Oct. 9, 1956 A. E. GRZENKOWSKI ET AL 2,765,817

MACHINE FOR FILLING DIRECT ACTING SHOCK ABSORBERS WITH HYDRAULIC FLUID

Filed March 1, 1951 6 Sheets-Sheet 1

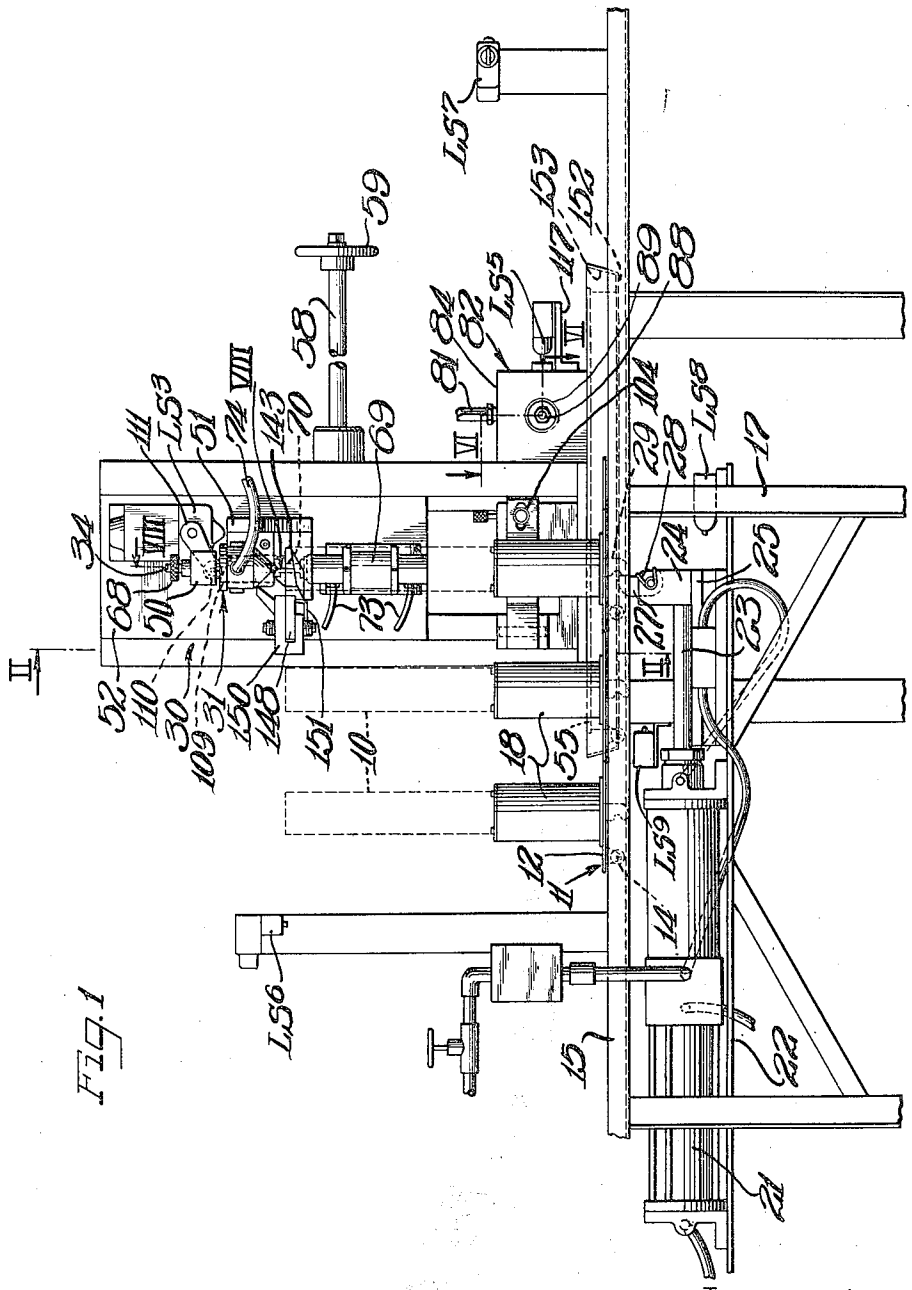


Fig. 1

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MACHINE FOR FILLING DIRECT ACTING SHOCK ABSORBERS WITH HYDRAULIC FLUID

Filed March 1, 1951 6 Sheets-Sheet 2

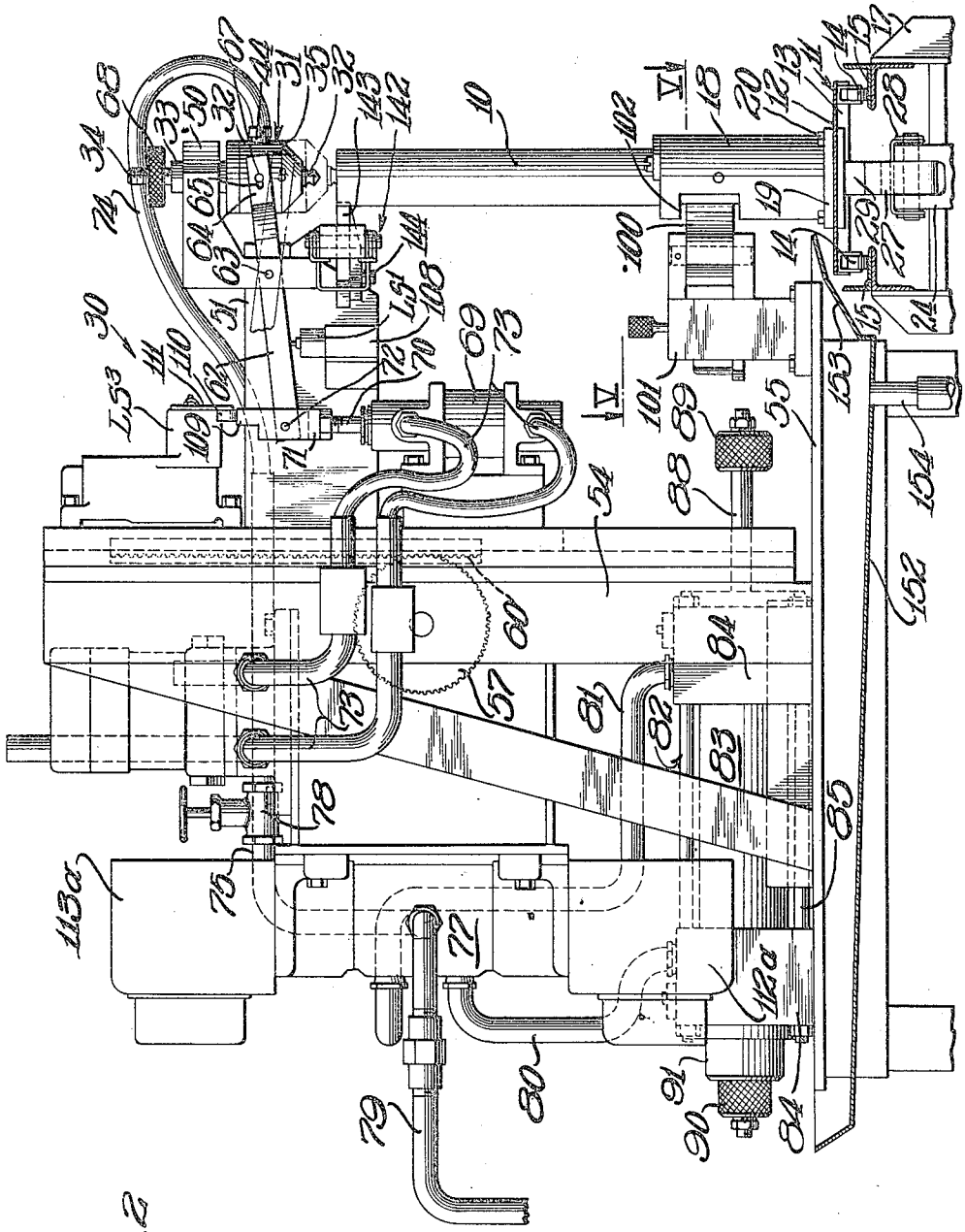


Fig. 2

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MACHINE FOR FILLING DIRECT ACTING SHOCK ABSORBERS WITH HYDRAULIC FLUID

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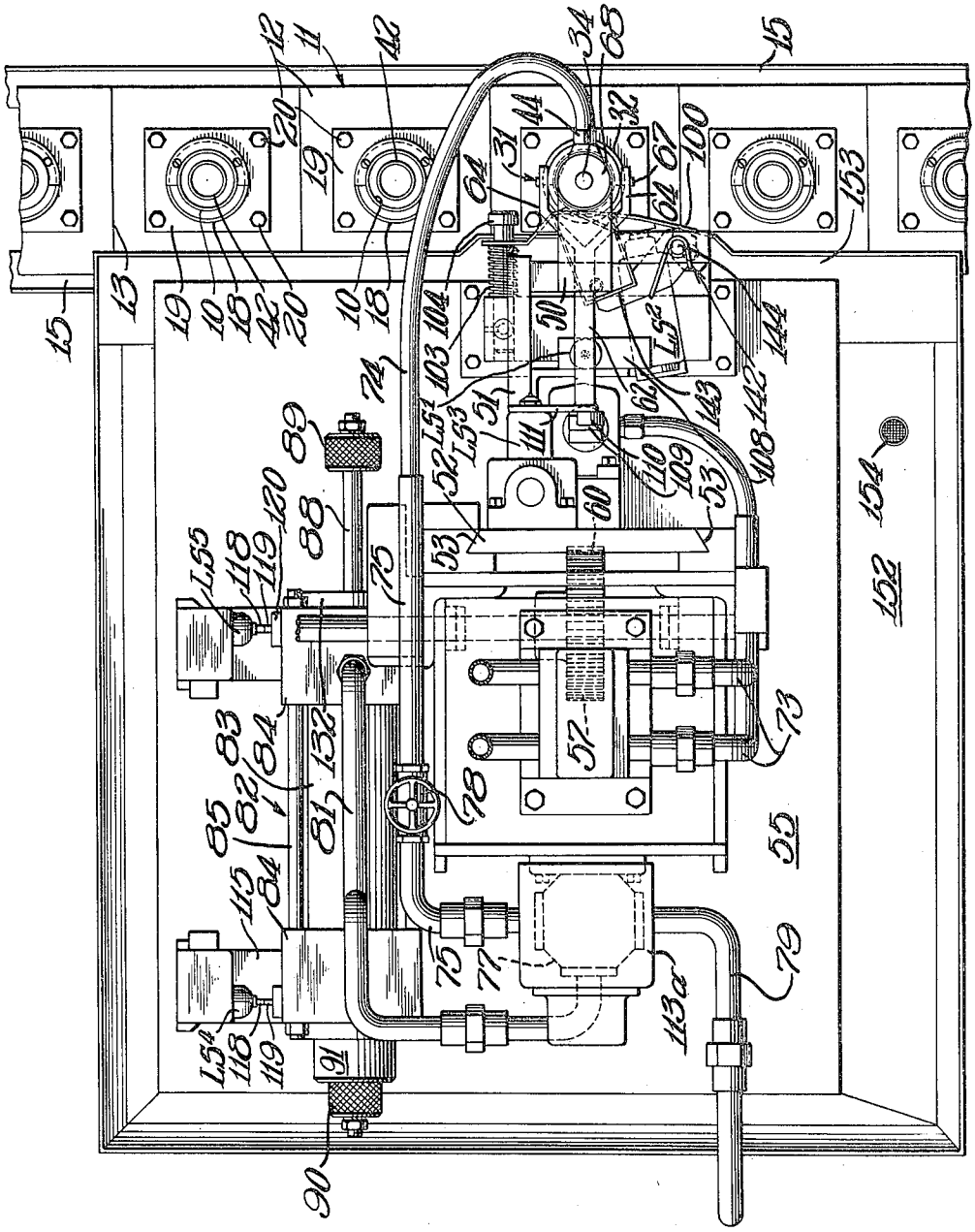


Fig. 3

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MACHINE FOR FILLING DIRECT ACTING SHOCK ABSORBERS WITH HYDRAULIC FLUID

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Fig. 4

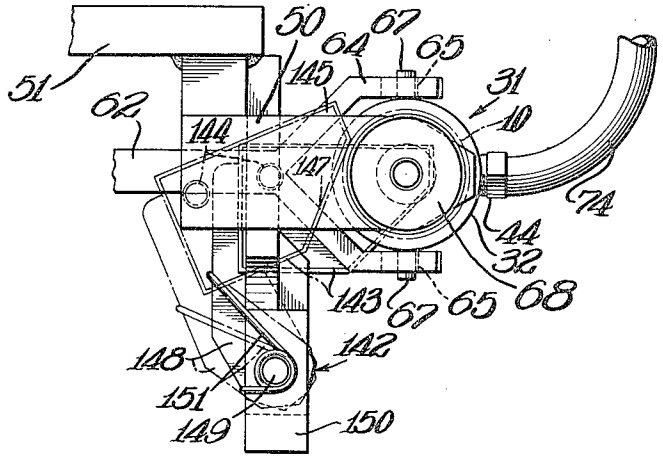
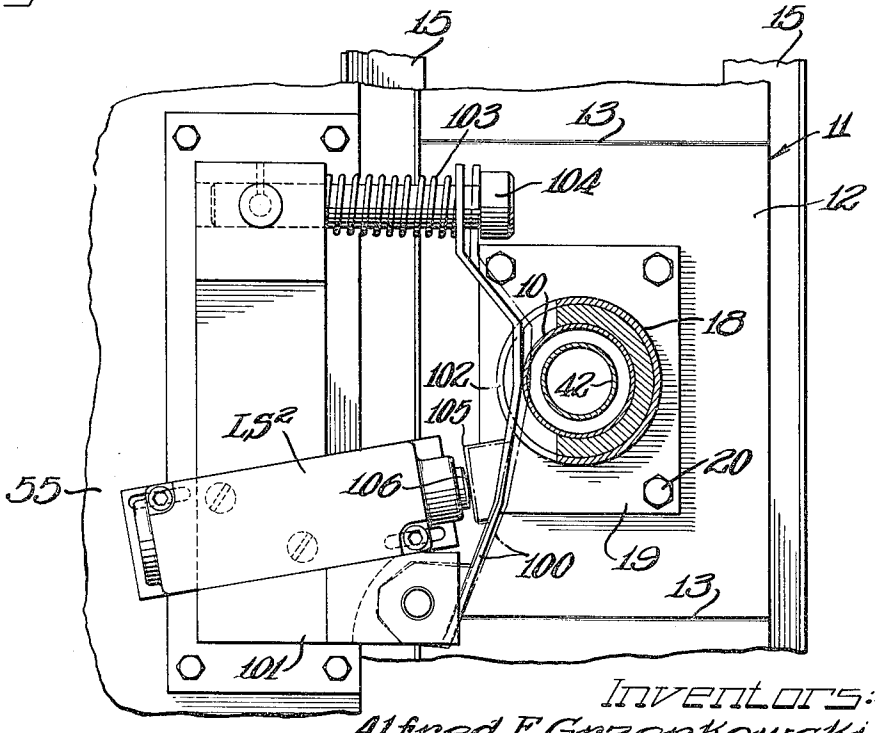


Fig. 5



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MACHINE FOR FILLING DIRECT ACTING SHOCK ABSORBERS WITH HYDRAULIC FLUID

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Fig. 6

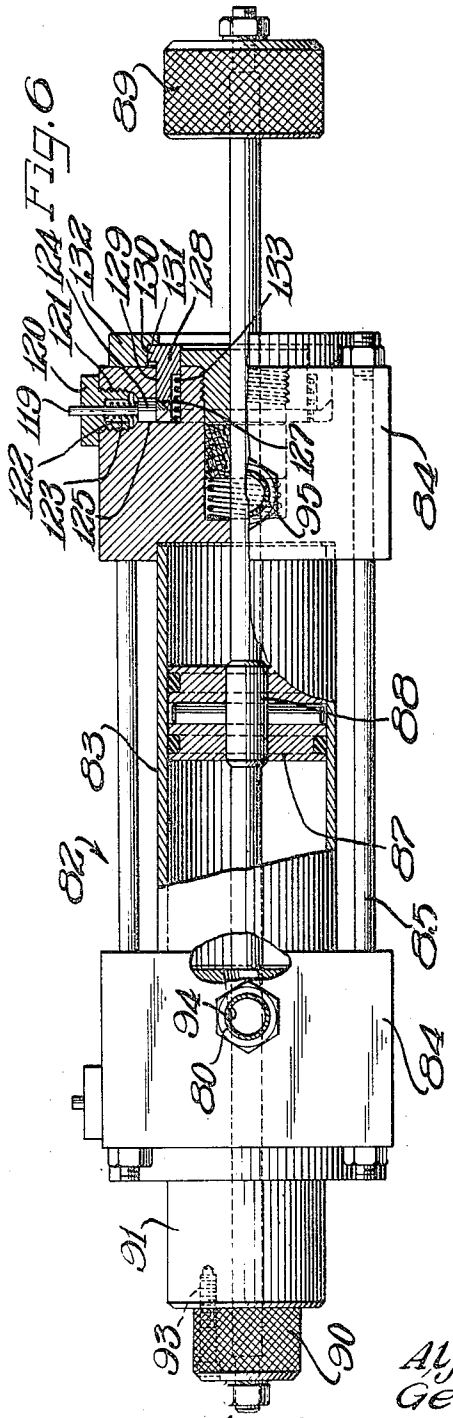


Fig. 7

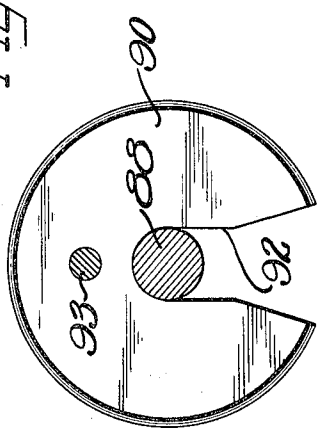
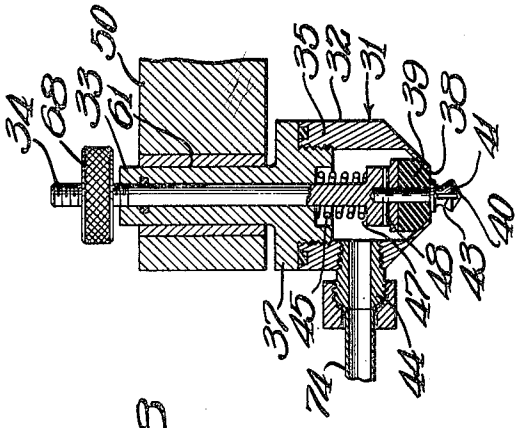


Fig. 8



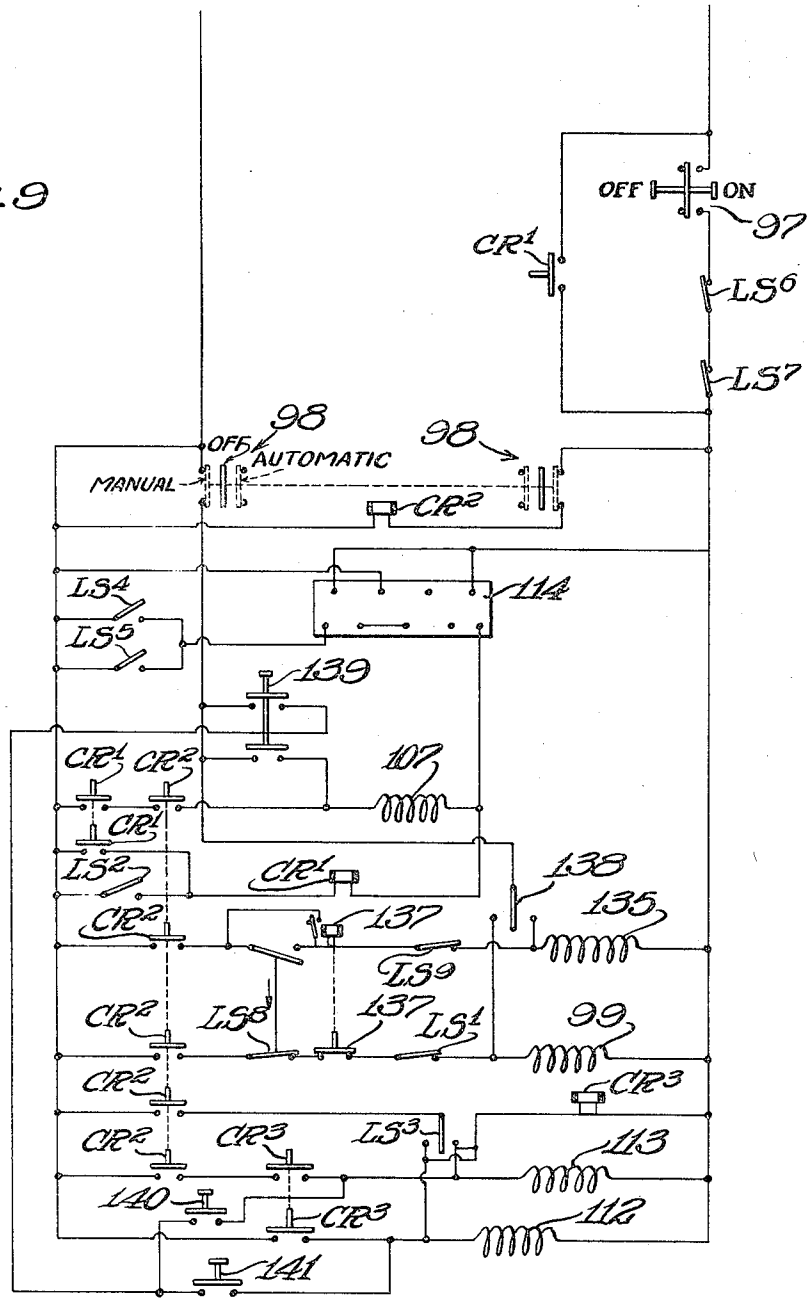
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MACHINE FOR FILLING DIRECT ACTING SHOCK ABSORBERS WITH HYDRAULIC FLUID

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Fig. 9



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United States Patent Office 2,765,817 Patented Oct. 9, 1956

2,765,817

MACHINE FOR FILLING DIRECT ACTING SHOCK ABSORBERS WITH HYDRAULIC FLUID

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Application March 1, 1951, Serial No. 213,396

16 Claims. (Cl. 141—160)

The present invention relates to machines for the mass production filling of direct acting shock absorber assemblies with hydraulic fluid.

In the manufacture of direct acting hydraulic shock absorbers various components of the shock absorbers are assembled within a cylindrical casing having a bottom closure and then a charge of hydraulic fluid, substantially filling the casing, is filled into the casings before final assembly of the remaining components of the shock absorber and sealing of the unit ready for service installation as for example in a vehicle. Heretofore filling of the partially completed shock absorbers has been accomplished by largely manual methods requiring substantial handling and manual operations.

It is an important object of the present invention to provide a machine for automatically filling a continuous succession of hydraulic shock absorbers.

Another object of the invention is to provide a filling machine for hydraulic direct acting shock absorbers which is adapted for manual or automatic control.

A further object of the invention is to provide improved control means in a direct acting shock absorber fluid filling machine.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of a preferred embodiment thereof, providing a typical example, in conjunction with the accompanying drawings, in which:

Figure 1 is a front elevational view of a machine embodying the features of the present invention;

Figure 2 is an enlarged fragmentary elevational and partially sectional view taken substantially on the line II—II of Fig. 1;

Figure 3 is a top plan view of the machine;

Figure 4 is a fragmentary enlarged top plan view of the filling head portion of the machine;

Figure 5 is an enlarged fragmentary transverse sectional and plan view taken substantially on the irregular section line V—V of Fig. 2;

Figure 6 is an enlarged sectional and elevational view taken substantially on the line VI—VI of Fig. 1;

Figure 7 is a transverse sectional view taken on substantially the line VII—VII of Fig. 6;

Figure 8 is an enlarged sectional detail view through the nozzle taken on substantially the line VIII—VIII of Fig. 1; and

Figure 9 is a simplified electrical diagram showing the electrical control system of the machine.

The machine of the present invention is equipped to support and convey a continuous succession of partially assembled shock absorber units 10 (Figs. 1, 2 and 3) in upright position into and past a filling station. For this purpose the machine includes an endless conveyor 11 comprising an endless series of articulated conveyor plates 12 connected together by suitable hinge connections 13 and each having a pair of laterally spaced anti-friction rollers 14 on the bottom thereof adjacent to its trailing end. Thereby the conveyor sections or plates 12 provide

mutual support for one another as the rollers 14 travel on spaced parallel horizontal rails 15 providing a track for the conveyor supported by a framework 17 that may be mounted upon the floor of the factory.

Each of the conveyor plates 12 has mounted thereon an upstanding, columnar hollow supporting member 18. By preference the supporting members 18 are cylindrical and tubular and secured to a base plate 19 which may be fastened as by means of screws or bolts 20 to the supporting conveyor plate 12. The internal diameter of each of the supporting cylinders 18 is dimensioned to receive freely but reasonably supportingly closely the lower portion of one of the shock absorber members 10, while the height of the cylindrical supporting members 18 is such as to support the shock absorber members 10 without tilting strain or canting, but yet short enough so that loading and unloading of the supporting cylinders is facilitated.

Step-by-step advance of the conveyor 11 is effected by means of a fluid operated actuator 21 of the cylinder and piston type supported on a platform 22 carried by the framework 17 below the upper run of the conveyor. A piston rod 23 projecting from the forward end of the actuator assembly has at its forward end a traveler block 24 which is reciprocably guided on a track 25 for conveyor advancing and retractional or return movements in a cycle of operation. Pivotally carried by and projecting above the traveler block 24 is a pivoted pawl or dog 27 which is normally spring urged into upright position by a spring 28 and is arranged to engage behind respective depending engagement lugs 29 on the bottoms of the conveyor plates. The construction and arrangement is such that the advancer dog 27 will engage successively with the conveyor lugs 29 and in the forward movement of the piston rod 23 to advance the traveler 24 will advance the conveyor correspondingly. Advance is effected by protraction of the rod 23 while return of the dog 27 is effected by retracting the piston rod 23 so that the dog is carried rearwardly until it engages and yields tiltably under the next conveyor lug 29 and then snaps up behind the conveyor lug to engage the same for the next advancing movement in the cycle. Any preferred controllable source of motivating fluid may be provided for the actuator 21.

Each successive one of the shock absorber units 10 to be filled is delivered by the conveyor 11 into position at a filling station wherein a filling head structure 30 functions to deposit a properly measured volume of hydraulic fluid into the upwardly opening casing of the shock absorber unit. The principal component of the filling head 30 comprises a filling nozzle assembly 31 which is supported above the conveyor 11 in centered relation to the longitudinal axis of the conveyor and directed downwardly for axial alignment with the shock absorber unit 10 conveyed into filling position therebeneath. The filling nozzle 31 comprises a hollow nozzle body member 32 having an upwardly projecting, preferably cylindrical, stem 33 which is axially bored and has a valve actuating rod or steam 34 slidably accommodated therein and projecting thereabove (Fig. 8).

By preference, the valve body 32 is formed in two parts comprising a lower shell member 35 of generally cup-shape which has the inner upper margin threaded so as to be threadedly attachable to an upper closure portion 37 with which the stem 33 is formed integral in one piece. The bottom of the nozzle member 35 is preferably formed of tapered shape both internally and externally converging toward a discharge orifice 38. In control of the orifice 38 is a valve member 39 which is of complementary tapered, preferably frusto-conical shape to the inner seating surface surrounding the orifice 38 and is carried by the lower end of the stem member 34. Depending from the valve member 39 is a coaxial flow distributor tip

member 40 formed with a downwardly and outwardly tapering shoulder 41 toward which fluid ejected under pressure from the orifice 38 will impinge and be directed at least in part radially outwardly and downwardly into the usual reservoir chamber of the shock absorber defined between the wall of a cylinder tube 42 and the outer casing of each of the shock absorber units 10 (Figs. 3 and 5). Since fluid must also be delivered into the cylinder tube 42, a pair of converging slots 43 are formed in the tip 40 through the shoulder 41, one of such slots being shown in Fig. 8. Hydraulic fluid under pressure is delivered into the chamber within the nozzle member 35 by means such as a nipple fitting 44 communicating through the wall of the nozzle member. Normally the valve member 39 seals the orifice 38 under the impulsion of a biasing member such as a coiled compression spring 45 bearing at its upper end against the upper nozzle member 37 and at its lower end against a shoulder 47 on the stem member 34. The valve member 39 may be clamped to the lower end of the stem member 34 by the distributor tip member 40 which, for this purpose, has a stem projecting up through the valve member 39 and into the lower end portion of the stem member 34 and is there pinned in place by a transverse pin 48.

In order to control the delivery of hydraulic fluid into the shock absorber units and to avoid overspreading of the fluid delivered from the nozzle, but to assure direct delivery of the fluid into the shock absorber unit, the nozzle during filling should be disposed with the orifice end thereof substantially in or below the plane of the upper end of the outer casing tube of the shock absorber unit being filled. On the other hand, in order to enable registration of the successive shock absorber units under the nozzle, the nozzle should be disposed clear of the upper ends of the shock absorber units. To this end, means are provided for vertically reciprocably shifting the nozzle 31 between an upper shock absorber clearing position as shown in full line in Fig. 2 and a lower filling position as toward which the nozzle is indicated as having been moved as shown in dash outline in Fig. 2. To this end, the nozzle is supported by a cantilever arm structure including a nozzle-carrying head member 50 overlying the conveyor 11 mounted at the outer end portion of a cantilever plate 51 disposed in a vertical plane on a vertically adjustable dovetail carriage member 52 vertically slidably supported in respective vertically disposed dovetail grooves 53 of a supporting column 54 rising from a table 55 disposed alongside the conveyor 11. The carriage 52 may be adjusted vertically by means of an adjustment gear 57 rotatably supported by the column 54 on an axle including a stem 58 carrying a hand wheel 59 by which the adjustment gear 57 may be rotated to effect vertical adjustment of the carriage 52 by action of the gear on a ratchet 60 on the back of the carriage member 52 (Figs. 1, 2 and 3). Thereby the elevation of the nozzle 31 for proper operation with respect to shock absorbers of various lengths can be adjusted as required.

As best seen in Fig. 8, the nozzle-supporting head 50 provides a vertically slidable guide support for the nozzle through the medium of the upwardly projecting stem 33 of the nozzle which is reciprocably slidably engaged within a sleeve bearing 61 carried by the supporting head. Vertical reciprocation of the nozzle 31 is effected by means of a lever 62 pivotally supported intermediate its ends as at 63 by a rear portion of the carrying head 50. The forward end portion of the arm 62 is forked to provide spaced parallel arms 64 having respective aligned, longitudinally elongated bearing apertures 65 within which are journaled pintle studs 67 disposed in aligned relation to project from respectively opposite sides of the nozzle member 35 of the nozzle body 32. Thus, by swinging the lever arm 62 about its pivot 63 movement of the nozzle 31 can be effected between the upper inactive position and the lowered filling position thereof.

In the up or inactive position of the nozzle 31, the valve 39, of course, seals the orifice 38 under the bias of the spring 45. In the down or filling position of the nozzle, means such an abutment shoulder member 68 on the upwardly projecting portion of the valve stem 34 engages the upper side of the carrying head 50 during the downward movement of the nozzle by the actuating lever 62 in advance or prior to the nozzle reaching the full downward filling position so that the valve stem 34 is brought to a stop and thereby also the valve 39 before the valve body 32 comes to a stop in filling position at the mouth of the shock absorber unit 10 to be filled. Thereby, the valve member 39 is retracted from the orifice 38 in opposition to the biasing spring 45 and the orifice is opened for discharge of hydraulic fluid from the nozzle into the shock absorber unit. The association of the valve member 39 and its stem 34 to the remainder of the nozzle assembly may therefore be considered as a lost motion connection permitting relative valve opening and closing movements between the valve member and the remainder of the nozzle assembly. Various requirements as to distance of travel of the nozzle 31 before the valve should be opened are accommodated by having the shoulder member 68 in the form of a knurled centrally apertured and threaded disk or wheel threaded onto the upper end portion of the stem 34 so that by appropriate threaded adjustment of the shoulder disk 68 up or down on the stem the appropriate adjustment can be effected. Through this arrangement, at all times, opening of the valve 39 is coincident with downward movement of the nozzle assembly 31 into fluid delivering position.

Swinging of the lever 62 to carry the nozzle assembly 31 up and down, coordinated with the conveyor 11 is effected by a double acting pneumatic-operator 69 of the cylinder and piston type mounted on the supporting column 54 of the machine and having a piston rod 70 projecting upwardly therefrom and provided with a connector member 71 which is pivotally connected by means of a pin 72 to the rear end portion of the lever 62. This pivotal connection will, of course, have proper lost motion provision to compensate for the arcuate movement of the connected end of the lever 62 relative to the connector 71 which is rectilinearly movable by the operator 69. Compressed air for motivating the operator 69 is supplied from a suitable source through a system of conduits or ducts 73.

Hydraulic fluid is supplied to the nozzle 31 through a flexible conduit 74 attached to the nipple 44 and communicating with a rigid duct 75 leading from a suitable hydraulic valve assembly 77 (Figs. 2 and 3). A hand wheel controlled shut-off valve 78 may be provided in the conduit or duct 75.

Inasmuch as different sizes of the shock absorber units 10 require respectively different volumes of hydraulic fluid, means are provided for measuring the volume of fluid delivered at every actuation of the nozzle 31 to deliver a charge of fluid. To this end, the control valve 77 is of the kind which will receive hydraulic fluid under pump pressure from a suitable source through a supply duct 79 and then shunt the hydraulic fluid alternatively into one of a pair of fluid ducts 80 and 81 leading separately from the control valve to opposite ends of a fluid measuring assembly 82. The arrangement and construction of the measuring assembly 82 is such that fluid delivered into one end of the assembly causes ejection of a measured volume of fluid from the opposite end of the assembly, the ejected fluid being returned to the valve 77 and directed into the nozzle supplying conduit 74, 75. The measuring device 82 is therefore automatically operable during operation of the machine responsive to fluid pressure.

In a preferred form, the measuring device 82 comprises a tubular cylinder 83 having at the opposite ends thereof respective, substantially identical head block structures 84 secured in fluid tight relation thereto as by means of connecting bolts or rods 85. Dividing the chamber

thus provided within the cylinder 83 is a piston 87 secured to a shaft 88 which projects slidably through each of the head blocks 84 with the piston at an intermediate portion of the rod. At one of the projecting end portions of the rod 88 is a stop block member 89. At the opposite outwardly protruding end of the rod 88 is secured a stop block 90, and by preference this end portion of the rod projects to a greater distance from the adjacent head block 84 than the opposite end portion of the rod so as to accommodate between the stop member 90 and the adjacent head block a calibrating member 91 determinative of the measured volume of fluid to be delivered in each stroke of the piston 87.

The measuring member 91 is in a convenient form in the shape of a cylinder having a longitudinal radially opening slot 92 by which the cylinder is applied to the rod 88, while a screw 93 extending through the stop member 90 and secured into the adjacent end of the cylinder 91 holds the cylinder against unintentional displacement from the rod. Thus, since the extent of throw of the piston 87 toward the opposite ends of the cylinder 83, as limited by the stop member 89 at one end and the measuring cylinder 91 at the other end of the unit determines the measured volume of fluid that will be displaced, it will be readily apparent that by selection of the length of the measuring cylinder 91 for any given requirement will provide for the same volume displacement at both ends of the cylinder. That is, when hydraulic fluid is delivered by the duct 80 through a port 94 through the head block 84 into the cylinder 83 fluid will be displaced by the piston 87 from the cylinder 83 through a port 95 into the duct 81 and thence to the filling nozzle 31 in a volume measured by the length of the piston stroke as limited by engagement of the adjacent end of the measuring cylinder 91 with the proximate head member 84. The return stroke when the fluid pressure is reversed to enter the cylinder 83 by way of the duct 81 will cause delivery of a corresponding volume of hydraulic fluid through the duct 80 and thence to the nozzle 31. It will be understood that as large a set of the measuring cylinders 91 of various calibrated lengths may be provided as necessary to accommodate all of the various sizes of shock absorbers to be filled as may from time to time require filling in production, the appropriately calibrated measuring cylinder being selected and substituted on the rod 88.

For integrated automatic or hand controlled operation of the apparatus, electrical control means are provided including electrical operating circuits as depicted in simplified, more or less schematic diagram in Fig. 9. The various hand-operated switches for the control circuit may be conveniently mounted on a panel board (not shown) as is conventional practice, at any convenient place. Assuming the various electrical controls to be in the non-operating condition shown in Fig. 9, automatic cyclical operation of the apparatus can be initiated by closing a master control switch 97 and moving a selector switch 98 to the automatic position. This completes a circuit which energizes and operates a control relay CR^2 which in turn closes a circuit through a solenoid operator including a coil 99 by which the conveyor operator 21 is activated to move the conveyor 11 forwardly and advance one of the shock absorber supporting members 18 into substantially coaxially aligned position under the nozzle 31.

If one of the shock absorber units 10 is in the thus aligned carrier 18, as shown in dash outline in Fig. 1 and in full outline in Figs. 2 and 5, a normally open, snap-type limit switch LS^2 is closed by the action of a switch operating lever arm 100 which is pivotally mounted adjacent to one end upon a bracket 101 supported by the machine table 55 in position to extend into the path of movement of the successive shock absorber units 10. For this purpose the upright tubular carriers 18 have respective chordal openings or slots 102 therein on the table-opposing sides thereof and exposing to the switch-actuating arm 101 a substantial portion of the periphery of the supported shock absorber unit 10. Then, as the conveyor 11 transports the shock absorber unit 10 to be filled into the filling position, engagement of the switch operating arm 100 with the periphery of the shock absorber unit swings the arm away from the shock absorber unit in opposition to a biasing compression spring 103 guided by a stud 104 associated with the distal end of the lever arm 100 and also carried by the bracket 101. As a result a pad or lug 105 on the actuating arm 100 drives against a switch button 106 of the switch LS^2, thereby closing the switch.

Closing of the switch LS^2 is predetermined to occur as the shock absorber unit 10 reaches filling position and initiates a series of sequential automatic operations as follows. A control relay CR is energized to energize a circuit through a solenoid operator including an actuating coil 107 and active to control operation of the pneumatic operator 69 to move the nozzle lever arm 62 for shifting the filling nozzle 31 into filling position. As the rear portion of the nozzle actuating arm 62 moves up, a normally closed limit switch LS^1 controlled by the arm 62 and carried on a bracket 108 attached to the cantilever support arm plate 51 is opened to break the conveyor advancing circuit including the solenoid coil 99, thus halting the conveyor.

Coincident with opening of the switch LS^1 a normally open limit switch LS^3 is closed by the upward movement of the nozzle arm actuating connector 71 which for this purpose has a switch operating cam portion 109 on its upper end engaged by a follower roller 110 at the distal end of a swingable switch operating arm 111 for the switch LS^3. By preference the switch unit LS^3 is carried by the upper portion of the machine column 54 and this switch is preferably a double acting switch of the ratchet type so that in succeeding cycles of operation it alternately closes a circuit including a solenoid coil 112 at one side of the hydraulic fluid controlling valve 77, or a circuit for energizing a solenoid including a coil 113 at the opposite side of the hydraulic valve 77. As shown in Fig. 2, the solenoid operator 112 may be disposed in a casing 112*a* while the solenoid operator 113 may be disposed in a casing 113*a* at the opposite side of the valve 77.

Operation of the hydraulic valve 77 shifts the same to cause hydraulic fluid to be delivered to the previously exhausted side of the measuring cylinder 83 so that a measured volume of hydraulic fluid will be ejected by the piston 87 from the opposite side of the measuring cylinder into the filling nozzle 31 which is now in filling position with respect to the shock absorber unit 10 which initiated the cycle. Closing of the limit switch LS^3 also energizes a control relay CR^3 involved in the hydraulic valve control circuits.

At completion of delivery of filling fluid either one of two limit switches LS^4 or LS^5, depending upon which direction the measuring cylinder piston 87 is driven, is closed and this sets into operation a timer 114.

By preference the limit switches LS^4 and LS^5 are mounted on respective brackets 115 and 117 carried by the respective opposite head blocks 84 of the measuring cylinder unit. Each of the limit switches has an actuating button 118 which is directed toward the opposing side of the adjacent head block 84 and is engaged by an operating pin 119 slidably mounted in a guide plug 120 threaded into a counterbore 121 in the head block and having a recess 122 in its inner portion accommodating a compression spring 123 which bears against a conically tipped head 124 at the inner end of the actuating pin. The head 124 is reciprocably guided in a bore 125 and bears against a cam bevel 127 at the inner end of an actuating ring member 128 reciprocably guided in a bore 129 concentrically about the axis of the piston rod 88. The actuating ring 128 has a lateral peripheral flange 130 of somewhat less thickness than a rabbet groove 131 in a retaining ring member 132 secured to the face of the head block 84 from which the piston rod 88 projects. Normally the actuat-

ing ring 128 is urged outwardly by a compression spring 133 so that the actuating pin 119 is driven inwardly by the spring 123 into the position wherein the respective switch controlled by the pin is in open condition. The outer end of the actuating ring 128 is exposed to the opposing end of the stop member 89 or the measuring cylinder 91, as the case may be, which upon engaging the actuating ring 128 at the completion of a filling fluid measuring stroke of the piston 87 depresses the engaged actuating ring 128, thereby camming the associated switch actuating pin 119 outwardly and closing the associated limit switch.

Operation of the timer 114 effects opening of the circuit controlled by the limit switch LS^2. As a result the solenoid including the coil 107 controlling the air valve for the pneumatic operator 69 is deenergized and the pneumatic operator 69 returns to the inactive position, reversing the nozzle arm 62 and raising the nozzle 31. This causes the limit switch LS^3 to be returned to neutral position and also causes limit switch LS^1 to close, starting the conveyor 11.

After a short increment of continued advancing movement of the conveyor, a limit switch 8 (Figs. 1 and 9) is actuated by the driving head 24 of the conveyor actuating mechanism to break the energizing circuit for the conveyor advancing solenoid operator including the coil 99 and to close a circuit including a solenoid coil 135 of a solenoid operator which effects control of the conveyor operator 21 to return the conveyor operating piston and thus retract the actuating head member 24 until the advancing dog 27 has been moved into operative opposion to the lug 29 of the next succeeding conveyor plate. Although upon release from the head 24, the limit switch LS^8 snaps back a control relay 137 maintains the circuit for the coil 99 open and maintains the circuit for the coil 135 closed until a normally closed limit switch LS^9 is opened by the conveyor actuating head member 24 to stop return movement of the conveyor actuator and deenergize the control relay 137 so that the circuit for energizing the conveyor advancing solenoid coil 99 is again closed and the cycle of operation repeated.

Should one of the shock absorber carrying members 18 be empty when it reaches the filling station under the nozzle 31, the limit switch LS^2 will, of course, not be operated, but the conveyor actuating head member 24 will move on until it again actuates the limit switch LS^8. Hence the conveyor actuating unit 21 will immediately repeat its cycle of operation and advance the conveyor to carry the succeeding shock absorber carrying member 18 into the filling position, and so on until a loaded shock absorber carrying member 18 comes under the nozzle 31.

If for any reasons it is desired to operate the machine manually, the two way switch 98 is put in the hand operation position and then each step in the cycle of operation can be carried out at the will of the operator by operation of a manual switch. To this end, a manually operated switch 138 is operable to effect advance and return of the conveyor 11. A manual switch 139 effects closing of circuit for operating the filling nozzle pneumatic operator 69. Manual switches 140 and 141 are operable to control the hydraulic valve for the fluid measuring and delivery mechanism.

Either during automatic operation or during hand operation, should one of the shock absorber units 10 be improperly loaded into one of the carriers 18 so that the upper end of the shock absorber unit projects above the plane for which the nozzle member 31 has been adjusted, the upper end portion of the improperly placed shock absorber unit will operate a safety limit switch LS^6 (Figs. 1 and 9) which breaks the master electrical circuit and stops the machine.

To assure unloading of the endless conveyor and thus avoid spilling of a filled shock absorber unit, a safety limit switch LS^7 is provided (Figs. 1 and 9) located to engage the filled shock absorber unit 10 that may not have been unloaded from the carrier 18 advanced to the limit of safe carriage of the filled shock absorber unit.

In order to avoid any possible dripping of hydraulic fluid from the nozzle 31 onto the conveyor 11 between filling operations, a drip collector 142 is provided including a receptacle 143 in the form of a pan having a rear sump portion including a drain 144 and a forward drip-collecting portion 145 including a cam edge 147. Supporting the drip pan pivotally is a bracket arm 148 which is pivotally connected as by means of a pin 149 to a supporting bracket 150 carried by the lower portion of the carrying head 50. Means such as a yoke-type torsion spring 151 having the legs thereof engaging the pivot pin 149 and the bracket 150 and the torsion yoke engaging the bracket arm 148 normally biases the drip collector pan into or toward a forward limit position as shown in full outline in Fig. 4 wherein the forward drip collecting portion of the pan is disposed under the nozzle 31 to collect any fluid that may drip therefrom when there is no shock absorber unit 10 under the nozzle. When one of the shock absorber units 10 is conveyed into filling position under the nozzle 31, the upper portion of the shock absorber unit cams against the cam edge 147 and moves the drip collector pan into out of the way position as indicated in full outline in Figs. 2 and 3 and in dot-dash outline in Fig. 4. When the shock absorber unit is out of the range of the nozzle 31, the drip collector pan snaps back into active relation under the nozzle.

Any fluid discharging from the drip collector drain 144 is disposed of in suitable manner, as for example by dropping down into a collecting trough 152 disposed about the machine table 55 and having a collecting lip 153 which projects forwardly a sufficient distance to be under the drip collector drain when the latter is in the drip collecting position under the nozzle. The trough 152 has a drain 154 (Figs. 2 and 3).

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

We claim as our invention:

1. In combination in apparatus for filling direct acting shock absorbers or the like units, a conveyor having upright tubular shock absorber unit supporting members thereon, a filling nozzle, means for operating said nozzle to fill the units carried by said tubular members, and electrical control means including a switch having an actuating lever arm disposed in the path of movement of the successive units carried by said members, each of said members having an opening therein exposing the periphery of the unit carried thereby and said arm extending into said opening for engaging the respective unit peripheries.

2. In combination in apparatus of the character described, a conveyor having a succession of upright tubular members thereon for supporting in upright condition respective direct acting shock absorber or like units to be filled, each of said members having a transverse slot therein opening to the same side of the conveyor, and an operation controlling assembly including a pivoted lever arm pivoted at one end and biased at the other end to position an intermediate portion of the lever arm within the slots in said members as the members move into association with said assembly so that the lever arm will be actuated by the unit supported in the member into which the arm extends.

3. In combination in apparatus of the character described, an intermittently operable conveyor, means on said conveyor for supporting a succession of upwardly opening direct acting shock absorber or like units to be filled with hydraulic or like fluid, a supporting structure in spaced relation above the conveyor, a filling nozzle carried by said supporting structure and directed downwardly toward the conveyor, means for moving said filling nozzle from an elevated clearance position to a low-

ered filling position and return to elevated position, means for supplying said fluid to the nozzle, and means for intermittently actuating the conveyor for successively registering units carried thereby under said nozzle and including means controlled by the successive units for controlling operation of said conveyor actuating means.

4. In combination in apparatus of the character described, an intermittently operable conveyor, means on said conveyor for supporting a succession of upwardly opening direct acting shock absorber or like units to be filled with hydrauiic or like fluid, a supporting structure in spaced relation above the conveyor, a filling nozzle carried by said supporting structure and directed downwardly toward the conveyor, means for moving said filling nozzle from an elevated clearance position to a lowered filling position and return to elevated position, means for supplying said fluid to the nozzle, and means for intermittently actuating the conveyor for successively registering units carried thereby under said nozzle and including means controlled by the successive units for controlling operation of said conveyor actuating means, said controlling means also controlling said means for moving the nozzle.

5. In combination in apparatus of the character described, an intermittently operable conveyor, means for actuating the conveyor, a filling nozzle disposed above the conveyor, means for actuating the filling nozzle, means for delivering measured quantities of fluid to the filling nozzle, and means controlled by members to be filled and carried by said conveyor for coordinating operation of said conveyor actuating means, said nozzle actuating means and said fluid measuring means.

6. In combination in apparatus for filling successively direct acting shock absorber or like units on a continuous assembly line, a conveyor mechanism for supporting the units in series, means for actuating the conveyor intermittently, a support overhanging the conveyor, a nozzle member carried by said support for movement between an elevated position above the tops of the shock absorber units into a position at the mouths of the successive units for filling the same, an actuating lever arm connected to the nozzle and pivotally movable for effecting the up and down movements of the nozzle, means for actuating said arm, a measuring mechanism communicating with said nozzle for supplying the nozzle with measured quantities of hydraulic or like fluid to be filled into the units, and an electrical circuit for cyclically coordinating the operation of said conveyor actuating means, said arm actuating means and said measuring mechanism.

7. In a cyclically operable direct acting shock absorber or like unit filling apparatus including an intermittently operable conveyor and conveyor actuating means, a filling nozzle, and fluid measuring and delivering means communicating with the nozzle, an electrical control circuit for coordinating operation of the apparatus including a control switch operable by the successive units to be filled for operating said nozzle, a control switch operated incident to operation of the nozzle for controlling said conveyor actuating means and a switch also operated incident to operation of the nozzle for controlling operation of said fluid measuring means, and a switch operated by the fluid measuring means for effecting repetition of the cycle of operation.

8. In a cyclically operable direct acting shock absorber or like unit filling apparatus including an intermittently operable conveyor and conveyor actuating means, a filling nozzle, and fluid measuring and delivering means communicating with the nozzle, an electrical control circuit for coordinating operation of the apparatus including a control switch operable by the successive units for operating said nozzle, a control switch operated incident to operation of the nozzle for controlling said conveyor actuating means and a switch also operated incident to operation of the nozzle for controlling operation of said fluid measuring means, a switch operated by the fluid measuring means for effecting repetition of the cycle of operation, and safety switches disposed in the path of movement of the units to be filled for breaking the circuit and stopping the apparatus if a unit is out of proper position on the conveyor or is left on the conveyor beyond a predetermined point beyond the filling nozzle.

9. In combination in fluid filling apparatus of the character described, a hollow nozzle body, a stem projecting from said body, a support slidably guiding said stem for reciprocal movement of the nozzle, means for supplying fluid into said nozzle body, said nozzle body having a nozzle body stem, means for reciprocably moving said nozzle body, said valve stem projecting beyond said nozzle body stem and having shoulder means thereon, and a shoulder on said support engageable by said shoulder means in the movement of the nozzle to effect engagement of the shoulder means with the shoulder, said nozzle body and nozzle body stem being movable to a limited additional extent after engagement of said shoulder means with said shoulder for thereby effecting displacement of the valve member from the orifice to open the orifice for discharge of fluid therefrom.

10. In combination in apparatus for filling direct acting shock absorbers or the like, a filling nozzle, means for supplying hydraulic or the like fluid, a measuring cylinder having a piston therein and a piston rod projecting from opposite ends of the measuring cylinder, means for alternately delivering said fluid into the opposite ends of the measuring cylinder, and means effecting communication with the opposite ends of the measuring cylinder and said nozzle so that fluid exhausted from the measuring cylinder in each stroke of the piston will be delivered to the nozzle, said piston rod having stops at the opposite ends thereof for engagement with respective stop structures at the opposite ends of the cylinder for thereby limiting measuring strokes of the piston.

11. In combination in apparatus for filling direct acting shock absorbers or the like, a filling nozzle, means for supplying hydraulic or the like fluid, a measuring cylinder having a piston therein and a piston rod projecting from opposite ends of the measuring cylinder, means for alternately delivering said fluid into the opposite ends of the measuring cylinder, and means effecting communication with the opposite ends of the measuring cylinder with said nozzle so that fluid exhausted from the measuring cylinder in each stroke of the piston will be delivered to the nozzle, said piston rod having stops at the opposite ends thereof for engagement with respective stop structures at the opposite ends of the cylinder for thereby limiting measuring strokes of the piston, said limiting stop at one end of the piston rod being removably interchangeable with different sized stops to effect delivery of variable volume of fluid to the nozzle.

12. In apparatus of the character described, a fluid measuring device including a cylinder having respective heads at the opposite ends thereof, a piston reciprocably operable in said cylinder, shaft portions projecting from the opposite ends of the piston through and beyond said heads, means for alternately delivering fluid to the opposite sides of the piston and for conveying from the cylinder the fluid from the respectively opposite side of the piston, switch actuator plungers projecting from said heads and normally biased toward retracted position, limit stop members on said projecting shaft portions, and members carried by said heads and actuated by engagement therewith of said stop members for protracting said plungers.

13. In apparatus for filling open-ended upstanding direct acting shock absorber or like casings, a conveyor for delivering the casings successively into a filling position, a filling nozzle mounted over the conveyor at said filling position and directed downwardly, means supporting the filling nozzle for up and down movement, means controlled by the successive casings as they reach the filling position for actuating said nozzle moving means to de-

press the nozzle toward the casing in filling position, means for supplying hydraulic or like fluid to said nozzle including a fluid measuring device having a cylinder with head members at the opposite ends thereof, a piston reciprocably operable in said cylinder, shaft portions projecting from the opposite ends of the piston through and beyond said heads, means for alternately delivering fluid to the opposite sides of the piston and for conveying from the cylinder the fluid from the respectively opposite side of the piston, switch actuator plungers projecting from said heads and normally biased toward retracted position, limit stop members on said projecting shaft portions, members actuated by engagement therewith of said stop members for protracting said plungers, and means for actuating said nozzle moving means for elevating the nozzle and including an electrical circuit having switches therein operable by said plungers for closing said electrical circuit as an incident to completion of supplying a measured volume of fluid by said measuring device in each cycle of operation of the apparatus.

14. In apparatus for filling direct acting shock absorbers, or like upwardly opening units, a fixed cantilever support, an arm mounted to rock about a horizontal axis on said cantilever support, a downwardly directing filling nozzle carried by an end portion of said arm adjacent to the distal end portion of said support, means for supporting an upwardly opening unit in filling position below said nozzle, means for rocking said arm to move said nozzle into and out of filling relation to the upper open end of the unit, means for delivering a measured volume of fluent material to the nozzle for filling into the unit, means for operating said arm rocking means and said fluent materials delivering means in coordination, said nozzle having a closure device including an operating plunger, and means on said cantilever support cooperating with said operating plunger for opening the nozzle for the down position and closing said nozzle in the up position relative to the unit.

15. In combination in a machine for filling with fluent material direct acting shock absorber or like upwardly opening units, a conveyor having a succession of unit supporting members thereon, a filling nozzle supported in overhanging vertically movable relation to the conveyor and adapted to fill a charge of the fluent material into each of the units supported by said members as each of the members comes into position under the nozzle with one of the units, a movable control arm element normally biased to be disposed in the path of the units and arranged to be moved thereby to one side of said path, and means actuated by movement of said control arm element as it is operated by the successive units for thereby moving the nozzle down into filling relation with respect to the open top of each unit that is moved by the conveyor members into position under the nozzle.

16. In apparatus for filling direct acting shock absorber or like units, a fixed cantilever support, an arm mounted to rock about a horizontal axis on said cantilever support, a downwardly directing filling nozzle carried by an end portion of said arm adjacent to the distal end portion of said support, an intermittently operable conveyor for supporting a succession of said units with one upwardly opening unit in filling position below said nozzle, means for intermittently moving said conveyor to move the units successively into position under the nozzle, means for rocking said arm to move said nozzle into and out of filling relation to the upper open end of the unit under the nozzle, means for delivering a measured volume of fluent material to the nozzle for filling into the unit thereunder, and means controlled by the units themselves for operating said conveyor moving means and said arm rocking means and said fluent material delivering means in cyclical coordination.

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