Dec. 31, 1929. J. E. BOYNTON 1,741,816

APPARATUS FOR PUMPING MATERIAL

Original Filed May 8, 1924 4 Sheets-Sheet I

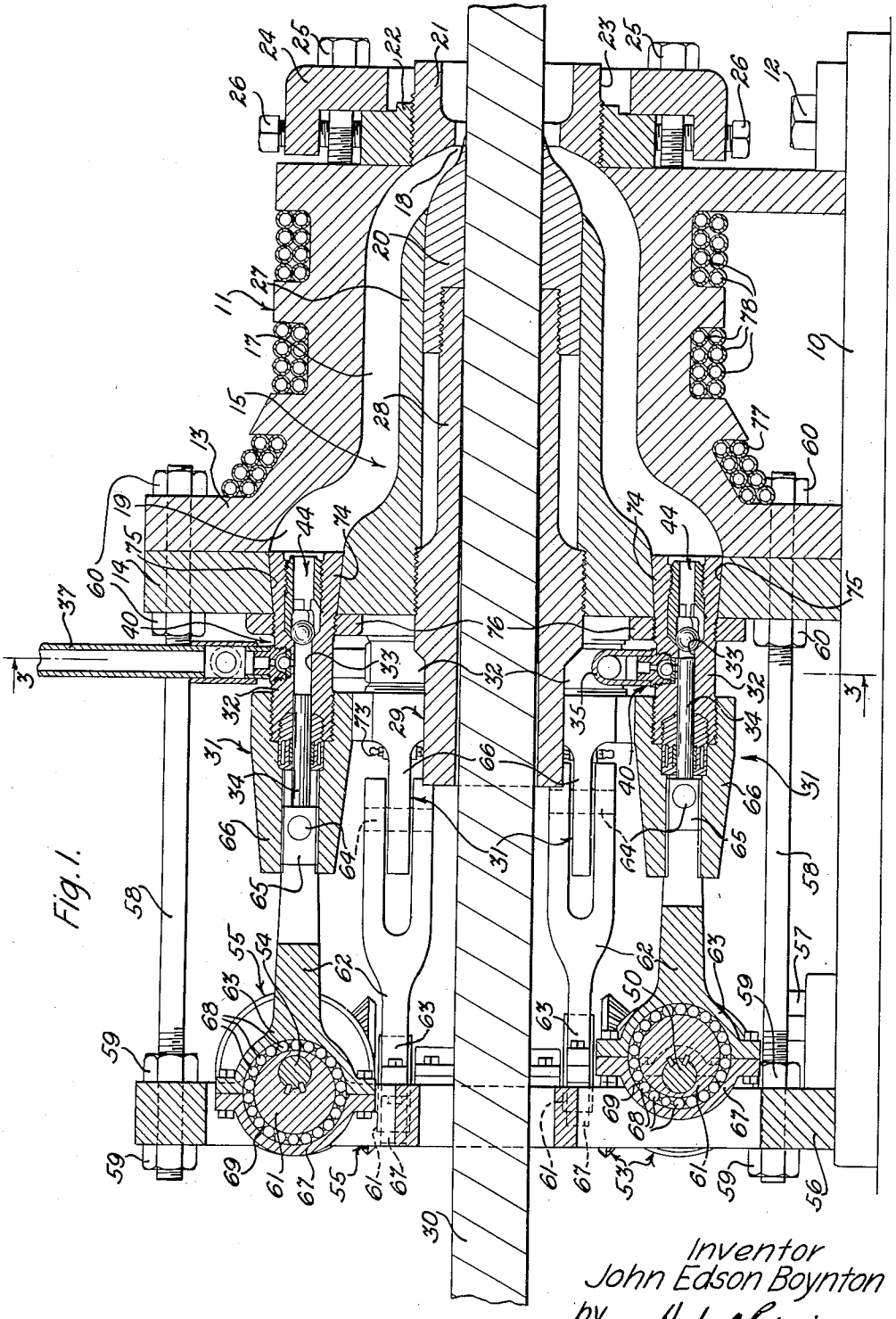


Fig. 1.

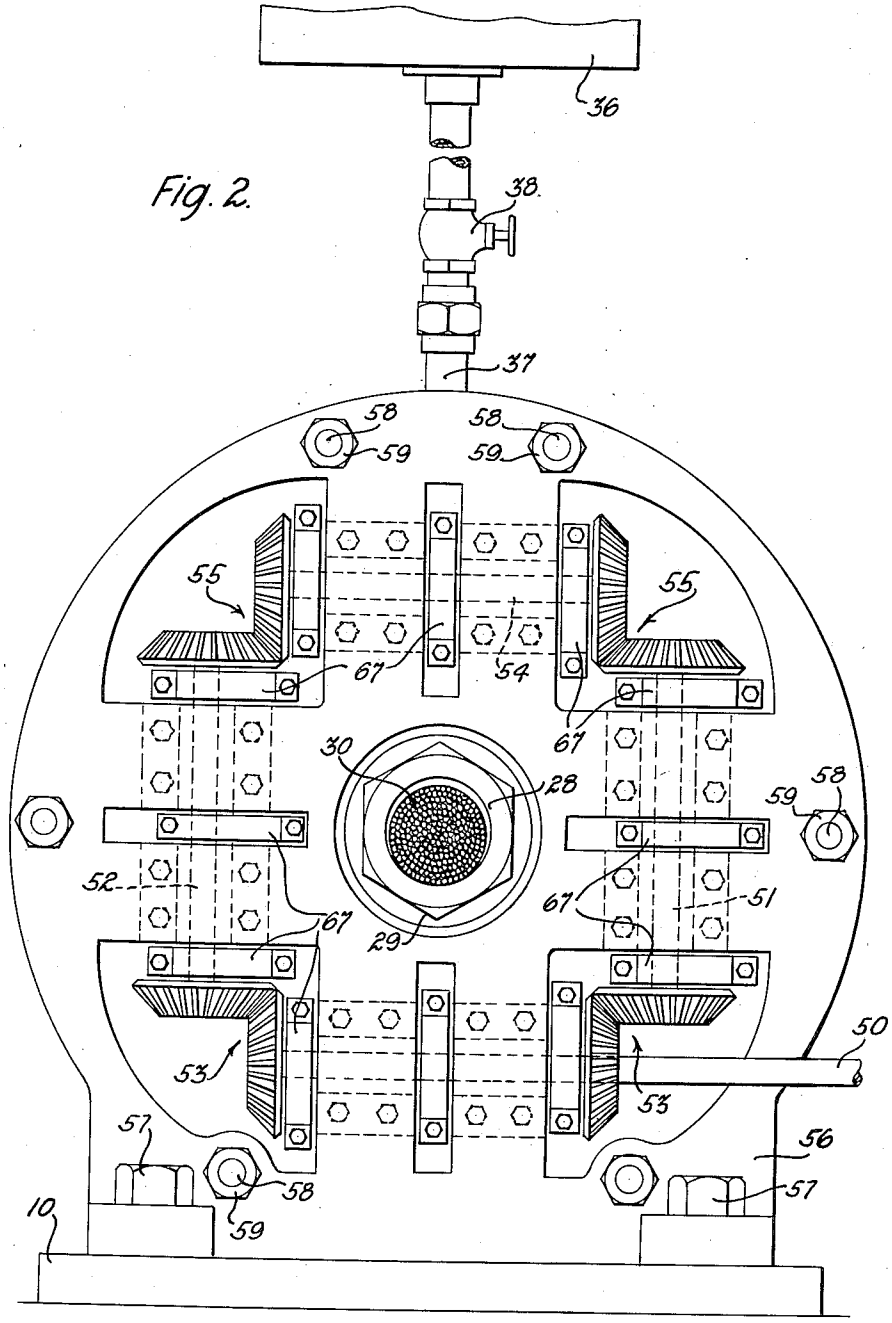
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Fig. 2.



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Fig. 3.

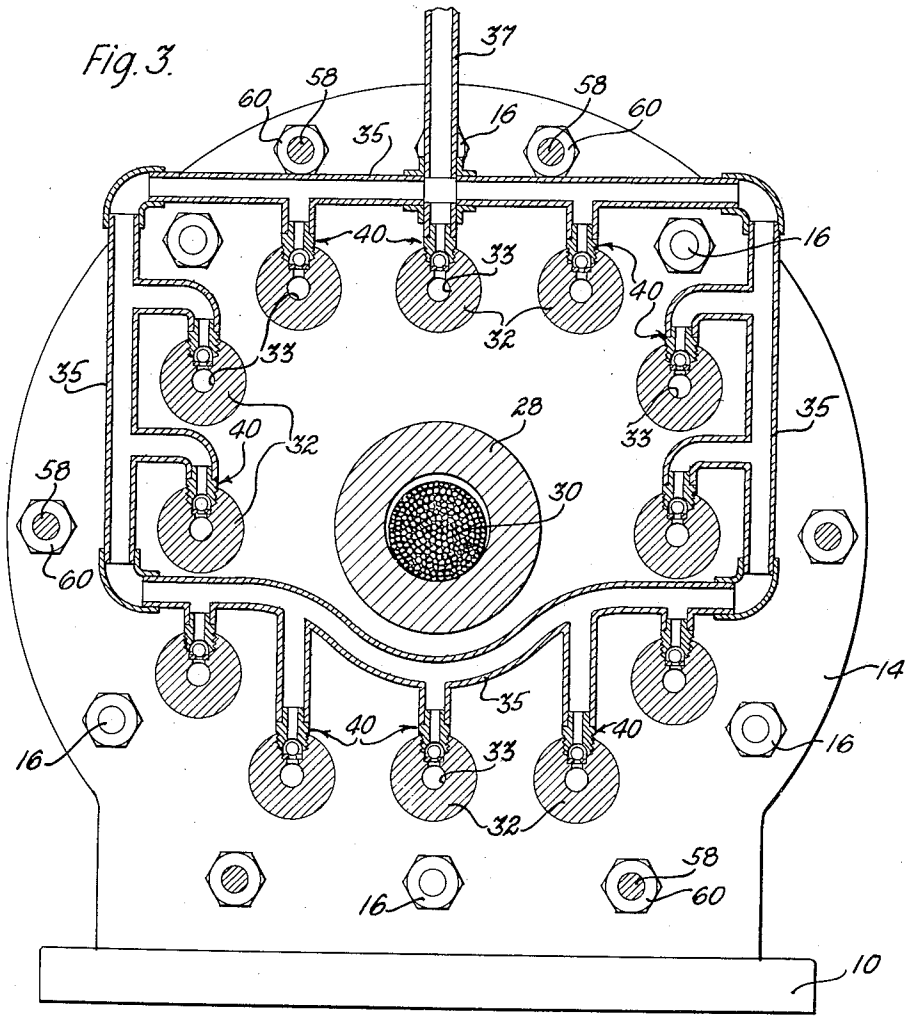
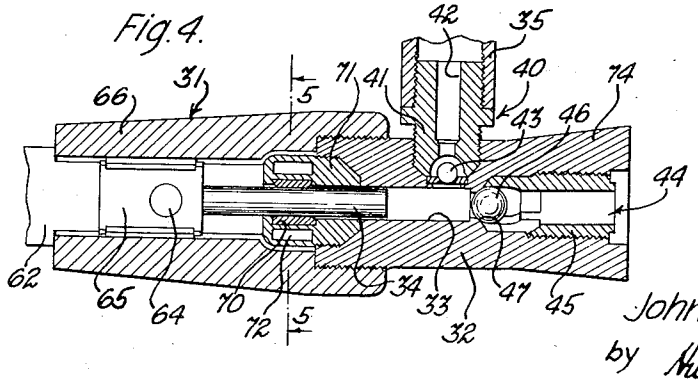


Fig. 4.



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Fig. 6.

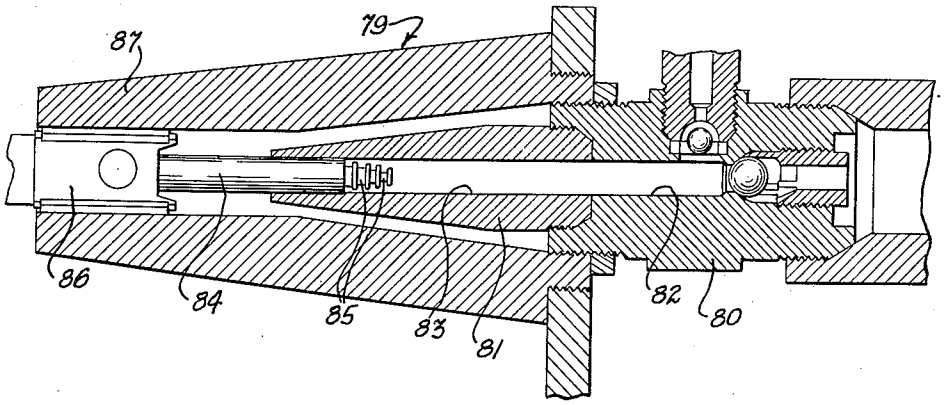
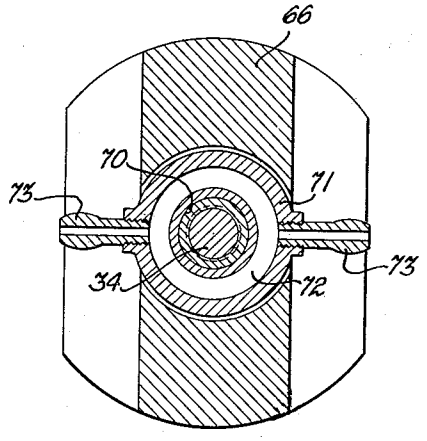


Fig. 5.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR PUMPING MATERIAL

Original application filed May 8, 1924, Serial No. 711,763. Divided and this application filed June 9, 1928. Serial No. 284,178.

This invention relates to apparatus for pumping material, more particularly to a pump especially adapted to such apparatus, and is a division of my copending application, Serial No. 711,763, which issued on July 16, 1929 as Patent No. 1,720,759.

An object of the invention is to provide an efficient and practical apparatus for pumping material.

Other objects of the invention are to provide a pump particularly adapted to handle fused metallic matter; and to provide an improved packing for such a pump.

A preferred form of the invention is embodied in an extruding machine for sheathing cable cores and comprising a plurality of pumps which receive fused metallic matter from a common supply thereof and force the fused matter into an annular chamber, the annular chamber having a discharge opening. A die is adjustably supported with respect to the discharge opening. A core tube projecting into the annular chamber and aligned with the die provides means by way of which a cable core may pass through the chamber so that matter forced into the annular chamber by the pumps will sheathe the core, the machine being so designed that the matter reverts to its solid state before it comes into contact with the core.

The fused metallic matter is supplied to the pumps by way of a common manifold, the pumps comprising a plurality of check valves which are particularly adapted to control the flow of the fused matter to the pumps. Other valves are provided for preventing a a back flow from the annular chamber to the pumps, and the pumps are so driven that fused matter is being forced continuously into the annular chamber whenever the machine is forming a sheath upon a cable core.

The pumps are packed by means of the matter being extruded, that is, a portion of the matter is solidified and employed to prevent leakage between the plungers and their respective cylinders. In one form of the invention, the matter is collected and solidified in pockets formed in the cylinder walls, and in another form of the invention, each of the plungers is adapted to carry a quantity of the matter in a solidified state in such a position that it prevents leakage between the plunger and its cylinder.

The core when it leaves the extruding machine is enclosed in a sheath of the solidified matter. The several pumps are disposed around the axis of the annular chamber in such manner that substantially equal pressures are obtained in all parts thereof so that the matter extruded from the machine is of substantially uniform density and texture. The pumps preferably comprise cylinders which project from a housing surrounding the annular chamber. The inner ends of the cylinders communicate directly with the annular chamber. The outer ends of the cylinders are free to move when the cylinders contract or expand in response to variations in the temperature thereof, or when the cylinders move radially with respect to the axis of the annular chamber during temperature changes in the extruding machine, as plungers slidably journaled in the cylinders are reciprocated by means mounted independently of the cylinders. This construction insures that deformation of the cylinders will not be occasioned when the temperature of the cylinders varies from the temperature of other parts of the machine.

The annular chamber comprises a cylindrical portion intermediate its ends, one of the ends being contracted to form the discharge opening and the other end being flared to receive the discharge openings of the pumps. The cylindrical portion of the annular chamber permits a relatively large quantity of matter to be stored under pressure in the chamber and permits the metal or the matter to be solidified at a point relatively remote from the discharge aperture, it being readily understood that the solidified matter can be displaced longitudinally in the cylindrical portion of the chamber with much less effort than it could be displaced in a chamber having converging walls. In line with the above construction, a plurality of means is provided for controlling the temperature of the matter as it passes along the cylindrical portion of the annular chamber, the means being regulatable to supply heat to or

to withdraw heat from the matter being extruded. These means permit the operator to cause a change in the state of the matter at any desired point in the annular chamber.

Other objects of the invention will become apparent as the detail description progresses, reference being had to the accompanying drawings, wherein

Fig. 1 is a central longitudinal section through an extruding machine which embodies the invention;

Fig. 2 is an end elevation of the extruding machine looking from the left in Fig. 1;

Fig. 3 is a section taken on line 3—3 of Fig. 1;

Fig. 4 is an enlarged central longitudinal section of one of a plurality of pumps which form parts of the extruding machine;

Fig. 5 is a section taken on line 5—5 of Fig. 4, and

Fig. 6 is a central longitudinal section through a pump which, if so desired, may be employed in place of the pump shown in Fig. 4.

It is believed that a complete understanding of the improved method will be procured by a description of the means by which it is performed.

Referring to the drawings wherein like reference characters designate like parts throughout the several views, the reference character 10 designates a base plate upon which is mounted the mechanism of an extruding machine embodying the invention. The reference character 11 designates generally a head which is disposed at one end of the base plate 10 and is rigidly secured thereto by a plurality of bolts 12. The head 11 comprises a tubular block 13, which together with a back plate 14, forms an annular chamber 15, the back plate 14 being rigidly secured to the tubular block 13 by means of a plurality of bolts 16 (Fig. 3). It will be noted that the annular chamber 15 comprises a cylindrical portion 17 intermediate its ends, one of the ends being contracted to form a discharge opening 18, and the other end being flared as at 19. The advantage of this construction will be explained hereinafter, but for the present it will suffice to state that the annular chamber 15 forms a passage for the matter to be extruded, the discharge opening 18 of the annular passage having associated therewith a core tube 20 and a die 21. The die 21 threadedly engages a die holder 22 and is provided at its outer ends with a plurality of flattened sides 23 adapted to receive a wrench, which may be used to bring the die into a plurality of adjusted positions with respect to the core tube 20. The die holder 22 is interposed between the tubular block 13 and a clamping plate 24 which may be adjusted by means of a plurality of bolts 25 into a position wherein it exerts sufficient pressure upon the die holder 22 to prevent displacement thereof relative to the discharge opening 18. The clamping plate 24 carries means for laterally adjusting the die holder 22. This means comprises a plurality of bolts 26 which engage the periphery of the die holder and may be used to effect lateral adjustment of the die holder, it being understood that it is necessary to loosen the bolts 25 when such lateral adjustment of the die holder 22 is to be made. It is apparent that the die holder 22, the clamping plate 24, and the associated bolts 25 and 26 constitute means whereby the die 21 may be adjusted laterally and longitudinally with respect to the axis of the core tube 20, the axis of the core tube 20 being coincident with the axis of the annular chamber 15. This construction permits the die 21 to be aligned accurately with respect to the discharge opening, and at the same time permits the operator to control the cross-sectional area of a stream of matter being extruded from the machine.

The core tube 20 may be adjusted longitudinally of its axis, the core tube being slidably and rotatably journaled in a sleeve 27 formed integral with the back plate 14. The means for adjusting the core tube longitudinally of its axis comprises a sleeve 28 with which the core tube makes threaded engagement. The sleeve 28 is screw threaded into the sleeve 27 and at its rearwardly extending end is provided with a plurality of flattened surfaces 29 adapted to be engaged by a wrench which may be employed to bring the sleeve 28 and the core tube 20, as a unit into a plurality of adjusted positions with respect to the die 21. This construction also permits the core tube 20 to be replaced quickly and easily as the operator need only withdraw the sleeve 28 from the sleeve 27, replace the core tube 20 and then return the sleeve 28 to the sleeve 27. The advantage of this construction is apparent.

As best shown in Fig. 1, the sleeve 28 and core tube 20 are adapted to accommodate a cable core 30 which may be drawn through the machine by any suitable means (not shown), or which may be drawn through the machine by matter being extruded from the machine. Since the die 21 may be brought into a position wherein its axis is coincident with the axis of the core tube, it follows that any matter extruded by way of the discharge opening 18 will form a sheath of uniform thickness around the cable core. The cable core, of course, will be drawn through the machine at a rate of speed proportional to the rate of speed at which the matter is extruded between the core tube and the die.

The annular chamber 15 is continuously supplied with matter to be extruded, the matter being forced into the annular chamber under sufficient pressure to cause it to be extruded between the core tube and the die. This means for supplying the annular cham-

ber with matter to be extruded includes a plurality of pumps 31, each of the pumps 31 comprising a cylinder 32 having a substantially central bore 33. The axes of the several cylinders 32 are disposed parallel to the common axis of the core tube 20, and of the die 21, the bores 33 of the cylinders opening directly into the flared end 19 of the annular chamber 15. As shown in Fig. 3, the axes of the cylinders 32 are substantially equi-distantly spaced from each other and approximately so from the common axis of the core tube and the die. Certain combinations of the cylinders are equi-distantly spaced from each other and from the axis. Therefore, the cylinders of the pumps may be said to be disposed around the common axis, or may be said to be disposed around the annular chamber 15. Slidably journaled in each of the cylinders 32 is a plunger 34 adapted to be reciprocated therein so that it may force matter, to be extruded, into the annular chamber 15. The matter to be extruded is supplied to the cylinders by way of a common manifold 35, which is preferably of substantially rectangular form and is connected to a receptacle 36 by means of a pipe 37 (Fig. 2). The receptacle 36 is adapted to hold a supply of the matter to be extruded, suitable means (not shown) being provided to keep the matter in a fused state so that it may gravitate by way of the pipe 37 to the manifold 35, and thence to the cylinders 32. A valve 38 disposed in the pipe 37 provides means whereby the operator may control the flow of fused matter to the cylinders.

A plurality of valve devices 40 prevent a back flow from the cylinders 32 into the manifold 35, one of the valve devices 40 being interposed between each of the cylinders 32 and the common manifold 35 (Fig. 4). Each valve device 40 is disposed in the intake opening of its associated cylinder 32 and comprises a valve cage 41 threaded or otherwise tightly and securely fitted into the intake opening. The valve cage 41 is provided with a central aperture 42, through which the fused matter must pass on its way to the cylinder. Disposed beneath the aperture 42 and retained in substantial alignment therewith is a solid ball 43 manufactured of matter of less specific gravity than that of the fused matter. It is obvious that the ball 43 will tend to float into a position wherein it closes the aperture 42 whenever the cylinder holds a quantity of fused matter.

Means are also provided for preventing a back flow from the annular chamber 15 to the several cylinders 32. Thus each pump 31 is provided with a check valve 44, which comprises a valve cage 45 seated in the discharge opening of the pump, the valve cage 45 being adapted to retain a ball 46 in the opening. The ball is adapted to engage a valve seat 47 formed in the opening.

From the foregoing detailed description of the pumps, it is apparent that if one of the plungers 34 is reciprocated in its cylinder, there will be an intermittent flow of fused matter from the receptacle 36 through the cylinder, and thence to the annular chamber 15, the balls 43 and 46 acting to control the flow of fused matter to and from the cylinder. It is also apparent that the forward strokes of the several plungers 34 may be so timed relative to each other that a continuous flow of fused matter into the annular chamber 15 is obtained. In this embodiment of the invention the pumps are driven so as to continuously force fused matter in the annular chamber 15 during the extruding operation.

The means for driving the pumps 31 comprises a shaft 50 which is adapted to drive two vertically disposed shafts 51 and 52 through the medium of a plurality of bevel gears 53, the shaft 50 being driven from any suitable source of power (not shown). The vertically disposed shafts 51 and 52 are adapted to drive a horizontally disposed shaft 54, the shaft 54 being operatively connected to the vertically disposed shafts 51 and 52 by means of a plurality of bevel gears 55. The driven shaft 50 and each of the shafts 51, 52 and 54 is rotatably journaled into an upright standard 56 rigidly secured to the base plate 10 by a plurality of bolts 57. The standard 56 is securely held in spaced relation with the head 11 by means of a plurality of threaded rods 58 which are rigidly secured to the standard by a plurality of nuts 59 and to the head by a plurality of nuts 60. Each of the several shafts 50, 51 52 and 54 has rigidly secured to it a plurality of eccentrics 61, each eccentric 61 being aligned with one of the pumps 31. Each eccentric 61 is operatively connected to the plunger 34 of its associated pump 31 by means of an eccentric rod 62, and an eccentric strap 63. The free end of each eccentric rod 62 is pivoted upon a wrist pin 64 carried by a cross-head 65, which is rigidly secured to the outer end of the associated plunger 34. The cross-head 65 is journaled in a plurality of guides 66 rigidly secured to the outer end of the cylinder 32 of the pump. The guides are virtually integral with the cylinders so that they remain in perfect alignment at all stages of expansion of the machine in general. The eccentric strap 63 preferably comprises a cap 67 and is rotatably journaled upon its eccentric by means of a roller bearing which consists of a plurality of rollers 68 and a cage 69. The employment of the roller bearing between the eccentric and its strap is advantageous in that proper lubrication between the eccentric and the strap is insured, it being understood that the eccentrics carry comparatively large loads and that they would tend to drive out any lubricating oil or the like which might be introduced between them and their straps if the roller bear-

ings were not provided. The several eccentrics 61 are so arranged relative to each other that fused matter is forced continuously into the annular chamber 15 when the extruding machine is in operation, the velocity for this continuous flow of fused matter being substantially constant when the machine is operated at a given speed. Of course the speed of the driven shaft 50 may be varied by means well known to those skilled in the art so that the rate of extrusion will correspond to the size of the core tube and its die or to other conditions obtaining at any particular time.

It will be noted that the outer ends of the cylinders 32 are free to move, when the cylinders contract or expand in response to variations in temperature and are also free to move when the back plate 14 contracts or expands, thus causing the cylinders to move in and out radially with respect to the axis of the annular chamber 15. As the guides 66 are mounted on the outer ends of the cylinders 32 and are not supported by any other means, they are also free to move when they or their respective cylinders move in response to variations in temperature. This construction is provided to prevent deformation of the cylinders 32 and distortion of the guides 66 when the temperature of the head 11 and the mechanism associated directly therewith varies from the temperature of the standard 56 and the driving mechanism mounted thereon.

Means is provided for packing each of the pumps 31, the means in each instance comprising a pocket or annular recess 70 (Fig. 4) turned in a collar 71 which is threaded into an enlargement of the bore 33 of the pump and may be considered a portion of the cylinder thereof. The annular recess 70 is adapted to collect and retain any fused matter seeking to escape through the clearance which must be provided between each plunger and the wall of its associated cylinder. The matter so collected tends to revert to its solid state, but to insure such a change of state, an annular chamber 72 is provided in the collar 71 into which a cooling fluid may be introduced by means comprising a plurality of nozzles 73 having central passages which communicate with the chamber 72 (Fig. 5). It is readily understood that flexible hose or the like (not shown) may be fitted over the nozzles 73 to connect the nozzles with any suitable supply of cooling fluid, and that means (not shown) may be provided for causing forced circulation of the cooling fluid through the annular chamber 72. Cooling fluid so introduced into the annular chamber 72 will lower the temperature of any fused matter collected in the annular recess 70 and cause it to solidify. The solidified matter will then pack the pump.

The pumps 31 are mounted in the head 11 in an improved manner, each pump comprising a frusto-conical head 74 adapted to seat in a similarly shaped aperture 75 formed in the back plate 14 (Figs. 1 and 4). Each pump is provided with a nut 76 threaded upon its cylinder and adapted to engage the back plate 14 to prevent displacement of the pump relative to the eccentric and also the manifold. The arrangement is such that the pressure which obtains in the annular chamber 15 tends to force the frusto-conical head against its seat, and as this construction permits the heads to be ground into the seats, it is obvious that a perfect seal will result in each instance, thus making it unnecessary to pack the heads.

Referring now to Fig. 1, the tubular block 11 is provided with a plurality of annular channels 77 to accommodate a plurality of coils 78 adapted to receive cooling or heating fluids whereby the temperature of the matter passing through the block may be controlled. By regulating the temperature of the flud introduced into the coils 78, it is possible to solidify the fused matter at any desired point in the annular chamber 15. Thus the coils 78 associated with the flared end 19 of the annular chamber 15 could be supplied with a heating fluid to prevent solidification of the fused matter, and the remaining coils could be provided with a cooling fluid of proper temperature to cause the fused matter to revert to its solid state as it enters the cylindrical portion 17. A sufficient supply of a matter in its solid state would then be stored in the annular chamber to negative the possibility that any matter might pass out in its fused state through the extruson aperture. Comparatively little power is required to move the solid matter along the cylindrical portion 17 because this portion of the chamber 15 has a constant cross-section.

Fig. 6 illustrates one of a plurality of pumps which may be employed in place of the pumps shown in Fig. 1. Thus a pump 79 is shown, which comprises a cylinder 80 having an extension 81, the cylinder 80 and the extension 81 having aligned bores 82 and 83 respectively. A plunger 84 adapted to reciprocate in the bore 83 carries means at its forward end for holding or retaining a quantity of the matter which is being extruded. The means preferably comprises a plurality of annular grooves 85 in which the matter may collect and solidify, the solidified matter being then held in a position wherein it packs the cylinder. Of course the pump is so designed that a comparatively low temperature will obtain in the extension 81 as compared with the temperature obtaining in the cylinder 80, and the plunger 84 is not brought into a position wherein the fused metal passing from the intake opening of the pump to the discharge opening thereof may fuse the mat-

ter solidified upon the forward end of the plunger. In Fig. 6 the plunger 84 is provided with a cross-head 86 slidably journaled in guides 87 rigidly secured to the cylinder 80. The guides 87 are so arranged that air may circulate about the extension 81 to keep it at a temperature below the temperature of the cylinder 80.

In the operation of the device a supply of the matter to be extruded is fused in the receptacle 36 and one end of the cable core 30 is threaded through the core tube 20 and the die 21, one end of the core being introduced into the core tube 20 by way of the sleeve 28. The valve 38 is then opened and the extruding machine set in operation. The fused matter flows to the several pumps 31 by way of the pipe 37 and the manifold 35, and the pumps force the fused matter into the flared end 19 of the annular chamber 15. The matter solidifies as it passes through the cylindrical portion 17 of the annular chamber and is formed by the core tube and the die into a sheath which encloses the cable core being drawn through the machine. This process is continuous as the receptacle 36 may be charged from time to time so that the pumps can continue indefinitely to force fused matter into the annular chamber 15. The length of the core and not the size of the receptacle 36 would in a manner determine the capacity of the extruding machine.

What is claimed is:

1. In a mechanism for pumping plastic matter, a cylinder, a plunger slidably mounted in the cylinder, means for actuating the plunger, and means for preventing leakage between the cylinder wall and the plunger comprising a pocket wherein a portion of the plastic matter is collected.

2. In a mechanism for pumping plastic matter, a cylinder, a plunger slidably mounted in the cylinder, means for actuating the plunger, and means for preventing leakage between the cylinder wall and the plunger comprising a pocket formed in the wall of the cylinder, the pocket being disposed to collect a portion of the plastic matter passing through cylinder.

3. In a mechanism for pumping plastic matter, a cylinder, a plunger slidably mounted in the cylinder, means for reciprocating the plunger, means for preventing leakage between the cylinder wall and the plunger comprising a pocket formed in the wall of the cylinder, the pocket being disposed to collect a portion of the plastic matter passing through the cylinder, and means for changing the physical state of the matter collected in the pocket.

4. In a mechanism for pumping plastic matter, a cylinder having an annular recess formed in its wall, the recess being disposed to collect plastic matter tending to escape from the cylinder, a plunger slidably mounted in the cylinder and engaging the matter collected in the recess, and means for actuating the plunger.

5. In a mechanism for pumping plastic matter, a cylinder having an annular recess formed in its wall, the recess being disposed to collect plastic matter tending to escape from the cylinder, a plunger slidably mounted in the cylinder and engaging the matter collected in the recess, means for actuating the plunger, and means for changing the physical state of the matter collected in the recess.

6. In a mechanism for pumping plastic matter, a cylinder and a plunger reciprocable relative to each other, and means for preventing leakage between the cylinder wall and the plunger comprising a pocket formed in one of said reciprocating members, adapted to collect the plastic matter during operation of the mechanism, and maintained at a lower temperature than the matter being pumped.

7. In an extruding machine, a housing having a chamber for matter to be extruded, and having an aperture communicating with the chamber, and a pump cylinder having a head seated in the aperture and provided with a bore communicating with the chamber, the outer surface of the head and the inner surface of the aperture being so shaped as to prevent longitudinal displacement of the cylinder away from the chamber.

8. In an extruding machine, a housing having a chamber for matter to be extruded and having a frusto-conical aperture communicating with the chamber, a cylinder having a frusto-conical head seated in the aperture to prevent displacement of the cylinder in a direction away from the chamber, a plunger for the cylinder, and means for recepirocating the plunger.

9. In an extruding machine, a housing having a chamber for matter to be extruded and having a tapered aperture communicating with the chamber, and a pump having a tapered head snugly seated in the aperture to prevent displacement of the pump in a direction away from the chamber, the pump having a discharge opening formed in the head and communicating with the chamber.

10. In mechanism for handling plastic material, a tubular member, a member extending into the tubular member and reciprocable relative thereto, and means for preventing leakage between said members comprising a recess formed in one of the members and adapted to collect a portion of the plastic material during the operation of the mechanism.

11. In mechanism for handling plastic material, a tubular member, a member extending into the tubular member and reciprocable relative thereto, and means for preventing leakage between said members comprising a

recess formed between said members and adapted to collect a portion of the plastic material during the operation of the mechanism and maintained at a lower temperature than the material being handled.

12. In a mechanism for pumping plastic matter, a cylinder and a plunger reciprocable relative to each other, a portion of the cylinder adjacent the plunger being provided with an annular recess adapted to collect a portion of the matter being pumped and provided with a passage for cooling fluid surrounding said recess, and connections for cooling fluid communicating with the passage.

13. In a mechanism for pumping fused metal having a low melting point, a cylinder, a plunger reciprocable therein, a portion of the cylinder adjacent the plunger being provided with an annular recess adapted to collect a portion of the metal being pumped, and means for maintaining the collected metal below its melting point comprising means for circulating a cooling fluid in close proximity to the collected metal.

In witness whereof, I hereunto subscribe my name this 26th day of May, A. D. 1928.

JOHN EDSON BOYNTON.