

Feb. 5, 1929.

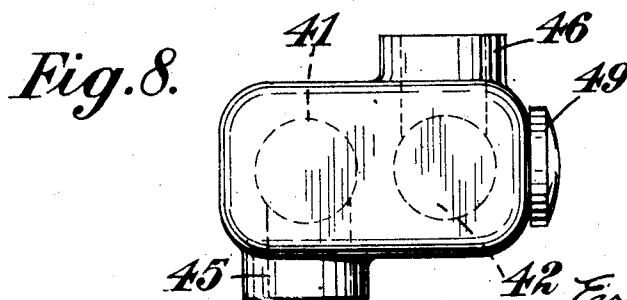
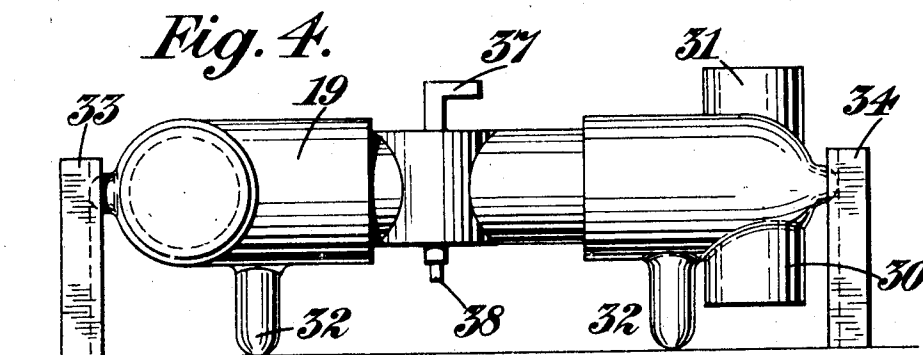
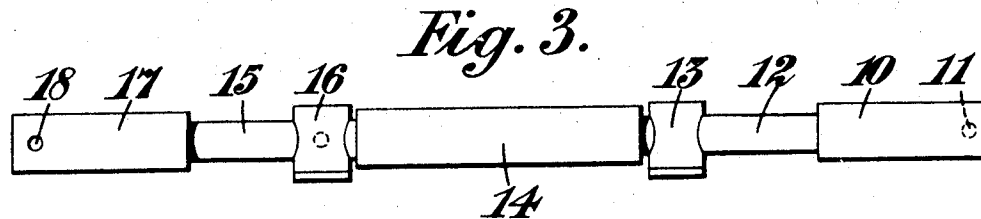
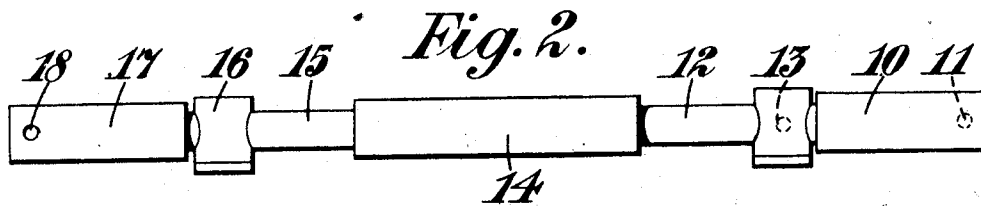
1,701,239

E. LUNGE

PUMP AND LIKE DEVICE FOR CONTROLLING THE RATE OF DELIVERY OF FLUIDS

Filed Nov. 13, 1925

2 Sheets-Sheet 1



INVENTOR

BY Ernest Lunge,
Hanson, Coit, Moore & Grindle,
ATTYS.

Feb. 5, 1929.

1,701,239

E. LUNGE

PUMP AND LIKE DEVICE FOR CONTROLLING THE RATE OF DELIVERY OF FLUIDS

Filed Nov. 13, 1925

2 Sheets-Sheet 2

Fig. 5.

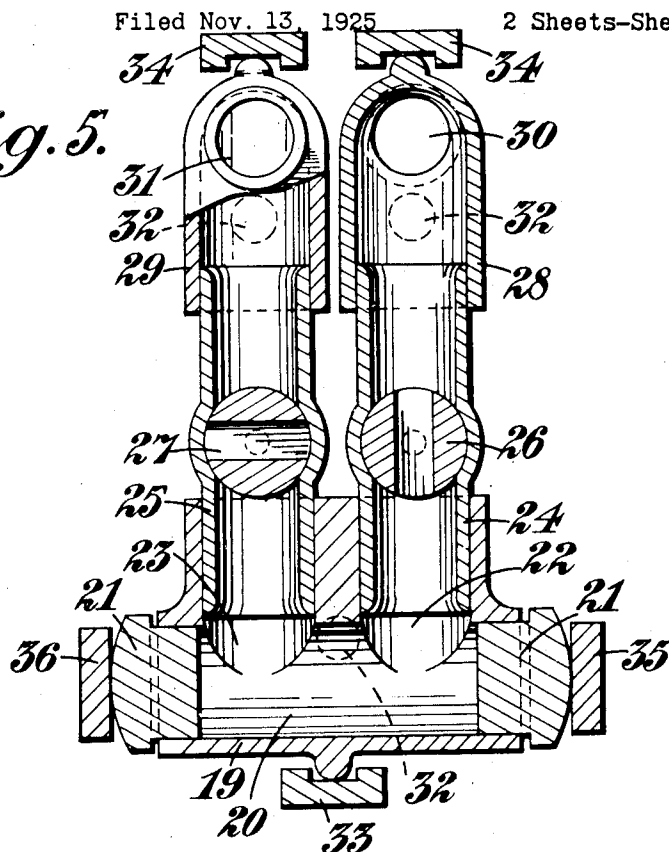


Fig. 6.

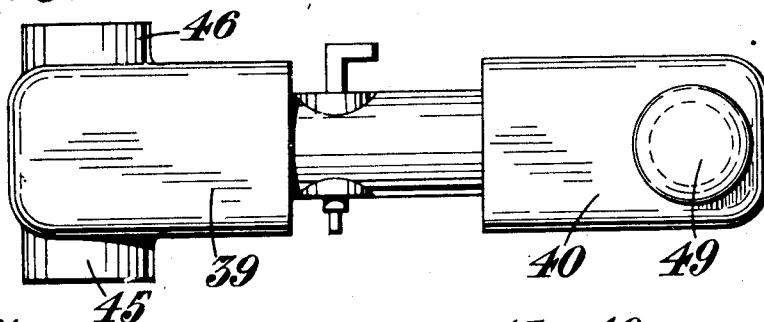
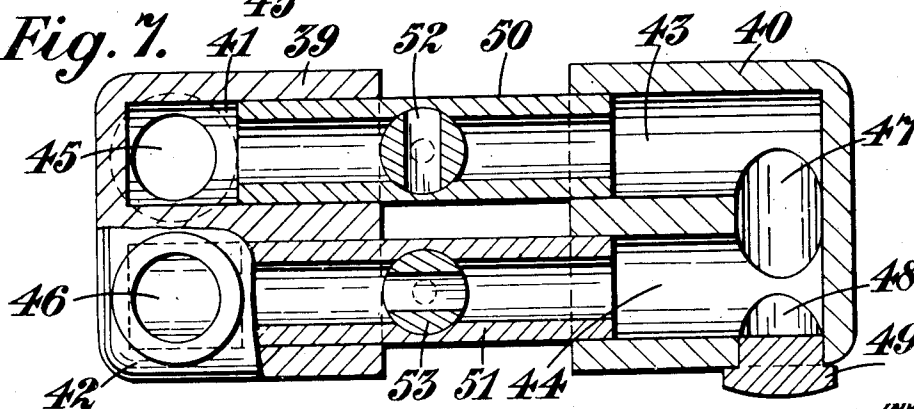


Fig. 7.



INVENTOR

By *Ernest Lunge,*
Watson, Coit, Moore & Grindle
ATTYS.

UNITED STATES PATENT OFFICE.

ERNEST LUNGE, OF LONDON, ENGLAND, ASSIGNOR TO COURTAULDS LIMITED, OF LONDON, ENGLAND, A BRITISH COMPANY.

PUMP AND LIKE DEVICE FOR CONTROLLING THE RATE OF DELIVERY OF FLUIDS.

Application filed November 13, 1925, Serial No. 68,875, and in Great Britain November 20, 1924.

This invention is for improvements in or relating to pumps and like devices for controlling the rate of delivery of fluids, and more specifically relates to a particular type of the apparatus for obtaining a continuous and uniform delivery of liquids at constant velocity, as described in patent application No. 68,874 filed November 13, 1925. According to that specification, the apparatus comprises the combination with two cyclically-actuated pumps whereof each has a delivery-stroke, which includes a period of delivery at the desired uniform rate, towards an outlet common to both of them, and whereof the said uniform delivery periods successively overlap one another, of a chamber which is expanded at such a rate as to accommodate within the apparatus during the overlapping periods and without altering the fluid pressure in the apparatus, all the flow towards the outlet that is in excess of the desired amount.

The apparatus described in the said specification is characterized in that the excess flow of the liquid which is being delivered towards the outlet is diverted from its path of flow, and accommodated in a special chamber, whereby the excess is temporarily subtracted from the total flow.

The present invention comprises apparatus for the same purpose but which is so constructed that the liquid which is being delivered towards the outlet is received and stored in the accommodating chamber whilst continuing its passage towards the outlet. The apparatus may, according to another feature of this invention, comprise two reciprocating delivery-pumps, and a chamber bounded by the pistons of the two said pumps, which chamber receives and stores the excess flow. According to a further feature of the invention the apparatus which comprises two reciprocating pumps and an intermediate chamber as above set forth, is characterized in that the three pump-chambers are arranged in series with one another, and all the liquid flows through all the chambers towards the outlet.

This intermediate or accommodating chamber may be termed a reciprocating pump, since its action is similar thereto, as herein later described; using this terminology, the invention comprises three reciprocating pumps operated in unison in the cycle described in the specification of concurrent patent application aforesaid, but characterized

in that the liquid flows through all the pump-chambers in series towards the outlet.

The invention also comprises various specific constructions such as are illustrated in the accompanying drawings, and the novel features of these constructions will be hereinafter pointed out.

In these drawings—

Figure 1 is a sectional elevation of a simplified or "diagrammatic" construction in accordance with this invention;

Figures 2 and 3 are corresponding plan views showing the parts in different positions;

Figure 4 is an elevation of one practical embodiment of this invention;

Figure 5 is a sectional plan of Figure 4;

Figure 6 is an elevation of a modified construction;

Figure 7 is a plan of the same; and

Figure 8 is an end view looking from the left of Figure 6.

Like reference characters indicate like parts throughout the drawings.

Referring first to Figure 1, the pump comprises a cylinder 10 provided with an inlet-opening 11 at one end for connection to a supply-pipe, and from the other open end a hollow piston-member 12 extends into the cylinder. This piston-member is provided with a valve 13 which can be opened to permit communication through the member 12, or closed to shut off such communication. The piston-member 12 enters an intermediate cylinder 14 and is provided with means for reciprocating it through a stroke whereof the limits are indicated in Figures 2 and 3 in a cycle of movement as hereinafter described.

In the other end of the cylinder 14 there is mounted a similar piston-member 15 which has a similar valve 16, and the other end of this piston-member 15 enters a cylinder 17 which is provided with an outlet or delivery-port 18.

The cycle of movement of the piston-member 12 from the position shown in Figures 1 and 2 consists of a delivery-stroke towards the left which includes a brief period of acceleration, a long period at a uniform velocity, and a brief period of slowing and stopping. This stroke is followed by a more rapid return-stroke towards the right which is accomplished at any convenient rate.

The cycle of movement of the piston-member 15 is exactly similar to that of the pis-

ton-member 12, but it is displaced in phase therefrom, so that its period of movement at a uniform rate overlaps at both ends the similar period of movement of the piston-member 12. That is to say, for each of the piston-members, the slowing-down of the delivery-stroke towards the left, the comparatively rapid return-stroke towards the right, and the acceleration up to the desired uniform delivery-rate towards the left all takes place within the period of uniform movement of the other piston.

The operation of this pump will now be described, and it will be assumed that the whole of the interior of the cylinders and pistons from the inlet 11 to the outlet 18 are filled with liquid. The piston-member 12 has its valve 13 closed, and it is moving at a uniform rate towards the outlet, so that it is delivering liquid thereto through the open valve 16. The piston-member 15 is moving at the same rate towards the left, and this movement is then stopped. Whilst the uniform movement of the piston-member 12 continues, the piston-member 15 is returned, on its quick return-stroke, with the valve 16 open, towards the right. Its motion is then reversed and accelerated until it is moving at the same rate as the piston-member 12 which is now reaching the end of its period of uniform movement towards the left. When the two pistons are moving at the same rate towards the left, the valve 16 is closed. The delivery of liquid to the outlet 18 is thereupon effected by the piston-member 15. The piston-member 12 which still has its valve 13 closed, is therefore still delivering liquid towards the outlet, but this liquid is accommodated by the movement of the piston-member 15 towards the outlet; in other words, a body of liquid is trapped between the valve 13 and the valve 16 and is moved with them towards the outlet, but is shut off therefrom.

Before the piston-member 12 ceases its period of uniform movement, the valve 13 is opened, and immediately thereafter the piston-member 12 reaches the end of its delivery-stroke towards the left. The continued movement of the piston-member 15 towards the left draws in liquid from the inlet 11 through the valve 13 so that the whole apparatus remains full of liquid and the rapid return-stroke of the piston-member 12 towards the right is effected. This does not interfere with the inflow of liquid to the space behind the valve 16, since the valve 13 is open.

Before the piston-member 15 reaches the end of its period of uniform delivery, the piston-member 12 returns to the right, reverses its movement and commences its period of uniform movement towards the left. Immediately thereafter, the valve 13 is closed, so that the two pistons are moving

simultaneously at the same rate towards the left with both valves closed, the piston-member 12 being on the early part of its period of uniform delivery, and the piston-member 15 approaching the end of its period of uniform delivery. The valve 16 may now be opened and the uniform delivery of the liquid to the outlet 18 is continued by the piston-member 12, since its valve 13 is closed. This completes the cycle of operations, for the various parts have returned to the position and arrangement indicated in Figure 1, at which the description of the cycle commenced.

The space between the valves 13 and 16 constitutes the "accommodating chamber" above referred to; it might be described as a reciprocating pump which is supplied with liquid on its suction-stroke through the valve 13 whilst that valve is moving to the right, and the valve 16 (closed) is moving to the left. Its delivery-stroke is effected by the movement of the valve 13 (closed) towards the left, whilst the valve 16 (open) is moving towards the right. The delivery takes place into the cylinder 17.

Turning now to the practical embodiments of this invention, the construction illustrated in Figures 4 and 5 comprises a body-portion 19 which is conveniently formed as a casting and is provided with a through-bore 20 which is closed by plugs 21. Two cylindrical bores 22, 23, which are parallel with one another, communicate with the space 20, and serve as cylinders for hollow piston-members 24, 25, respectively. These pistons are provided with valves 26, 27, respectively, and at their upper ends they engage with cylinders 28, 29, respectively. In this construction the cylinders 28, 29 are formed as separate parts, and one of them, 28, communicates by a lateral port or branch 30 with the supply-pipe for the fluid and the other cylinder communicates with a lateral port or branch 31 to constitute the outlet or delivery-device. The whole device is supported by three pegs or the like 32, whereof one is formed on each of the parts 19, 28, 29 respectively. The parts are supported endwise by means of brackets 33, 34, and laterally by brackets 35, 36, which also hold the plugs 21 in position.

It will be seen that this construction provides perfect flexibility for the whole apparatus, and avoids any possibility of trouble through lack of alignment of the various parts. The pistons 24, 25 take their alignment from their respective cylinders 22, 23, and the cylinders 28, 29 take their alignment from their respective pistons. The pressure of the liquid within the apparatus holds it securely in contact with the brackets 34, 35, 36, after it has taken up its own alignment.

The valves 26, 27 are operated by any convenient mechanism, indicated diagrammatically at 37, 38, as the pistons reciprocate.

The operation of this device is exactly similar to that described with reference to Figure 1, the piston 24 corresponding to the piston 12, the chamber 20 to the cylinder 14, the piston 25 to the piston 15, the inlet 30 to the inlet 11, and the outlet 31 to the outlet 18.

The construction illustrated in Figures 6, 7 and 8, is simpler, in that the various features designed to permit self-alignment of the parts are omitted. Two castings 39, 40 are each provided with a pair of bores 41, 42 and 43, 44, respectively. The cylinders 41, 42 communicate with the inlet 45 and the outlet 46 respectively, and the two cylinders 43, 44 are put in communication with one another by a passage 47. This passage is conveniently formed by drilling through from the outside and the opening 48 is closed by a removable plug 49.

Hollow pistons 50, 51, provided with valves 52, 53, respectively, are reciprocated each in a pair of cylinders in a similar manner to the construction illustrated in Figures 4 and 5, any suitable mechanism being used for reciprocating the cylinders and operating the valves according to the cycle of movement hereinbefore described with reference to Figure 1.

It will be appreciated that the general construction of the device is simple and inexpensive, and moreover, it is such that the parts can be very readily taken apart, cleaned

and reassembled in a minimum of time by unskilled labour.

It will be understood that the invention is not limited to the specific constructions hereinbefore described, for obviously the general design of the whole device is such as lends itself to many modifications in its practical embodiments, and all such are held to lie within the scope of this invention.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In pumping apparatus, the combination of a body portion having two cylindrical bores communicating with one another, a tubular piston reciprocable in and projecting from each of said bores, a member having a cylindrical bore engaging the other ends of each of said pistons, and taking its alignment therefrom, and abutments engaging endwise said body-portion and said member to prevent separating movement thereof.

2. In pumping apparatus, the combination of two pump chambers in series with one another, a piston reciprocable in each of said chambers, so that it has a period of uniform motion in the delivering direction which overlaps the corresponding period of the other pump, valves in said pistons, and means for operating said valves.

In testimony whereof I affix my signature.

ERNEST LUNGE.