

No. 724,212.

PATENTED MAR. 31, 1903.

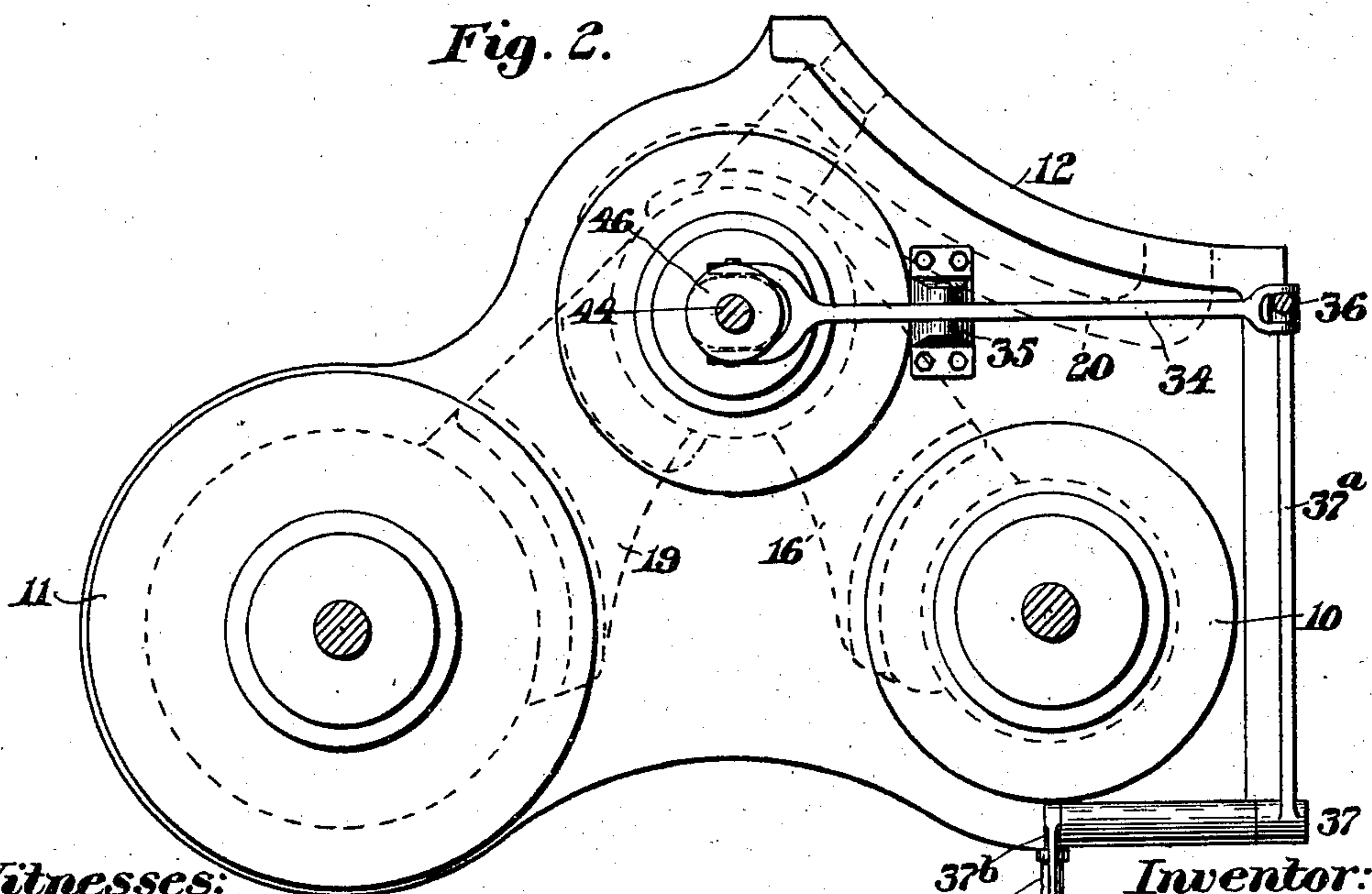
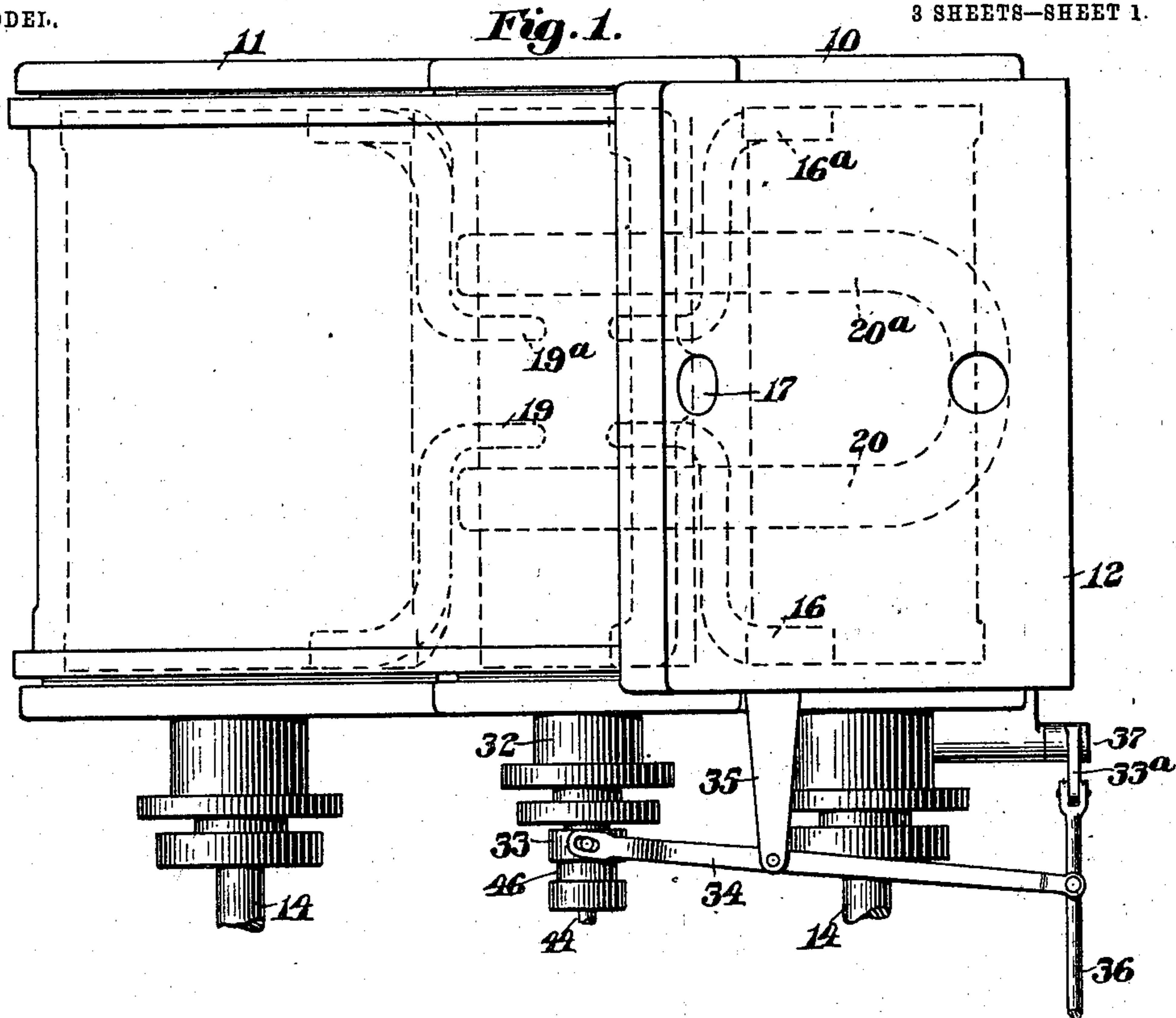
H. F. SHAW.

VALVE.

APPLICATION FILED DEC. 10, 1902.

NO MODEL.

3 SHEETS—SHEET 1.



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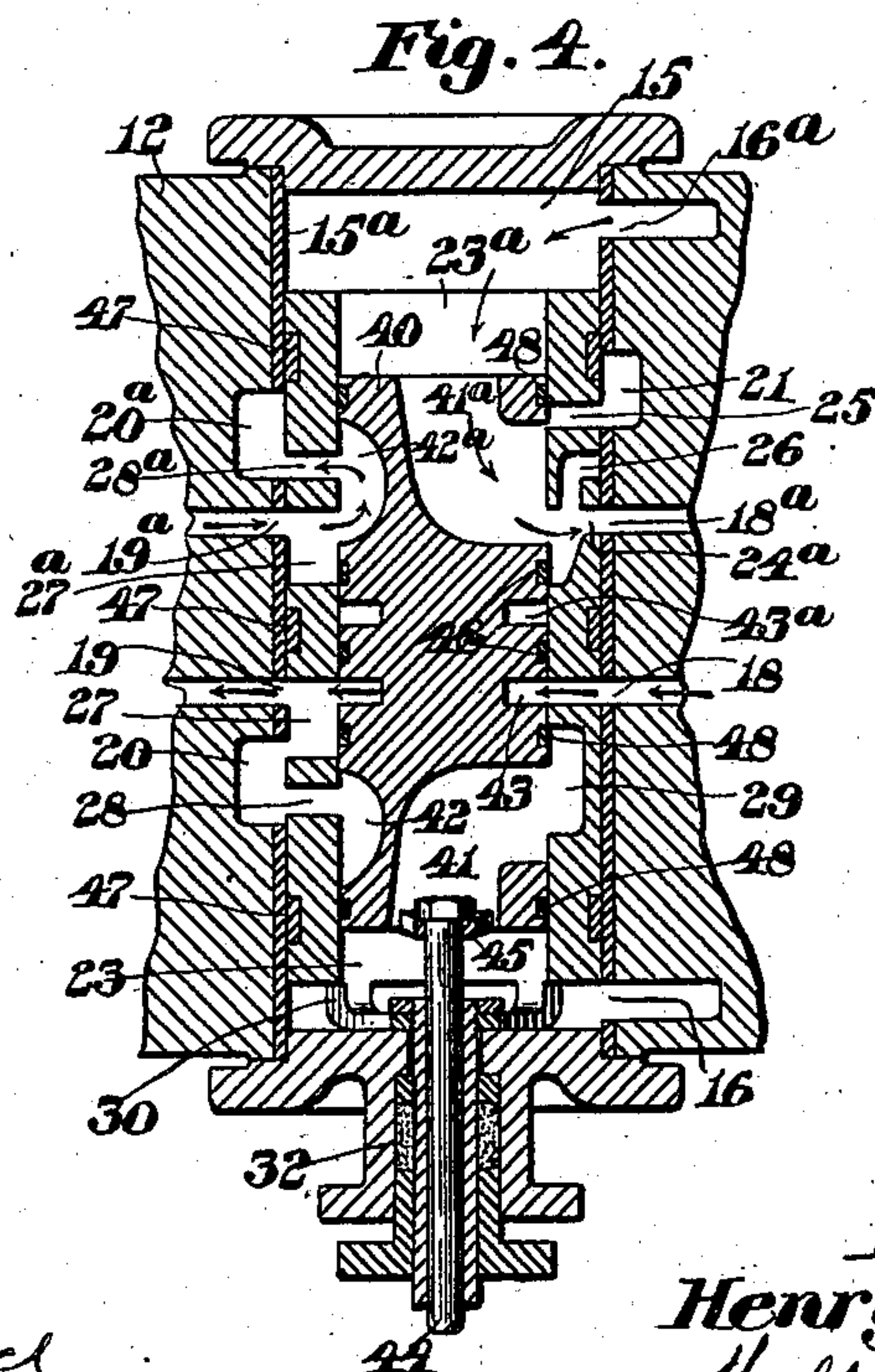
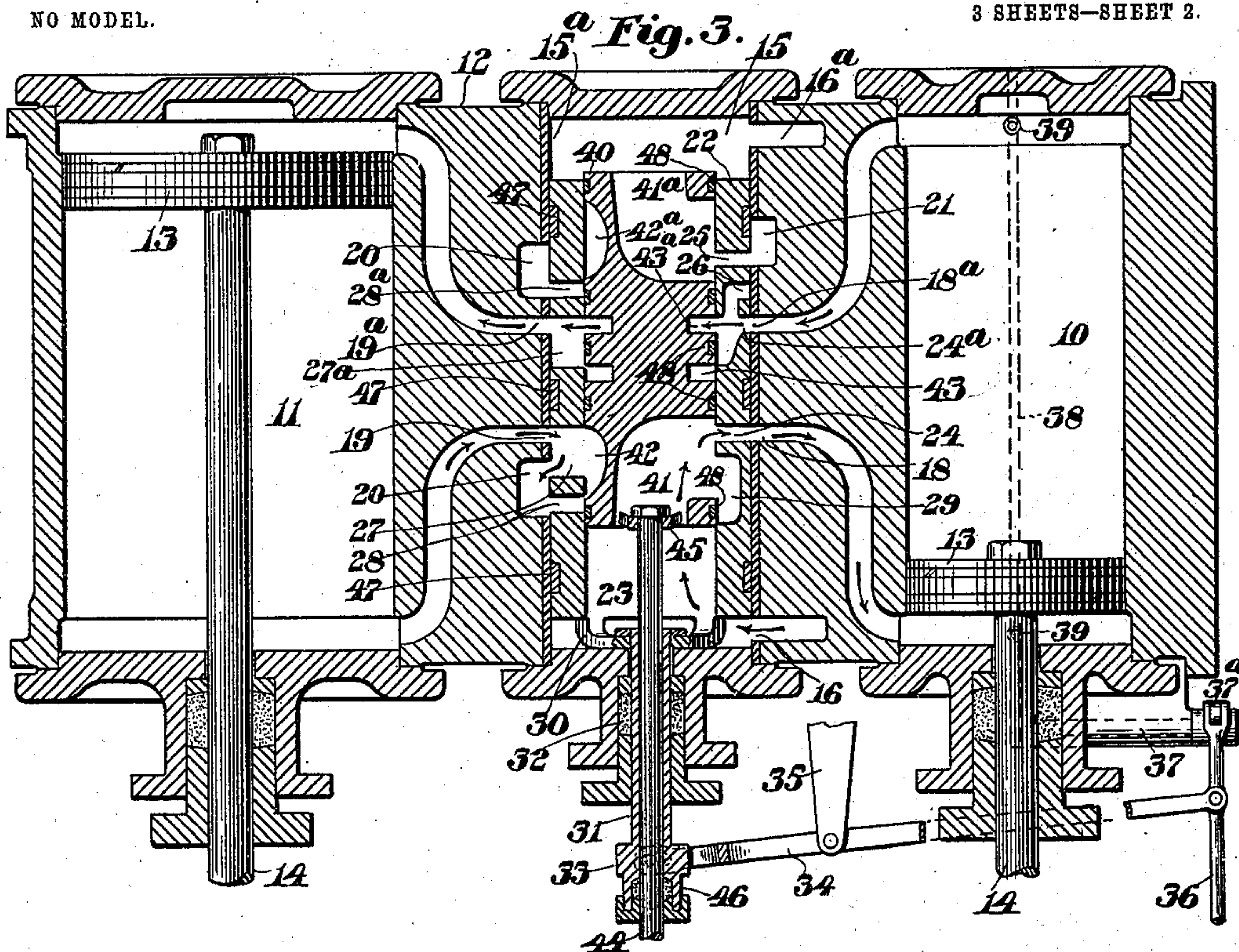
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3 SHEETS—SHEET 2.



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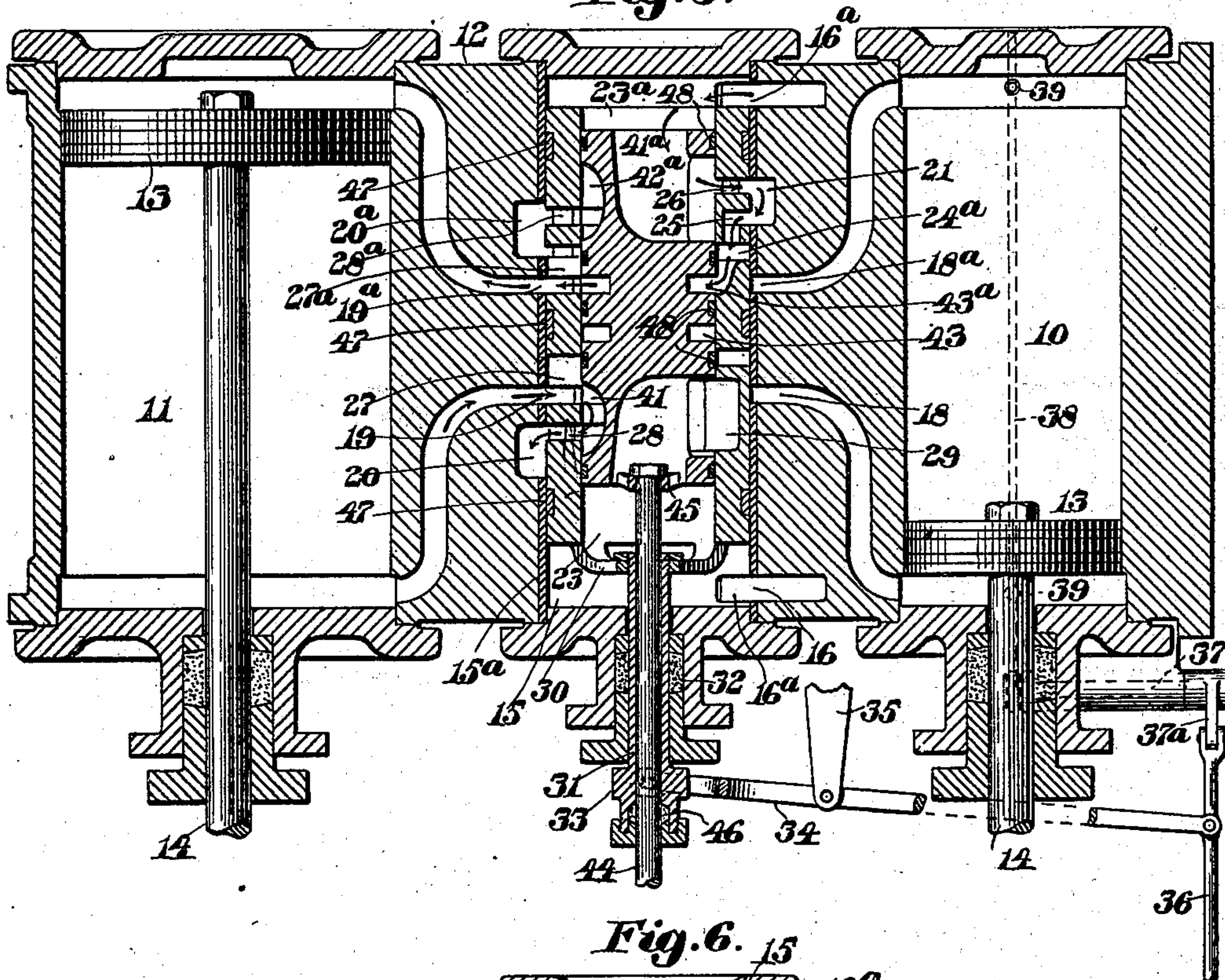
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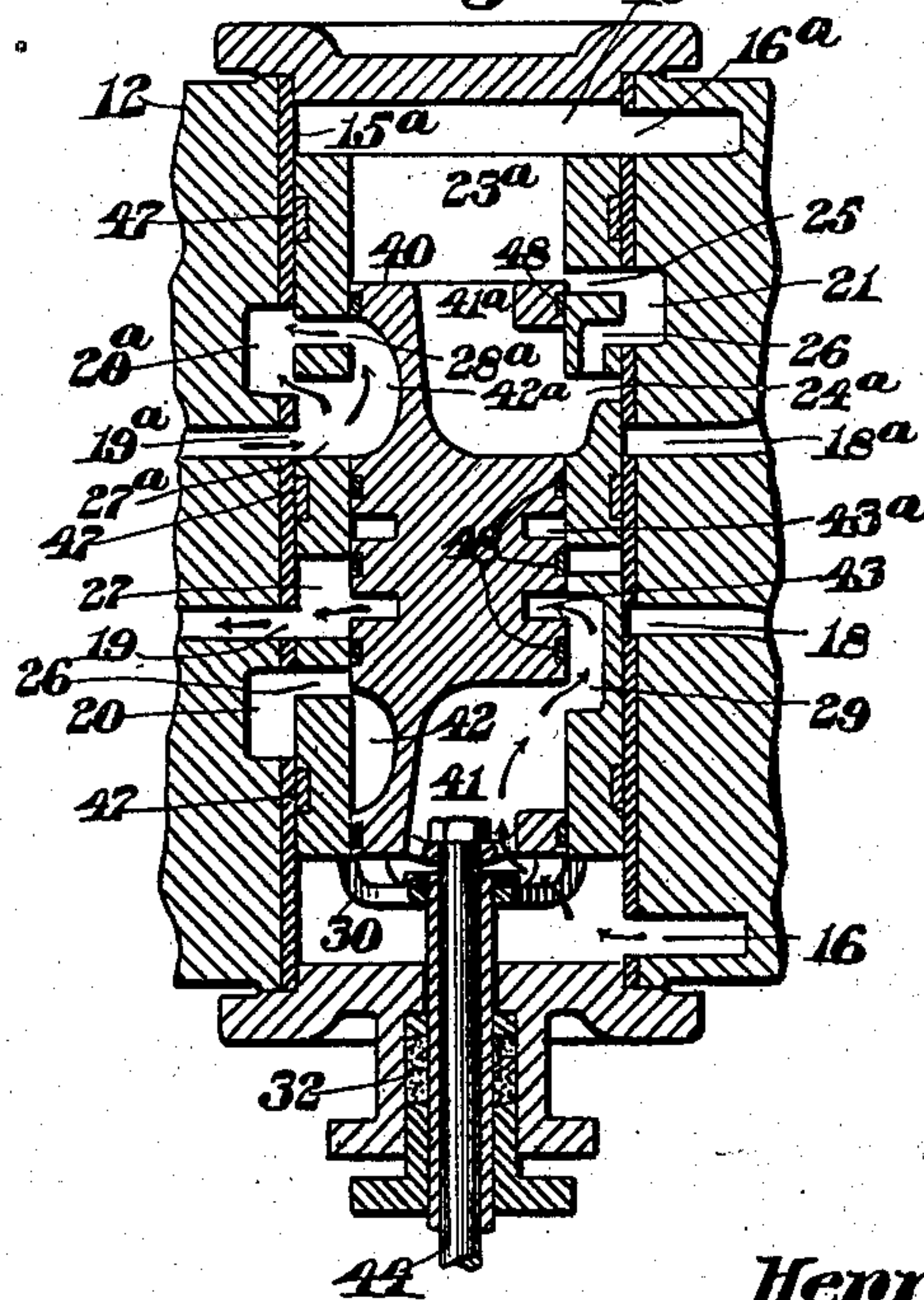
NO MODEL.

3 SHEETS—SHEET 3.

*Fig. 5.*



*Fig. 6.*



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# UNITED STATES PATENT OFFICE.

HENRY F. SHAW, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF  
TO ALVIN D. PUFFER, JR., OF LEXINGTON, MASSACHUSETTS.

## VALVE.

SPECIFICATION forming part of Letters Patent No. 724,212, dated March 31, 1903.

Application filed December 10, 1902. Serial No. 134,625. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY F. SHAW, a citizen of the United States of America, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Valves, of which the following is a specification.

My invention relates to valves, and more particularly to those adapted for use with compound locomotive-engines.

It has for its principal object the provision of means for enabling the engine in connection with which it is used to be worked either as compound to secure the greatest efficiency or as single-expansion to obtain the increased power for use in starting or on heavy grades.

In the accompanying drawings, Figure 1 is a top plan view of one-half of the saddle of a locomotive containing a high and low pressure cylinder and the valve therefor embodying one form of my invention. Fig. 2 is an elevation of said saddle looking at the inner end. Fig. 3 is an irregular longitudinal horizontal section taken centrally through the valve and cylinders, showing the valve and pistons at one extreme position. Fig. 4 is a central longitudinal horizontal section of the valve in its opposite position. Fig. 5 is a view similar to Fig. 3 with the valve-casing moved to secure the operation of the engine as single expansion; and Fig. 6 is a view similar to Fig. 4, but with the casing in its reverse position.

Similar characters indicate like parts throughout the several figures of the drawings.

The numerals 10 and 11 designate, respectively, high and low pressure cylinders of an engine, which are here shown as cast in the saddle 12 of a locomotive and containing the usual pistons 13 with the piston-rods 14. A valve-chest 15 may be situated in the saddle in proximity to the cylinders, and from this chest, preferably through a finished sleeve 15<sup>a</sup>, driven into the same, open ports 16 16<sup>a</sup> near opposite ends and connected with the steam-supply at 17, intermediate ports 18 18<sup>a</sup>, providing a common admission and exhaust for opposite ends of the high-pressure cylinder, ports 19 19<sup>a</sup>, providing a common admission and exhaust

for opposite ends of the low-pressure cylinder, and separate exhaust-ports 20 20<sup>a</sup> for the low-pressure cylinder leading to the open air or, in certain types of engines, to a condenser. As illustrated, the ports open through the walls of the chest in the form of vertical slots 16 16<sup>a</sup> and 18 18<sup>a</sup>, being situated at one side with the first two near the ends and the latter two intermediate, while the ports 19 19<sup>a</sup> and 20 20<sup>a</sup> are at the opposite side and symmetrically situated near the center of the chest with final exhaust-ports 20 20<sup>a</sup> at the outside. All these ports may be cored out through the saddle. At one end of the chest, between the ports 16<sup>a</sup> and 18<sup>a</sup>, is a recess 21, preferably of the same length as said ports, but of greater width, the purpose of which will be hereinafter described.

Within the chest is located a movable hollow casing 22, which may be cylindrical to fit the chest and of less length than the distance between the supply-ports 16 16<sup>a</sup>. This casing is provided with supply-ports 23 23<sup>a</sup>, conveniently formed by its open ends, and on the high-pressure side with ports 24 24<sup>a</sup>, cooperating with the chest-ports 18 18<sup>a</sup>, and ports 25 26, which may communicate with one another through the recess 21, and the latter of which also communicates with the port 24<sup>a</sup> through the body of the casing, and on the opposite or high-pressure side with ports 27 27<sup>a</sup> and 28 28<sup>a</sup>, cooperating, respectively, with ports 19 19<sup>a</sup> and 20 20<sup>a</sup>. The casing is also provided with a recess 29 adjacent to the port 24.

Means are preferably provided by which the engineer may change the position of the casing to vary the relation of the casing-ports and chest-ports, these means being here shown as comprising a yoke 30, attached to one end of the casing and carrying a sleeve 31, extending through a stuffing-box 32 in the cylinder-head. A block 33 may be secured to or formed integrally with the sleeve, and to this is pivoted a lever 34, fulcrumed at some suitable point, as a projection 35, from the saddle and connected, through a rod 36, with a suitable lever located within the cab. With the lever 34 may also be connected, through a rock-shaft 37 and oppositely-ex-



tending arms 37<sup>a</sup> 37<sup>b</sup>, a bar 38 to simultaneously actuate relief-cocks 39 39 at each end of the high-pressure cylinder.

Within the casing operates the valve 40, 5 having externally the generally cylindrical form of the interior of the casing. As here illustrated, this valve has at its opposite ends passages 41 41<sup>a</sup>, opening through the end of the valve-body and also through the side to- 10 ward the high-pressure cylinder for a convenient distance along the body. Opposite the side openings of each of these passages, or on the low-pressure side, are recesses or passages 42 42<sup>a</sup>, shown as occupying about the same 15 length of the valve, while between the pairs of passages and recesses are two preferably circumferential grooves or passages 43 43<sup>a</sup>. The valve-rod 44 may be secured to a yoke 45, extending across the end of the valve and 20 passing through a stuffing-box 46 in the block 33. Packing-rings 47 and 48 are seated in grooves in the casing and valve-body, respectively, and prevent leakage of steam between adjacent ports.

25 Referring to Fig. 3, where the parts are arranged to secure a compounding of the cylinders, the valve is shown at its extreme outward position, giving full admission to the inner end of the high-pressure cylinder. The 30 steam therefore follows the paths indicated by the arrows, passing through the supply-ports 16 and 23 in the chest and casing, respectively, then through the valve-passage 41, the casing-port 24, and the chest-port 18, 35 and enters the high-pressure cylinder. As the piston moves under the pressure of the admitted steam the charge in the opposite end of the cylinder, which has completed its initial expansion, passes out through the chest- 40 port 18<sup>a</sup> into the casing-port 24<sup>a</sup>, through the valve-passage 43<sup>a</sup>, and through the casing-port 27<sup>a</sup> and chest-port 19<sup>a</sup> to the outer end of the low-pressure cylinder to undergo further expansion. Exhaust from the opposite 45 end of the low-pressure cylinder takes place through the chest-ports 19 and 20, these being connected by the port 27 in the casing. In the opposite position of the valve, whereby admission is secured to the outer end of the 50 high-pressure cylinder, travel of the steam is indicated by the arrows in Fig. 2, it now being supplied through the ports 16<sup>a</sup> and 23<sup>a</sup>, entering the low-pressure cylinder through the valve-passage 43 and exhausting through 55 the port 20<sup>a</sup>. The travel through the other ports is in the opposite direction to that previously described.

To permit the obtaining of greater piston area, and consequently greater power, the 60 cylinders are arranged to operate under single expansion, in the present instance steam being delivered to the low-pressure cylinder only, the high-pressure cylinder being cut out of action. This is effected by moving 65 the casing outward in the chest through its lever system to secure the relation of parts illustrated in Figs. 5 and 6. This completely

closes the chest-ports 18 18<sup>a</sup> of the high-pressure cylinder and opens the relief-cocks, and, 70 as shown by the arrows in the former figure, the steam is supplied through the ports 16<sup>a</sup> and 23<sup>a</sup> and thence passes through the ports 25 and 26 and connecting chest-recess 21 into the casing-port 24<sup>a</sup> and then through the valve-passage 43<sup>a</sup>, casing-port 27<sup>a</sup>, and chest- 75 port 19<sup>a</sup> into the outer end of the low-pressure cylinder. As the piston advances the expanded steam in the opposite end of the cylinder exhausts through the chest-port 19, casing-port 27, valve-recess 42, casing-port 28, 80 and chest-port 20. For admission to the opposite end of the low-pressure cylinder the steam enters, as illustrated in Fig. 6, through the supply-ports 16 and 23 and then through the casing-recess 29, valve-passage 43, and 85 casing and chest ports 27 19. At the same time exhaust takes place through the chest-port 20<sup>a</sup>, casing-port 27<sup>a</sup>, valve-recess 42<sup>a</sup>, casing-port 28<sup>a</sup>, and chest-port 20<sup>a</sup>.

To secure the proper relation of the vari- 90 ous ports and passages under the movement of the casing, it will be noted that one of each of the pairs of coacting ports 19 27 19<sup>a</sup> 27<sup>a</sup> and 20 28 20<sup>a</sup> 28<sup>a</sup> has a width equal to at least double the travel of the casing. The ports 95 20 20<sup>a</sup> and 27 27<sup>a</sup> are here so illustrated. The inner opening of the port 24<sup>a</sup> is also similarly extended in width.

Having thus described my invention, I 100 claim—

1. The combination with high and low pressure cylinders and a valve-chest, of a casing located within the chest, a valve operable within the casing, and means for moving the casing to permit of steam being admitted 105 either successively to the high and low pressure cylinders or directly to the low-pressure cylinder.

2. The combination with high and low pressure cylinders and a valve-chest, of a casing 110 located within the chest, a valve operable within the casing, and means for moving the casing to permit of steam being admitted either successively to the high and low pressure cylinders or shut off from the high-pres- 115 sure cylinder and admitted to the low-pressure cylinder only.

3. The combination with high and low pressure cylinders, of a valve-chest provided with admission and exhaust ports and a recess, a 120 movable casing provided with cooperating ports, two of which may communicate through the recess, and a valve operable within the casing.

4. The combination with high and low pres- 125 sure cylinders, of a valve-chest provided with admission and exhaust ports, a movable casing provided with cooperating ports, two of which communicate through the body of the casing, and a valve operable within the casing. 130

5. The combination with high and low pressure cylinders, of a valve-chest provided with admission and exhaust ports and a recess, a movable casing provided with cooperating



ports, two of which may communicate through the recess and one of these communicate with another port through the body of the casing, and a valve operable within the casing.

5 6. The combination with high and low pressure cylinders, of a valve-chest provided with admission and exhaust ports, a movable casing provided with cooperating ports, two of which communicate through the body of the  
10 casing and have an interior opening equal in width to at least double the travel of the casing, and a valve operable within the casing.

7. The combination with high and low pressure cylinders, of a valve-chest provided with  
15 sets of admission and exhaust ports for each of the cylinders, a movable casing provided with common admission and exhaust ports cooperating with those for the high-pressure cylinder and separate admission and exhaust  
20 ports cooperating with those for the low-pressure cylinder, and a valve operable within the casing.

8. The combination with high and low pressure cylinders, of a valve-chest provided with  
25 sets of admission and exhaust ports for each of the cylinders, a movable casing provided with common admission and exhaust ports cooperating with those for the high-pressure cylinder, separate admission and exhaust  
30 ports cooperating with those for the low-pressure cylinder and two other ports which may coact for admission to the low-pressure cylinder, and a valve operable within the casing.

9. The combination with high and low pressure cylinders, of a valve-chest provided with  
35 sets of admission and exhaust ports for each of the cylinders, a movable casing provided with admission and exhaust ports cooperating with those for both cylinders, the width of  
40 both the admission and exhaust ports for the low-pressure cylinder in one of these coacting elements being at least double the travel of the casing, and a valve operable within the casing.

45 10. The combination with high and low pressure cylinders, of a casing provided with supply-ports and sets of admission and exhaust ports for each cylinder, of a valve operable within the casing provided at opposite ends  
50 with passages connecting the supply-ports with the admission-ports for the high-pressure cylinder, passages connecting the exhaust-ports of the high-pressure cylinder with the admission-ports for the low-pressure cylinder  
55 and passages connecting the admission and exhaust ports for the low-pressure cylinder.

11. The combination with high and low pressure cylinders, of a casing provided with supply-ports and common admission and exhaust  
60 ports for the high-pressure cylinder and common admission and exhaust and separate exhaust-ports for the low-pressure cylinder, and a valve operable within the casing provided at opposite ends with passages connect-  
65 ing the supply-ports with the admission-ports of the high-pressure cylinder and passages connecting these ports with the common ad-

mission and exhaust ports for the low-pressure cylinder, and passages connecting the admission and exhaust and separate exhaust-  
70 ports for the low-pressure cylinder.

12. The combination with high and low pressure cylinders, of a cylindrical casing provided with supply-ports and sets of admission and exhaust ports for each cylinder, of  
75 a generally cylindrical valve operable within the casing provided at opposite ends with passages connecting the supply-ports with the admission-ports for the high-pressure cylinder, circumferential passages connecting  
80 the exhaust-ports for the high-pressure cylinder with the admission-ports for the low-pressure cylinder and passages connecting the admission and exhaust ports for the low-pressure cylinder.  
85

13. The combination with high and low pressure cylinders, of a cylindrical casing provided with supply-ports and sets of admission and exhaust ports for each cylinder, of  
90 a generally cylindrical valve operable within the casing provided at opposite ends with passages connecting the supply-ports with the admission-ports for the high-pressure cylinder, passages connecting the exhaust-ports  
95 for the high-pressure cylinder with the admission-ports for the low-pressure cylinder and recesses at one side connecting the admission and exhaust ports for the low-pressure cylinder.

14. The combination with high and low pressure cylinders, of a valve-chest provided with  
100 a supply-port, admission and exhaust ports and a recess, of a movable casing provided with cooperating ports, two of which may communicate through the recess, and a valve  
105 operable within the casing provided with suitable passages, one of which connects a supply-port of the casing with the communicating ports.

15. The combination with high and low pressure cylinders, of a valve-chest provided with  
110 a supply-port and admission and exhaust ports, a movable casing provided with cooperating ports, two of which communicate through the body of the casing, and a valve  
115 operable within the casing provided with suitable passages, one of which connects the supply-port of the casing with the communicating ports.

16. The combination with high and low pressure cylinders, of a valve-chest provided with  
120 a supply-port and admission and exhaust ports, a movable casing provided with cooperating ports and a recess, and a valve operable within the casing provided with suitable  
125 passages, two of which may communicate through the casing-recess and connect the supply-port with an admission-port for the low-pressure cylinder.

17. The combination with high and low pressure cylinders, of a valve-chest provided with  
130 sets of admission and exhaust ports for each of the cylinders, a movable casing provided with common admission and exhaust ports



coöperating with those for the high-pressure cylinder and separate admission and exhaust ports coöperating with those for the low-pressure cylinder, and a valve operable within the casing provided with suitable passages, two of which may connect the ports for the high-pressure cylinder with the admission-ports for the low-pressure cylinder.

18. The combination with high and low pressure cylinders, of a valve-chest provided with supply-ports and sets of admission and exhaust ports for each of the cylinders, a movable casing provided with common admission and exhaust ports coöperating with those for the high-pressure cylinder, separate admission and exhaust ports coöperating with those for the low-pressure cylinder and two other ports which may coact for admission to the low-pressure cylinder, and a valve operable within the casing provided with suitable passages, two of which may connect the ports for the high-pressure cylinder with the admission-ports for the low-pressure cylinder and one of these two may connect the supply-port of the valve-chest and admission-port for the low-pressure cylinder through the two coacting casing-ports.

19. The combination with high and low pressure cylinders, of a valve-chest provided with sets of admission and exhaust ports for each of the cylinders, a movable casing provided with admission and exhaust ports coöperating with those for both cylinders, the width of both the admission and exhaust ports for the low-pressure cylinder in one of these coacting elements being at least double the travel of the casing, and a valve operable within the casing provided with separate admission and exhaust passages so located that both an admission and exhaust passage may communicate with the casing-ports for the low-pressure cylinder in all positions of the casing.

20. The combination with high and low pressure cylinders and a valve-chest, of cocks communicating with the high-pressure cylinder, a casing located within the chest, a valve within the casing, and means for simultaneously moving the casing and operating the cocks.

Signed by me at Boston, Massachusetts, this 4th day of December, 1902.

HENRY F. SHAW.

Witnesses:

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SYLVANUS H. COBB.