Aug. 27, 1963 H. L. HUNT 3,101,873

DISPENSING PUMP WITH HIGH PRESSURE AND LOW PRESSURE PISTONS IN SERIES

Filed March 14, 1960 2 Sheets-Sheet 1

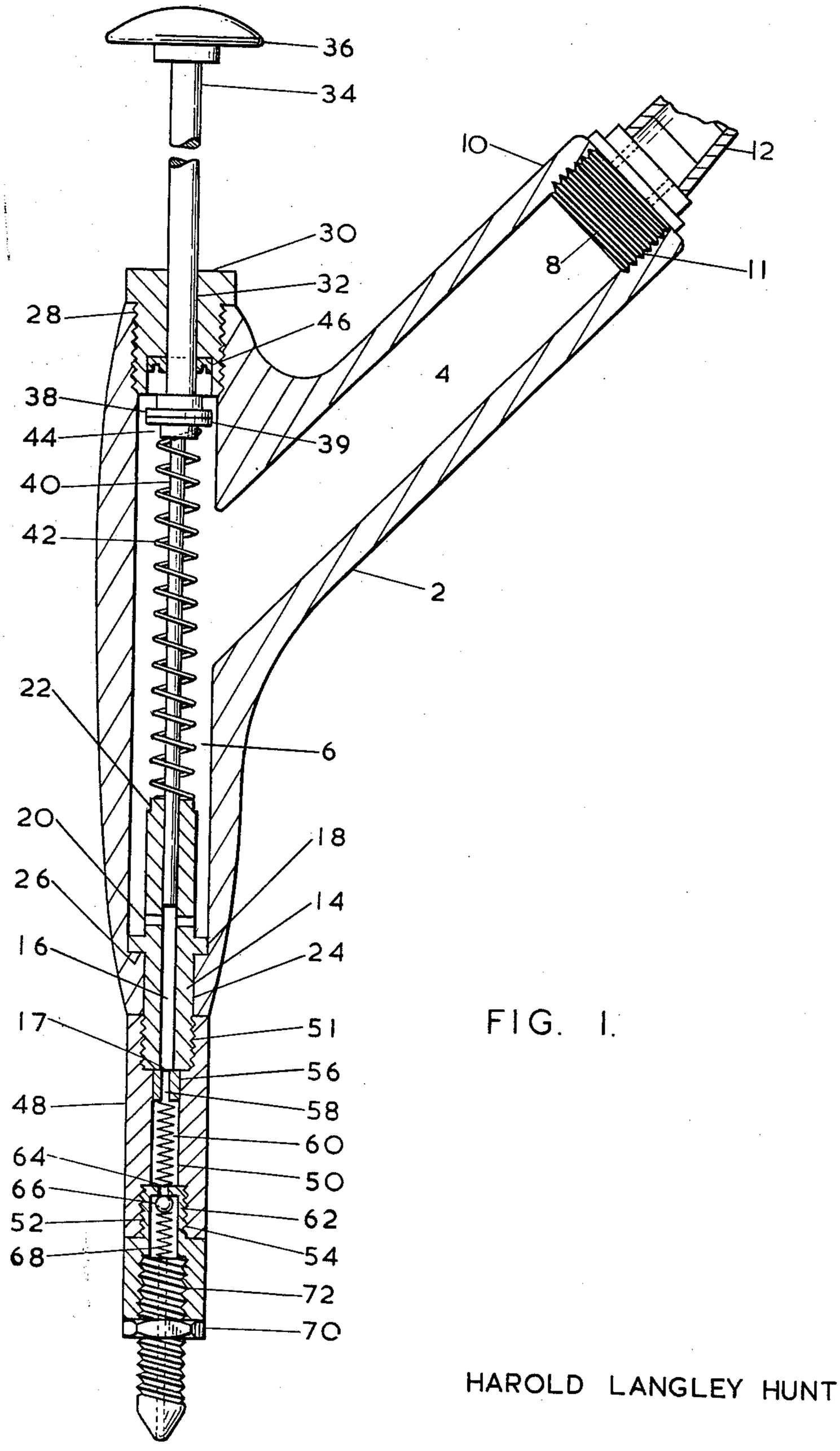

FIG. 1.

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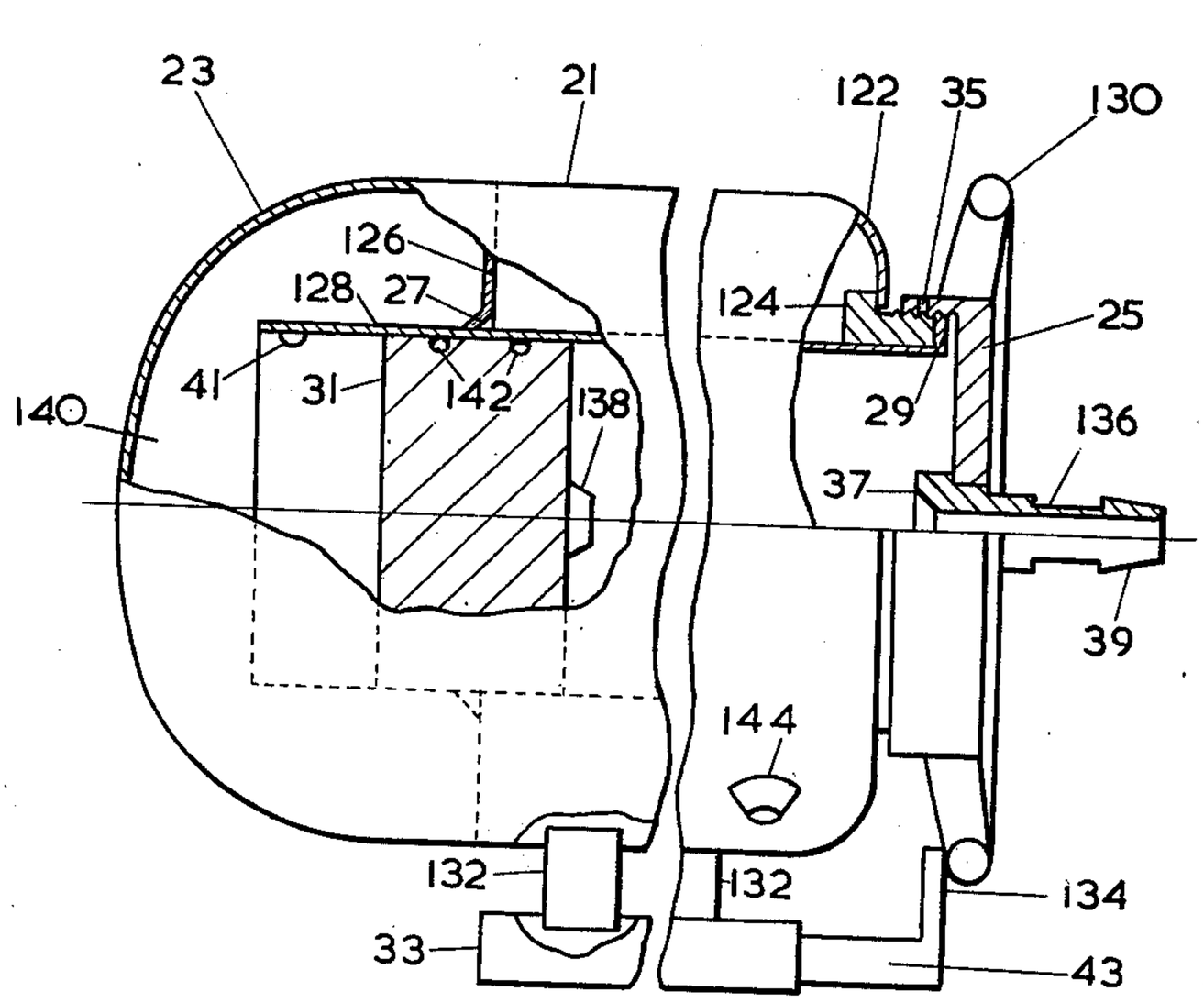

FIG. 2.

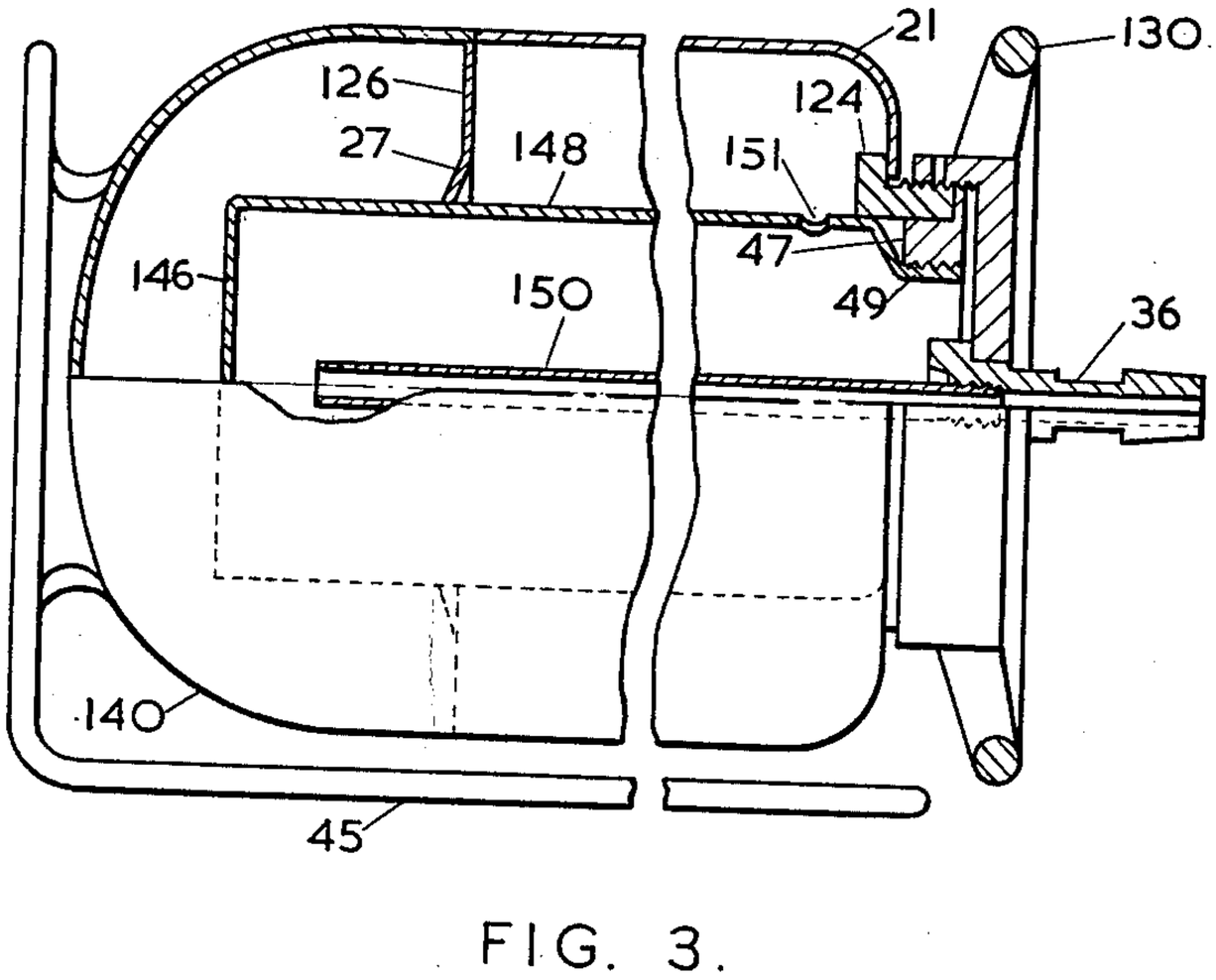

FIG. 3.

HAROLD LANGLEY HUNT

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DISPENSING PUMP WITH HIGH PRESSURE AND LOW PRESSURE PISTONS IN SERIES

Harold L. Hunt, 35 Glenleigh Ave.,
Bexhill-on-Sea, England

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7 Claims. (Cl. 222—252)

This invention relates to dispensers for fluids and other materials capable of extrusion at atmospheric temperatures by manually-operable devices, such as grease guns, such as lubricating oil or greases, insecticides, germicides, and suchlike fluids or semi-fluids for spraying or injection purposes.

The object of the invention provides more efficient dispensers of simple construction.

One aspect of the present invention comprises a method of dispensing a fluid wherein successive movements of a single operating member cause fluid to be dispensed at a plurality of different pressures successively.

Another aspect of the present invention comprises a piston-operated pump comprising two cylinders of different diameters and respective pistons, so arranged that a primary movement of a first piston sweeps a first of said cylinders to transfer any contents of said first of said cylinders into a second of said cylinders, and a secondary movement of said first piston causes a second piston to sweep the second of said cylinders.

The invention will be described with reference to certain embodiments shown in the accompanying drawings in which:

FIG. 1 shows a grease gun in sectional longitudinal elevation.

FIG. 2 shows a dispenser in longitudinal plan view, partly in cross-section, capable of supplying fluid or the like to the gun or pump shown in FIG. 1, while

FIG. 3 shows a modified form of dispenser in longitudinal elevation, partly in cross-section.

FIG. 1 shows a sectional elevation of a grease gun. The gun includes a body casting 2 having a grease duct 4 and a grease chamber 6. A hose connector 8 is fitted to the free end 10 of the body casting by matching screw threading 11 and is connected to a hose 12 fed with grease at a pressure of about 50 to 60 pounds per square inch from a pressure container (FIG. 2 or FIG. 3). The hose connector 8 includes a non-return inlet valve (not shown). A cylinder insert 14 has a bore of .125 inch in diameter constituting a high pressure cylinder 16 open at 17 to leave an aperture, a collar 18, feed holes 20 through to the cylinder 16 and a reduced portion 22. The insert 14 fits into and protrudes through an opening 24 in the body casting 2 and the collar 18 abuts against a shoulder 26 formed between the grease chamber 6 and the opening 24. An opening 28 at the other end of the body casting 2 is closed by a plug 30 having a guideway 32 for the rod 34 of an operating ram which terminates in a head 36. The rod 34 is secured to a collar 38 which, to provide for self-alignment abuts against a similar collar 39 which carries a spindle constituting a high pressure piston 40 slidable in the cylinder 16. A high pressure piston return spring 42, in the form of a helical compression spring embraces the piston 40 and abuts against the reduced portion 22 of cylinder insert 14 and against a similar reduced portion 44 on the collar 39, and urges the piston 40 to the beginning of its stroke, i.e. upward as shown in FIG. 1 of the drawings. The length of the stroke of the piston 40 within the high pressure cylinder 16 is 1¾ inches. The plug 30 has a gland 46 to prevent leakage of grease between the guideway 32 and the rod 34.

A barrel 48 has a screwthreaded recess 51 to accommodate the correspondingly screw threaded part of the

insert 14 protruding from the body casing 2. The barrel 48 also has a bore constituting a low pressure cylinder 50 and screw threaded outlet recess 52 housing an outlet non-return ball valve 54. A low pressure piston 56 of .1875 inch diameter having an orifice 58 is slidable in cylinder 50 and is urged to the beginning of its stroke by low pressure piston return spring 60 in the form of a helical compression spring abutting against the piston 56 and against the casing 62 of the ball valve 54. The length of the stroke of piston 56 in cylinder 50 is 1 inch. The ball valve 54 has an externally screw threaded casing 62 with a hole 64 against which a ball 66 is urged by a compression spring 68. A nozzle assembly 70 constituting outlet means completes the grease gun and is secured by screw threading 72 to the casing 62 of the ball valve 54 and hence to the barrel 48.

It will be appreciated that the high pressure piston 40 and the rod 34 must be sufficiently long for the piston 40 to be able to slide the low pressure piston 56 to the end of its stroke.

In operation, grease from the pressure container is fed under pressure into hose 12, passes through hose connector 8 (and the non-return valve incorporated therein), grease duct 4, grease chamber 6, feed holes 20, into high pressure cylinder 16, through orifice 58 in low pressure piston 56, into low pressure cylinder 50 and to the hole 64 in ball valve casing 62; the force exerted by spring 68 and the pressure at which the grease is fed to hose 12 should be such that the pressure of the grease in the hole 64 is not sufficient to lift the ball 66 of the ball valve 54.

By depressing the head 36 of the operating ram, high pressure piston 40 is slid along high pressure cylinder 16, spring 42 is compressed and feed holes 20 are closed by the wall of the piston. Grease is expelled from the high pressure cylinder 16, passes through orifice 58, low pressure cylinder 50, hole 64, lifts ball 66 of ball valve 54 against the force exerted by spring 68 and is expelled through nozzle assembly 70. The pressure at which it is expelled depends upon the force applied to the operating ram and on the diameter of the high pressure piston: the greater the force and the smaller the diameter, the greater the pressure. In practice, the pressure achieved might well be of the order of e.g. 10,000 to 12,000 pounds per square inch. The amount of grease expelled at this pressure is equal to the volume of that part of the cylinder 16 between the feed holes 20 and its end, and may well be comparatively small.

When the high pressure piston 40 reaches the end of the high pressure cylinder 16, it passes through aperture 17 and will contact and move the low pressure piston 56 along the low pressure cylinder 50 as the operating ram is further depressed, thus expelling grease from the low pressure cylinder, through ball valve 54, and nozzle assembly 70. The low pressure piston being of greater diameter than the high pressure piston, the grease is expelled during this part of the stroke at a lower pressure of the order e.g. of 5,000 pounds per square inch. On the other hand, the volume of grease expelled for a given length of stroke from the low pressure cylinder is greater than that expelled for the same length of stroke from the high pressure cylinder.

At the end of the stroke, ball 66 of the ball value 54 seats again on hole 64 by the action of compression spring 68; low pressure cylinder 56 is returned to the beginning of its stroke by low pressure piston returning spring 60; high pressure piston 40 is returned to the beginning of its stroke by high pressure piston return spring 42 and frees feed holes 20 to allow grease to pass through them; and so soon as high pressure cylinder 16 and low pressure cylinder 50 have been refilled with grease the operation described can be repeated.

The grease gun described, thus delivers an initial shot

of grease albeit of small volume at a high pressure, well able to clear most blocked or tight-fitting bearings, followed by a subsequent shot of grease albeit at a lower pressure, of substantially greater volume. The advantages of this grease gun over one which only delivers minute shots of grease at high pressures and over one only able to deliver large quantities of grease at much lower pressures are clearly apparent.

In FIGS. 2 and 3 the outer casing consists of a sheet metal cylinder **21** with domed ends **122** and **23**, welded otherwise fixed to the cylinder **21**. Into the front end **122** is inserted a solid metal annulus **124** externally threaded to receive a front closure member **25**.

The rear end **23** carries an internal sheet metal annulus **126** with an internal rearwardly coned portion **27** for guiding the container **128** of FIG. 2, or container **148** of FIG. 3 during its insertion into the dispenser.

Into the front annulus **124** is inserted the cylindrical container **128**, the rear end of which is guided during entry by the members **126**, **27** and the front end of which has an external lip **29** which engages the end of the annulus **124**. The front closure member **25** is now screwed onto the annulus **124** by means of the handwheel **30** integral with the closure member **25**. The rear end of the container **128** is open but is formed with internal projections **41** or is otherwise formed to hold the piston-like follower **31** within the container **128**. The follower **31** is preferably of aluminum or a light alloy or of any other suitable material wtih pressure retaining rings **142** to prevent leakage between the contents of the inner container **128** and the outer container **21**, **22**, **23** or vice versa.

To the outer shell **21** are fixed short lugs **132** carrying a tube **33** in which is housed a pump **43** with which to pressurise the chamber **140**. Either or both of the lugs **132** may be hollow to act as connections between the pump tube **33** and the chamber **140**. The pump **43** is inserted into tube **33** and the pump handle **134** can be rotated so as to be able to be engaged with the rim of the hand wheel **130** in order to prevent back pressure causing the pump handle to rise when chamber **140** in the container **21**, **122**, **23** is under pressure.

The lip **29** on the container is preferably held between two annular washers. The cylindrical internally screwed portion of closure member **25** is apertured at one or more places such as **35** so that when the closure member is unscrewed while the chamber **140** is under pressure, the pressure will be released through the apertures **35** before the closure member **25** is completely unscrewed.

An outlet tube **136** is fixed centrally in the closure member **25**. The inner end **37** of the tube **136** and the central boss **138** of the follower **31** are preferably complementary in shape so as to form an air tight joint when in contact.

The outer end **39** of tube **136** is formed for the attachment of a hose for either of two purposes. Either to fill the container **128** when empty by means of an external source under pressure, or for connection to a grease gun or suchlike injection equipment, or to a spray gun.

When a filled container **128** is fixed in position in FIG. 2 as described and a hose connected between the outlet tube **136** and the pressure injection equipment, the pressure in the chamber **140** between the outer casing and the container **128** is increased by operating the pump **43** until a pressure indicator **44** of any desired type shows that the internal pressure is of the required value.

As the grease or liquid within the container **128** is used by the injection equipment, the follower **31** moves along the container **128** until eventually the central boss **138** contacts the inner end **37** of the outlet tube **39**.

After release of pressure from the chamber **40** the container **128** may be refilled by means of a hose attached to the outlet tube **39** and fed from an external source under pressure.

Alternatively, the container **128** may be removed and

refilled by insertion of the forward end of the container into a source of grease or liquid and by pulling the piston follower **31** to the rearward end of the container and then reinserting the container in the shell, **21**, **122**, **23**. For this purpose an internally-screwed recess (not shown) will be provided in the rear end of the follower for inserting a rod having a pull-handle.

A manually-operable pressure-release valve (not shown) may also be provided in the outer casing **21**, **122**, **23**.

The pressure chamber **140** could be arranged in any other desired manner so long as it surrounds the rear end of container **128** in an airtight manner. The air or gas pressure could be applied from a source of compressed gas removably attached to the dispenser, or applied to an inlet valve when an increase in pressure is required.

An L-shaped sledge **45** can be fixed to the dispenser as shown in FIG. 3.

Some quickly vaporisable liquids such as are used as insecticides may be difficult to contain by piston-rings, and for dispensing such liquids the container **128**, of FIG. 2 may be replaced by a container **148**, as shown in FIG. 3, which has a closed bottom end **146**. The container itself may be lipped for fixing in the casing **21**, **122**, **23**, but for using a screw-top commercial can as the container **148** the adaptor **47** of FIG. 3 can be used. The adaptor **47** is externally lipped for fixing in the dispenser and is internally screwed at **49** to receive a can **148**. In this case, a tube **150** is fixed in the outlet **136** to extend down into the contents of the can **148**.

The pressure chamber **140** communicates with the interior of the container **148** through a hole or holes **51** suitably placed so that gas to gas communication exists between the chamber **140** and the interior of container **148**. When an attached spray gun is operated, the liquid is forced up the tube **150** and through the outlet **136**.

The air-hole may be in the base of the externally-screwed neck of the can **148** in which case it will register with a radial channel in a washer fitting over the neck and communicating with the pressure chamber **140**.

What I claim is:

1. A piston-operated pump comprising structure providing a first cylinder of a given diameter and having inner and outer ends, and providing a second cylinder of a materially larger diameter and having inner and outer ends, the cylinders being axially aligned, with the outer end of the first cylinder ending at, and in open communication with, the inner end of the larger second cylinder, said structure providing a fluid inlet into an intermediate portion of the first cylinder, and providing a fluid outlet from the outer end of the second cylinder, first and second pistons effectively disposed in the first and second cylinders, respectively, for forward pumping movement therein, spring means normally maintaining the second piston at the inner end of the second cylinder, the second piston having a central channel therethrough of a diameter smaller than that of the first piston, the first piston having a fully retracted position, within the first cylinder, wherein its front end is at a first location to the rear of the fluid inlet, and having a fully advanced position wherein its front end is at a second location in contact with the second piston when the latter has been moved into its most fully advanced position within the second cylinder, the first piston being of such length that, when it is in its said fully retracted position, an unobstructed portion thereof lies outside of the first cylinder of a length at least equal to the distance between said locations, and a manually operable plunger axially aligned with the first piston to cause movement thereon from its said fully retracted position to its said fully advanced position, the first portion of said movement causing the first piston to pump fluid, of a given quantity per unit travel of the first piston, from the first cylinder into the second cylinder, through said central channel, and thence through the second cylinder and

through the outlet, without moving the second cylinder, the remainder of said movement causing the first piston to engage the second piston to seal the inner end of said central channel and to move the second piston to its said most fully advanced position, such movement of the second piston acting to pump fluid through the outlet of a substantially greater quantity per unit of travel of the second piston.

2. A piston-operated pump comprising structure providing a first cylinder of a given diameter and having inner and outer ends, and providing a second cylinder of a materially larger diameter and having inner and outer ends, the cylinders being axially aligned, with the outer end of the first cylinder ending at, and in open communication with, the inner end of the larger second cylinder, said structure providing a fluid inlet into an intermediate portion of the first cylinder, and providing a fluid outlet from the outer end of the second cylinder, first and second pistons effectively disposed in the first and second cylinders, respectively, for forward pumping movements therein, spring means normally maintaining the second piston retracted to the inner end of the second cylinder, means defining a by-pass channel leading from the outer end of the first cylinder to a location in the second cylinder in front of the retracted second piston, the first piston having a fully retracted position within the first cylinder, wherein its front end is at a first location to the rear of the fluid inlet, and having a fully advanced position wherein its front end is at a second location in contact with the second piston when the latter has been moved into its most fully advanced position within the second cylinder, the first piston being of such length that, when it is in its said fully retracted position, an unobstructed portion thereof lies outside of the first cylinder of a length at least equal to the distance between said locations, and a manually operable plunger axially aligned with the first piston to cause movement thereof from its said fully retracted position to its said fully advanced position, the first portion of said movement causing the first piston to pump fluid, of a given quantity per unit of travel of the first piston, from the first cylinder into the second cylinder, through said bypass channel, and thence through the second cylinder and through the outlet, without moving the second cylinder, the remainder of said movement causing the first piston to engage the second piston and move it to its said most fully advanced position, such movement of the second piston acting to pump fluid through the outlet of a substantially greater quantity per unit travel of the second piston.

3. A piston-operated pump having an inlet and an outlet, comprising a small-diameter high-pressure cylinder and a large-diameter low-pressure cylinder aligned axially with each other and connected respectively with the inlet and with the outlet of the pump, the outlet end of the high-pressure cylinder being in open communication with the inlet end of the low-pressure cylinder, high-pressure and low-pressure pistons disposed respectively within the high-pressure and low-pressure cylinders, means for normally maintaining each piston retracted toward the inlet end of its cylinder, operating-ram means for moving the high-pressure piston within its cylinder to and through the outlet thereof and for further moving the high-pressure piston into the low-pressure cylinder to contact the low-pressure piston and move it toward the outlet end of the low-pressure cylinder, the retracted high-pressure piston having an unrestricted length outside the high-pressure cylinder at least as great as the sum of the two said movements thereof by the said operating-ram means, the low-pressure piston having a channel extending longitudinally therethrough to permit fluid discharged from the high-pressure cylinder during the first part of its said movement to enter the low-pressure cylinder without moving the low-pressure cylinder.

4. A fluid dispenser which includes a hollow barrel body in which is mounted a pump as claimed in claim 3, which comprises an outlet nozzle adjacent said fluid outlet of said pump and an inlet nozzle adjacent said fluid inlet to said pump, and which also includes a pressurised fluid reservoir, and a tube connecting said reservoir to said inlet nozzle.

5. A fluid dispenser comprising a hermetically sealed barrel-like outer container having an access opening in one end surrounded by an annular sealing ledge, a sealing cover removably attached to said end and having an inner sealing surface overlapping related to the sealing ledge to seal the junction of said end and sealing cover, the sealing cover being provided with an ejection nozzle for the fluid to be dispensed, a hollow-cylindrical inner container for the fluid to be dispensed disposed within the outer container and having both ends open, the inner container being removable and replaceable through the access opening, one end of the inner container having a surrounding outwardly extending flange disposed sealingly between said sealing ledge and said inner surface of the sealing cover to hold the inner container firmly in place and to facilitate sealing between said ledge, inner container, and cover surface, a follow-up piston within the inner container which confines the material to be dispensed within the inner container, and means for supplying gas within the outer container through a wall thereof to develop a dispensing pressure in the space within the outer container, whereby said piston is urged toward said nozzle to dispense said fluid therethrough under said pressure.

6. A fluid dispenser according to claim 5, wherein the volume of the said inner container is small compared to that of the said outer container, whereby the said dispensing pressure applied when the inner container is full suffers only a small decrease as the inner container is emptied by the dispensing of the said fluid therefrom.

7. A fluid dispenser according to claim 5, wherein the said outer container includes an outwardly extending male-threaded annulus surrounding the said opening and defining the said sealing ledge, the said cover including an inwardly extending female-threaded annulus surrounding the said inner sealing surface for threaded engagement with the male-threaded annulus to hold the applied cover securely and sealingly in place, the female threaded annulus having at least one pressure-relieving radially disposed opening therethrough for relieving the pressure of gas from the outer container when the cover is only partially unscrewed therefrom.

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