No. 705,414. Patented July 22, 1902.

R. T. LOVE.

VALVE GEAR.

(Application filed Dec. 27, 1901.)

(No Model.) 3 Sheets—Sheet 1.

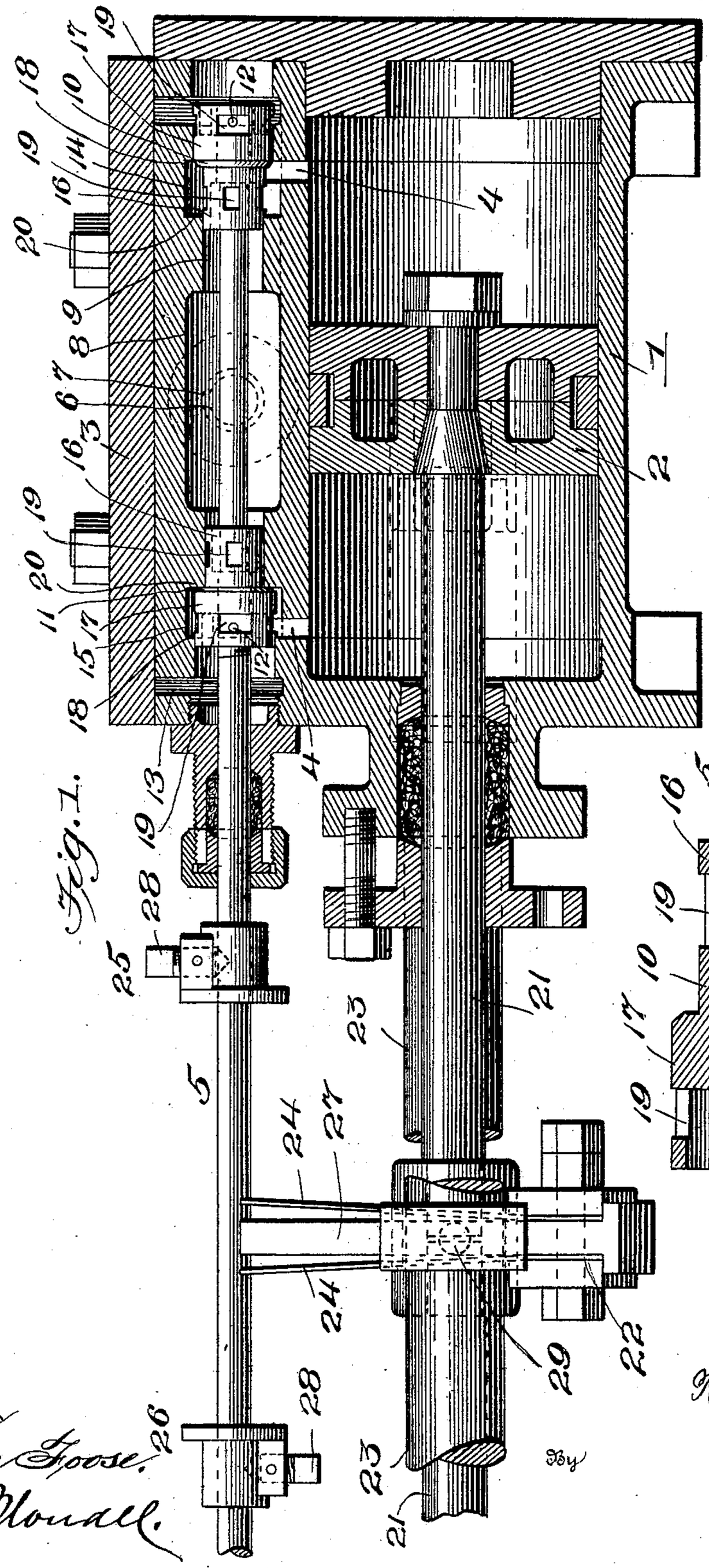

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

Fig. 6.

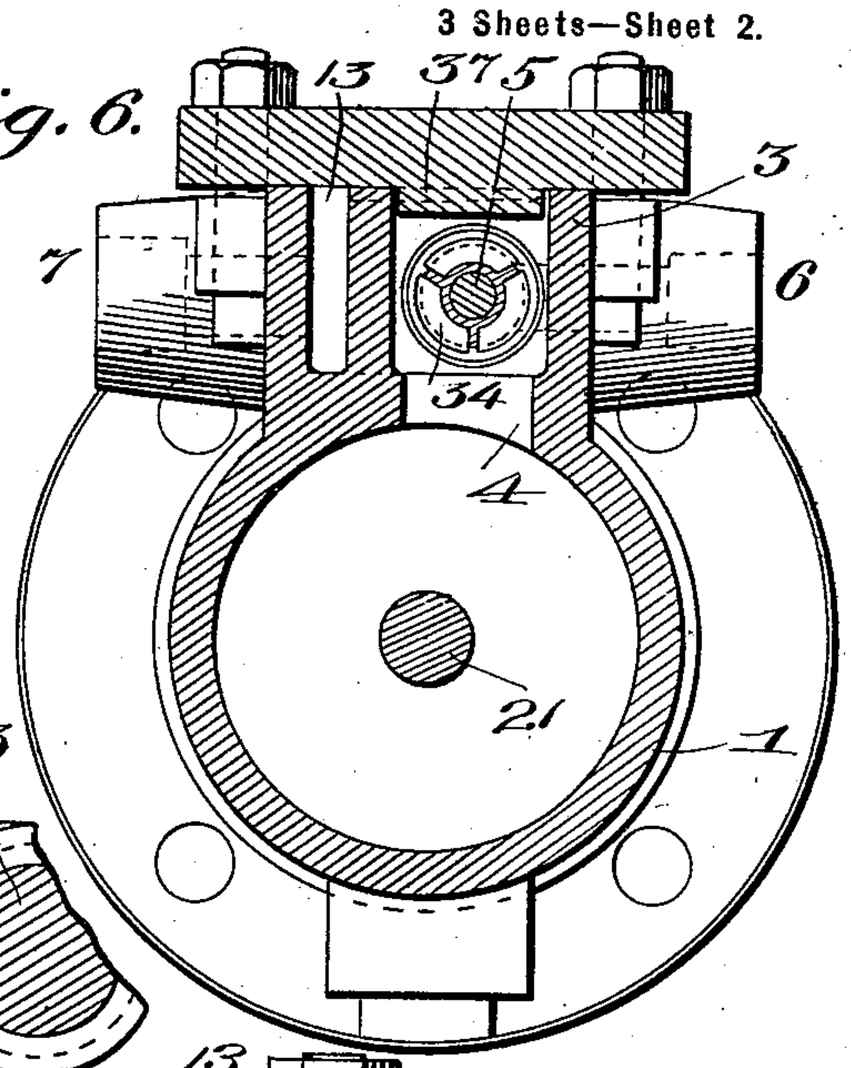


Fig. 2.

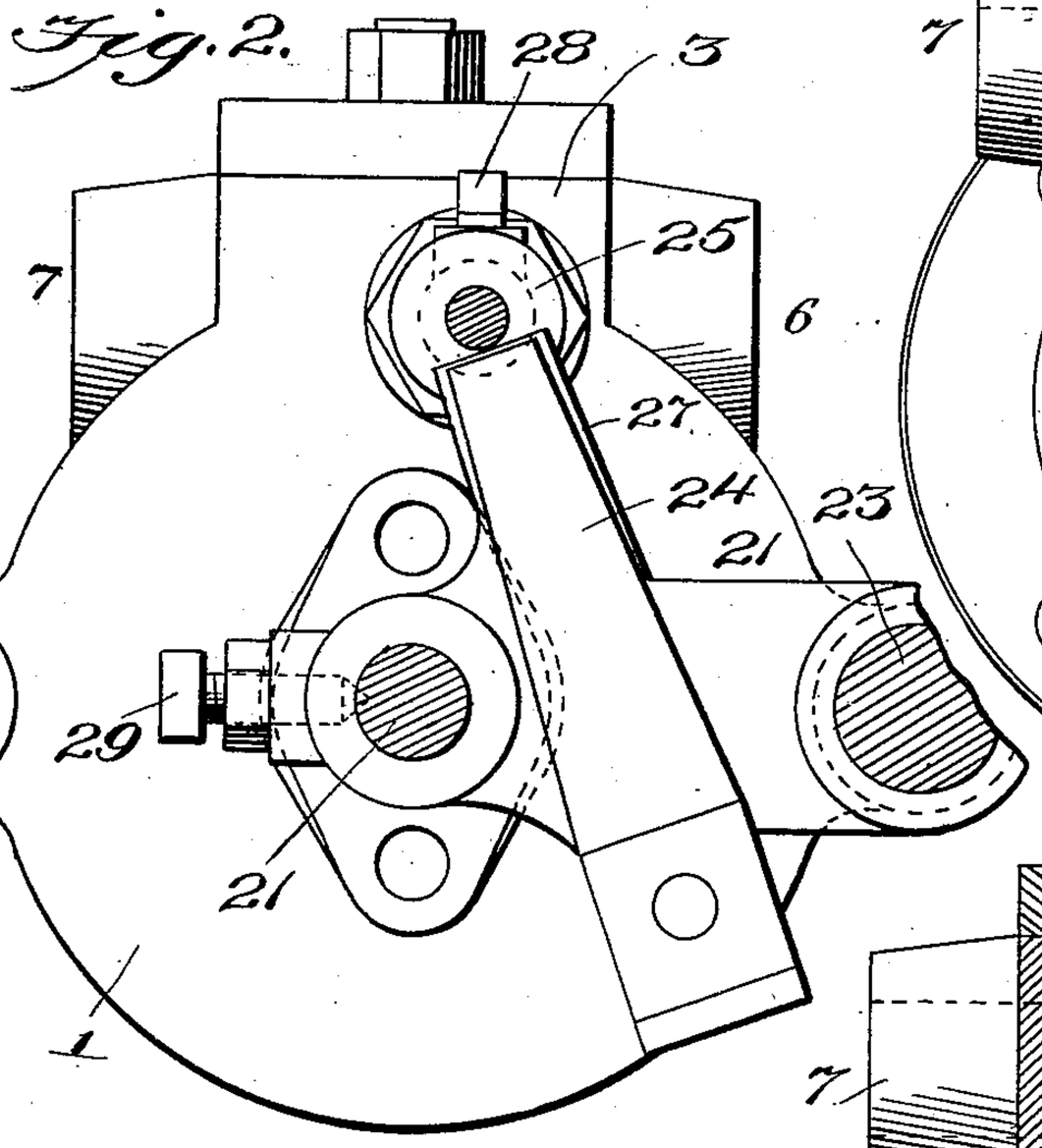
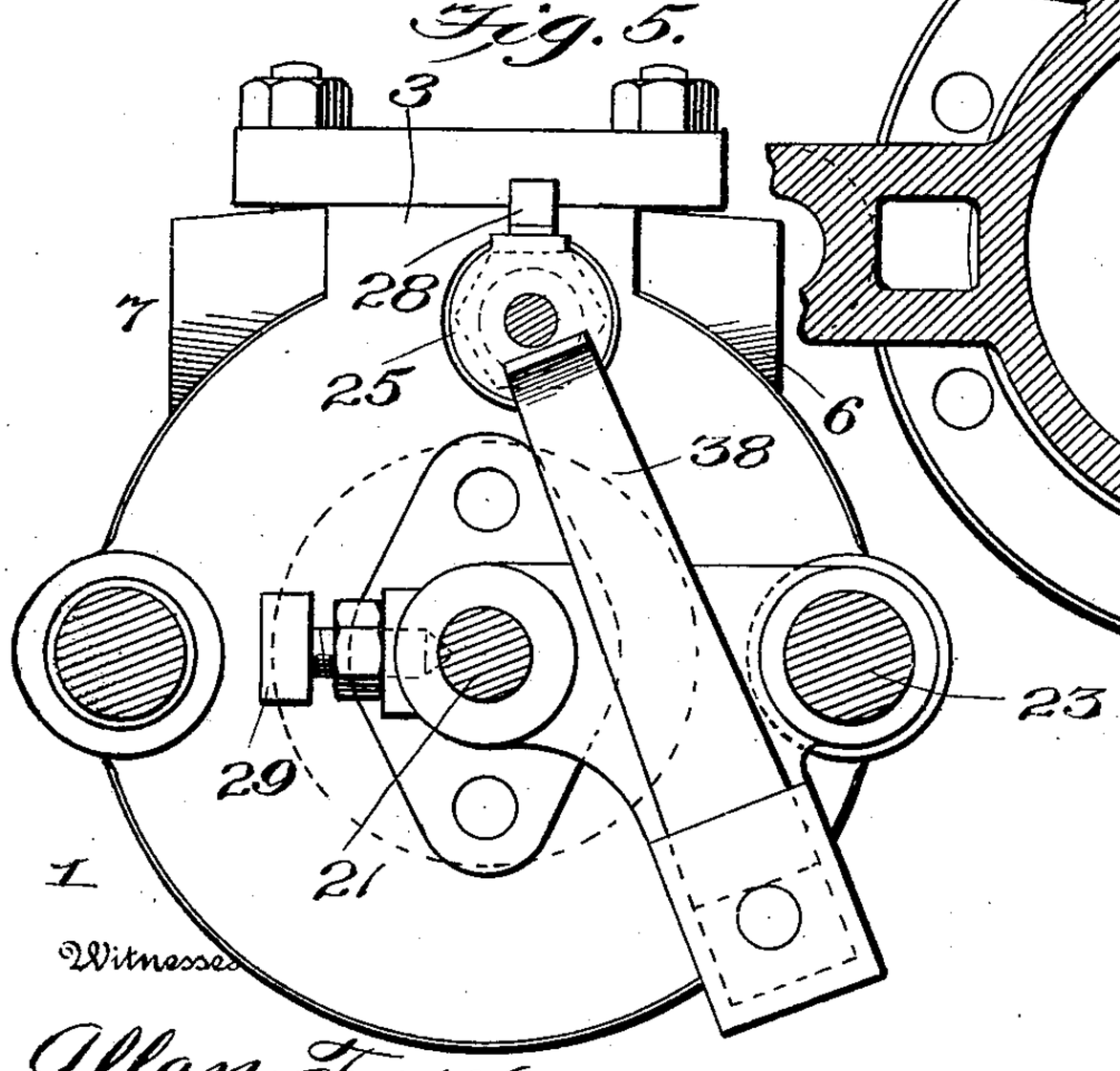


Fig. 5.



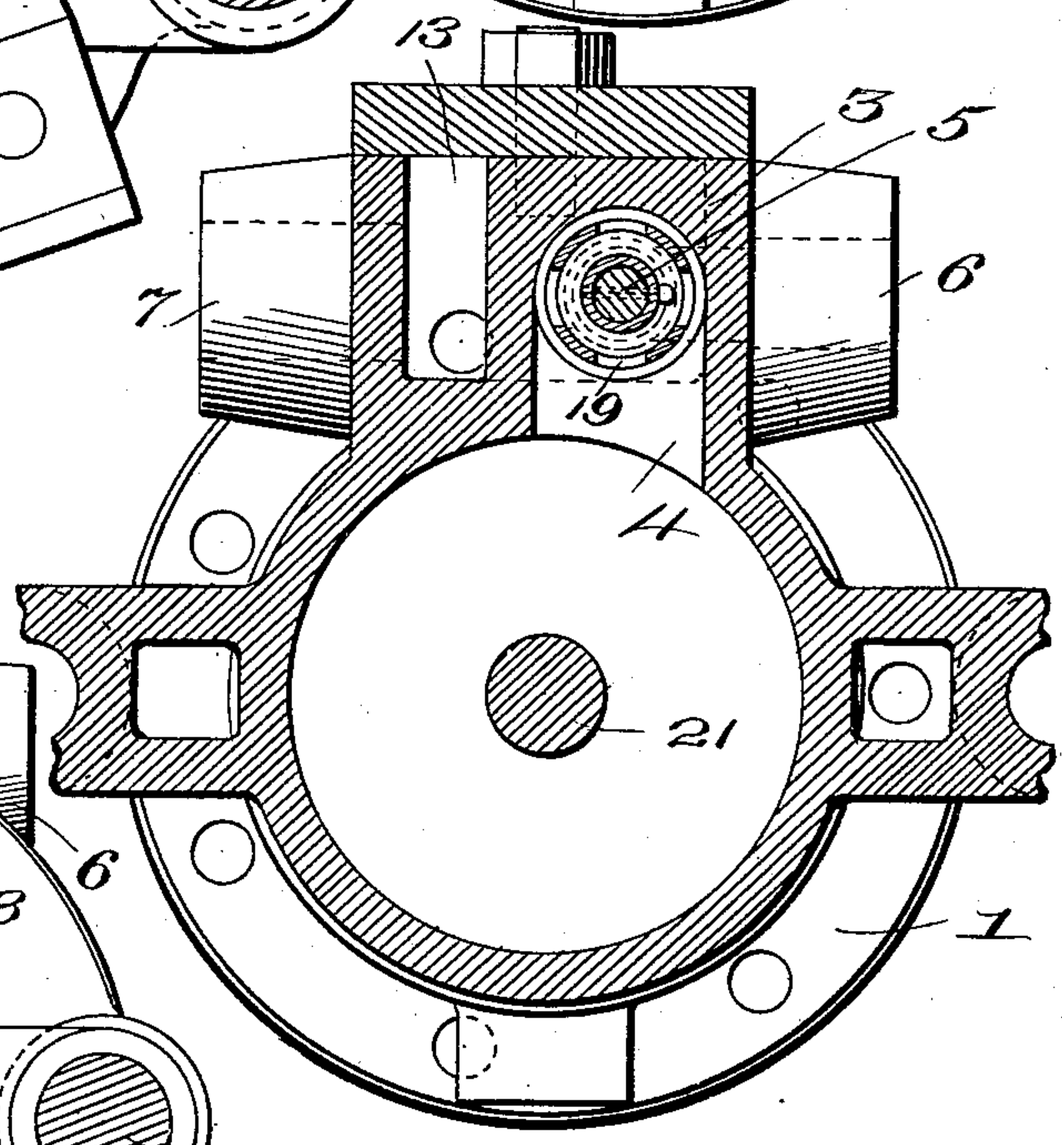


Fig. 3.

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VALVE GEAR.

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(No Model.) 3 Sheets—Sheet 3.

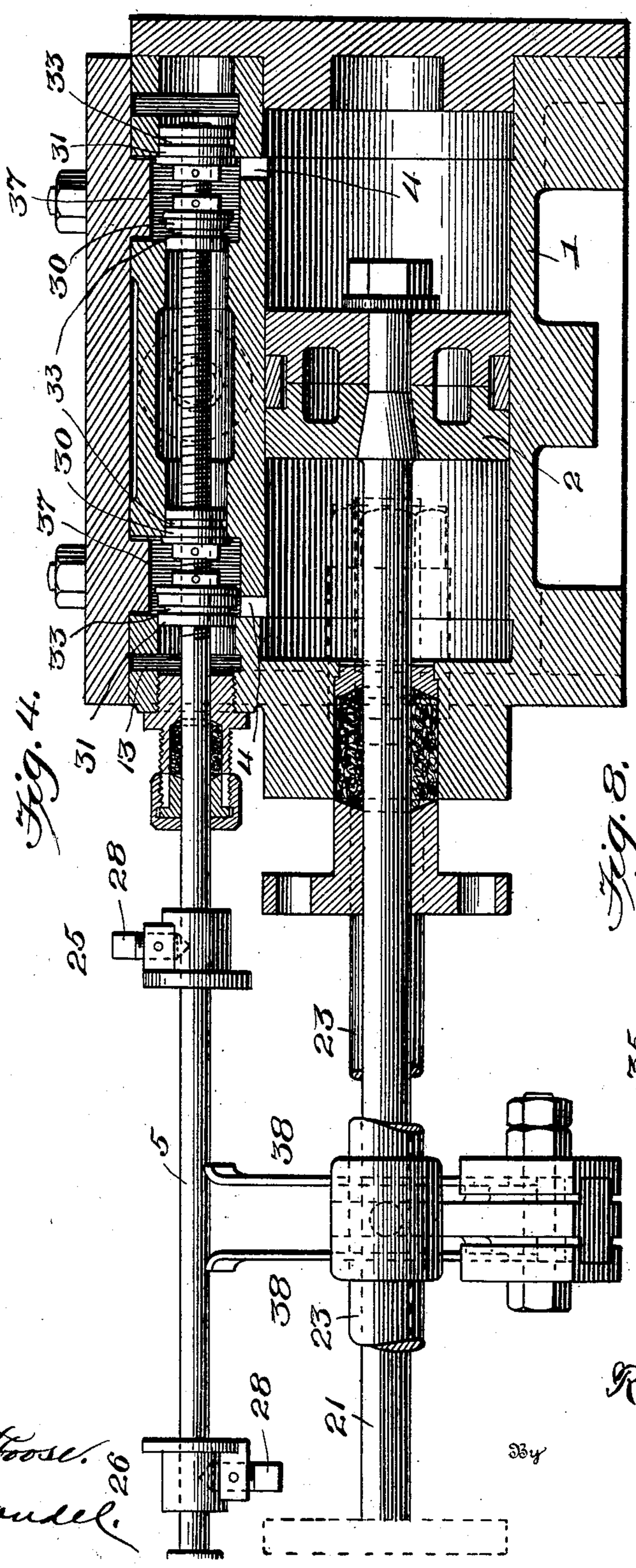
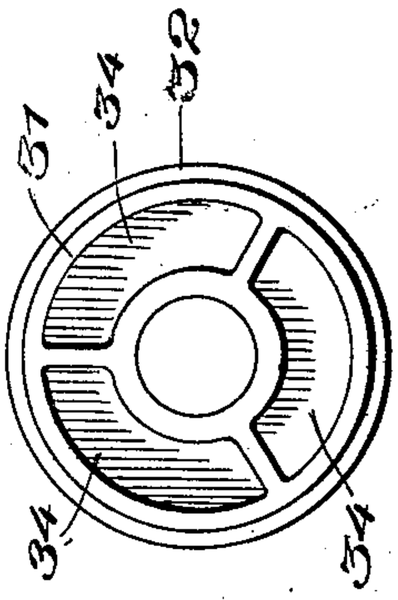


Fig. 4.



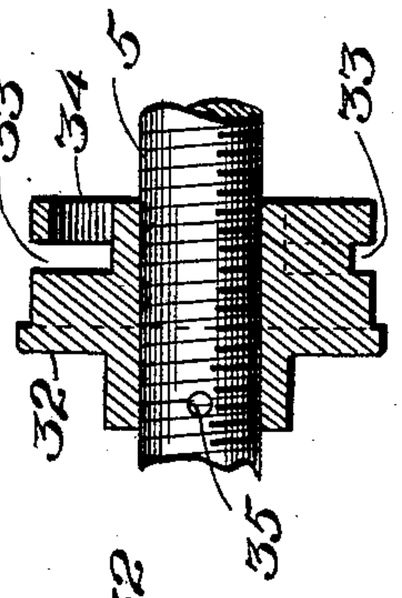
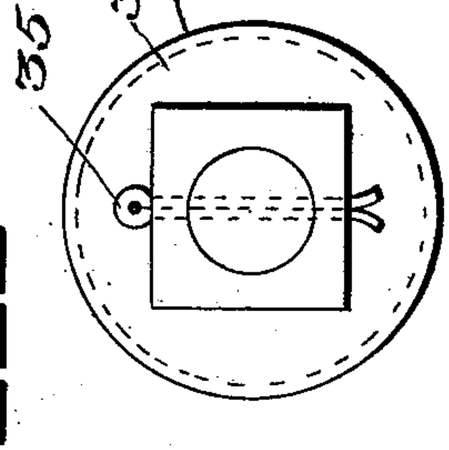


Fig. 8.



Witnesses
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UNITED STATES PATENT OFFICE.

ROBERT TEMPLETON LOVE, OF STEWARTON, SCOTLAND.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 705,414, dated July 22, 1902.

Application filed December 27, 1901. Serial No. 87,411. (No model.)

To all whom it may concern:

Be it known that I, ROBERT TEMPLETON LOVE, a subject of the King of Great Britain, residing at Stewarton, in the county of Aye, Scotland, have invented certain new and useful Improvements in Valve-Gear; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to valve-gear, and more particularly to that class of gear which is used upon direct-acting engines, such as steam-pumps; and it has for its object to simplify the same and render it more efficient.

With these ends in view my invention consists in the improved construction and novel arrangements of valve-gear and the parts of an engine coöperating therewith, as will be hereinafter more particularly set forth.

In the accompanying drawings, in which the same reference-numerals indicate corresponding parts in each of the views in which they occur, Figure 1 is a longitudinal sectional view of so much of an engine as is necessary to show my improvements. Figs. 2 and 3 are cross-sectional views of the same. Fig. 4 is a view similar to Fig. 1, showing modifications of some of the parts. Figs. 5 and 6 are cross-sectional views of Fig. 4; and Figs. 7 and 8 are detail views, Fig. 8 showing the valve in three positions.

Referring more particularly to the drawings, 1 indicates the steam-cylinder of a direct-acting engine, which may be of any ordinary construction and in which is located the piston 2. The valve-chamber 3 communicates with the opposite ends of the cylinder through ports 4 in the usual manner and is provided with a valve rod or spindle 5, which is reciprocated in any suitable manner, preferably by mechanism which will be described hereinafter. The valve-casing is provided with the ordinary steam inlet 6 and exhaust 7, preferably opposite each other and substantially midway of the casing. The inlet communicates with the steam-chamber 8, which in turn communicates with the ports 4 through a channel 9, which extends to and past the ports, thereby forming valve-seats for what I shall call "compound" or "differential" valves 10 and 11. These valves are secured to the rod or spindle 5 in any suitable manner, as by screw-threads or cotter-pins 12, or both, so as to be reciprocated with the rod. The exhaust communicates with the ports 4 through a passage or channel 13, which communicates with the outer ends of the channel 9 beyond the valves 10 and 11. The channel is preferably enlarged at its center to form the steam-chamber 8 to facilitate the entrance and operation of the steam and also near each end to form what may be called "supplemental" steam-chests 14 and 15.

The valves 10 and 11 are preferably made cylindrical, and each one virtually forms two valves of different diameters, which I will designate as 16 and 17, respectively. The smaller valve is located within the portion of the channel 9 between the main steam-chest and the supplemental chests, and the larger valves are located beyond the supplemental chests, that portion of the channel being preferably enlarged, but of a less diameter than the supplemental chest, so that a shoulder 18 is formed substantially on a line with the outer wall of the port 4.

The valves 16 and 17 are each provided with longitudinal openings which terminate in ports 19 in the wall or periphery of the valve. The longitudinal openings in the inner or smaller valve extend from the inner end thereof, so as to communicate with the steam-inlet, and those in the outer or larger valves extend from the outer end and communicate with the exhaust. The supplemental steam-chests are made of such a length relatively to the lengths of the valves and the ports therein that when the valve-rod is moved to the limit of its stroke in either direction the inner end of the outer valve at the opposite end of the casing will engage with a shoulder 20, formed at the inner end of the supplemental steam-chest, and prevent leakage of steam; but when the rod 5 is standing midway of its stroke steam will be admitted to each supplemental chamber, and thereby equalize the steam-pressure at both ends and balance the valves.

Although the valve-rod 5 may be recipro-

cated in any desired manner, I have found it preferable to provide the piston-rod 21 with a cross-head 22, which may engage with one of the guide-rods 23 of the pump, and to provide the head with suitable tripping mechanism, as springs 24, either single or laminated, which will engage with collars 25 and 26 on the valve-rod. If desired, a support 27 may be provided to assist the springs if the resistance to longitudinal movement of the valves should be too great for the springs unaided. The collars may be adjustably secured to the rod 5 in any suitable manner, as by set-screws 28, and the cross-head may be secured to the rod 21 in a similar manner by the screw 29.

Instead of forming the valves 10 and 11 from a single piece of material, as above described, they may each be formed from two pieces 30 and 31, as shown in Figs. 4 and 8. In this form I prefer to provide the outer end of the inner valve and the inner end of the outer valve each with a flange or extension 32, which are adapted to engage with the shoulders 18 and 20 at the ends of the supplemental steam-chests and assist in closing the channel 9 against the passage of steam at those points. The ports or steam-passages through this form of valve are preferably formed by a circumferential groove or channel 33, which communicates through the longitudinal openings 34 with the inlet and exhaust, respectively, in the same manner as in the single-piece valve. In this form of valve each of them may be adjusted on the rod independently of the others and be secured by a cotter-pin 35, if desired. To do this, the rod 5 is screw-threaded from its outer end as far as necessary for the innermost valve, as shown in Fig. 4.

The valves may be provided with packing-rings, or they may work in liners in which the ports are formed in the usual manner; but as such features are well known and form no part of my invention I have not deemed it necessary to illustrate them. The valve-chest may be formed by coring instead of boring, and the tops of the supplemental chests may be closed by a projection 36 upon the under side of each end of the cover 37.

In Fig. 4 the outer ends of the springs 38 are shown as slightly curved or bent outward, so as to cause the tips to engage with their respective collars substantially in a line with the movement or travel of the collars, thus securing a better engagement than where the flat surface of the spring engages with the collar. Instead of providing the cross-head with the flexible or yielding means for operating the valves it is evident that the collars may be provided with the ordinary springs or elastic cushions, which will operate with the same result as the springs on the piston-rod.

When operating an engine provided with my improved valve-gear and the parts stand in the position shown in Figs. 1 and 4, steam will enter the cylinder upon the side of the piston next to the cover through the valve 10 and supplemental chamber 14. As the piston is forced away from the cover and when near the end of its stroke one of the springs 24 will encounter the collar 26 on the valve-rod and carry it with it; but as the pressure of the steam in the supplemental chamber 14 is bearing against the outer or larger portion 17 of the valve and is bearing against the inner or smaller portion 16 of the valve 11 it is evident that the spring 24 will meet with resistance in moving the collar and valve-rod equal to the difference in the steam-pressure against said valves. This will cause the spring to be bent or deflected until its strength is equal to or slightly greater than this steam-pressure, when the rod will be started on its movement to reverse the valves. As soon, however, as the rod has moved a slight distance the valve 16 opens the channel 9 into the supplemental chamber 15 and permits steam to enter it before the valve 16 at the other end has been closed, thus causing the steam to press with equal force against the valves at the two ends and balance the valves. As soon as this occurs the spring which has been bent by the unequal steam-pressure exerts its force against the collar 26 and carries the valve-rod far enough to close the entrance of steam to the supplemental chamber 14 and at the same time opens the port at that end to the exhaust through the larger valve 17. Simultaneous with this movement the larger valve 17 at the opposite end of the cylinder is moved outward far enough to close the exhaust and to open the port 4 to the entrance of steam through the supplemental chamber 15, which will cause the piston within the cylinder to be driven in the opposite direction. Near the end of its stroke in the reverse direction the spring 24 will engage with the collar 25 and move the valve-rod in the same manner as in the first instance. By proportioning the strength of the springs to the areas of the valves a very desirable result in operating the valves is secured.

The exhaust-valves are shown with a small amount of overlap or cover and the steam-valves with a slight lead to admit steam to one side of the piston before cutting it off from the other. The amount of lead or overlap may be varied as desired. When the exhaust-valves are given a large amount of overlap, the engine will to some extent be self-governing, for if the pump fails to draw water and the engine runs away the steam-pressure will fall in the chests and be unable to produce a sufficient deflection of the springs to operate the valves.

This engine may be used as a hydraulic motor, as it can be worked by water under pressure as well as by steam, or it can be used with compressed air.

Having described my invention, I claim—

1. In a direct-acting engine, a cylinder provided with ports and a valve-casing having steam inlet and exhaust ports, a valve of two different diameters at each port for control-

ling the entrance of a motive power to and its exit from the cylinder, a smaller portion of each valve communicating with the inlet and the larger portion with the exhaust, and means for operating the valves.

2. In a direct-acting engine, a cylinder provided with ports and a valve-casing having steam inlet and exhaust ports, a valve of two different diameters at each port for controlling the entrance of a motive force to and its exit from the cylinder, a smaller portion of each valve communicating with the inlet and the larger portion with the exhaust, means for operating said valves, and means for balancing them during a portion of said operation.

3. In a direct-acting engine, a cylinder provided with ports and a valve-casing having steam inlet and exhaust ports, a valve of two different diameters at each port for controlling the entrance of a motive force to and its exit from the cylinder, a smaller portion of each valve communicating with the inlet and the larger portion with the exhaust, and yielding means for operating said valves.

4. In a direct-acting engine, a cylinder provided with ports and a valve-casing having steam inlet and exhaust ports, a valve of two different diameters at each port for controlling the entrance of a motive force to and its exit from the cylinder, a smaller portion of each valve communicating with the inlet and the larger portion with the exhaust, means for mechanically moving said valves a portion of their length and the rest of their length by said motive force.

5. In a direct-acting engine, a cylinder provided with ports and a valve-casing having steam inlet and exhaust ports, a valve of two different diameters at each port, and springs for operating the valves, said valves each having its smaller portion communicating with the inlet and the larger portion communicating with the exhaust and being balanced during a portion of their operation.

6. In a direct-acting engine, a cylinder provided with ports and a valve-casing having steam inlet and exhaust ports, a valve of two different diameters at each port, and adjustable means for yieldingly operating said valves, each having its smaller portion communicating with the inlet and the larger portion communicating with the exhaust.

7. In a direct-acting engine, a cylinder provided with ports, a valve of two diameters for each port, the smaller portion of each valve communicating with the inlet and the larger portion communicating with the exhaust, and means for operating said valves.

8. In a direct-acting engine, a cylinder provided with ports, a cylindrical valve for each port, each valve being of two diameters and having ports in its periphery which communicate with the opposite ends, respectively, of the valve, and means for reciprocating said valves over the ports so as to admit a motive force to and permit its escape from the cylinder.

9. In a direct-acting engine, a cylinder provided with ports, a piston therein, the rod of which is provided with a cross-head, springs on the cross-head, a valve of two diameters for each port, a rod connected with said valves, and stops adjustably secured to said valve-rod on opposite sides of and in position to be engaged by said springs.

10. In a direct-acting engine, a cylinder provided with ports, a steam-chest communicating with said ports and a valve-casing having steam inlet and exhaust ports, two valves each of two different diameters in said chest, one for each port, each having its smaller portion communicating with the inlet and the larger portion communicating with the exhaust, and means for operating the valves.

11. In a direct-acting engine, a cylinder provided with ports, a valve-chamber provided with a steam-chest and two supplemental steam-chests, one for each port, a valve of two different diameters for each supplemental chest, each valve being provided with means for controlling the entrance of steam to and its exit from the cylinder, and means for operating said valves.

12. In a direct-acting engine, a cylinder provided with ports, a valve-chamber provided with a steam-inlet, exhaust, a steam-chamber and two supplemental steam-chests, and a channel for establishing communication between said steam-chests, the ports and the exhaust, a valve in each channel at each supplemental chest provided with ports for communicating with the inlet and exhaust, yielding means for operating the valves and balancing them during a portion of their movement.

In testimony whereof I affix my signature in presence of two witnesses.

ROBERT TEMPLETON LOVE.

Witnesses:

JOHN W. MCCOLLY,

I. L. J. HALL.