Nov. 10, 1964 J. C. BYSTRICKY ETAL 3,156,320

LUBRICATING DEVICE

Original Filed April 7, 1959 6 Sheets-Sheet 1

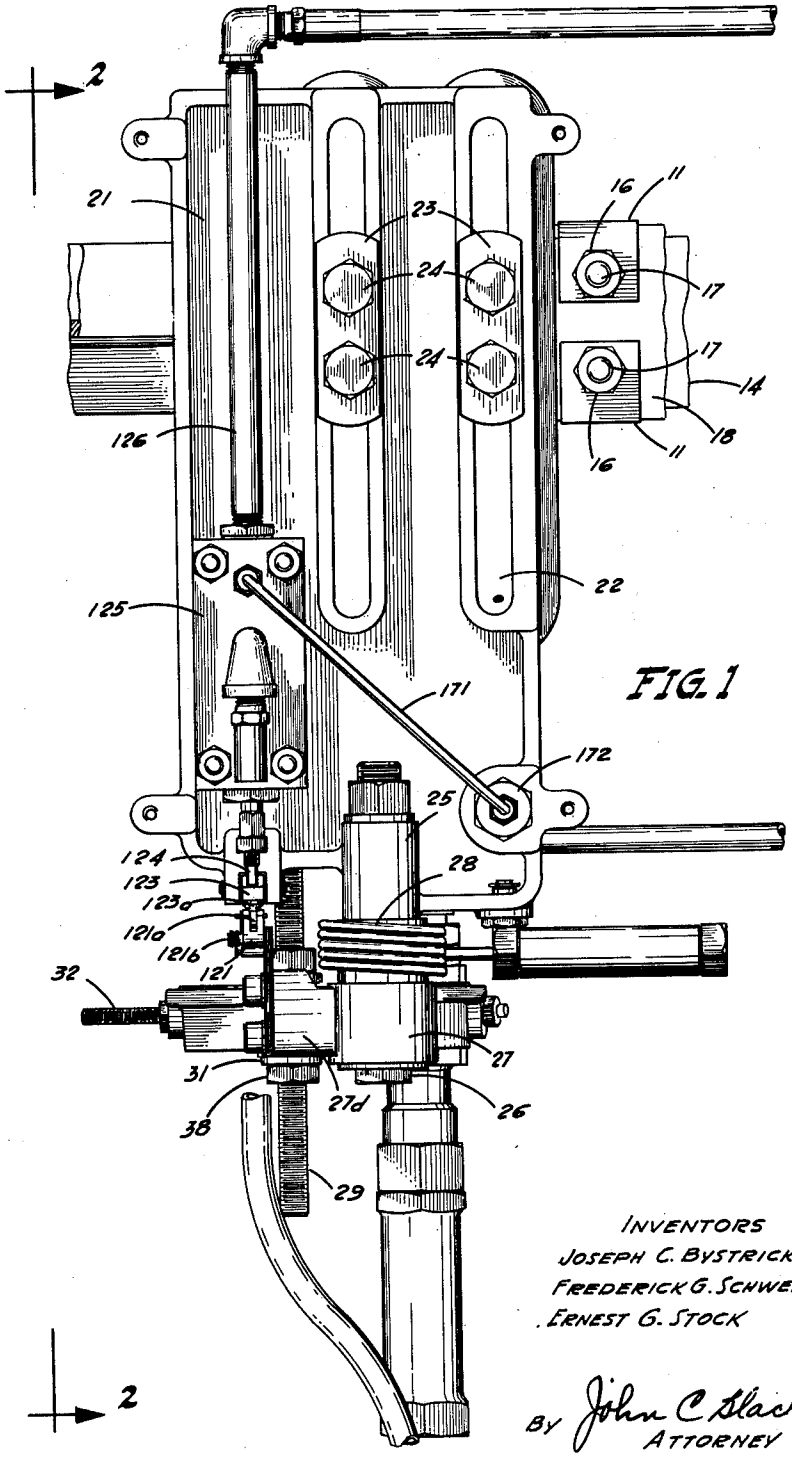


FIG. 1

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LUBRICATING DEVICE

Original Filed April 7, 1959 6 Sheets-Sheet 2

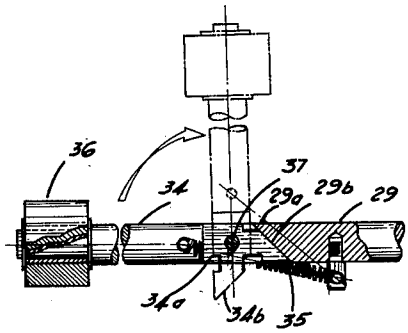


FIG. 7.

FIG. 2.

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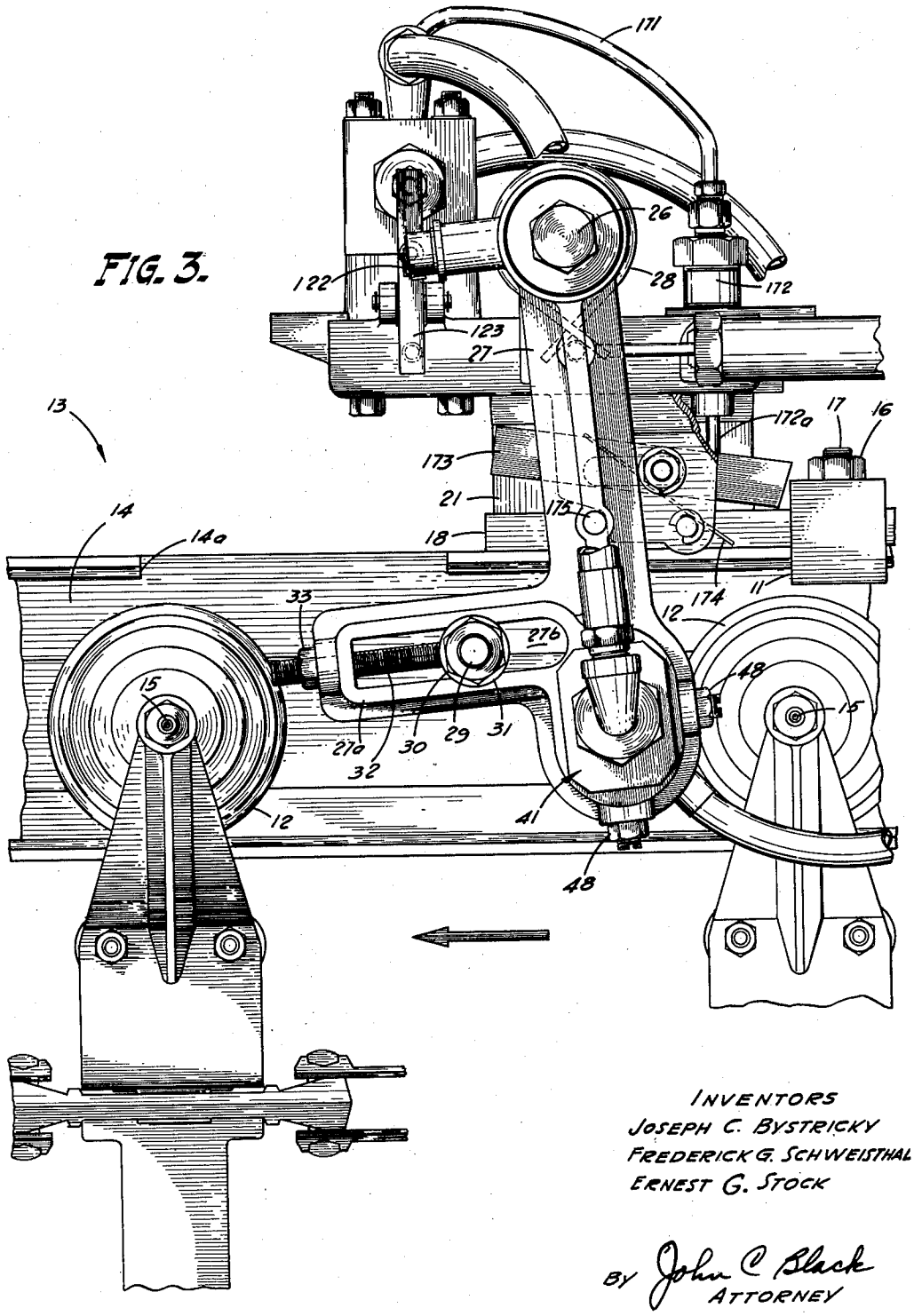
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FIG. 3.



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LUBRICATING DEVICE

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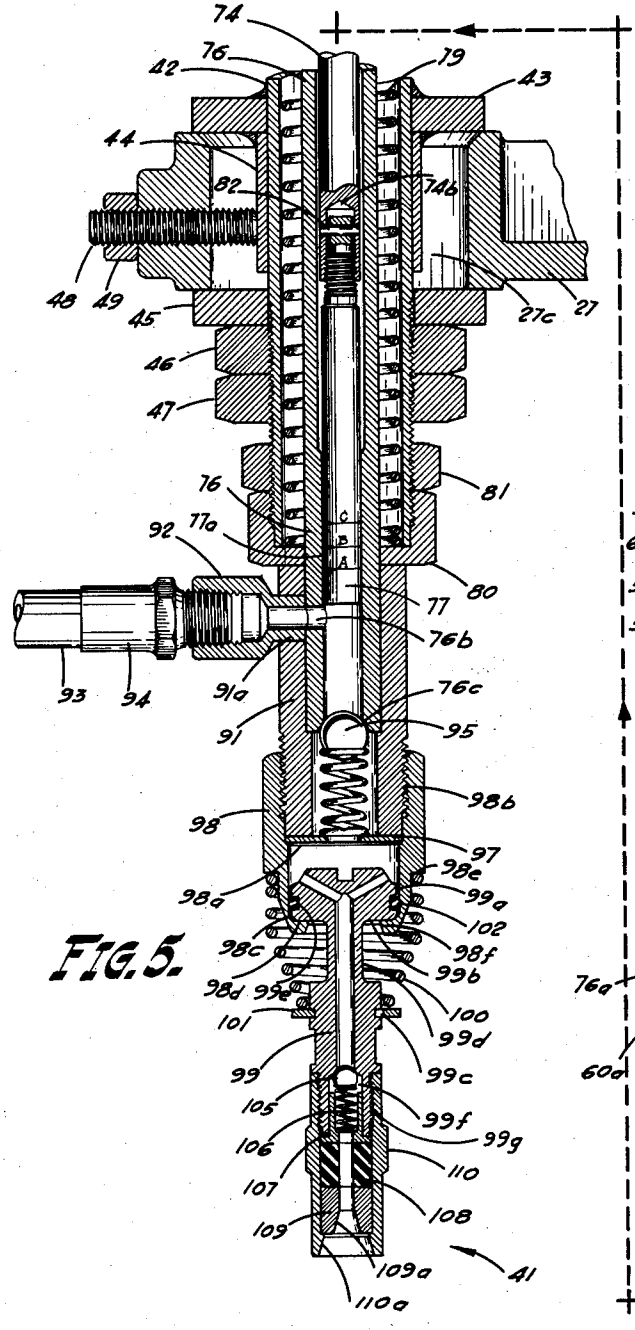
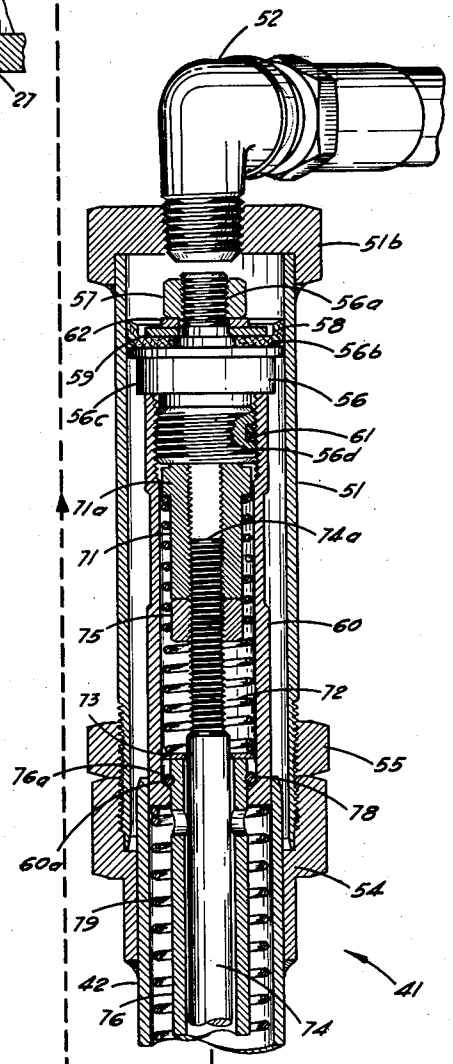


FIG. 5.

FIG. 4.



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LUBRICATING DEVICE

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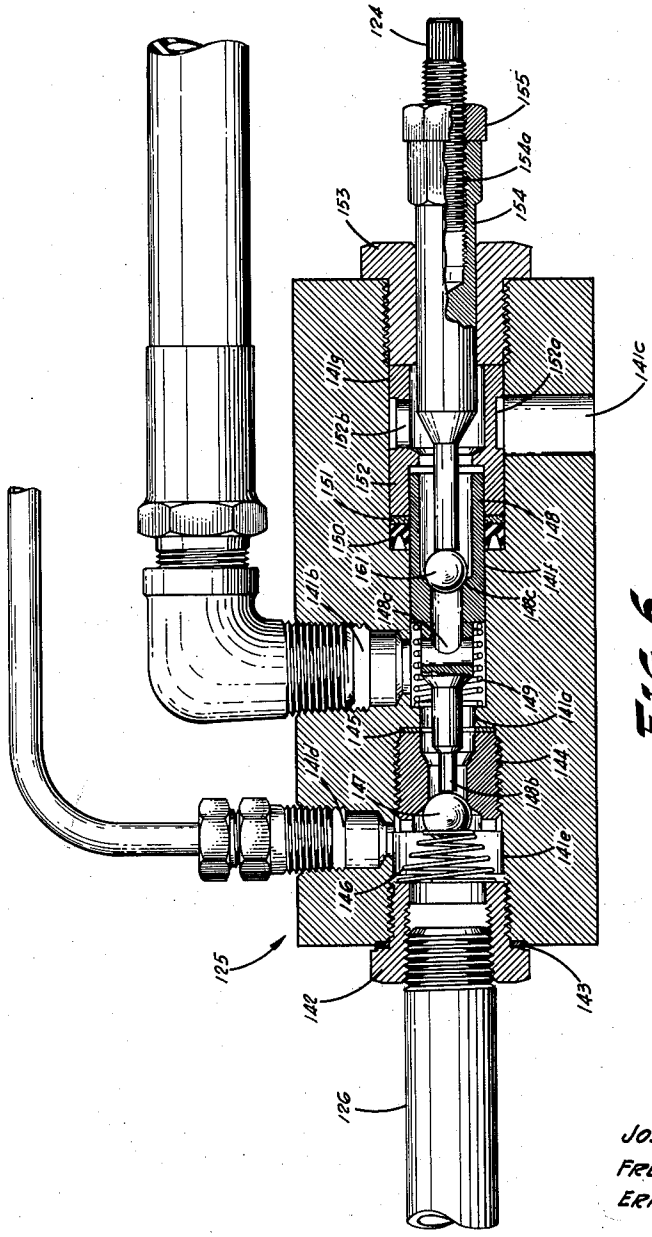


FIG. 6.

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LUBRICATING DEVICE

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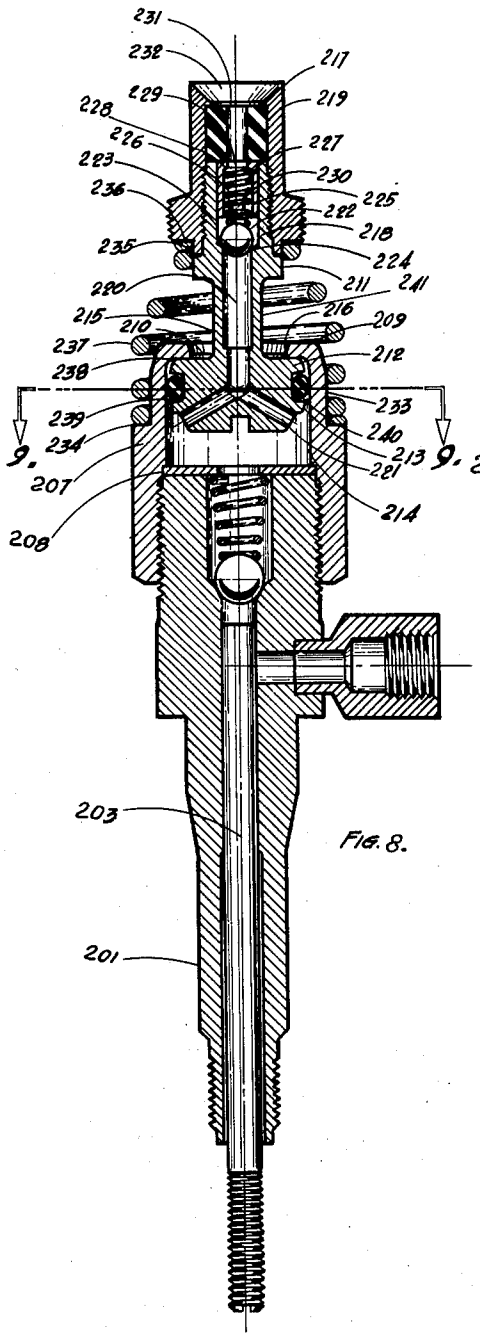


FIG. 8.

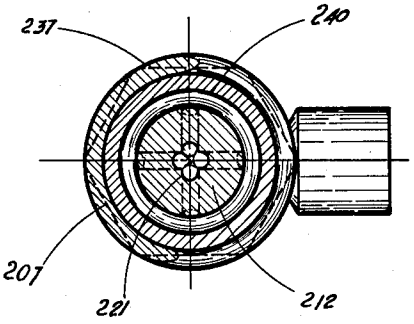


FIG. 9.

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3,156,320

LUBRICATING DEVICE

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Original application Apr. 7, 1959, Ser. No. 804,845. Divided and this application June 1, 1961, Ser. No. 114,053

11 Claims. (Cl. 184—29)

This application is a division of applicants' co-pending application, Serial No. 804,845, filed April 7, 1959, now abandoned, which is a continuation-in-part of applicants' co-pending, but now abandoned, application, Serial No. 668,996, filed July 1, 1957.

This invention relates to a lubricating gun and nozzle. More particularly it relates to a lubricating gun and nozzle which is useful in an automatic system for lubricating the wheels or rollers of a trolley conveyor.

Lubricating apparatus of this type is disclosed and claimed in Schweisthal et al. Patent 2,696,277. Briefly, the patented apparatus includes a section of track welded into the conveyor system track. A rider positioned in the path of the trolley rollers is moved through a small arc by each roller. The rider carries a lubrication gun with it. As the rider and gun are moved by the roller, the gun moves into alignment with a fitting on the roller. An electric switch is then actuated to energize a solenoid. The solenoid operates a linkage to move the gun into engagement with a fitting on the roller and causes the gun to pump a measured amount of lubricant into the fitting. The fittings convey the lubricant to the roller bearings.

Those acquainted with the art have considered it to be commercially impracticable to support the lubrication gun and its actuating means coaxially for movement as a unitary assembly into engagement with the trolley rollers. It was thought that the movement of a substantial mass into engagement with the roller fitting at high speed would necessarily cause damage to the fitting. This was especially true where the actuating means was an air operated piston assembly. In the prior art devices in which the lubrication gun was rotated into engagement with the roller fitting there was no problem. In this case, there was no mass moving in a direction coaxial with the fitting which had to be stopped by the fitting. Such constructions are generally low in cost. However, such systems have the misalignment disadvantages as well as an inability to be actuated to the lubricating position and retracted to an at rest position with sufficient speed to properly lubricate the rollers moving at medium and high speeds.

The patented construction permits the proper operation of the lubricator at all known conveyor speeds. Hence, a design generally of this type has a distinct advantage. The applicants have therefore provided a unique lubrication gun and actuator assembly together with a unique nozzle construction which permits the use of the high speed patented type of lubricator with its inherent operational advantages together with the cost advantage of the prior art devices.

In addition, several other advantages are now possible because of the improved coaxial unitary structure of applicants. The stroke of the lubrication gun, nozzle, and power actuating mechanism is now substantially unlimited. This particular feature is very important in commercial conveyor installations. After a short period of use, the trolley rollers and fittings are characterized by widely varying positions as they pass the lubricating gun. After a period of use, the rollers have a tendency to pivot inwardly toward the track in a plane normal to

the track when the trolley is loaded. Also replacement roller dimensions will vary considerably. Hence, the ability of the lubricator to compensate for fittings which vary in their distance from the lubrication gun in its retracted position is very important.

In the above described old style lubricators, the alignment of the lubrication gun nozzle with the fitting could be assured for only one fitting position. If the positions of the fittings varied substantially in an axial direction, the nozzle exterior engaged the fitting or missed the fitting entirely. If the variance were slight, the amount of lubricant dispensed by the lubrication gun into the fitting varied with the relative axial position of the fitting. If the fitting position varied in a nonaxial direction, the nozzle could not properly engage the fitting. In applicants' improved construction, no misalignment results from varying fitting positions in the axial direction nor does the amount of lubricant dispensed vary. In addition, misalignment, within limits, of the fitting in a noncoaxial direction is compensated for in applicants' improved flexible nozzle. This will be described in more detail below.

In the patented construction, the use of linkages between the lubrication gun and its power actuating means necessarily limited the amount of stroke which could be utilized to compensate for varying fitting positions in the axial direction. To permit a substantially unlimited compensating stroke in the patented construction would necessitate the use of a more costly linkage construction. Applicants' improved construction incorporates an air motor actuator which is connnected directly to the gun so that a longer compensation stroke is obtained by a mere change in an air cylinder length.

It is therefore an object of this invention to provide an improved lubrication gun and nozzle construction which is useful in a conveyor lubricator of the type hereinbefore described. In the preferred embodiment this improved construction is characterized by a nozzle which is pivotal and reciprocable with respect to the lubrication gun body together with internal and external resilient biasing means associated with the nozzle.

Another object of the invention is the provision of an improved automatic lubricator for a conveyor controlled and driven solely by compressed air and including no linkage in the gun moving mechanism.

Another object of the invention is to provide a lubricator for a conveyor which is quickly detachable from the conveyor.

Another object of the invention is to provide a lubricator adjustable to provide different measured lubricant outputs.

With respect to the latter feature, it will be appreciated that the nozzle is subjected to extreme lateral as well as axial forces. This is especially true when the lubrication gun attempts to lubricate a damaged or misaligned trolley roller. For example, it often happens that the trolley yokes are bent during use. The rollers are secured to the yokes. In some instances, the yokes are only slightly bent in which event the flexible nozzle will pivot to compensate for the resulting misalignment and assure proper lubrication of the roller bearing.

Often, however, the yokes are so severely bent that some portion of the roller other than its peripheral surface engages the lubricator rider. Since the rider aligns the lubrication gun and nozzle with the fitting only when it is actuated by the peripheral surface of the roller, misalignment of the nozzle and fitting will result. If the misalignment is great enough, the nozzle of the lubrication gun will glance off the side of the fitting or strike the yoke directly. This produces extreme severe lateral forces. The rigid nozzle of the patented con-

struction is subject to breakage under these conditions. However, these forces are readily absorbed by the improved flexible nozzle with no damage to either the nozzle, the lubrication gun, or the trolley structure.

The high speed power means and the mass of the improved lubrication gun and power means cause the impact of the nozzle against the yoke to be necessarily severe. In order to assure complete protection of the lubrication gun in all instances, no matter how severe the impact, the applicants have provided a reduced nozzle section which is subject to fracture upon intolerably high forces. This prevents injury to the lubrication gun.

Conventional flexible and swivel nozzles are not satisfactory for use in trolley lubricators because of the extreme forces and also because of the inability to maintain a seal and rapidly and accurately realign themselves after engagement with one fitting and prior to engagement with the next fitting. A rapid and positive realignment is necessary in view of the use of conveyors with speeds as high as 100 feet per minute and with spacing as small as 6 inches between front and back wheels of the trolleys. Because of the necessity of rapid and positive realignment of the nozzle, it has been necessary in prior art constructions to use a rigid nozzle even though it is subject to breakage.

Accordingly, it is another object of the present invention to provide a rugged, flexible nozzle which can rapidly and accurately return itself to a predetermined alignment position.

Another object of the present invention is the provision of a single, unique, low friction sealing structure for flexible nozzles.

A feature of the invention is the provision of a lubricator nozzle having a tubular portion of a highly elastic material and a fitting-engaging end member of a shock-resistant metal engaged by the tubular member.

Another feature of the invention is the use of a flexible nozzle comprising a rigid socket, a rigid swivel arm reciprocable and pivotable in the socket and a powerful spring for urging the arm into an aligned position relative to the socket.

Another feature of the invention is the provision of a flexible nozzle of the type described above having an O ring disposed between the juxtaposed surfaces of the socket and arm to effect excellent sealing with minimum friction upon pivotal and reciprocable motion of the arm.

Another feature of the invention is the provision of special transverse passageways in the swivel arm for reducing the accumulation of air pockets in the socket.

Another feature of the invention is the provision of a thin wall section in the nozzle to prevent damage to an integral pumping device.

Other objects and features will be evident upon a reading of the following description in which:

FIG. 1 is a fragmentary, top plan view of a lubricator forming one embodiment of the invention;

FIG. 2 is a sectional elevation view taken along line 2—2 of FIG. 1;

FIG. 3 is a fragmentary elevation view of the lubricator shown in FIG. 1;

FIGS. 4 and 5 are fragmentary longitudinal section views of a lubricant gun and gun-moving mechanism of the lubricator shown in FIG. 1;

FIG. 6 is a vertical sectional view of a valve mechanism of the lubricator shown in FIG. 1;

FIG. 7 is a fragmentary, top plan view of a ratchet type cam follower or rider of the actuator shown in FIG. 1;

FIG. 8 is a sectional elevation view of a modified nozzle for use with a conveyor lubricator of the type shown in U.S. Patent No. 2,696,277 hereinbefore mentioned; and

FIG. 9 is a sectional view along line 9—9 of FIG. 8.

In general, the invention provides a lubricator which preferably is detachably clamped to the top of a conveyor rail. The lubricator has a pivotal arm carrying a pneumatic piston and cylinder unit along with a gun nozzle and a plunger. A rider or follower connected to the arm is driven by a conveyor roller to swing the gun and pneumatic unit along with the roller. The roller carries a fitting into which lubricant is to be injected. The gun is swung in an arc while the fitting moves in a straight line. Also, due to the different paths of movement of the swinging gun and the fitting which moves in a straight line, the gun and fitting are aligned with one another for only a limited portion of their travel and the nozzle is moved very rapidly into engagement with the fitting. A valve is actuated when the gun aligns itself with the fitting to cause the pneumatic unit to sequentially move the nozzle of the gun into engagement with the fitting and actuate the plunger to pump a measured quantity of lubricant through the fitting. To avoid shock from impact between the nozzle and fitting, the pneumatic unit and the nozzle are resiliently cushioned; and the nozzle preferably includes a tubular member of rubber or rubber-like material which, in one form of the invention, has a metal facing member for engaging the fitting while in an alternate form of the invention the tubular member directly engages the fitting. The stroke of the plunger preferably is adjustable to vary the quantity of lubrican pumped.

The position of the roller and fitting may vary coaxially with respect to the gun due to wear or bending of the conveyor. The patented construction compensates for some variation but the linkage restricts the amount of available compensation. The applicants' construction is substantially unlimited in the compensation it provides. In the commercial embodiment the selected compensation is eleven times the compensation of the commercial embodiment of the patented construction. The nozzle is biased to an axial position and is pivotable in all radial directions through an agle in the order of 20° to other positions compensating for any variation in the position of the fitting.

More particularly, a lubricator assembly **10** (FIGS. 1, 2) automatically pumps a lubricant through fittings **15** carried by rollers **12** of a conveyor **13** of the overhead trolley type. The rollers **12** travel along lower flanges of a rail or I-beam track **14**, and the lubricator is detachably mounted as a unitary assembly on the upper flange of the rail. A frame base **18** of the lubricator assembly is secured tightly against the upper flange by clamps **11**, nuts **16**, and studs **17**.

The base **18** supports a lubricator unit **20** for lubricating the rollers **12** at the righthand, as viewed in FIG. 2, and also supports a second lubricator unit (not shown) identical to the unit **20** for lubricating the rollers on the left hand of the track.

The unit **20** has a base frame **21** having adjustment slots **22** (FIG. 1) and clamped adjustably to the base **18** by clamping plates **23** and cap screws **24** threaded into tapped bores in the base **18**. A journal **25** integral with the frame **21** supports pivot means **26** on which a pendulum-like arm or carrier means **27** is freely pivotal. A torsion spring **28** fixed at one end to the arm **27** and at the other end to the frame **21** urges the arm **27** counter-clockwise as viewed in FIG. 3 to a normal or retracted position as shown in FIG. 3 and permits movement against the spring in a clockwise direction.

A rod **29** is fixed to a forwardly projecting portion **27***a* of the arm **27** by nuts **30** and washers **31**. An adjustment screw **32** and locking nut **33** permit adjustment of the rod laterally in slot **27***b*. The rod has an end slot **29***a* (FIGS. 2 and 7) into which a flattened end **34***a* of a rider or follower rod **34** fits. The end **34***a* is pivotally mounted on the rod **29** by a vertical pin **37**. Complementary bevelled adjacent edges **29***b* and **34***b* prevent counter-clockwise rotation, as viewed in FIG. 7, of the rod **34** relative to the rod **29** beyond the position of the rod **34** shown in FIG. 7. In this position the rods **29** and

34 are slightly overcenter relative to one another and to parallel tension springs 35 secured to the rods. The springs 35 tend to hold the rods 29 and 34 in their shown positions; but, on application of a sufficient force to the rod 34 in a direction tending to swing the rod 34 clockwise, the rod pivots clockwise and swings overcenter relative to the rod 29, the springs 35 then swinging the rod 34 further in a clockwise direction. Thus, the rods 29 and 34 and the connecting elements constitute a one-way or ratchet type structure.

The rod 34 carries a rider or follower roller 36 at its outer end which is normally in the path of the rollers 12 and which rides upwardly and over each roller 12 advanced to the left, as viewed in FIG. 3, and carrying the arm 27 therewith. The upper flange of the I-beam 14 is cut out at 14*a* to provide clearance for the roller 36 as it is moved upwardly over each roller 12. If the rollers 12 move in the opposite direction, the rod 34 and its roller 36 are rotated by the rollers 12 and the springs 35 out of the path of the rollers. This prevents breaking of the arm 34.

The arm 27 carries adjustably on the lower end thereof a pneumatic drive and lubricant gun unit 41, which may be assembled on and detached from the arm 27 as a unit, thus facilitating maintenance of the unit 41. The lower end of the arm has a slot 27*c* (FIG. 5) through which a mounting and guiding tube 42 of the unit 41 extends. A clamping plate 43 and reinforcing sleeve 44 are welded or brazed to the tube 42. The clamping plate 43 and a clamping plate or washer 45 are clamped against opposite sides of the arm 27 by nuts 46 and 47 threaded on the righthand end (FIG. 5) of the tube 42 to rigidly hold the unit 41 perpendicular to the arm 27 and in a horizontally extending position. Circumferentially spaced adjustment screws 48 and lock nuts 49 aid in holding the unit 41 in adjusted position relative to the arm 27, and control the vertical position of the unit 41 relative to the arm 27.

The unit 41 includes an air cylinder 51 (FIG. 4) having an air supply fitting 52. The cylinder and fitting are connected to a coupling 51*b*. The fitting 52 is also connected to a flexible conduit 53 of a known rubber or rubber-like compound. The lower end of the cylinder 51, as shown in FIG. 4, is threaded into a female fitting 54 brazed or welded to the tube 42, and is locked mechanically to the fitting by a locking nut 55. The joint between the cylinder 51 and fitting 54 preferably is rigid but not airtight. The upper end of the fitting 54 is spaced radially from the adjacent end of the tube 42 so that the cylinder 51 can overlap the tube 42. A piston 56 has a stud 56*a* on which a nut 57 is threaded to clamp a known pump leather 58 of known composition against a flat face 56*b*. A washer 59 and lockwasher 62 are positioned between the nut 57 and the pump leather. On the other side of a slightly reduced portion 56*c* of the piston an axially extending threaded plug portion 56*d* projects. A sleeve 60 is threaded on the plug portion 56*d*, and a lock plug 61 of nylon or the like fitting in transverse bore 56*e* in the plug portion locks these elements together against accidental displacement.

An elongated nut 71 is urged against the end of the plug portion 56*d* by a compression spring 72 seated between an enlarged portion 71*a* of the nut 71 and a washer 73. A threaded end 74*a* of a push rod 74 is threaded into the nut 71 and locked in adjusted position by a nut 75. The rod 74 is slidably supported by the washer 73 coaxially of a tube 76 which guides a cylindrical plunger 77 (FIG. 5) aligned with and secured to the push rod 74. The tube 76 is slidable within the sleeve 60 which serves as a guide portion of the piston for motion of the tube 76 therewithin, and the tube is prevented from moving further downward as viewed in FIG. 5, relative to the sleeve 60 by a ring 78 fitting in a peripheral groove 76*a* in the tube 76 and normally abutting an internal shoulder 60*a*. A return compression spring 79 having a spring

force substantially less than the spring 72 normally urges the sleeve 60 upwardly and seats at its lower end against a centrally bored cap member 80 (FIG. 5) threaded on the tube 42 and locked thereon by nut 81. The cap member 80 slidably supports the tube 76. The plunger 77 is threaded into a socket 74*b* in the rod 74, and the plunger and rod are locked together by a pin 82.

A tube 91 is fixed in sealing relation to the lower end of the tube 76, as viewed in FIG. 5; and the compression spring 79 urges the tubes 76 and 91 upward, the cap member 80 acting as a stop to limit such movement. A female fitting 92 connected to a flexible conduit or hose 93 by a male fitting 94 is fixed to the tube 91 and sealed in a bore 91*a* thereof in alignment with a bore 76*b* in the tube 76. A check valve ball 95 is urged into a ball seat 76*c* in the end of the tube 76 by a compression spring 96 seated on the ball and on a perforated spring seating plate 97 held against the end of the tube 91 by shoulder 98*a* forming the end of a tapped counterbore 98*b* of a swivel socket or bushing member 98. The bushing is threaded onto the threaded end of the tube 91 and forms a pressure tight seal therewith. A reduced portion 98*c* of the bushing 98 is spun over at the lower end thereof to form a ball-and-socket joint with an enlarged head 99*a* of a swivel arm or end tube 99.

The head 99*a* has a flat annular seating surface 99*b* which normally is seated against flat surface 98*d* of the overturned end of the bushing 98 by the action of compression spring 100 seated between annular shoulder 98*e* and snap washer 101 secured in annular groove 99*c* in the tube. The tube 99 has a reduced portion 99*d* adjacent the head 99*a* to permit pivotal movement of the tube 99 relative to the end of the bushing 98 which is tapered outwardly at 98*f* to provide extra clearance. The periphery of the head 99*a* is of substantially lesser diameter than that of the interior of the bushing 98 to permit free pivoting of the head 99*a* in the bushing. A highly resilient sealing ring 102 fits in peripheral annular groove 99*e* in the head 99*a* to form a pressure-tight resilient seal between the head and the bushing.

A check valve is formed by the bottom of a counterbore 99*f*, a ball 105, and a compression spring 106. The spring 106 is seated in a cup-shaped flanged tube 107 which is retained against the end of the tube 99. A sealing plug or bushing 108 of resilient material and a sleeve 109 are held between the tube 107 and an internally shouldered nozzle tip 110. The nozzle tip 110 is threaded over threaded reduced end portion 99*g* of the tube 99 to retain the tube 107, bushing 108, and sleeve 109 in place. The sleeve 109 has a tapered or frustoconical entrance portion 109*a* designed to fit sealingly over the rounded fittings 15. The sleeve 109 is preferably made of beryllium copper which defroms slightly when it strikes the fittings. As a result it assures a seal between itself and the fittings regardless of the angle of the fitting. Also, it has no tendency to wear especially when backed up by the rubber bushing 108.

The nozzle tip 110 has a tapered or frustoconical entrance portion 110*a* to guide the nozzle over each fitting 15 and position the fitting 15 in the entrance portion 109*a* to receive lubricant therefrom. The entrance portion 109*a* is adapted to form a pressure-tight seal with each fitting both when the sleeve 109 is aligned with the fitting and when the tip is cocked at somewhat of an angle relative to the fitting as occurs when the unit 41 is swung out of axial alignment with the fitting during the lubricating operation.

Referring now to FIGS. 2 and 3 a ratchet type dog 121 and a bracket 122 are carried by a projection 27*d* of the arm 27. A lever 123 having a rounded projection 123*a* is carried by the frame 21 adjacent the dog 121. The lever 123 engages a plunger 124 for operating a valve 125. The valve 125 is mounted on the frame 21. As each fitting 15 approaches the unit 41, the roller 12 carried with that fitting engages the rider roller 36

and swings the arm 27 clockwise as viewed in FIG. 3. The dog 121 moves upwardly (FIG. 2) and engages projection 123*a* when the fitting 15 and the unit 41 are in alignment. The lever 123 urges the plunger 124 to the left to operate valve 125.

This actuation of the plunger 124 causes air under pressure supplied to the valve 125 from a flexible air conduit 126 to be supplied to the conduit 53 and the upper end of the cylinder 51 as viewed in FIG. 4. The piston 56, sleeve 60, tube 76 and the elements carried thereby then are driven as a unit downward relative to the tube 42 against the fitting 15.

The piston 56, sleeve 60, push rod 74 and plunger 77 continue to travel while the nozzle unit and tubes 76 and 91 remain fixed relative to the tube 42 after any momentary compression of the spring 100 and momentary movement of the head 99*a* back into the bushing member 98. Lubricant below (FIG. 5) the plunger 77 is forced through the check valves 95 and 105, the nozzle and the fitting 15 into the bearing structure of the roller 12. This lubricating portion of the stroke of the piston 56 and plunger 77 continues until the locking nut 75 engages the washer 73 to stop further movement. In the lubricating portion of the stroke, a precisely measured quantity of the lubricant is forced into and through the fitting. Both the feed and lubricating portions of the operation occur during a short arcuate movement of the arm 27 so that the end tube 99 and elements 109 and 110 pivot only slightly relative to the bushing 98 and tubes 76 and 91.

As the piston 56 completes its stroke, roller 121*a* (FIG. 2) rolls over the end of the plunger 125 and releases the plunger 125 to cut off the air supply to the unit 41 and permit escape of the air under pressure in the cylinder 51. This will be described in more detail below. The springs 72 and 79 then rapidly return the piston 56 and sleeve 76 and elements carried thereby to their retracted positions. Further movement of the roller 12 swings the roller 36 over the top of the roller 12. The roller 36 then is urged with the arm 27 to its retracted position by the spring 28. As the arm 27 returns, the ratchet type dog 121 pivots against the action of a spring 121*b* (FIG. 1) as it engages the plunger button 123*a* and does not actuate the valve 125. The unit 20 then is in a condition to repeat the lubricating cycle as the next succeeding roller 12 and fitting 15 come to the rider roller 36.

A lubricant reservoir or cylinder 131 (FIG. 2) is fixed to the mounting plate 18 and air under pressure is supplied to a suitable piston (not shown) therein to continuously supply lubricant under pressure to the conduit 93 and grease gun portion of the unit 41 so that, after the lower end of the plunger clears the hole 76*b* (FIG. 5), lubricant under pressure fills the nozzle up to the check valve ball 105 to replace that previously forced from the gun.

The quantity of grease pumped during each operation is dependent on the distance between the locking nut 75 and washer 73 when the piston 56 is fully retracted as determined by the engagement of the tube 91 with the cap 80 (FIGS. 4, 5). This determines the stroke of the plunger 77, and this may be adjusted by threading the push rod 74 further into or further out of the nut 71. In the preferred embodiment, this adjustment may be made by disconnecting the cylinder 51 from the tube 42 and removing the piston 56, the nut 71, and the spring 72. The fitting 94 is removed to permit visual observation of the plunger 77 through the opening 76*b*. The plunger is positioned with the desired line of scale 77*a* at the left edge of the opening. With the plunger held in this position the nut 75 is threaded further toward the right until it engages the washer 73. The unit 41 then is reassembled. Although only three lines are shown on scale 77*a*, it will be appreciated that any number of lines may be provided for a greater selection of lubricant quantities.

The valve 125 (FIG. 6) has a valve body 141 provided with a bore 141*a* communicating with a supply port 141*b* for the piston 56 and cylinder 51, an exhaust port 141*c* and a lockout port 141*d*. A female air supply fitting 142 is threaded into counterbore 141*e* and sealed by gasket 143, and a valve bushing 144 fits in the counterbore against gasket 145. Spring 146 presses ball 147 toward a position closing the opening in the bushing 144.

A plunger sleeve 148 normally is urged to the right in counterbore 141*f* by spring 149 and has a T-shaped passage 148*a* therein and a projecting end portion 148*b*. The sleeve 148 is slidable in sealing rings 150 and 151 and counterbore 152*a* in bushing 152. The bushing is held in position by a threaded bushing 153 threaded into tapped end of counterbore 141*g*. The bushing 152 has an annular groove 152*a* forming a passage from lateral bore 152*b* to the exhaust port 141*c*. Rod 154 is slidable in the bushing 153, and carries the plunger 124 adjustably in a tapped bore 154*a* therein with a locking nut 155 holding the plunger 124 in adjusted position.

When the ratchet dog 121 (FIG. 1) causes the plunger 124 to be moved to the left, as viewed in FIG. 6, the rod 154 initially moves ball 161 into sealed engagement with valve seat 148*c* and then moves plunger sleeve 148 to the left to move ball 147 away from sealed engagement with bushing 144. Air under pressure then flows to the unit 41 to operate the piston 56. The nozzle engages the fitting and the grease gun pumps lubricant into the roller 12. When the ratchet dog 121 subsequently releases the plunger 124, air pressure seals the ball 147 against the bushing 144 and the air under pressure in the counterbore 141*a* drives the sleeve 148 to the right until limited by the end of counterbore 152*a* after which the air under pressure unseats the ball 161 and air is exhausted from the valve 125 and unit 41 to the atmosphere.

So long as the conduit 126 is connected by a manually controlled shutoff valve (not shown) to a suitable supply of air under pressure, the port 141*d* and a conduit 171 (FIGS. 1 and 3) supply air under pressure to a pneumatic unit 172. A plunger 172*a* in the unit 172 is urged downwardly (FIG. 3) to hold a latching lever 173 in retracted position against spring 174. If the air pressure is cut off from conduit 126, the plunger 172*a* is retracted and rod 175 carried by the arm 27 is engaged by the lever 174 at the uppermost point in the swinging movement of the arm 27 and the lever 173 holds the arm 27 and rider element 36 elevated and out of the path of the rollers 12.

It will be obvious that elements corresponding to the cylinder 51 (FIG. 4), the sleeve 60 and the elongated nut 71 but each longer by the same amount or each shorter by the same amount than the lengths of the corresponding elements 51, 60 and 71 may be substituted for the elements 51, 60 and 71 to provide longer or shorter travel of the grease gun portion of the unit 41 and/or the plunger 77. Thus, the construction provides great flexibility in the length of throw of the grease gun and the length of the pumping stroke of the plunger 77.

Although the unit 41 moves the nozzle tip 110 and sleeve 109 very rapidly against the fitting 15, the sleeve is very durable, and shock to the fitting and to the remainder of the unit is prevented by the action of the sleeve, the resilient bushing 108, and the springs 79 and 100. The spring 72 also cushions the movement of the locknut 75 against the washer 73 to prevent shock. In the return stroke of the piston, the springs 72 and 79 return the members 60 and 76 to their starting positions without shock. The moving parts of the unit 41 are made as light as possible. By reducing the momentum of the moving parts, shock to the unit 41 and fittings 15 is minimized.

In the embodiment of the invention shown in FIGS. 8 and 9, a generally annular swivel socket 207 is threaded on member 201. A flat, annular washer 208 prevents the leakage of lubricant between a member 201 and the

socket 207. The top of the socket 207 is rolled inwardly at 209 to define an axial aperture 210 in the socket. An elongated swivel arm 211 is pivotally and reciprocably held by the socket 207. The bottom of arm 211 comprises a generally cylindrical enlarged portion 212. The enlarged portion 212 is slightly smaller in diameter than the inside diameter of the socket 207. Thus, the outer periphery 213 of the enlarged portion 212 is slightly spaced from the inside periphery 214 of the socket 212. The outer periphery 213 of the enlarged portion 212 is slightly rounded along its longitudinal length so that the enlarged portion 212 can pivot in any direction within the socket 207.

When the enlarged portion 212 is pivotally moved in any direction in the socket 207, its movement is preferably limited to about 20° from the axis of the socket by engagement of a surface 215 of the central portion of the arm 211 with a tapered periphery 216 of the turned-in end 209 of the socket 207.

The swivel arm 211 is provided with an axial lubricant passage 220 and preferably four radially spaced branch inlet passageways 221 connected with the central passageway 200. A ball check 222 is disposed in an axial counterbore 223 of the passageway 220. A valve seat 224 is provided for the ball check 222. It has been discovered that the provision of the branch passageways 221 reduces the tendency of air collecting and being trapped within the socket 207. If air were trapped in the socket 207, it would compress when additional lubricant is pumped from the carrying member 201 into the socket 207. With compression of the air in the socket 207, little or no lubricant would be forced past the ball check 222 and several wheels on the conveyor would not be lubricated. The reliability of operation of the lubricator would be lessened. However, the provision of the passageways 221 has a tendency to "wash" air pockets from within the socket 207.

A bushing 225 is confined in the counterbore 222. The bushing 225 is disposed in close proximity to the ball check 222 in its closed position on the seat 224. The bushing 225 acts as a stop for the ball check 222 in its open position. The bushing 225 has an axial passageway 226 for the lubricant. A biasing spring 227 for the ball check 222, disposed within the passageway 226, engages a shoulder 228 formed by a restricted portion 229 of the passageway 226. A plurality of spaced transverse apertures 230 are provided at the lower peripheral end of the bushing 225 for lubricant flow therethrough when the ball check 222 engages the bottom of the bushing 225 in its open position.

A nozzle tip 217 is threaded on the top 218 of the swivel arm 211. An annular sealing plug 219 of a suitable resilient material prevents the leakage of lubricant between the swivel arm 211 and the nozzle tip 217 and also between the nozzle and the fittings it engages. The plug 219 is elongated to absorb axial shock forces. The sealing plug 219 and the nozzle tip 217 are provided respectively with axial lubricant passageways 231 and 232. The top of the nozzle tip 217 is flared outwardly to properly center itself with each fitting it engages.

The swivel socket 207 is preferably formed from hexagonal stock. The top of the socket 207 is necked down at 233 to provide a transverse shoulder 234. Similarly, the nozzle tip 217 is preferably formed from hexagonal stock, and its bottom is necked down at 235 to provide a transverse shoulder 236.

A strong alignment spring 237 tapered toward its upper end is disposed around and in engagement with the necked down portions 233 and 235 of the socket 207 and nozzle tip 217 respectively. The spring 237 also engages the shoulders 234 and 236 and is held in compression therebetween. With the spring 237 under compression, the enlarged portion 212 of the swivel arm 211 is normally held tightly against the inner surface 238 of the turned-in end 209 of the swivel socket 207. The spring 237 normally maintains the swivel arm 211 and the nozzle tip 217 in coaxial alignment with the swivel socket 207.

The outer periphery 213 of the enlarged portion 212 of the swivel arm 211 has an annular groove 239 formed therein. An annular O ring 240 is disposed within the groove 239. The cross-section of the O ring 240 is sufficiently large to cause the O ring 240 to be deformed under compression between the surface 214 and the surfaces of the groove 239. In FIG. 9, the O ring is not shown in section although the line 9—9 of FIG. 8 passes therethrough. It has been found that this type of O ring and retaining groove construction has provided an especially effective seal around the entire periphery of the enlarged portion 212 in all pivotal positions of the swivel arm 211 without unduly restricting the movement of the arm 211 and without appreciably affecting the ability of the spring 237 to rapidly restore the swivel arm 211 from a non-axial position to the aligned position coaxial with the socket 207. The O ring and retaining groove construction has also been found to provide an effective and durable seal when the swivel 211 is axially displaced consequent to the nozzle striking a fitting with a severe force.

Provision is also made to prevent damage to the member 201 or piston 203 in the event that the nozzle is subjected to a lateral force of undue severity. More specifically, the swivel arm 211 is necked down to a thin wall section 241 at its center. In the event of a lateral force of extreme severity, the section 241 will be sheared off, thereby preventing damage to the member 201 and piston 203. A new swivel arm assembly can then be secured to the member 201.

While there has been described what is at present believed to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein; and it is contemplated to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a lubricating device, a cylinder having a supply port at one end thereof, a piston slidable in the cylinder and having a head and a guide portion, a spring of a predetermined strength urging the piston toward said one end of the cylinder, a tubular member carried by the guide portion of the piston and slidable relative to the guide portion of the piston, a second spring of substantially greater strength than said predetermined strength and urging the tubular member away from the head of the piston, a plunger member fixed rigidly to the piston and slidable in the tubular member to force a lubricant therethrough, the tubular member having a lubricant supply opening therein, and nozzle means mounted on the end of the tubular member in alignment therewith.

2. The lubricant device of claim 1 wherein the plunger member is adjustably secured to the piston and is provided with indicia observable through the opening in the tubular member.

3. The lubricating device of claim 1 wherein the tubular member and the nozzle means are provided with interconnecting means having flat annular interengaging surfaces for orienting the nozzle means relative to the tubular member and permitting pivotal movement of the nozzle means relative to the tubular member, and a spring so acting between the nozzle means and the tubular member as to urge the surfaces together.

4. In a lubricating device, a cylinder member, means defining a piston in slidable engagement with the cylinder, means urging the piston means away from one end of said cylinder, a tubular member slidable in the cylinder relative to said piston means and having a grease supply opening therein, nozzle means carried by the tubular member, means supplying grease to the tubular member and the nozzle means through the opening, a plunger slidable in the tubular member connected to the piston means, means urging the piston means away from

the tubular member and having a substantially greater strength than said first urging means, and means for supplying air under pressure to the other end of said cylinder to sequentially move the piston means and tubular member in a direction toward the one end of the cylinder until the movement of the nozzle is retarded and move the plunger along the tubular member to force grease through the nozzle.

5. A self-aligning flexible nozzle comprising: a rigid generally annular swivel socket, an internal transverse projection at the end of the socket providing a restricted aperture, a rigid elongated swivel arm, an enlarged portion of circular cross-section at one end of the arm disposed loosely within the socket adjacent the transverse projection, the other portion of the arm projecting through the aperture, said other portion of the arm engageable with the transverse projection upon predetermined pivotal movement of the arm in a radial direction, a transverse annular groove around the periphery of the enlarged portion of the arm, an O ring disposed in the groove and held under compression between the groove and the adjacent inner surface of the socket, opposed external shoulder surfaces integral with the socket and the arm and serving when in engagement to locate the arm in alignment with the socket and permitting pivotal movement therebetween, a powerful spring disposed around and circumferentially engaging adjacent portions of the socket and arm intermediate the shoulders and held under compression between the shoulders, said spring urging the arm in a predetermined position relative to the axis of the socket and urging the enlarged portion of the arm into engagement with the transverse projection.

6. The combination claimed in claim 5, wherein said adjacent outer peripheral portions of the swivel socket and the swivel arm are in engagement with the spring along an appreciable longitudinal distance to provide more rapid and accurate alignment of the swivel arm with the swivel nozzle in said predetermined position.

7. The combination claimed in claim 5 wherein the adjacent portion of the socket is larger than the adjacent portion of the swivel arm and wherein the spring is tapered in a direction extending from the socket portion toward the arm portion.

8. A self-aligning flexible nozzle comprising: a rigid generally annular swivel socket having a generally cylindrical passageway therein, an internal transverse projection at one end of the socket providing a restricted aperture, a rigid elongated swivel arm, an enlarged portion of circular cross-section at one end of the arm disposed loosely within the socket adjacent the transverse projection to permit reciprocable movement within the socket, the outer periphery being slightly convex in the longitudinal direction to permit pivotal movement within the socket, the other portion of the arm projecting through the aperture, the end of the enlarged portion of the arm adjacent the transverse projection and the transverse projection having flat interengaging surfaces transverse to the longitudinal axes of the arm and projection, a transverse annular groove around the periphery of the enlarged portion of the arm, an O ring disposed in the groove and held under compression between the groove and the adjacent inner surface of the socket, opposed external shoulder surfaces integral with the socket and the arm, a powerful spring disposed around adjacent portions of the socket and arm intermediate the shoulders and held under compression between the shoulders, said spring urging the arm to a predetermined position relative to the axis of the socket and urging the enlarged portion of the arm into engagement with the transverse projection.

9. The combination claimed in claim 8 together with a rigid generally annular nozzle tip secured in telescoping arrangement to the other end of the swivel arm, an elongated annular sealing plug of a resilient material disposed within the nozzle tip adjacent the swivel arm to partially absorb the axial forces exerted on the flexible nozzle and an annular fitting engaging element of a relatively soft metallic material deformable upon engagement with each fitting retained in the nozzle tip adjacent the fitting engaging end thereof and retaining the sealing plug in compression against the swivel arm.

10. A self-aligning flexible nozzle comprising: a rigid generally annular swivel socket having a generally cylindrical passageway therein, an inwardly projecting edge at one end of the socket providing a restricted aperture, and having a transverse annular flat surface, a rigid elongated swivel arm, an enlarged portion of circular cross-section at one end of the arm disposed loosely within the socket adjacent the inwardly projecting edge to permit reciprocable movement of the arm within the socket, the outer peripheral surface of the enlarged portion being slightly convex in the longitudinal direction to permit pivotal movement within the socket, the end of the enlarged portion adjacent to the projection having a transverse annular flat surface adapted to abut the flat surface of the projection, the other portion of the arm projecting through the aperture, said other portion of the arm engageable with the inwardly projecting edge upon predetermined pivotal movement of the arm in any radial direction, a transverse annular groove around the peripheral surface of the enlarged portion of the arm, an O ring disposed in the groove and held under compression between the groove and the adjacent inner surface of the socket, opposed external shoulder surfaces integral with the socket and the arm, a powerful spring disposed around adjacent portions of the socket and arm intermediate the shoulders and held under compression between said shoulders, said spring urging the arm to a predetermined position relative to the axis of the socket and urging a forward end of the enlarged portion of the arm into engagement with the inwardly projecting edge, generally axial passageways in the socket and the arm and a plurality of radially spaced, inclined passageways in the enlarged portion of the swivel arm extending from the arm passageway to the convex peripheral surface adjacent a rearward end of the arm to interconnect the generally axial passageways of said socket and arm.

11. A lubricating device of the type in which a plunger is reciprocated in a pumping chamber having an inlet and an outlet to pump fluid into a chamber adjacent the outlet and in which the fluid is forced under pressure by the plunger from the latter chamber through an element defining a passageway disposed adjacent a central portion of the latter chamber, said device characterized by the element defining radially spaced inclined passageways extending from said first-mentioned passageway into the latter chamber at spaced locations about said chamber, whereby air pockets tending to collect in the latter chamber are washed through one or more of the inclined passageways into said first-mentioned passageway.

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