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LUBRICATING MECHANISM FOR STRIP CASTING MACHINES

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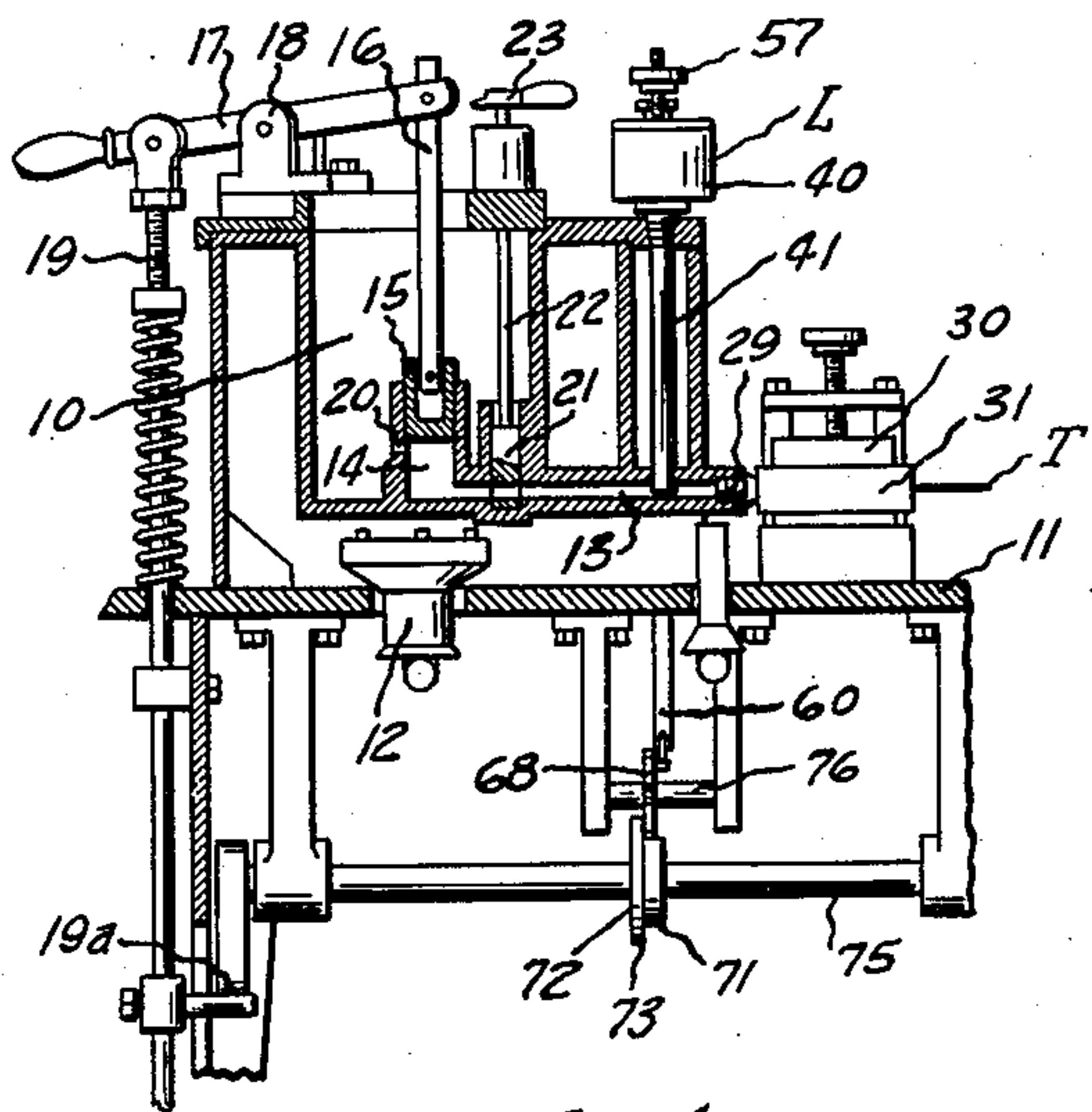


Fig. 1

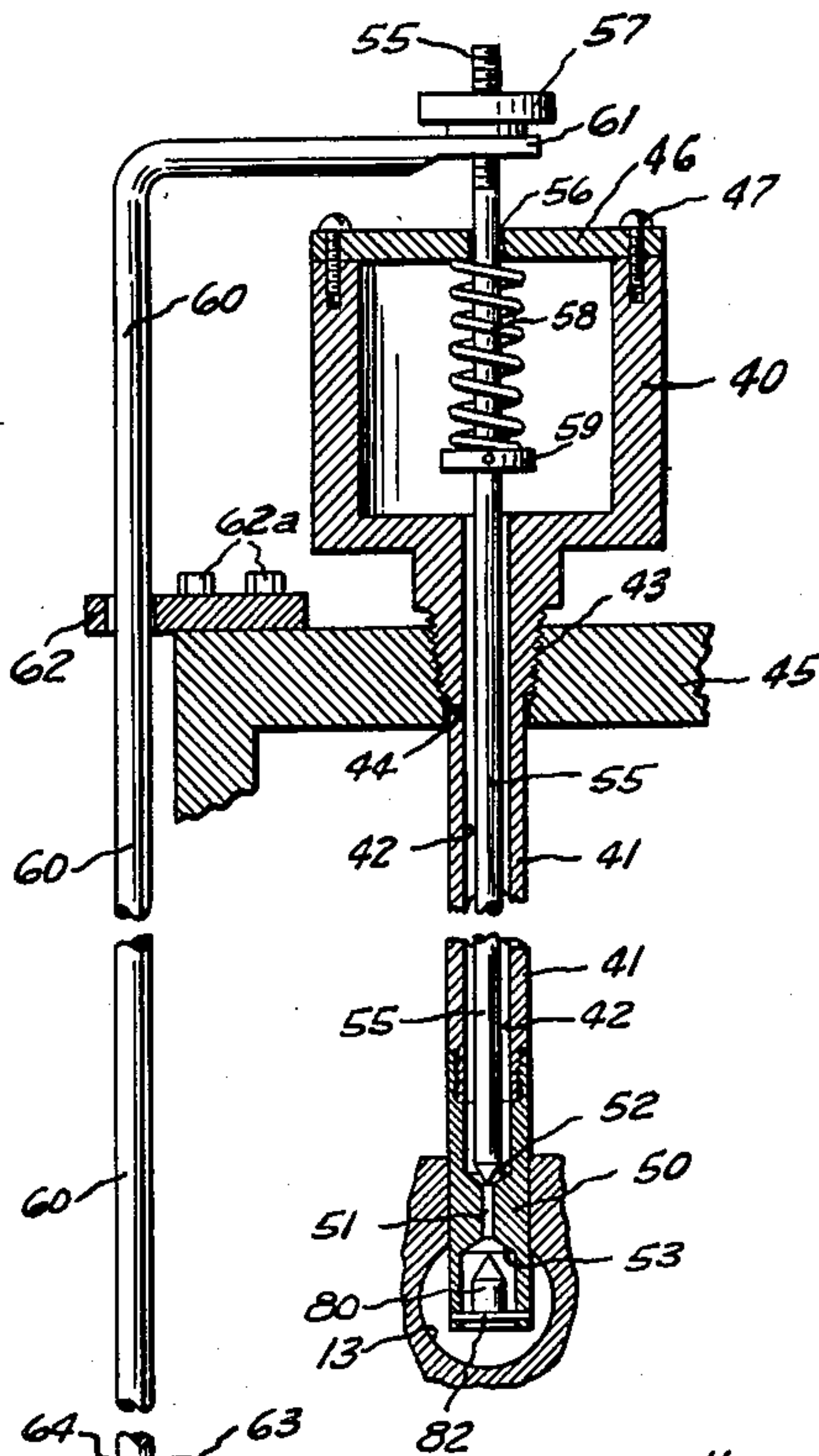
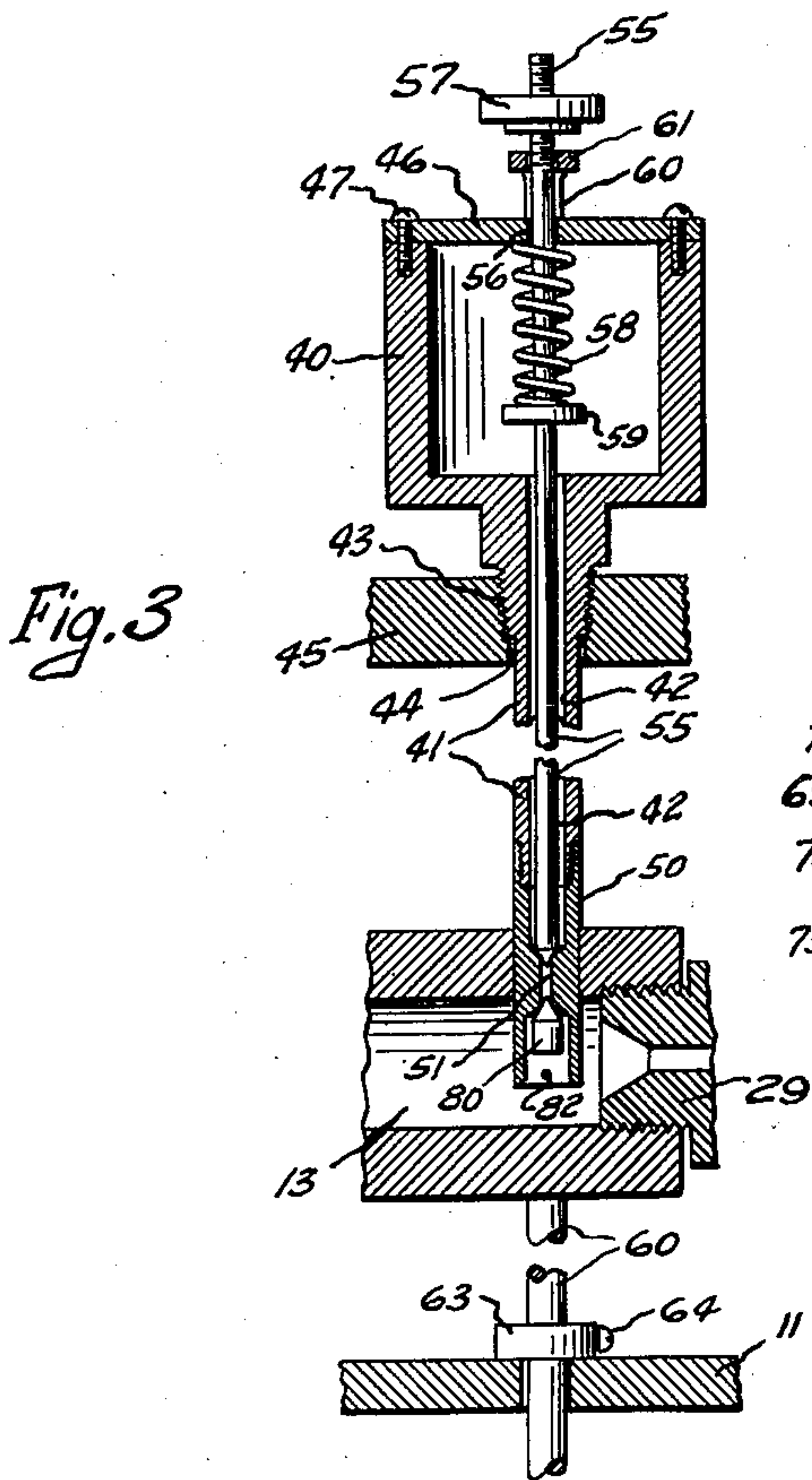


Fig. 2



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LUBRICATING MECHANISM FOR STRIP
CASTING MACHINES

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3 Claims. (Cl. 22—57.2)

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This invention relates to new and useful improvements in lubricating mechanisms for use in strip casting machines for making printers' leads, slugs and rules.

The machines used for die-expressing or drawing strips of type metal are adapted to form a continuous metal bar by drawing the same from a body of molten metal, the metal being drawn through the shaped channel of a suitable mold or die and cooled while passing through said channel, so that the metal enters one end of the channel as a fluid and emerges from the other end thereof as a solid strip bar. The movement of the strip or bar through the channel is effected by pulling upon the solidified portion thereof protruding from the die, the molten metal being subjected merely to sufficient pressure to cause it to follow through the die channel rather than to a pressure great enough to directly expel or extrude the metal through such channel.

The lubricating device of the invention is designated particularly for introducing a lubricant into the channel of the die for facilitating the drawing of the formed metal through the die and preventing frictional adherence of the formed strip to the walls of the die channel, so that the strip is formed with smooth surfaces and of a uniform size.

One object of the invention is to provide an improved lubricating mechanism for inserting lubricant into the strip forming channel of the die of a machine for making printers' leads, slugs and rules, and the like.

An important object of the invention is to provide a lubricating mechanism having valve means for controlling the admission of lubricant to the channel of the die of the strip forming machine, said valve means being normally closed and opened at predetermined intervals to admit lubricant to the channel as aforesaid.

Another object of the invention is to provide a lubricating mechanism of the character described having means for preventing backflow of lubricant or molten metal into the body of the lubricator mechanism.

A particular object of the invention is to provide a lubricating apparatus having a reservoir and valve means normally closed and intermittently opened for controlling flow of lubricant from said reservoir, the outlet from the reservoir past the valve means communicating with a small secondary lubricant chamber having an outlet into the molten metal passage of the strip casting machine, whereby lubricant from the reservoir is admitted at predetermined intervals

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into the secondary chamber and is withdrawn from said chamber into the molten metal passage of the strip casting machine, the secondary chamber being provided with a backflow check valve at its outlet end for preventing molten metal from entering said chamber.

Another object of the invention is to provide a lubricating mechanism of the character described having an improved actuating mechanism for opening the control valve between the lubricant reservoir and the secondary lubricant chamber, whereby the valve is opened at predetermined intervals and is positively resiliently maintained closed at all other times to prevent undesired flow of oil from the reservoir, and also to prevent admission of molten metal to such reservoir.

A still further object of the invention is to provide means for adjustably controlling the movement of the valve separating the lubricant reservoir from the secondary lubricant chamber to control the amount of lubricant permitted to pass through the valve when the valve is opened.

Another object of the invention is to provide a lubricating system of the character described which is readily removable and replaceable, if desired or necessary.

Additional objects and advantages of the invention will readily be apparent from the reading of the following description of a device constructed in accordance with the invention, and reference to the accompanying drawings thereof, wherein:

Figure 1 is a view, partly in elevation and partly in section, of a portion of a machine for making printers' leads, slugs, rules, and the like, and showing a lubricating mechanism constructed in accordance with the invention incorporated therein,

Figure 2 is an enlarged vertical cross-sectional view of the lubricating mechanism, showing the lubricant admitting valve opened to permit passage of oil, and

Figure 3 is a similar view of the valve mechanism, taken at right angles to Figure 2, showing the lubricant controlling valve closed.

In the drawings, the numeral 10 designates a melting pot or crucible, substantially cylindrical in form, which is mounted on a bench or table top 11 of a strip casting machine used for forming continuous bars of metal from a molten body thereof, in the form of printers' leads, slugs, rules, and the like. Beneath the crucible is mounted a gas burner or other heating element 12 to which fuel is supplied for heating the crucible for melt-

ing the type metal, lead, or similar soft metal alloys capable of fusion or melting at moderate temperatures and having a fair degree of tensile strength when cold, which metals are used in forming the strip. The crucible is provided with an outlet passage or spout 13 communicating with the lower portion of the crucible and extending laterally therefrom. The inner end of the passage communicates with the lower end of a pump cylinder 14, which is disposed in the body of the crucible and forms an integral part of the lower portion or bottom thereof. A piston or plunger 15 is slidable within the cylinder and is actuated by means of a connecting rod 16 extending upwardly from the piston and connected to one end of a lever 17 which is fulcrumed between lugs 18 formed on the upper end of the crucible body. The lever 17 is actuated by means of a push rod 19, which is connected with the outer end thereof and extends downwardly below the table top to a suitable crank or cam mechanism 19a which causes reciprocating movement of the push rod and thus, likewise, causes reciprocating movement of the piston 15 in the cylinder 14. Such reciprocating movement of the piston lifts the piston until it is positioned above a lateral opening 20 in the side wall of the cylinder, whereby molten metal may enter through said opening into the bore of the cylinder, whereupon downward movement of the piston will force the metal outwardly along the passage of the spout 13 in the usual manner.

A rotatable ported cylindrical plug valve 21 is mounted in the spout passage 13 for controlling flow of molten metal through the passage of said spout. A valve stem 22 extends upwardly from the valve plug to a point above the upper end of the crucible and is provided with a handle 23 for manipulation by the user of the device.

A nozzle or tip member 29 is screw-threaded into the outer end of the outlet spout or throat 13 from the crucible and has an axial flow passage therethrough for permitting the molten metal to flow outward through the nozzle and into the bore or shaped channel of a die or mold 31 which determines the form of the strip of type metal produced by the machine. The extreme outer portion or tip of the nozzle is preferably substantially hemispherical in configuration, and this hemispherical tip end of the nozzle engages in a concave or frusto-conical opening formed in the entrant end of the die or mold. The details of structure of the die or mold and the cooling system therefor are not essential to this invention, and may comprise any suitable arrangement, though the structure of the die and cooling system shown and described in my co-pending application for United States Letters Patent, Serial No. 20,855, filed April 14, 1948, is preferable.

A clutch and pulling mechanism (not shown), of any desired suitable type, is mounted on the table top 11 near the exit end of the die for positively drawing the strip T of type metal from the die in the usual manner. The strip so drawn from the die may subsequently be cut into sections of any predetermined desired length by a cutting mechanism (not shown) of any suitable or usual structure.

In the forming of the strip of type metal, the metal supplied to the die enters the bore or channel of the die in molten form and is caused to solidify or set adjacent the outlet or exit end of the die channel, such solidification or setting being effected by cooling means 30 in heat-exchanging relationship with the die. Since the

formed strip must be pulled from the exit end of the channel through the die, it becomes readily apparent that the presence of lubricant in the channel of the die is desirable for facilitating the passage of the solidified type metal through the die. The drawing of the formed metal strip from the die may thus be facilitated by introducing a suitable lubricant, such as engine oil or the like, into the spout 13 so that portions of the lubricant will be carried into the die channel along with the molten metal from the spout passage. It is also important to note that the quantity of lubricant admitted to the die must be very accurately controlled in accordance with the amounts required for properly lubricating strips of various thicknesses, etc.

For so supplying lubricant, the lubricating mechanism L has been provided. The lubricating mechanism includes a cup or container 40 having an elongate cylindrical tube or conductor 41 extending axially downward from its lower end and containing a flow passage 42. The portion of the tube adjacent to the bottom of the cup is enlarged in diameter and provided with external screw-threads 43, whereby the tube may be inserted into and secured in an opening 44 in the housing 45 for the outlet throat from the crucible and extend downwardly therein. A cap or cover plate 46 is removably positioned on the upper end of the cup 40 and held in place thereon by means of screws 47.

A valve body or housing 50 is screw-threaded onto the lower end of the tube 41 and forms a downward continuation of said tube, the lower end of said valve body terminating in the throat passage 13 from the crucible to the outlet nozzle 29. The valve body is provided with an axial bore 51 which is reduced in diameter throughout its mid-portion so that an upwardly facing valve seat 52 is formed near the upper end of the housing and a downwardly facing valve seat 53 is formed near the lower end of the housing. An elongate valve plunger 55, having a diameter smaller than the bore 42 of the tube and larger than the reduced bore 51 of the valve housing, is freely movable longitudinally of the tube into and out of engagement with the upwardly facing seat 52 of the valve housing. The upper end of the valve plunger 55 extends upwardly through an axial opening 56 in the cover 46 and is provided with external screw threads at its upper end for receiving an adjusting nut 57 for purposes which will be hereinafter described. A helical coiled spring 58 surrounds the valve plunger and is confined between the bottom of the cap 46 and a flange or ring 59 which is riveted or otherwise secured to the valve plunger at a point spaced above the bottom of the cup 40 when the plunger is in its lowermost position. The spring exerts its force to constantly urge the valve plunger into engagement with the upwardly facing seat 52 in the valve housing 50 for controlling flow of lubricant from the cup 40 through the tube 41 and into the reduced passage 51 of the valve housing.

An elongate substantially L-shaped lift rod 60, has a bifurcated end 61 on its short horizontal portion, and the valve plunger 55 extends upwardly between the arms of the bifurcated end of such lift rod with the nut 57 above the arms, as clearly shown in Figure 2. The elongate vertical portion of the lift rod extends downwardly through an opening in a guide plate 62 secured by means of bolts 62a to the upper end of the housing 45, and then extends on downwardly

through an opening in the table top 11. A stop washer or ring 63 is adjustably mounted on the lift rod above the table top by means of a set screw 64, for limiting downward movement of the lift rod. A roller wheel 65 is mounted on a transverse pin 66 at the lower end of the lift rod and is positioned to be engaged by a cam pin 67 carried by a rotatable follower disc 68 forming a part of a Geneva movement mechanism.

The follower disc 68 is provided with a plurality of uniformly spaced notches 69 in its periphery, and between the notches the periphery of the disc is formed with concave sections 70, whereby such concave sections will engage and ride upon the circular surface 71 of the actuating disc 72 of the Geneva type movement. The actuating disc is provided with an annular flange 73 along one side, and an actuating pin 74 is carried by the flange and adapted to engage in the notches 69 of the follower disc to cause the follower disc to be turned through a predetermined number of degrees. The circular surface 71 of the actuating disc is cut away adjacent the pin 74 to permit the points on each side of the notches in the follower disc to pass when the pin is engaged in one of the notches, so that the next adjacent concave surface 70 is turned into contact with the circular surface 71 of the actuating disc. Manifestly, the actuating disc must be turned through a number of rotations equal to the number of notches 69 in the follower disc to cause a single rotation of the follower disc.

The actuator disc is mounted on the drive shaft 75, which actuates the other parts of the strip casting machine and more particularly which drives the cam or gear mechanism which causes reciprocation of the push rod 19 to actuate the piston 15 of the molten metal pump. The follower disc 67 is mounted upon a stub or jack shaft 76 extending parallel to the main drive shaft 75 and spaced therefrom a distance sufficient to permit the co-action of the follower disc and the actuator disc just described.

The foregoing constitutes the usual Geneva-type movement, and causes intermittent movement of the lift rod 60 when the pin 67 engages the roller wheel 65 at the lower end of such lift rod. It will be seen, therefore, that the lift rod 60 will be lifted by the pin 67 one time for each six revolutions of the principal drive shaft 75 in the form of the movement illustrated in the drawings. Manifestly, the number of notches 69 and concave faces 70 formed on the follower disc 68 may be varied from the number shown, to obtain different ratios between the revolutions of the principal drive shaft and the lifting of the lift rod. Also, it will readily be seen that any other suitable mechanism for causing intermittent movement of the lift rod 60 may be employed rather than the Geneva movement illustrated.

When the lift rod 60 is elevated by the pin 67, the bifurcated end 61 of the horizontal portion of the lift rod will engage beneath the nut 67 threaded on the upper end of the valve plunger 55, and will lift the valve plunger away from the upwardly facing seat 52 in the valve housing 50. The distance which the plunger will be lifted may be varied and controlled by adjusting the position of the nut 57 on the threaded upper end of the valve plunger. When the pin 67 has moved out of engagement with

the roller 65 at the lower end of the lift rod, the rod will drop downwardly until the stop ring 63 engages the upper surface of the table top 11 of the strip casting machine, and the bifurcated end 61 of the lift rod will be normally spaced slightly below the nut 57 on the valve plunger. The valve plunger is normally constantly resiliently held in engagement with the upwardly facing valve seat 52 by means of the helical spring 58 acting downwardly upon the flange member 59 carried by the plunger, so that the oil or any other desired lubricant contained in the cup 40 will be prevented from flowing from the bore 42 of the tube 41 into the reduced passage 51 of the valve housing until the plunger is lifted by the lift rod in the manner just described. Furthermore, the engagement of the valve plunger with the seat 52 will also prevent entrance of molten metal into the bore of the lubricant tube 41.

It is preferable that the movement of the lift rod which elevates the valve plunger to permit lubricant from the reservoir or cup to flow into the throat passage be so timed with respect to the movement of the piston 15 of the molten metal pump in the crucible that the valve plunger will be elevated for only a short portion of the time during which the piston is moving upwardly to draw molten metal from the crucible into the pump cylinder and the molten metal in the throat passage is under suction. With the valve plunger so elevated to open the passage through the valve seat, lubricant from the reservoir and lubricant tube 41 may flow past the plunger and seat and into the throat passage. The amount of lubricant permitted to flow past the plunger and seat is therefore controlled by the interval of time during which the plunger is lifted off such seat, and lubricant cannot flow from the reservoir into the throat passage at any other time.

For preventing molten metal from the throat passage from backflowing upwardly into the reduced portion 51 of the bore of the valve housing, a check valve float or closure member 80 is movably mounted in the lower portion of the valve housing below the downwardly facing seat 53 formed therein. The check valve float is provided with a conical seating surface at its upper end which is arranged to engage against the seat 53 to prevent upward flow of molten metal therepast. The check float is maintained in place in the lower open end of the valve housing by a small transverse pin 82 fixed across the lower end of the housing and supporting and limiting downward movement of the float. The pin permits the float to move a sufficient distance below the seat 53 to allow lubricant to pass from the reduced portion of the bore of the housing into the throat housing, but when the molten metal is placed under pressure by the downward movement of the piston of the molten metal pump the float will be lifted back into engagement with the downwardly facing seat to prevent the molten metal from flowing into the reduced passage of the valve housing or to the valve plunger 55. Since the check float is preferably formed of steel or similar metal, it will float upon the molten type metal and will normally engage against the downwardly facing seat 53. However, when the pump piston is moved upwardly to draw additional molten metal into the cylinder a suction is created in the throat passage which will draw the check float downwardly away from the seat and permit lubricant contained in the bore of the valve housing to be drawn past said float and

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into the molten metal in the throat passage. When the piston again moves downwardly, pressure is reapplied to the molten metal and the check float is lifted back into engagement with the valve seat 53, and the molten metal is thus prevented from entering the bore of the housing. Any molten metal passing the check float will, however, be prevented from entering the bore of the lubricant tube 41 by the valve plunger 55 engaged against the upwardly facing valve seat 52. In effect, therefore, the reduced portion 51 of the bore of the valve housing forms a small secondary lubricant chamber separated from the lubricant reservoir or cup 40 by the engagement of the valve plunger 55 with the upwardly facing seat 52 at the upper end of the valve housing, and separated from the molten metal in the throat passage by the check float 80 engaging the downwardly facing seat 53 at the lower end of the housing.

Therefore, while the molten metal in the throat passage is under pressure applied by the downward stroke of the pump piston the molten metal cannot enter the reduced passage or secondary chamber 51, or if some metal does pass such check float the valve plunger 55 engaging the seat 52 prevents such metal from entering the bore of the lubricant tube and the reservoir. Furthermore, when the pump piston is moved upwardly to draw additional molten metal into the pump cylinder, the suction created thereby will move the check float downwardly away from the seat 53, but lubricant will not be permitted to flow from the reservoir through the secondary chamber into the throat passage until the valve plunger 55 is lifted by the lift rod. As has already been pointed out, the valve plunger is not lifted except during a short interval of time during the upward or suction stroke of the pump piston, so that the passage through the upwardly facing seat is open during only a small part of the time that the check float is open. Thus, the lubricant permitted to pass from the reservoir through the secondary chamber into the throat passage is limited and controlled in amount by the period of time during which the valve plunger is elevated. Also, a small portion of the lubricant will be retained in the secondary chamber 51 when the check float again seats against the downwardly facing valve seat, and this lubricant will pass into the throat passage during subsequent opening movements of the check float occurring when the valve plunger 55 is not lifted. Therefore, the quantity of lubricant admitted into the molten metal in the throat passage is strictly controlled by the valve plunger, and lubricant is not admitted to the passage except during the suction stroke of the molten metal pump piston.

Due to the fact that the lubricant cup 40 and the lubricant conductor tube 41 are supported in the housing 45 by means of the screw-threaded engagement of the enlarged portion of the tube with the housing, it will readily be seen that the cup, tube and valve housing 50 may be lifted from within the opening 44 after the screw threads have been disengaged. Such removal of the lubricator provides access to the valve housing, whereby the seats and check float may be renewed or the housing replaced, if desired.

From the foregoing, it will be seen that an improved lubricating device has been provided for feeding lubricant into the strip forming channel of the die of a strip casting machine for making printers' leads, slugs, and rules and the

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like; said lubricating mechanism having valve means for positively controlling the admission of lubricant to the channel of the die of the strip forming machine. It will further be seen that the valve means of the lubricating mechanism is normally resiliently restrained in closed position, and is opened only at predetermined intervals to admit lubricant through the small secondary chamber into the throat passage of the machine. Further, the lubricating mechanism has been provided with means for preventing back-flow of lubricant and molten metal into the body of the lubricator mechanism. The provision for controlled opening of the valve plunger controlling flow of lubricant from the reservoir, in combination with the secondary chamber, provides for strict control of the amount of lubricant admitted to the throat passage to pass with the molten metal through the die channel. It will also be seen that the valve mechanism is operated at intervals which preclude the admission of molten metal into the valve housing or lubricator body; that the opening of the valves is so controlled that undesired flow of fluids in either direction is prevented; and, that the lubricator mechanism is readily adjustable and removable, if desired.

The foregoing description of the intention is explanatory only, and changes in the details of the construction illustrated may be made by those skilled in the art, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:

1. In a strip casting machine having a crucible for containing molten metal and having a passage from the crucible to a strip forming die and having a molten metal pump for forcing molten metal from the crucible through the passage to the die, a lubricating mechanism for introducing lubricant into the passage from the crucible to the die which includes, a lubricant reservoir cup, a conductor tube from the reservoir cup to the molten metal passage of the machine, upwardly operable downwardly closable valve members in the conductor controlling flow of lubricant from the reservoir to the molten metal passage, a spring in the reservoir cup normally biasing the valve members toward closed position, a lift rod connected with the movable valve member for lifting said movable valve member against the action of the spring, and an intermittent movement mechanism for lifting the lift rod and operated in timed relationship with the movement of the molten metal pump for opening the valve means at predetermined desired intervals to admit lubricant to the molten metal passage, a check valve in the conductor tube spaced from the first-named valve members for preventing flow of molten metal into said conductor, the bore of the conductor between said first-named valve members and said check valve constituting a secondary lubricant reservoir.

2. A lubricating mechanism for a strip casting machine having a melting pot with an outlet passage therefrom to a strip forming die which includes, a lubricant container having a downwardly extending conductor communicating therewith, a valve housing removably connected to the lower end of the conductor and having a flow passage therethrough with an upwardly facing seat and a spaced downwardly facing seat formed therein, said valve housing communicating with the outlet passage from the melting pot

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of the strip casting machine whereby lubricant from the container may pass through the conductor and valve housing to the outlet passage, a downwardly movable valve member in the lubricant conductor engageable with the upwardly facing seat in the valve housing, a spring in the lubricant container engaging and normally biasing said valve member to closed position in engagement with said upwardly facing seat, and an upwardly movable check valve member in the lower portion of the valve housing below the downwardly facing seat engageable with said downwardly facing seat for preventing back flow through the valve housing and conductor to the lubricant container.

3. A lubricating mechanism for introducing lubricant into the passage from the crucible to the die of a strip casting machine which includes, a lubricant reservoir cup, a conductor tube from the reservoir cup to the molten metal passage of the machine, a valve housing removably connected to the lower end of the conductor tube and having a flow passage therethrough with an upwardly facing valve seat and a spaced downwardly facing valve seat formed therein, an elongate valve plunger movable vertically in the

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conductor tube and engageable with the upwardly facing valve seat in the valve housing, a spring confined in the reservoir cup and engaging and biasing the plunger into engagement with the upwardly facing valve seat, a lift rod having an adjustable lost-motion connection with the valve plunger above the reservoir cup, actuating means for intermittently lifting the lift rod to lift the plunger at predetermined intervals, and a check valve member in the removable valve housing below the downwardly facing valve seat and engageable with said seat to prevent upward flow back past said seat.

HARRY L. HORN.

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