Nov. 10, 1936. L. M. DECKER 2,060,003

PUMP

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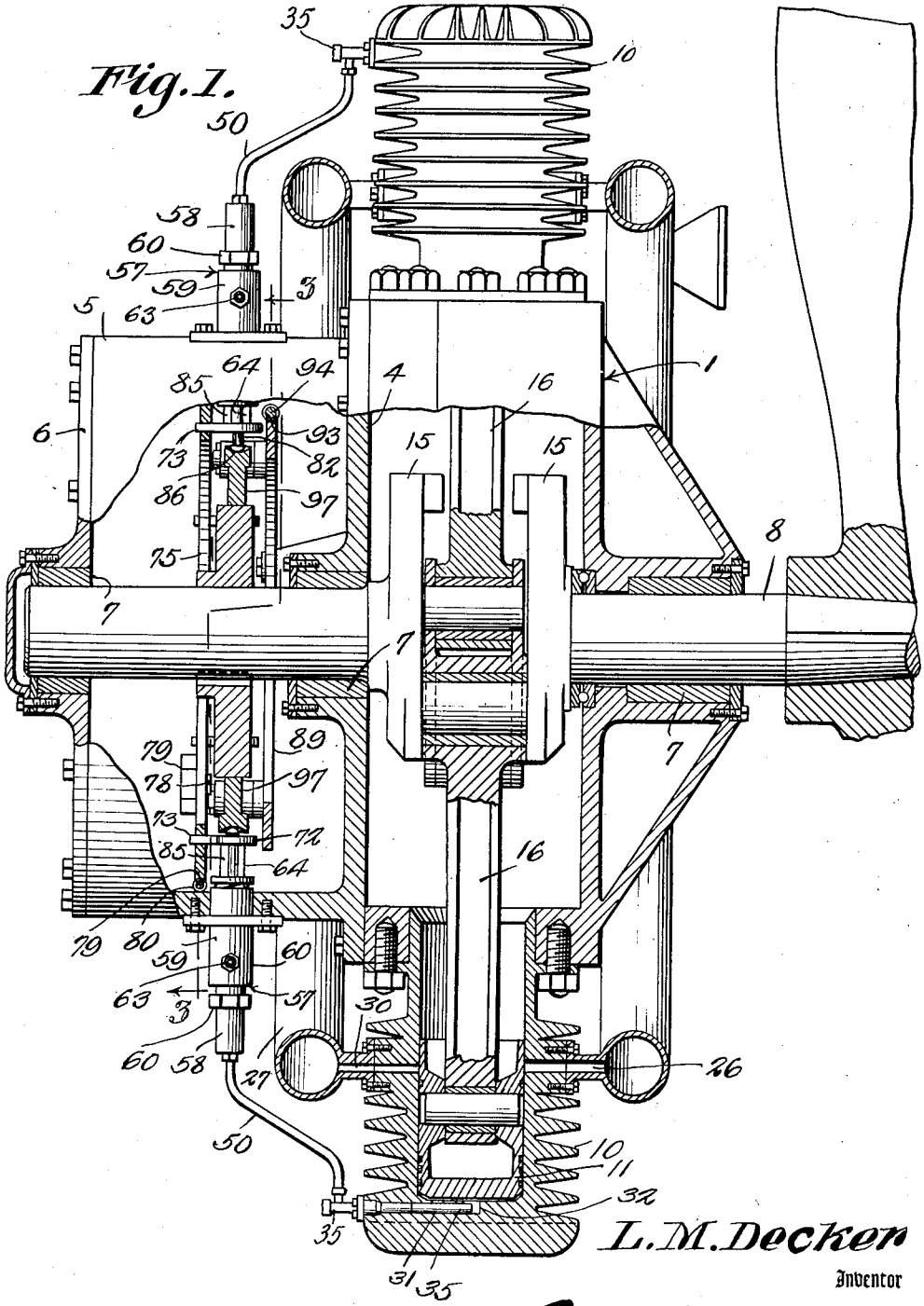
Fig. 1.




L. M. Decker

Inventor

By C. A. Snow & Co.

Attorneys.

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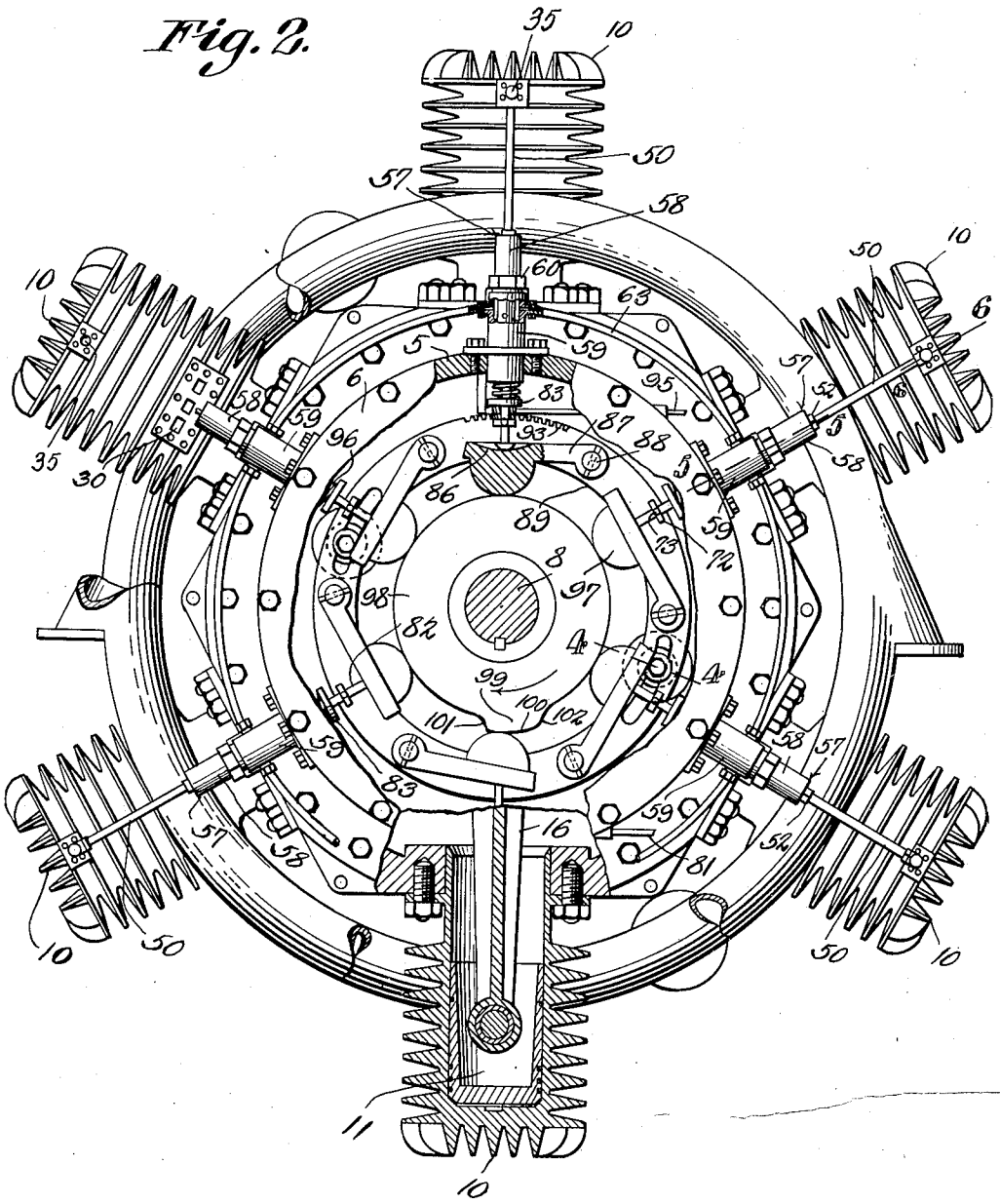
Fig. 2.




L. M. Decker
Inventor

By C. A. Snow & Co.
Attorneys.

Nov. 10, 1936. L. M. DECKER 2,060,003

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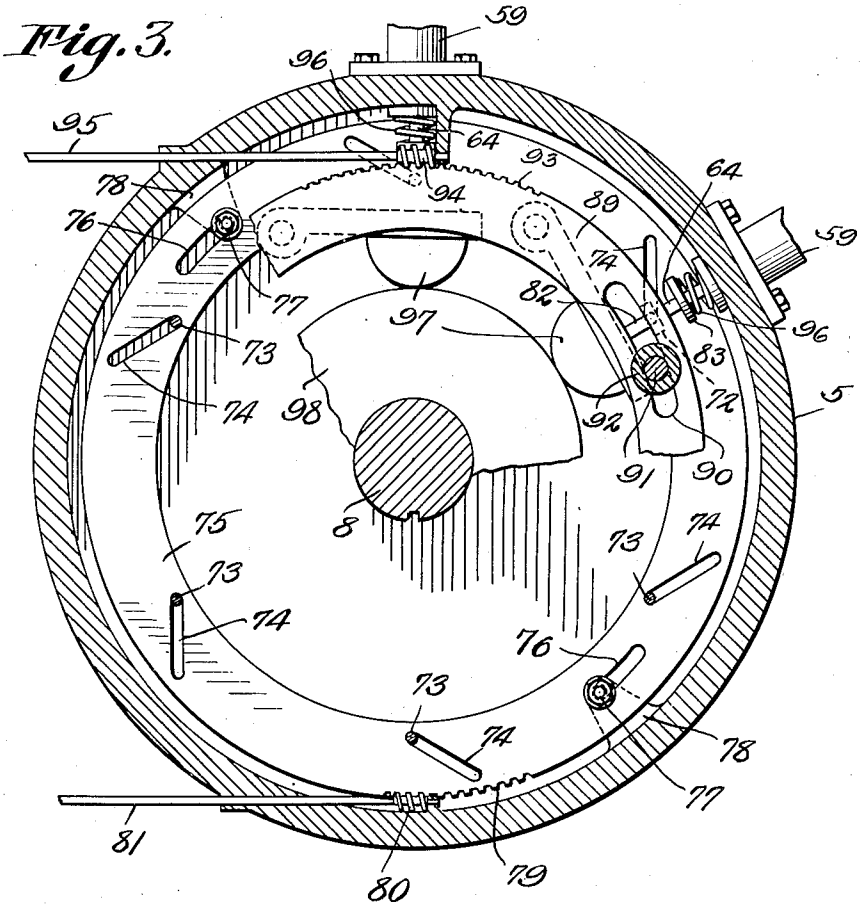
Fig. 3.



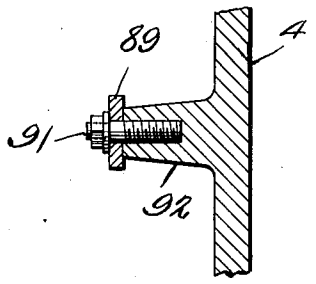




Fig. 4.

L. M. Decker

Inventor

By C. A. Snow & Co.

Attorneys.

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Fig. 5.

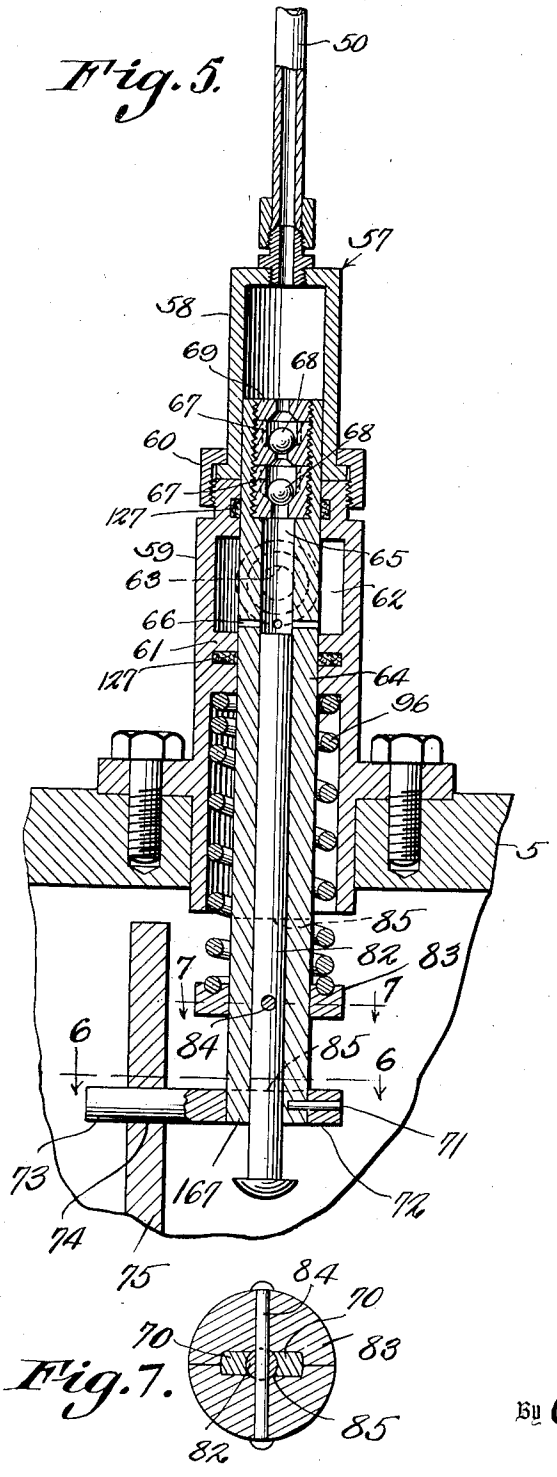


Fig. 6.

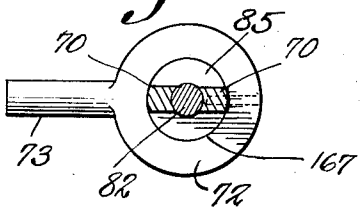


Fig. 7.




L. M. Decker

Inventor

By Cushman & Co.

Attorneys.

Patented Nov. 10, 1936 2,060,003

# UNITED STATES PATENT OFFICE

2,060,003

## PUMP

Lewis M. Decker, Baton Rouge, La.

Application April 9, 1934, Serial No. 719,785

3 Claims. (Cl. 103—37)

This invention aims to provide a pump wherein novel means is provided for shifting an inner cylinder within an outer cylinder, to vary the amount of liquid discharged by a plunger operating within the inner cylinder, novel means being provided for operating the plunger.

It is within the province of the disclosure to improve generally and to enhance the utility of devices of that type to which the invention appertains.

With the above and other objects in view, which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed, may be made within the scope of what is claimed, without departing from the spirit of the invention.

In the drawings:

Fig. 1 shows in vertical section, a device constructed in accordance with the invention;

Fig. 2 is a view in elevation, looking at the left hand end of the device in Fig. 1, parts being broken away, and parts being in section;

Fig. 3 is a section on the line 3—3 of Fig. 1;

Fig. 4 is a section on the line 4—4 of Fig. 2;

Fig. 5 is a section on the line 5—5 of Fig. 2;

Fig. 6 is a section on the line 6—6 of Fig. 5;

Fig. 7 is a section on the line 7—7 of Fig. 5.

In carrying out the invention, there is provided a stator 1, having a removable side plate 4, carrying an outstanding tubular casing 5, to the outer end of which a removable cover plate 6 is secured. The stator 1 and the cover plate 6 are supplied with bearings 7, wherein a main shaft 8 is journaled.

Cylinders 10 are secured to the stator 1. Pistons 11 are mounted to reciprocate in the cylinders 10, and are operatively connected by a crank mechanism 15.

For each of the cylinders 10, a radial fuel pump is provided, the cylinder of the pump being marked by the numeral 57. The cylinder 57 may be alluded to as an outer cylinder, and is a composite structure, including a first member 58, to the end of which a conduit 50 is connected, the conduit being connected to the nozzle 35. The outer pump cylinder 57 includes a second member 59, the members 59 and 58 of the outer pump cylinder being held together, in end-to-end relation, by a coupling 60. There is a transverse partition 61 in the second member 59 of the outer pump cylinder 57, and the partition forms a fuel chamber 62 in the member 59 of the pump cylinder. The fuel, preferably oil, is supplied to the chamber 62 by means indicated at 63, that means preferably being a pipe joining the members 59 of the pump cylinders, and connected to a source of fuel supply (not shown).

An inner cylinder 64 is mounted for longitudinal adjustment in the partition 61, in the head of the second member 59 of the outer cylinder 57, and in the first member 58 of the outer pump cylinder. The inner cylinder 64 is surrounded by packings 127, located in the partition 61 and in the head of the second member 59 of the outer pump cylinder 57. The inner pump cylinder 64 has a bore 65. Transverse ports 66 are formed in the inner cylinder 64 and establish communication between the fuel chamber 62 and the bore 65 of the inner cylinder 64. Valve cages 67 are provided, and contain check valves 68, which close away from the engine cylinder 10. The valve cages 67 are mounted in the upper end of the cylinder 64, and are held therein by a retainer 69, which may be threaded into the outer end of the said cylinder 64.

Referring to the means whereby the inner cylinder 64 is adjusted longitudinally in the outer cylinder 57, it is shown in the drawings that the inner cylinder 64 is cut away on each side, as shown at 85, to intersect the bore 65 of the inner cylinder, thereby forming a circular foot 167 at the inner end of the cylinder 64, and forming two oppositely-disposed spindles 70, which connect the foot 167 with the body portion of the cylinder 64. The foot 167 is secured at 71 in a disk 72, carrying a lateral projection or pin 73. The pins 73 are received slidably in inclined slots or guides 74, formed in an actuating member 75, such as a ring. The ring 75 is provided with circumferential slots 76, receiving laterally projecting supporting elements 77, carried by inwardly projecting brackets 78 on the casing 5, the construction being such that the ring 75 may be adjusted circumferentially. Although any desired means may be provided for adjusting the ring 75 circumferentially, it is suggested that the ring 75 be provided with a rack 79, meshing with a worm 80, on a shaft 81, the shaft 81 being journaled in the casing 5.

The pump plunger is marked by the numeral 82 and an abutment 83 is secured to the plunger by a pin 84 or the like, movable lengthwise of the inner cylinder 64 in the side recesses 85 of the said cylinder, the abutment 83 being slidable on the spindle portions 70 of the inner cylinder. A

compression spring 96 surrounds the cylinder 64, one end of the spring engaging the partition 61 of the cylinder member 59, and the opposite end of the spring engaging the abutment 93 that is secured at 94 to the plunger 82.

The plungers 82 rest in recesses 86 formed in radius arms 87, pivoted at 88 to a ring or actuating member 89. The ring or actuating member 89 is provided with circumferential slots 90, receiving supporting elements 91, mounted on laterally projecting lugs 92 on the side plate 4 of the stator 1, the construction being such that the ring or carrier can be adjusted circumferentially. Any desired means may be supplied for imparting circumferential adjustment to the carrier ring 89. For instance, the ring 89 may have a rack 93, meshing with a worm 94 on a shaft 95, journaled in the casing 5, and under the control of an operator.

The radius arms 87 have projections 97, bearing on a disk 98, secured by any desired means to the shaft 8, within the casing 5. The disk 98 is provided on its edge with a cam 99, including a circumferential surface 100, the cam having an end 101, and a less abrupt end 102, the cam constituting means for actuating the pump plungers 82, by way of the radius arms 87.

*The pumping operation*

The fuel oil enters the fuel chamber 62 through the oil supply means shown at 63, and moves through the ports 66 and enters the bore 65 of the inner cylinder 64, in advance of the plunger 82. The shaft 8 rotates the disk 98. The abrupt end 101 of the cam 99 engages the projection 97 on the radius arm 87 and swings the radius arm, to impart a snap-like pumping stroke to the plunger 82. The projection 97 of the radius arm 87 rides along the edge 100 of the cam 99 and then is eased down along the part 102 of the cam, the plunger 82 being lowered, by the action of the spring 96, so that the chamber 62 and the upper part of the bore 65 of the inner cylinder 64 can fill again with fuel oil. On the up-stroke of the plunger 82, the fuel is forced past the check valves 68, through the conduit 50, and moves through the nozzle 35.

*The firing operation*

As the piston 11 moves to complete its compression stroke, some of the air supplied through the port 26 is trapped in the cylinder 10, as the piston 11 closes the ports 26 and 30. The air thus trapped is compressed and its temperature is raised to a point where it will ignite the charge delivered through the opening 32 as the piston 11 arrives at the end of its compression stroke.

*Plunger control*

By means of the shaft 95, the worm 94 and the rack 93, the ring 89 can be moved circumferentially on its supports 91. This causes a circumferential shifting of the radius arms 87 and the operator is enabled to control, through a wide range, the time when the radius arms 87 actuate the pump plungers 82, the speed of the engine being regulated and controlled accordingly.

*The fuel control*

By means of the shaft 81, the worm 80, and the rack 79, or their equivalents, the ring 75 may be moved circumferentially on the supports 78. The inclined slots or guides 74 of the ring 75, cooperating with the projections 73, move the inner cylinder 64 axially with respect to the outer cylinder 57. In this way, the fuel inlet ports 66 are shifted with respect to the end of the pump plunger 82 and afford an automatic and unrestricted by-pass for excess fuel. Thus the fuel delivered in advance of the plunger 82 is regulated, the plunger 82 stopping at a predetermined height, determined by the position of the actuators or radius arms 87. The slots 76 in the ring 75, which receive the supporting elements 77, are of such length that when the ring is moved circumferentially by the shaft 81, the worm 80 and the rack 79, the inner cylinder 64 will be adjusted between predetermined limits within which the port 66 always is in full communication with the chamber 62. The slots 90 of the ring 89 have a similar relation to the supporting elements 91, and the plunger 82, therefore, will always uncover the port 66 when the plunger 82 makes its suction stroke.

*General operation*

The operation of the device has been set forth hereinbefore, step by step, but, broadly stated, is as follows:

The firing takes place in the cylinder 10, due to the action of the piston 11 and other mechanisms. The pump supplies fuel to the cylinder 10 through the nozzle mechanism 35 or its equivalent, the charge being first measured, and then injected by the same mechanism.

What is claimed is:

1. A pump comprising an outer cylinder provided with a bore and having an outlet communicating with one end portion of the bore, an inner cylinder disposed substantially in coaxial relation to the outer cylinder and adjustable longitudinally in the bore of the outer cylinder, the inner cylinder having a bore, the outer cylinder having a chamber disposed in the bore of the outer cylinder about a portion of the inner cylinder, the inner cylinder having a plurality of circumferentially spaced ports establishing communication between the chamber of the outer cylinder and the bore of the inner cylinder, means for supplying liquid to the chamber, a plunger slidable in the bore of the inner cylinder, means for operating the plunger to eject liquid through the outlet, and means for adjusting the inner cylinder longitudinally, thereby to vary the cut-off distance between the inner end of the plunger and the ports and thus bring about a measuring of the liquid ejected through the outlet by the plunger, the last-specified means comprising a ring supported for rotation with respect to a center, the ring having a slot which is inclined with respect to a circle struck from said center, the inner cylinder having a projection slidably received in the slot, and a combined means for holding the ring against free rotation and for imparting a finely adjusted rotation to the ring at the will of an operator, the location of the chamber in the outer cylinder serving to give the chamber a constant and predetermined capacity, regardless of the longitudinal adjustment of the inner cylinder and regardless of the position of the plunger.

2. A pump comprising an outer cylinder provided with an outlet, an inner cylinder longitudinally adjustable in the outer cylinder, a plunger slidable in the inner cylinder, the outer cylinder having an inlet chamber extended longitudinally of the inner cylinder, the inner cylinder having a transverse port communicating with the chamber and opened and closed by the plunger, the port being of small diameter com-

pared with the length of the chamber, to provide for a quick cut-off by the plunger and to provide for a large range of longitudinal adjustment in the inner cylinder while the port remains of a fixed area and in continuous communication, throughout its entire area, with the chamber, means under the control of an operator for adjusting the inner cylinder longitudinally between fixed limits wherein the port maintains continuous communication, at a fixed area, with the chamber, and mechanism for reciprocating the plunger, said mechanism embodying means under the control of an operator and so constructed relatively to the means for adjusting the inner cylinder longitudinally that the second-specified means will adjust the stroke of the plunger within limits between which the plunger will open and close the port regardless of the position to which the port has been shifted by the longitudinal adjustment of the inner cylinder.

3. Pumping mechanism comprising a plurality of outer cylinders each provided with an outlet, an inner cylinder longitudinally adjustable in each outer cylinder, a plunger slidable in each inner cylinder, each outer cylinder having an inlet chamber extended longitudinally of the corresponding inner cylinder, each inner cylinder having a transverse port communicating with the corresponding chamber and opened and closed by the corresponding plunger, each port being of small diameter compared with the length of the chamber, to provide for a quick cut-off by the plunger and to provide for a large range of longitudinal adjustment in the inner cylinder while the port remains of a fixed area and in continuous communication, throughout its entire area, with the chamber, means under the control of an operator for adjusting all of the inner cylinders at once, from a single point of force application, longitudinally between fixed limits wherein the ports maintain continuous communication, at fixed areas, with the chambers, and mechanism for reciprocating the plungers, said mechanism embodying means under the control of an operator from a single point of force application, and so constructed relatively to the means for adjusting the inner cylinders longitudinally that the second-specified means will adjust the stroke of the plungers within limits between which the plungers will open and close the ports regardless of the position to which the ports have been shifted by the longitudinal adjustment of the inner cylinders.

LEWIS M. DECKER.