

4. The combination as defined in claim 1 including means for removably securing said cooling plug to said extrusion nozzle, and said fluid media introducing means is defined by said securing means.

5. The combination as defined in claim 1 wherein said upper chamber is defined by inner and outer generally cylindrical walls in spaced telescopic relationship, said first end wall closes said upper chamber at an upper end thereof, and an end wall generally parallel to and spaced from said partition closes the inner of said cylindrical walls thereby imparting a generally U-shaped configuration to said upper chamber as viewed in axial section.

6. The combination as defined in claim 1 including a coating of polytetrafluoroethylene on the exterior of said cooling plug.

7. The combination as defined in claim 1 wherein said upper chamber is of a generally U-shaped configuration in axial section, and said coolant introducing means and said fluid media directing means are conduits disposed in coaxial telescopic relationship.

8. The combination as defined in claim 1 wherein said coolant introducing means and said fluid media directing means are conduits disposed in coaxial telescopic relationship, means are provided for removably securing said cooling plug to said extrusion nozzle, and said fluid media introducing means is defined by said securing means.

9. The combination as defined in claim 1 wherein said upper chamber is of a generally U-shaped configuration in axial section, means are provided for removably securing said cooling plug to said extrusion nozzle, and said fluid media introducing means is defined by said securing means.

10. The combination as defined in claim 1 wherein said upper chamber is of a generally U-shaped configuration in axial section, said coolant introducing means and said fluid media directing means are conduits disposed in coaxial telescopic relationship, means are provided for removably securing said cooling plug to said extrusion nozzle, and said fluid media introducing means is defined by said securing means.

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