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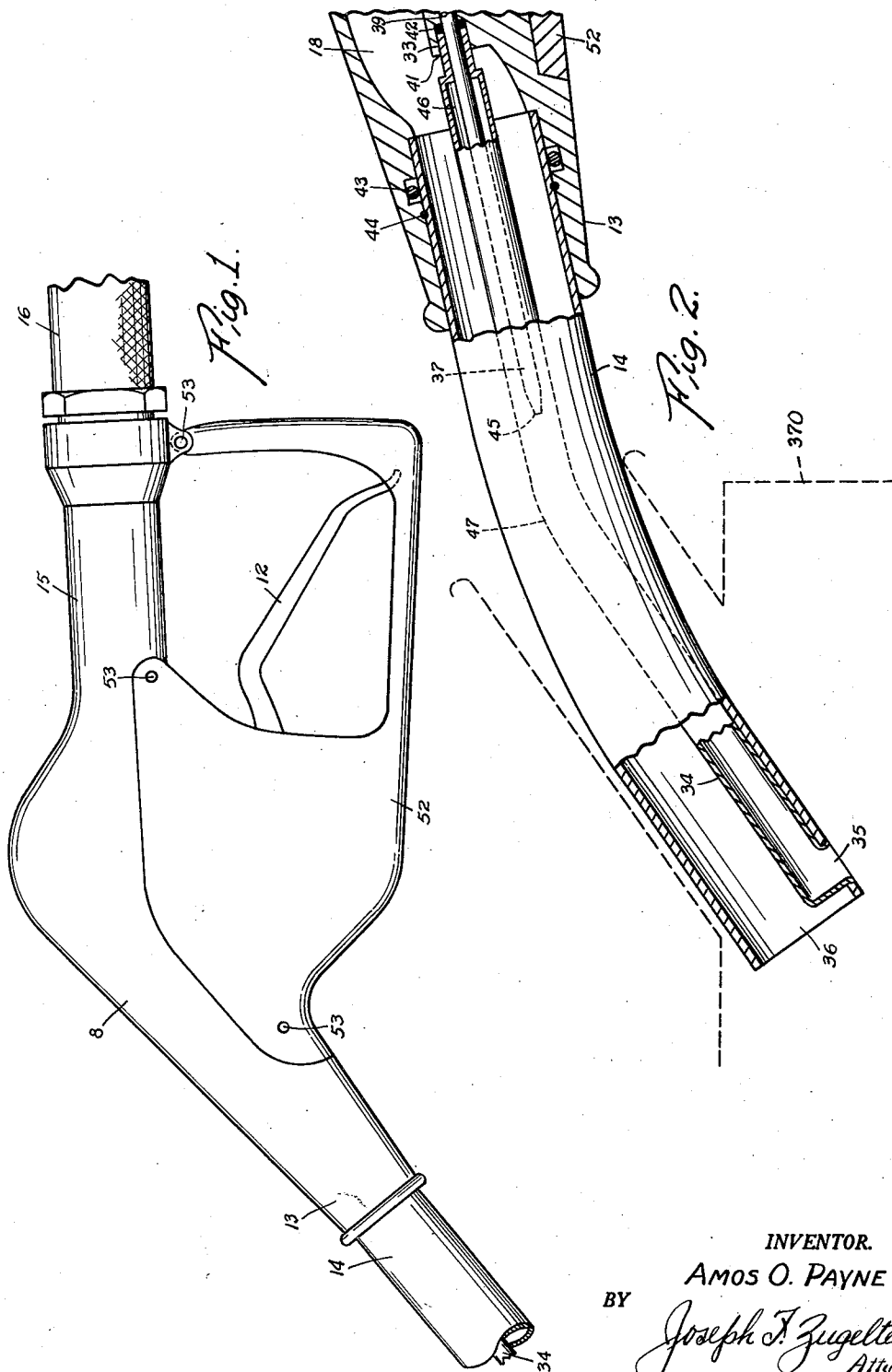
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FILLING NOZZLE WITH AUTOMATIC SHUT-OFF

Filed May 5, 1952

3 Sheets-Sheet 1



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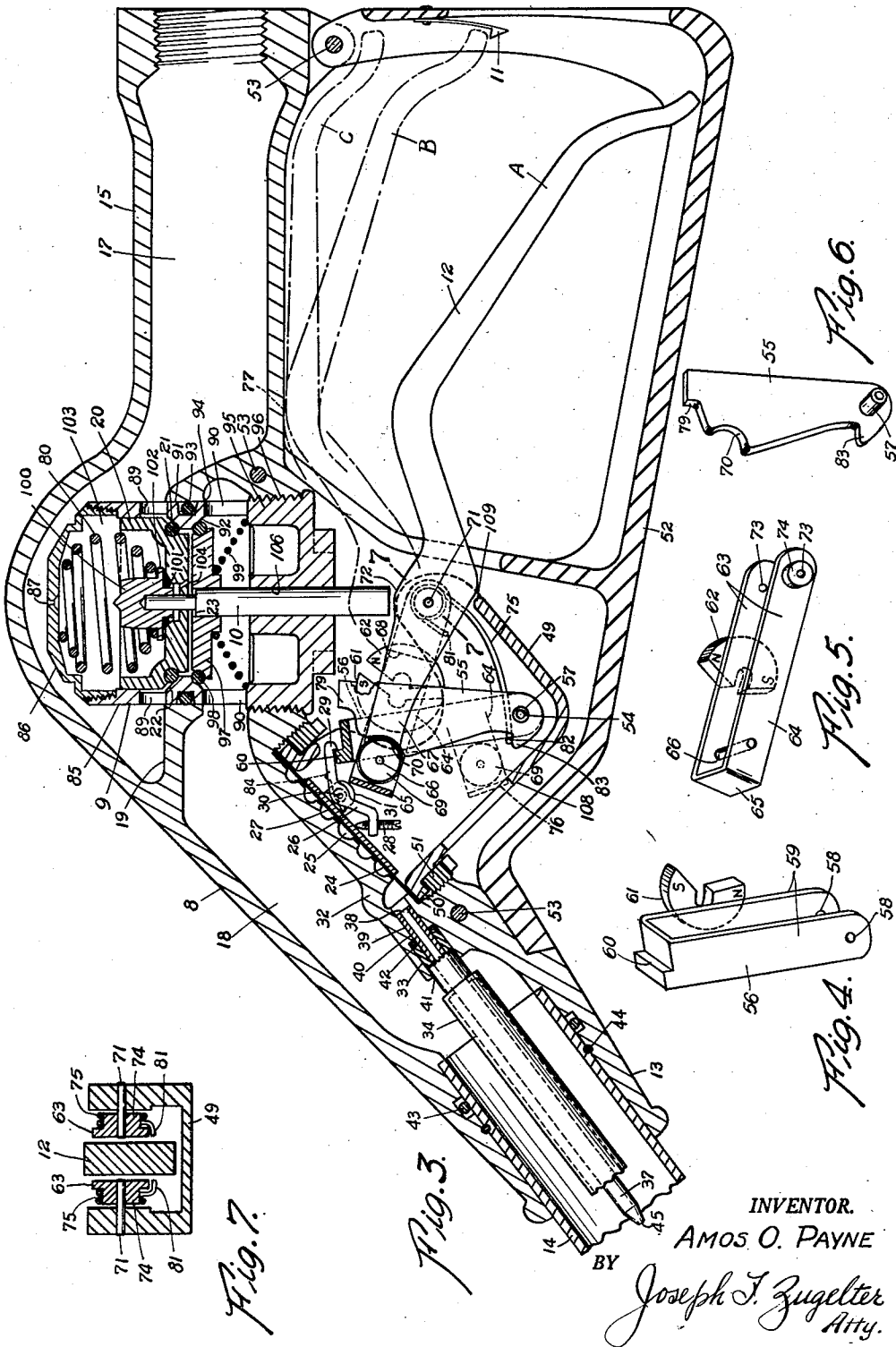
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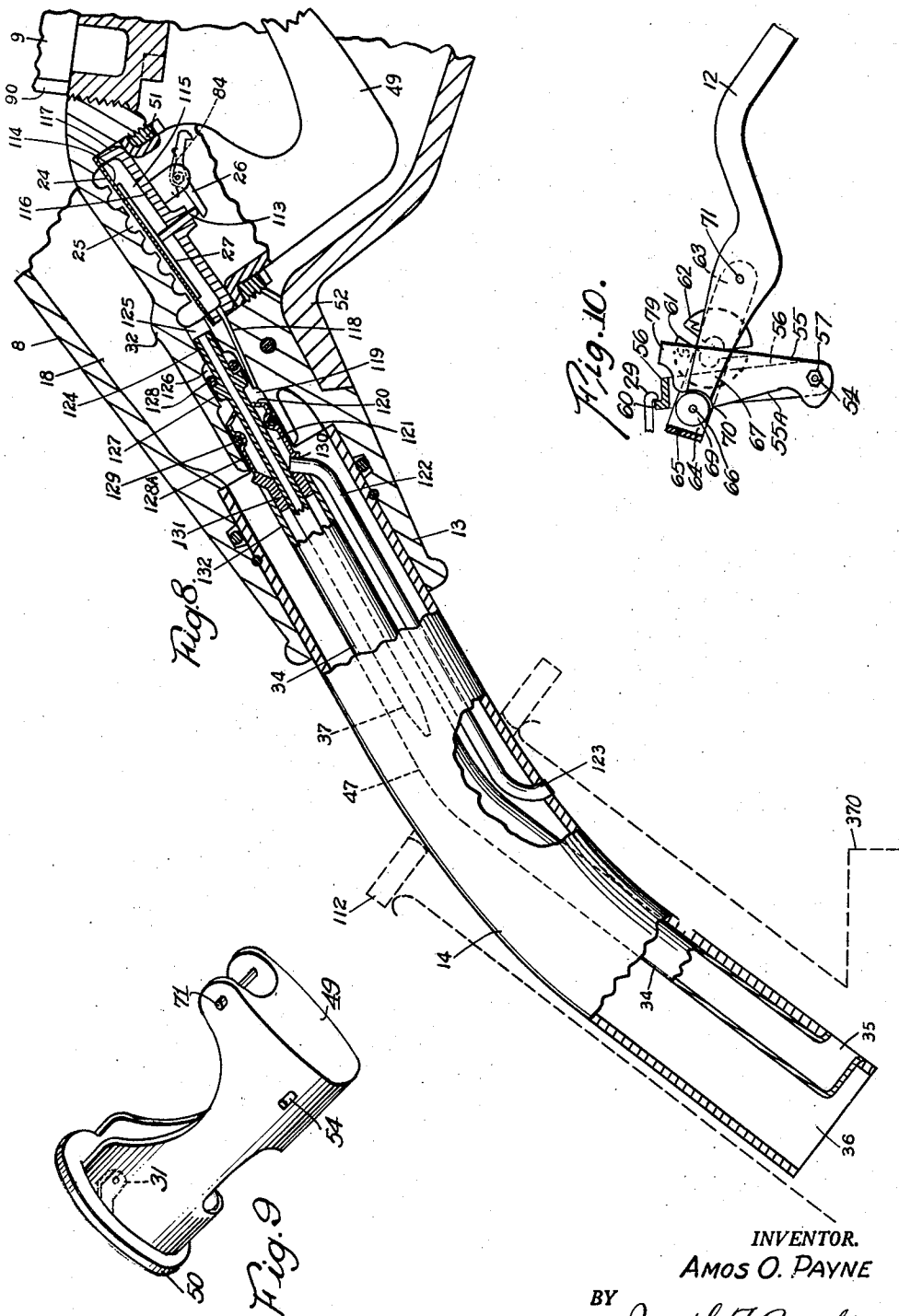
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FILLING NOZZLE WITH AUTOMATIC SHUT-OFF

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Application May 5, 1952, Serial No. 286,058

24 Claims. (Cl. 226—127)

The present invention relates to a filling nozzle or liquid dispensing apparatus provided with an automatic shut-off mechanism, whereby filling of a receptacle to a certain level automatically terminates the flow of liquid through the nozzle and into the receptacle, so as to avoid overfilling the receptacle. The apparatus includes a main valve to be manually opened by means of a hand lever, and diaphragm means operative to trip the main valve, automatically to closed position as hydrostatic pressure builds up within a small standpipe submerged in the liquid of the receptacle.

An object of the invention is to provide improved means magnetic in character, for automatically tripping the main valve to closed position upon attainment of a predetermined level of liquid in the receptacle, and for re-setting the automatic mechanism for subsequent operation.

Another object is to eliminate the uncertainty of automatic closing of the main valve heretofore experienced in filling nozzles of the automatic type.

A further object is to provide in an apparatus of the character stated, an improved main valve characterized by unusual reliability and ease of operation under all pressure conditions; ease of assembly and placement as a unit within the body or frame of the dispensing apparatus; and freedom from closing shock and resistance to flow, among other advantages to become manifest hereinafter.

Another object of the invention is provide in an automatic device of the kind referred to, a form of construction whereby all operating parts are fully protected from injury under conditions of hard usage and abuse, with provision made for quick and easy replacement of parts when necessary.

A further object is to provide a novel and advantageous swivel construction at the product dispensing tube or spout, whereby proper insertion thereof into receptacle openings or necks of various shapes and sizes is assured.

Another object is to provide a dispensing tube or spout construction in which means is provided for trapping residual liquid remaining therein after a dispensing operation, and isolating such liquid from the diaphragm chamber, thereby preventing erratic performance of the automatic trip and premature deterioration of the diaphragm.

Another object is to provide a liquid dispensing apparatus in which parts may quickly and easily be removed and replaced, for conversion of the apparatus for automatic operation, or for full manual operation, as may be desired.

The foregoing and other objects are attained by the means described herein and illustrated upon the accompanying drawings, in which:

Figure 1 is a side elevational view of the filling nozzle of the present invention, part of the spout or dispensing tube being broken away.

Figure 2 is an enlarged cross-sectional view taken on a vertical plane through the spout or dispensing tube, and

2

a portion of the nozzle body, the spout being shown extended into the filler neck of a receptacle to be filled with liquid.

Figure 3 is an enlarged cross-sectional view taken on a vertical plane through the liquid dispensing apparatus.

Figure 4 is a perspective view of a magnetic hammer which forms part of the automatic tripping mechanism.

Figure 5 is a perspective view of an operating lever carrier, with magnet attached.

Figure 6 is a perspective view of a sear.

Figure 7 is a cross-sectional view taken on line 7—7 of Figure 3.

Figure 8 is a view similar to Figure 2, showing a modification.

Fig. 9 is a perspective view of the cage or support shown at 49 in Fig. 3.

Fig. 10 is an elevational view of the tripping and resetting mechanism, isolated from the cage or support in the interest of clarity of disclosure.

The device of the present invention has been designed primarily for the purpose of transferring or dispensing liquids under pressure, from a source of supply to a tank or other receptacle. Included in the device is a means or mechanism for automatically terminating the flow of liquid when the level of liquid in the receptacle or tank being supplied, reaches a predetermined height. Accordingly, the device is useful for filling fuel tanks, and oil and water reservoirs of vehicles, aircraft, vessels, and machines of various types, as well as for any other purpose involving transfer of liquids from a source of supply to a receptacle.

Automatic filling devices of the general character herein disclosed have been produced from time to time, and have in some circumstances performed more or less satisfactorily the functions intended therefor; however, the prior devices were not considered reliable or dependable under all conditions of usage, particularly when they had to withstand certain types of jarring or vibrations, or mishandling. Some were too sensitive, and would trip the main valve to closed position prematurely, while others failed at times to trip the main valve in time to avoid spillage of the liquid dispensed. In most instances, erratic or improper performance was due to failure to utilize available tripping energy advantageously, or to the fullest possible extent, while in other instances the form of energy available to trip the valve was injudiciously chosen and applied. The problem in all cases is to properly amplify and apply the minute amount of energy available for tripping the main valve, which valve is comparatively heavy and largely insensitive to the weak forces available for tripping purposes. The available forces, therefore, must be greatly amplified and advantageously utilized, if dependable performance of the automatic filling device is to be achieved.

In the present device, the necessary great amplification of the available tripping energy is obtained with the use of small permanent magnets which are conditioned by the weak energy of hydrostatic pressure occurring in a small standpipe, to strike an effective valve-tripping blow at the precise moment that the pressure reaches a predetermined value. The magnetic means operates, also, to re-set the tripping mechanism for a subsequent dispensing and automatic tripping operation, in such a manner as to nullify the effects of manual interference on the part of an operator or attendant. The details of the structure and the precise mode of operation in these respects will become manifest as the description proceeds.

Referring to the drawings, 8 indicates the body of the filling nozzle which houses a main valve 9 having an operating stem 10 to be displaced upwardly for opening the

3

valve, by means of an operating lever 12. At the nose 13 of the body, a curved spout 14 is applied and through which is delivered a liquid to be dispensed. The liquid may flow through the hollow spout whenever the main valve is held in the open position. At the end of the body opposite the nose 13 is a hollow handle 15 into which a fluid under pressure may be introduced by way of a flexible hose 16. The chamber 17 within the hollow handle is separated from the chamber 18 within the nose of the body, by means of the main valve 9 and the dividing wall 19 which supports it, in part.

To simplify the understanding of the main valve tripping mechanism, particularly in the early portion of this description, the main valve may be considered to constitute merely a vertically movable piston 20 carrying a flexible sealing ring 21 adapted to rest upon a stationary valve seat 22 in the closed position of the valve. When the stem 10 is elevated by means of the operating lever 12, a shoulder 23 on the stem strikes the lower face of the piston 20, thereby to elevate the piston and open the valve. By so regarding the main valve, an understanding of the tripping mechanism is more readily obtained.

Operation of the tripping mechanism is initiated by means of a flexible diaphragm 24 which forms one wall of a pressure chamber or cavity 25 into which air may be introduced under slight pressure, to distend the diaphragm and move it toward a latch 26. The diaphragm is impervious to liquid and air, and may carry a wear plate 27 to avoid puncture of the diaphragm as it moves to apply pressure upon the pointed end of an adjusting screw 28 carried by the latch 26. It may here be pointed out that the latch comprises a pair of arms, one of which carries the adjusting screw 28, and the other of which has a free end provided with a hook 29. Intermediate its ends, the latch is pivoted as at 30, upon a stationary support or ear 31 disposed outwardly of the diaphragm and its pressure chamber 25. A light spring 34 biases the latch clockwise.

From the foregoing, it will be understood that an increase of air pressure in the diaphragm chamber 25 may distend the diaphragm sufficiently to displace the set screw 28 downwardly, thereby to move the latch 26 in counter-clockwise direction about its pivot 30, causing the hook end 29 of the latch to elevate. This sets in motion the valve tripping mechanism, as will be explained.

The manner of introducing air under slight pressure into the diaphragm cavity or chamber 25, is explained as follows. The wall 32 of the body which forms part of the chamber 18 is bored lengthwise of the nose 13 to receive the hollow reduced end 33 of a hollow air tube 34 which extends down through the spout 14 and terminates at an opening 35 near the outer open end of the spout indicated at 36, Figure 2. The open end 35 of the air tube may terminate at the side of the spout as shown, or if preferred, the open end of the air tube may be substantially flush with the open end 36 of the spout. By referring to Figure 2, it will be evident that a head of liquid produced in the tank or receptacle 370, will eventually reach the opening 35 and enter part way into the air tube 34, thereby to entrap a quantity of air within the tube. As the level of liquid rises within the tank or receptacle 370, the air entrapped within the tube 34 is gradually compressed, and the air so compressed is conveyed to the diaphragm chamber 25 by way of the secondary air tube 37, the opposite open ends of which are in communication with the interior of the primary air tube 34 and of the diaphragm cavity or chamber 25. The upper open end 38 of the secondary air tube projects beyond the reduced end 33 of the primary air tube 34, and may be securely fixed within the counterbore 40. The bore 41, on the other hand, may loosely receive the extension or reduced end 33 of the primary air tube, so that the latter may rotate within the bore 41. To avoid leakage at the bore 41, a suitable packing ring 42 may

4

be applied at the end of the air tube extension 33 and about the smaller air tube at 40.

The spout 14, as previously stated, may rotate or swivel relative to the nose 13 of the filling nozzle body. For this purpose, a ring of packing material 43, may be provided between the spout and the interior wall of the nose, this serving to preclude leakage of liquid along the outside surface of the spout. Any suitable means, such as a lock wire 44 or the equivalent, may hold the spout within the nose 13, permitting the spout to rotate therein.

Referring to Figure 2, it is readily evident that rotational adjustments of the spout 14 will result in rotation of the bent air tube 34 unitarily, so that the filling nozzle may be used in a convenient manner for insertion of the spout into the necks of storage tanks or the like, irrespective of any peculiarity in the shape of the filler neck.

The reduced open end 45 of the secondary or inner air tube 37 is located at a point well within the primary air tube 34, so as to form therewith a catch pocket 46 within the nose portion of the body, to receive and isolate any liquid that might run into the inside of air tube 34 in the event that the filling nozzle be held or hung with the spout projecting upwardly. The pocket 46 thereby serves to catch and isolate residual liquid and prevent its reaching the diaphragm and chamber 25. This serves to prevent early deterioration of the diaphragm and precludes erratic performance that might result if a volatile liquid were permitted to evaporate and expand within the diaphragm chamber. The forward open end 45 of the secondary air tube may extend as far as the bend 47 of the primary air tube, if desired. Tube 37, of course, should be straight, and coaxial with the bearing which supports the spout within the nose 13 of the filling nozzle body. As was previously pointed out, the spout 14 and the primary air tube or standpipe 34 are to rotate as a unit, while the secondary or inner air tube 37 remains stationary therein.

From the foregoing, it will become readily apparent how the creation of a hydrostatic pressure within the standpipe 34, resulting from an increasing level of liquid within the tank 370, may distend the diaphragm 24 to lift the latch hook 29 for setting the tripping mechanism in operation. The tripping mechanism is described as follows.

Attached to the wall 32 is a hollow cage or support 49 having a flanged circular end 50 which is pressed firmly against the margin of the diaphragm, to maintain an airtight joint between the diaphragm and its chamber 25. A lock nut 51 or any equivalent means may be employed in so mounting the cage or support 49 upon the body of the filling nozzle. The perforate ear 31 which carries the pivot 30 for the latch 26 is a stationary part of the cage or support, and all elements of the tripping mechanism preferably are housed within the cage or support 49 so as to render the assembly readily attachable or replaceable as a unit. This construction facilitates assembly of the entire apparatus, while at the same time protecting the elements of the tripping mechanism against possible injury or damage. It should be evident that displacement of the operating lever guard 52 by removal of the several pins or fasteners 53, will expose the cage or support 49 and permit bodily removal thereof upon unscrewing the lock nut 51. As is clearly illustrated by Figure 1, the operating lever guard 52 normally provides a protective cover for the tripping mechanism and the stem of main valve 9. It serves also as a guide and as a guard for the normally exposed hand-grip end of the operating lever 12.

A mounting shaft 54 for a sear 55 and a magnetic hammer 56, extends transversely through the cage member and has its opposite ends supported by opposite side walls of the cage member. A pair of hubs 57 extending from opposite sides of the sear 55 (Figure 6), receive the shaft 54, and at opposite ends of the hub, the shaft passes through the perforations 58—58 (Figure 4) of the magnetic hammer 56, so that the sear and the hammer may

5

rock independently of one another upon the mounting shaft 54. As indicated upon the detail views, the sear may be in the form of a plate, whereas the magnetic hammer 56 comprises a U-shaped member having spaced parallel legs 59 and a leg-connecting portion which provides a projection for keeper 60 to be engaged by the latch hook 29.

One leg 59 of the hammer member 56 has fixedly attached thereto a permanent magnet 61, the opposite poles of which are identified by the letters N and S appropriately denoting the north and the south poles respectively, of the magnet. These poles are disposed one above the other as shown upon Figure 4.

A second and cooperating permanent magnet 62, likewise having its poles marked with the letters N and S, is fixedly mounted upon one leg 63 of an operating lever carrier 64, shown in detail by Figure 5. This carrier has spaced parallel legs 63 and a transverse connecting portion 65, the legs 63 being so spaced apart that the carrier 64 may move freely between the legs 59 of the magnetic hammer member 56. A shaft or pin 66 spans the legs of the carrier 64 near the end 65 of the carrier, and upon this pin or shaft 66 is rockingly mounted the forward end of the operating lever 12. Forwardly from the line 68, the operating lever is bifurcated to provide a pair of spaced parallel arms 67 which fit between the legs 63—63 of the carrier 64 (Figure 5). Between the spaced parallel legs 67 of the operating lever, a freely rotatable roller 69 is mounted upon the shaft 66. In the cocked condition of the tripping mechanism, roller 69 rests upon the ledge 70 of the sear, thereby providing a fulcrum for the forward end of the operating lever.

With the ledge 70 of the sear providing a fulcrum for the roller end of the operating lever, it may be noted that said lever can be moved about the fulcrum from the position A to the position B, the understanding being that the shaft indicated at 71 does not pass through the lever 12. This is made clear in the illustration of Figure 7. When the operating lever is in position A, it is free of contact with the main valve stem 10 so that the main valve remains closed. As the operating lever is moved toward position B, a primary contact area 72 of the lever abuts the lower end of the valve stem 10 and elevates the valve piston 20 to the open position. All the while, the fulcrum end of the operating lever is supported upon the ledge 70 of the sear, and as long as the lever 12 is held in the B position, liquid under pressure may pass the main valve and flow through the spout 14. Any suitable form of displaceable latch is represented conventionally at 11, for holding the operating lever at position B, if desired, so that the attendant may concern himself with other duties while the dispensing operation is in progress. Such a latch does not interfere with automatic closing of the main valve.

As indicated upon Figure 7, the stud shafts 71 are fixed upon opposite sides of the cage or support 49, and extend inwardly a distance sufficient to provide pivotal mountings for the legs 63—63 of the operating lever carrier 64, at the perforations 73—73. Bosses or bushings 74 may be applied in alignment with the perforations 73, at opposite sides of the legs 63, for the purpose of supporting a spring 75, the function of which will be later explained. As Figure 7 indicates, the inner ends of the shafts 71 are spaced apart sufficiently to permit unobstructed movement of the operating lever between them. As indicated by the broken lines 76 upon Figure 3, the carrier 64 may under certain conditions drop to a lowered position about the pivot shafts 71, carrying with it the roller 69 and the fulcrum end of the operating lever. This condition results from movement of the sear 55 about its pivot 54 in clockwise direction, thereby to displace the sear ledge 70 from the roller supporting position. When this occurs, the hand and fingers of the operator pull the lever 12 to the position C, the lever having thereby moved about a secondary fulcrum 77 located between the primary 72

6

and the free rear end of the lever. With the operating lever in position C, the roller end 69 thereof is lowered as indicated at 76, the primary fulcrum 72 having dropped away from the lower end of stem 10 a distance sufficient to permit full closing of the main valve.

The foregoing explains in a general way, the manner in which the several parts of the automatic tripping mechanism are related one to another, for the achievement of certain motions which are peculiar to the operation of the device. The explanation will now refer to the details of operation and the succession of motions inherent in the structure.

The mechanism as illustrated by Figure 3, is in condition to begin a cycle of operation. The operating lever 12 is lowered, and the main valve is closed. The fulcrum end of the operating lever is at rest upon the ledge 70 of the sear, and the latch head 29 is in engagement with the keeper or projection 60 of the magnetic hammer element 56. As long as the latch is so engaged, the ledge 70 will be held in position to provide a fulcrum for the roller end of the operating lever. Therefore, the lever 12 may be moved from position A to position B, or to any intermediate position, for elevating the main valve stem 10 and establishing a flow of liquid through the spout 14. Delivery of liquid from the spout under such circumstances may continue indefinitely as long as the delivery is unobstructed, and no liquid rises in the standpipe 34 of the spout. Assuming now, that liquid is being delivered into a tank or receptacle such as 370 of Figure 2, the level of liquid within the tank or receptacle eventually will rise until some of the liquid enters the open end 35 of the standpipe, whereupon a quantity of air will be compressed within the standpipe above the liquid level, and the force of compression will be transmitted through air tube 37 to the diaphragm 24. The diaphragm, being flexible, will move against the set screw 23 of latch 26, thereby causing the hook end 29 of the latch to disengage the keeper 60 of hammer 56. Immediately upon release of the hammer, the magnet 62 on carrier 64 will attract the magnet 61 which is fixed upon the hammer, thereby causing the hammer to approach with increasing velocity and force, the anvil 79 at the top of the sear.

The magnetic propulsion of the hammer greatly amplifies the force with which the anvil 79 is struck by the hammer, so that the sear is very forcefully displaced in clockwise direction about its pivot 54 to remove the ledge 70 from supporting position with respect to roller 69 and the fulcrum end of the operating lever. With the sear and the ledge 70 thereof so displaced, the carrier 64 and the forward end of the operating lever thereto attached, will drop downwardly about pivot 71, or to the position indicated by the broken lines 76, of Fig. 3. This movement is assured by reason of the fact that the hand and fingers of the operator or attendant are holding the hand-grip end up, while the spring 80 of the main valve imposes a downward force upon the intermediate portion of the operating lever at 72. As the result of this combination of forces, the operating lever is moved to position C, at which the fulcrum end of the lever is lowered to the broken line position 76 and the contact area 72 of the lever is spaced from the lower end of the main valve stem. The main valve accordingly will be closed, and the dispensing function of the filling apparatus will be terminated, notwithstanding the possibility that the operating lever may be held at position C by the hand and fingers of the operator or attendant.

Under the conditions just mentioned, the north pole of magnet 62 will be found lowered and opposed to the north pole of magnet 61, so that the north pole of magnet 62 repelling the north pole of magnet 61, moves and returns the hammer 56 to cocked position, at which it is held by the hook 29 of latch 26. It may here be noted that the latch will not engage the hammer if the spout remains in the liquid of the tank or receptacle 370, because pressure within the diaphragm chamber result-

ing from such a condition would keep the diaphragm distended and the latch 29 elevated, to prevent engagement of the latch. It is then necessary for the operator to remove the spout from the receptacle, and re-cock the mechanism by momentarily raising the operating lever to position B or C, which places the magnets again in repelling position to engage the latch with the hammer.

The operator or attendant, by releasing his grip upon the lever 12, conditions the apparatus for return of the fulcrum or roller end of the lever to the cocked position of Figure 3, the return movement being assisted by the spring 75 and the weight of the grip end of the handle. Spring 75 is coiled about the bushings 74, and one end thereof may rest upon the carrier member 64 at the location 81, while the opposite end 82 of the spring may rest upon a projection 83 of the sear, so that the sear thereby may be urged to the initial position at which its ledge 70 will support the roller 69 and the fulcrum end of the operating lever.

To restate briefly the operation of the device, the lifting of latch 29 releases the hammer 56 so that the hammer and its magnet 61 will be attracted to the right by the second magnet 62, thereby causing the hammer 56 to strike the sear 79. As the sear is displaced to the right, its ledge 70 leaves the roller 69, allowing the operating lever carrier 64 to swing downwardly about the pivot 71. This leaves the operating lever without a fulcrum at ledge 70, so the lever drops down and permits closing of the main valve as previously explained. As to resetting, the carrier 64 in its lowered dotted line position of Fig. 3, has its S magnetic pole (of magnet 61) disposed at the S pole of magnet 62, thereby resulting in repulsion between the two S poles, which urges the hammer 56 to the left. Latch 29 then hooks onto the hammer, as in Figs. 3 and 10. Then as the operator grasps and pulls the operating handle 12 upwardly, the roller 69 rides up the forward edge 55A of the sear and finds its seat on the ledge 70, to re-establish a fulcrum for the operating handle or lever 12.

It may here be noted that the magnets 61 and 62, depending upon the power thereof, should be spaced far enough apart when the tripping mechanism is cocked, that a very light latch 26 will be sufficient to effectively hold the magnets apart, as in the Figure 3 position. A very small effort on the part of the tripping diaphragm will then be adequate to trip the latch for initiating the main valve closing operation. Once the latch has been tripped, the magnets 61 and 62 will approach one another with rapidly increasing force, to positively drive the hammer against the sear anvil to displace the fulcrum ledge 70 in the manner and for the purpose previously explained herein in detail.

From the foregoing explanation, it will appear that the magnetic feature of the device serves not only to trip the main valve to closed position by reason of the attractive power of the magnets, but in addition, the repelling power of the magnets is utilized in re-setting the automatic mechanism to cocked or initial position. Whereas in prior devices of the automatic tripping type the lack of power generally resulted in erratic and undependable operation, the tripping power employed in the device of this invention is adequate to avoid unpredictable operation and the exercise of great or extraordinary care in manufacture and assembly of the apparatus. The present device therefore may be produced at much less expense and with greater assurance of operativeness, than any other similar devices heretofore proposed.

It is noteworthy that the automatic filling nozzle herein disclosed may easily be converted to a conventional type nozzle for manual operation, since to make the conversion it is necessary only to increase the length of roller shaft 66 and anchor the opposite ends thereof in the opposed side walls of the cage or support member 49, so that the operating lever 12 may be lifted and lowered manually to open and close the main valve in conven-

tional manner. When the apparatus is so constructed, all of the moving parts within the cage or support member 49 may be omitted. It should be apparent, therefore, that conversion from automatic to manual operation, or from manual to automatic operation, involves simply the application of a cage or support member 49 embodying the necessary operating mechanism.

For the purpose of explaining the tripping mechanism, in the foregoing description, the main valve 9 has been treated as one which is typical or conventional; however, the particular main valve disclosed is in fact structurally and functionally superior to known valves in its class. It includes a double poppet and dash pot arrangement which insures easy, controlled opening and freedom from closing shock or "hammer" at all pressures, and the construction is such as to reduce to a material degree the pressure drop through the valve.

Referring to Figure 3, the valve body is in the form of a cylinder 85, the upper end of which is closed by a perforated screw cap 86. The small perforation or dash-pot port 87 in the cap permits a restricted inflow of liquid from the pressure side of the valve, or from chamber 17, at all times. The resultant pressure of liquid imposed upon the top area of the piston 20, while the valve is closed, maintains a seating force independent of that of spring 80, for effectively holding the valve closed. Above the main valve seat 22, the cylindrical body of the valve is amply ported as at 89, to provide for unrestricted inflow of liquid when the valve opens, and beneath the seat are the outlet ports 90 which are in communication with the spout.

Between the ports 89 and 90, the valve body has a cylindrical middle section 91 which carries the seats 22 and 92, and this section may be annularly grooved as shown, to accommodate an endless gasket ring 93 to engage and seal against the cylindrical wall of the bore 94 of wall 19. This form of support for the valve body, enables bodily downward displacement of the body for removal of the valve as a unit, after removal of the tripping mechanism cage 49. It may be noted that the lower end of the valve body has a head 95 exteriorly threaded to engage the threads 96 in wall 32, whereby upon application of a wrench to head 95 the whole valve may be unscrewed and displaced bodily from the apparatus. This head has a bore 106 through which the valve stem 10 may be reciprocated.

Beneath the valve member or piston 20 is an outlet check valve 97 which is centrally bored for sliding movement upon the stem 10, this check valve having a circumferential gasket 98 to seat upon the valve seat 92. The check valve is yielding pressed lightly against its seat 92 by means of a spring 99, the force of which spring is to be overcome by pressure of liquid passing the piston when the latter is lifted from its seat 22. The space between check valve 97 and piston 20 is very limited normally, to avoid retention of liquid between the valves, so that leakage may not be induced by expansion of entrained liquid between the valves.

Upon the top of the valve stem is loosely positioned a small secondary poppet valve 100 which rests upon a seat 101 formed in the top surface of the piston 20. A flange 102 of valve 100 supports the spring 80, which acts normally to resiliently seat both the small poppet and the piston 20. When the stem 10 is lifted by manipulation of the operating lever 12, the small secondary poppet valve 100 opens first, to relieve pressure from the dash-pot chamber 103 by way of the exhaust port 104. Thus, with pressure in the dash-pot chamber relieved, the lifting of the piston 20 by shoulder 23 of the valve stem 10, is greatly facilitated irrespective of the amount of pressure existing in chamber 17. This is due to the fact that the effective area of the top of piston 20 is greater than the area of seat 22. Closing of the piston valve 20 at a speed sufficient to cause shock or hammer, is precluded by so proportioning the dash-pot port 87 and the clearance of

the piston within the cylinder 85, that the piston is forced to descend at a slow rate of speed.

From the foregoing explanation, it is readily understood that the main valve may easily be removed as a unit, and replaced with a new or reconditioned valve, without resort to any complex time-consuming procedure. The same is true of the automatic tripping mechanism and the flexible diaphragm, wherefore there is little reason ordinarily to remove the filling nozzle from service for any appreciable period of time, or to even disconnect it from the supply hose for repairs. All vital parts of the apparatus are fully enclosed and protected from accidental injury, and in general the apparatus is designed to withstand hard usage and abuse of extraordinary severity.

In Figure 8 is shown a modified form of diaphragm-operated means for displacing the latch 26 of the automatic tripping mechanism. The construction here illustrated includes a pressure balancing means for the exposed face of the diaphragm, to overcome any tendency of the diaphragm to trip the latch prematurely as the result of air pressure building up within the receptacle undergoing filling. This building up of air pressure within the receptacle can occur under various circumstances which cause interference with a free displacement of air from the receptacle during the filling operation. It can occur, for example, in a case where the spout too closely fits the filler opening of the receptacle, or when, as indicated upon Figure 8, a sealing member 112 is employed to substantially close the filler neck of the receptacle during the filling operation. In all such cases there is posed the possibility that air displaced by liquid may enter the port 35 of the standpipe under sufficient pressure to prematurely trip the latch 26 for closing the main valve, before any liquid reaches the level of said port. The same problem may be presented when filling is performed through a port in or near the bottom of a tank or receptacle, rather than conventionally at the top thereof.

Under circumstances as above related, premature tripping of the mechanism may be eliminated by balancing the pressure of air at opposite faces of the diaphragm during the filling operation and until the level of liquid within the receptacle enters the standpipe end 35. The means for accomplishing this result is described below, with reference to Figure 8 of the drawings.

In describing Figure 8, the principal structural elements which are common to Figure 8 and the drawing figures which precede it, are identified by the same reference characters. This avoids much repetition, while at the same time contributing to a ready comprehension of the disclosure. No alteration of the main valve 9 is necessary, and the cage or support 49 may contain the elements heretofore described for controlling movements of the operating lever and the main valve stem. The spout 14 may rotate as previously explained, and within it may be located the standpipe or primary tube 34 housing the secondary or inner air tube 37, the latter conducting air under pressure to the diaphragm chamber 25. As air in the chamber 25 increases in pressure, the diaphragm distends to lower the plunger 113, which in turn rotates the latch 26 in counter-clockwise direction, to release the hammer as heretofore explained, for actuating the main valve tripping mechanism.

Assuming now, that the receptacle 370 of Figure 8 is undergoing rapid filling and the air displaced by liquid is unable to freely leave the receptacle, it becomes evident that a pressure of air may build up in the standpipe 34 sufficient to distend the diaphragm 24 and rotate the latch 26, before the receptacle is filled. This premature actuation of the latch would be considered a fault, the remedy for which would be to impose an equal pressure of air upon the diaphragm at the face 114 thereof, in opposition to the pressure in chamber 25. This may be accomplished by establishing a secondary pressure chamber 115, into which air from the receptacle may be introduced simultaneously with entry of air into the primary cham-

ber 25. The flow of air into both chambers should be such as to equalize the pressure at both faces of the diaphragm, as long as the liquid level within the receptacle is below the standpipe opening 35.

Chamber 115 may be established by means of a cupped partition member 116 having a central opening as shown, to accommodate the plunger 113. The member 116 may include an annular flange 117 clamped between the diaphragm 24 and the upper peripheral edge of the cage 49. An air passage 118 leads from the chamber 115 to a cavity or bore 119 in the nose wall 32, which communicates by way of an opening 120 and a chamber 121, with a balancing air tube 122. The air entry end 123 of the balancing air tube passes through the wall of spout 14 above the standpipe port 35, at a location which will subject the end 123 to pressure generated within the receptacle 370 incident to charging thereof with liquid.

From the foregoing, it will be evident that air under pressure within the receptacle 370, will be free to follow two separate paths simultaneously, to chambers at opposite faces of the diaphragm 24. That is, air will flow into the balancing air tube 122 at 123, then into the cavity 121 whence it leaves by way of opening 120, bore 119, and passage 118, to enter the secondary diaphragm chamber 115. Similarly, air from the receptacle will enter the standpipe port 35, passing through secondary air tube 37 and into the primary diaphragm chamber 25, where it imposes pressure on the diaphragm substantially equal to the pressure in chamber 115. The forces at opposite faces of the diaphragm are thereby kept in balance, and the diaphragm is rendered inactive, as long as air can freely enter the ports 35 and 123.

As soon as the level of liquid in the receptacle rises to the extent that it covers and enters the port 35, a change occurs in the pressure of air within tubes 37 and 122, that is, the air in tube 37 is subjected to additional compression which increases the pressure in the diaphragm chamber 25 above that in the secondary diaphragm chamber 115. This results in distention of the diaphragm downwardly to actuate the latch 26 and initiate tripping of the main valve in the manner previously explained.

It is necessary, of course, to maintain a separation between the air masses that flow through the tubes 37 and 122, to the diaphragm chambers 25 and 115, respectively. One method of accomplishing this, is to maintain continuity of the tube 37 from its tapered forward end to its rear end 124, where the tube is rotationally received within the counterbore 125 of wall 32. Tube 37 preferably is concentric with the nozzle portion 13. A second counterbore 126 receives an annular shoulder 127 on tube 37, and behind the shoulder is a gasket ring 128 which seals off the space 126 from the chamber formed by bore 119.

About the tube 37, forwardly of shoulder 127, is soldered or otherwise fixed a hollow plug 128A which rotationally fits the bore 119. This plug is sealed annularly by means of the gasket ring 129, to avoid leakage between bore 119 and chamber 18, while permitting rotation of the plug within said bore. At the location 130, the rear end of tube 122 is placed in communication with the plug chamber 121, and is securely fixed to the plug body by soldering or otherwise. The plug has a machined cylindrical forward end 131 which is tightly fitted into the rear end 132 of the outer air tube or standpipe 34, in leakproof manner. The plug, the standpipe, and the inner air tube 37, as well as the balancing air tube 122, are in effect an integral structure rotatable with the spout 14 about the axis of the nose 13.

It will be evident from the foregoing explanation, that the construction illustrated by Figure 8 provides a solution for the problem, when presented, of balancing the diaphragm when the filling operation is accompanied by excessive internal receptacle pressure. In the absence

of such a pressure problem, the device illustrated by Figures 1 to 7 will meet the requirements of an automatic nozzle. Of course, the device of Figure 8 can be used under any circumstances, the presence or absence of excessive internal receptacle pressures being immaterial to the proper functioning thereof.

In either form of the device herein disclosed, the spout may be fixed against rotation, if desired, in which event some simplification of structure and assembly might be effected. The nature of the main valve utilized in the device may be altered, if desired, and various other modifications and changes in structural details may be resorted to, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim is:

1. A filling nozzle for the control of a liquid under pressure, comprising in combination, a hollow body including an apertured partition wall dividing the body to provide a pressure chamber and a delivery chamber, a self-closing valve for controlling flow of liquid through the aperture of said wall, an operating lever having a handle end and a fulcrum, and a contact area to abut a portion of the valve when the handle end of the lever is manually moved about the fulcrum in one direction, to open the valve, a displaceable sear including an anvil and a displaceable support for the fulcrum of the operating lever, a movable hammer disposed in striking relation to the anvil, a latch normally holding the hammer spaced from the anvil, magnetic means tending to drive the hammer against the anvil for displacing the sear and removing its fulcrum support from supporting relationship to the operating lever, and means operative at times to displace the latch from holding position with respect to the hammer, thereby to release the hammer to the driving influence of said magnetic means.

2. A filling nozzle in accordance with claim 1, including means magnetically operated to restore the hammer to latched position, and means to restore the sear to lever fulcrum supporting position, when the operating lever is free of restraint.

3. A filling nozzle for the control of a liquid under pressure, comprising in combination, a hollow body including an apertured partition wall dividing the body to provide a pressure chamber and a delivery chamber, a self-closing valve controlling flow of liquid through the aperture of said wall, a stem movable to open the valve, an operating lever having a handle, a contact area to abut the valve stem, and a fulcrum about which the lever may be moved by manipulation of the handle, to shift the contact area and move the stem to valve opening position, a displaceable support for the lever fulcrum, and magnetic means operative alternatively to displace said support from lever-supporting position and to restore said support to lever-supporting position.

4. A filling nozzle for the control of a liquid under pressure, comprising in combination, a hollow body including an apertured partition wall dividing the body to provide a pressure chamber and a delivery chamber, a self-closing valve controlling flow of liquid through the aperture of said wall, a stem movable to open the valve, a movable operating lever including a handle and a contact area to abut and move the valve stem to open valve position, a displaceable support for the operating lever, a movable hammer, a releasable latch normally holding the hammer in restraint, magnetic means operative upon release of the latch, to drive the hammer into position for displacing said lever support and relieving the valve stem of the controlling influence of said operating lever, said magnetic means including a magnet shiftable to a position for magnetically restoring the hammer to the holding influence of the latch, and means for returning the displaceable support to operating lever supporting position.

5. A filling nozzle for the control of a liquid under pressure, comprising in combination, a hollow body in-

cluding an apertured partition wall dividing the body to provide a pressure chamber and a delivery chamber, a self-closing valve controlling flow of liquid through the aperture of said wall, a stem movable to open the valve, a movable operating lever including a handle and a contact area to abut and move the valve stem to open valve position, a displaceable sear including a displaceable support for the operating lever, a movable hammer disposed in striking relation to the sear, magnetic means urging the hammer to strike and displace the sear and the lever support associated therewith, a latch normally holding the hammer in restraint, and means operative at times to displace the latch from holding position with respect to the hammer, thereby to release the hammer to the driving influence of said magnetic means.

6. A filling nozzle for the control of a liquid under pressure, comprising in combination, a hollow body having an inlet port, and a hollow nose providing an outlet port, a bent tubular spout having an open outer end, and an inner end rotatably mounted upon the nose, to deliver liquid fed thereto through the outlet port, a self-closing valve within the body for controlling flow of liquid through the ports, and releasable means including a latch for holding the valve temporarily in open position, a flexible diaphragm located adjacent to the latch and movable to exert force upon the latch to trip same and release the valve for closing, a bored wall with which the diaphragm forms a chamber, said chamber being open to atmosphere through the bore, which bore is substantially coaxial with the outlet port, an elongate secondary air tube communicating with said bore and the diaphragm chamber, said air tube having an open forward end terminating within the spout, a primary air tube having an inner end rotatable about the secondary air tube in air-tight relation thereto, and spaced substantially concentrically thereabout to provide a catch pocket, and an open outer end on the primary air tube bent within the spout to terminate near the open outer end of the spout, to receive liquid in which the outer end of the spout may be immersed, thereby to entrap and compress a quantity of air in the primary tube, for distending the diaphragm.

7. A device in accordance with claim 6, in which the open forward end of the primary air tube is exposed at an opening in the side of the spout, and is fixed to the spout for rotation bodily therewith.

8. A filling nozzle for the control of a liquid under pressure, comprising in combination, a hollow body having an inlet port, and a hollow nose providing an outlet port, a bent tubular spout having an open outer end, and an inner end rotatably mounted upon the nose, to deliver liquid fed thereto through the outlet port, a self-closing valve within the body for controlling flow of liquid through the ports, and releasable means including a latch for holding the valve temporarily in open position, a flexible diaphragm located adjacent to the latch and movable to exert force upon the latch to trip same and release the valve for closing, a bored wall with which the diaphragm forms a chamber, said chamber being open to atmosphere through the bore, which bore is substantially coaxial with the outlet port, an elongate rotatable primary air tube having an inner end communicating with said bore and the diaphragm chamber, said tube having an open outer end terminating near the open outer end of the spout, to receive liquid in which the outer end of the spout may be immersed, thereby to entrap and compress a quantity of air in the primary air tube, for distending the diaphragm.

9. A device in accordance with claim 8, in which the spout has a side opening, and the open forward end of the primary air tube is exposed at said side opening, and means fixing a portion of said air tube to the spout for rotation bodily therewith, said primary air tube being bent intermediate its ends in substantial correspondence with the bend of the tubular spout.

10. A diaphragm operated tripping mechanism com-

prising in combination, a hollow cage having spaced side walls and a circular open end, the latter providing an annular seat for a flexible diaphragm, a latch pivoted upon the cage and having a hook end and a free end, the latter being close to the plane of the annular seat in position to be moved by distention of the diaphragm, an operating lever including a fulcrum end, a carrier for said lever having a pair of spaced legs including means pivotally supporting the fulcrum end of the operating lever, the legs having rear ends, and means pivoting the rear ends of the carrier legs to the cage side walls at opposite sides of the lever, whereby the lever may be moved between said legs past the side wall pivot means, a magnet fixed to the carrier and having a north pole and a south pole spaced apart, the poles being in a plane substantially parallel to the plane of pivotal movement of the carrier, an elongate hammer having opposite ends, means pivoting one end of the hammer to the cage at a distance from the latch hook, a keeper at the other end of the hammer to be engaged and held by the latch hook, a magnet fixed to the hammer, and having north and south poles in position to be attracted by the poles of the carrier magnet in the latched position of the hammer, but restrained normally by the latch, a sear having opposite ends, means pivoting one end of the sear to the cage at a distance from the latch, the other end of the sear including an anvil to be struck by the hammer powered by the force of attraction of the magnets upon disengagement of the latch from the keeper of the hammer, and a ledge on the sear normally supporting the fulcrum end of the operating lever, the ledge being displaced from the supporting position aforesaid as the sear is moved about its pivot under the impact of the hammer blow, and means yieldingly tending to rotate the sear about its pivot means, to a position of engagement with the operating lever fulcrum.

11. A device as specified in claim 10, in which a stop limits pivotal movement of the carrier in one direction, to a position at which like poles of the magnets are disposed in opposition, tending to repel the hammer toward the latch hook.

12. A device as specified in claim 10, in which the fulcrum end of the operating lever carries a roller for engaging the supporting ledge of the sear, and yielding means is provided to constantly urge the sear toward the roller.

13. A filling nozzle for the control of a liquid under pressure, comprising in combination, a hollow body including an apertured partition wall dividing the body to provide a pressure chamber and a delivery chamber, a self-closing valve controlling flow of liquid through the aperture of said wall, a stem movable to open the valve, a movable operating lever including a handle and a contact area to abut and move the valve stem to open valve position, a displaceable sear including a displaceable support for the operating lever, a movable hammer disposed in striking relation to the sear, magnetic means urging the hammer to strike and displace the sear and the lever support associated therewith, a latch normally holding the hammer in restraint, a flexible diaphragm acting to displace the latch from holding position with respect to the hammer, thereby to release the hammer to the driving influence of said magnetic means, and means for flexing the diaphragm to displace the latch, said means comprising an air chamber closed by the diaphragm, a standpipe having one end communicating with said chamber, and an opposite end immersible in a rising level of liquid, to create a diaphragm-distending pressure in the standpipe and the diaphragm chamber.

14. A filling nozzle for the control of a liquid under pressure, comprising in combination, a hollow body having an inlet port, and a hollow nose providing an outlet port, a bent tubular spout having an open outer end, and an inner end rotatably mounted upon the nose, to deliver liquid fed thereto through the outlet port, a

self-enclosing valve within the body for controlling flow of liquid through the ports, and releasable means including a latch for holding the valve temporarily in open position, a flexible diaphragm located adjacent to the latch and movable to exert force upon the latch to trip same and release the valve for closing, a bored wall with which the diaphragm forms a chamber, said chamber being open to atmosphere through the bore, which bore is substantially coaxial with the outlet port, an elongate secondary air tube communicating with said bore and the diaphragm chamber, said air tube having an open forward end terminating within the spout, a rotatable primary air tube having an inner end surrounding the secondary air tube in air-tight relation thereto, and spaced thereabout to provide a catch pocket, an open outer end on the primary air tube bent within the spout to terminate near the open outer end of the spout, to receive liquid in which the outer end of the spout may be immersed, an air pressure balancing conduit having one end open to the exterior of the spout intermediate the open outer end of the primary air tube and the nose of the nozzle body, the remaining open end of said conduit terminating near the diaphragm exteriorly of the diaphragm chamber aforesaid, and means forming a second diaphragm chamber opposed to the diaphragm chamber first mentioned, and in communication with the air pressure balancing conduit.

15. A filling nozzle for the control of a liquid under pressure, comprising in combination, a hollow body having an inlet port, and a hollow nose providing an outlet port, a tubular spout having an open outer end, and an inner end mounted upon the nose, to deliver liquid fed thereto through the outlet port, a self-closing valve within the body for controlling flow of liquid through the ports, and releasable means including a latch for holding the valve temporarily in open position, a flexible diaphragm located adjacent to the latch and movable to exert force upon the latch to trip same and release the valve for closing, means providing a primary and a secondary chamber at opposite faces of the diaphragm, an elongate primary air tube having an inner end communicating with the primary diaphragm chamber, and an outer open end terminating near the open outer end of the spout to receive liquid in which the outer end of the spout may be immersed, and an air pressure balancing conduit having one end open to the exterior of the spout intermediate the open outer end of the primary air tube and the nose of the nozzle body, the remaining open end of said conduit being in communication with the secondary diaphragm chamber.

16. A device in accordance with claim 15, in which the spout, the air tube, and the air pressure balancing conduit are rotatable as a unit relative to the nose of the hollow body.

17. A device in accordance with claim 15, in which is included a secondary air tube conveying air from the primary air tube to the primary diaphragm chamber, said secondary air tube having a forward end terminating at a location within the primary air tube intermediate the ends of the latter, said forward end being spaced from the inside surface of the primary air tube.

18. A filling nozzle for the control of a liquid under pressure, comprising in combination, a hollow body having an inlet port, and a hollow nose providing an outlet port, a tubular spout having an open outer end, and an inner end mounted upon the nose, to deliver liquid fed thereto through the outlet port, a self-closing valve within the body for controlling flow of liquid through the ports, and releasable means including a latch for holding the valve temporarily in open position, a flexible diaphragm including means movable upon flexure of the diaphragm in one direction, for exerting force upon the latch to trip same and release the valve for closing, air pressure means to so flex the diaphragm for tripping the latch, and air pressure means yieldingly opposing said flexure of the diaphragm in the course of the filling operation.

19. A device in accordance with claim 18, including means whereby both of the air pressure means are influenced by pressure of air generated in a receptacle undergoing filling, and the air pressure means first mentioned is influenced additionally by the rise of liquid level within the receptacle.

20. A filling nozzle for the control of a liquid under pressure, comprising in combination, a hollow body having an inlet port, and a hollow nose providing an outlet port, a bent tubular spout having an open outer end, and an inner end rotatably mounted upon the nose, to deliver liquid fed thereto through the outlet port, a self-closing valve within the body for controlling flow of liquid through the ports, and releasable means including a latch for holding the valve temporarily in open position, a flexible diaphragm located adjacent to the latch and movable to exert force upon the latch to trip same and release the valve for closing, means providing a chamber to one side of the diaphragm, having a passageway exposing the chamber to atmosphere, an elongate secondary air tube substantially coaxial with the outlet port and in communication with the passageway of the chamber aforesaid, said air tube having an open forward end terminating within the spout, a primary air tube having an inner end rotatable about the secondary air tube in substantially air-tight relation thereto, and spaced substantially concentrically about the latter, to provide a catch pocket about the secondary air tube, and an open outer end on the primary air tube terminating near the open outer end of the spout, to receive liquid in which the outer end of the spout may be immersed, thereby to entrap and compress a quantity of air in the primary air tube for distending the diaphragm, the primary air tube being bent intermediate its ends in substantial correspondence with the bend of the tubular spout.

21. A device in accordance with claim 20, in which the open forward end of the primary air tube is exposed at an opening in the side of the spout, and is fixed to the spout for rotation bodily therewith.

22. A filling nozzle for the control of a liquid under pressure, comprising in combination, a hollow body including an apertured partition wall dividing the body to provide a pressure chamber and a delivery chamber, a self-closing valve controlling flow of liquid through the aperture of said wall, a stem movable to open the valve, a movable operating lever including a handle and a contact area to abut and move the valve stem to open valve position, a displaceable support for the operating lever, a movable hammer, a releasable latch normally holding the hammer in restraint, means operative upon

release of the latch, to drive the hammer into position for displacing said lever support and relieving the valve stem of the controlling influence of said operating lever, means including a magnet shiftable to a position for magnetically moving the hammer and restoring the latter to the holding influence of the latch, and means for returning the displaceable support to operating lever supporting position.

23. A filling nozzle for the control of a liquid under pressure, comprising in combination, a hollow body having an inlet port, and a hollow nose providing an outlet port, a bent tubular spout having an open outer end, and an inner end rotatably mounted upon the nose, to deliver liquid fed thereto through the outlet port, a self-closing valve within the body for controlling flow of liquid through the ports, and releasable means including a latch for holding the valve temporarily in open position, a flexible diaphragm located adjacent to the latch and movable to exert force upon the latch to trip same and release the valve for closing, a bored wall with which the diaphragm forms a chamber, said chamber being open to atmosphere through the bore, which bore is substantially coaxial with the outlet port, an elongate primary air tube having an inner end rotatable in substantial concentricity to said bore, and means providing a catch pocket within the primary air tube to catch residual liquid directed toward the diaphragm chamber through the primary air tube when the open outer end of the tube is elevated higher than the filling nozzle body.

24. A device in accordance with claim 23, wherein the means providing the catch pocket comprises an elongate secondary air tube having an inner end communicating with the diaphragm chamber through the bore of the wall, said secondary air tube having an outer open end extended lengthwise within the inner end of the primary air tube, with a space between the said air tubes to provide the catch pocket, the inner end of the pocket being closed to passage of entrapped liquid into the diaphragm chamber.

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