No. 830,811. PATENTED SEPT. 11, 1906.

E. E. THOMAS.

STEAM ACTUATED VALVE.

APPLICATION FILED OCT. 12, 1905.

4 SHEETS—SHEET 1.

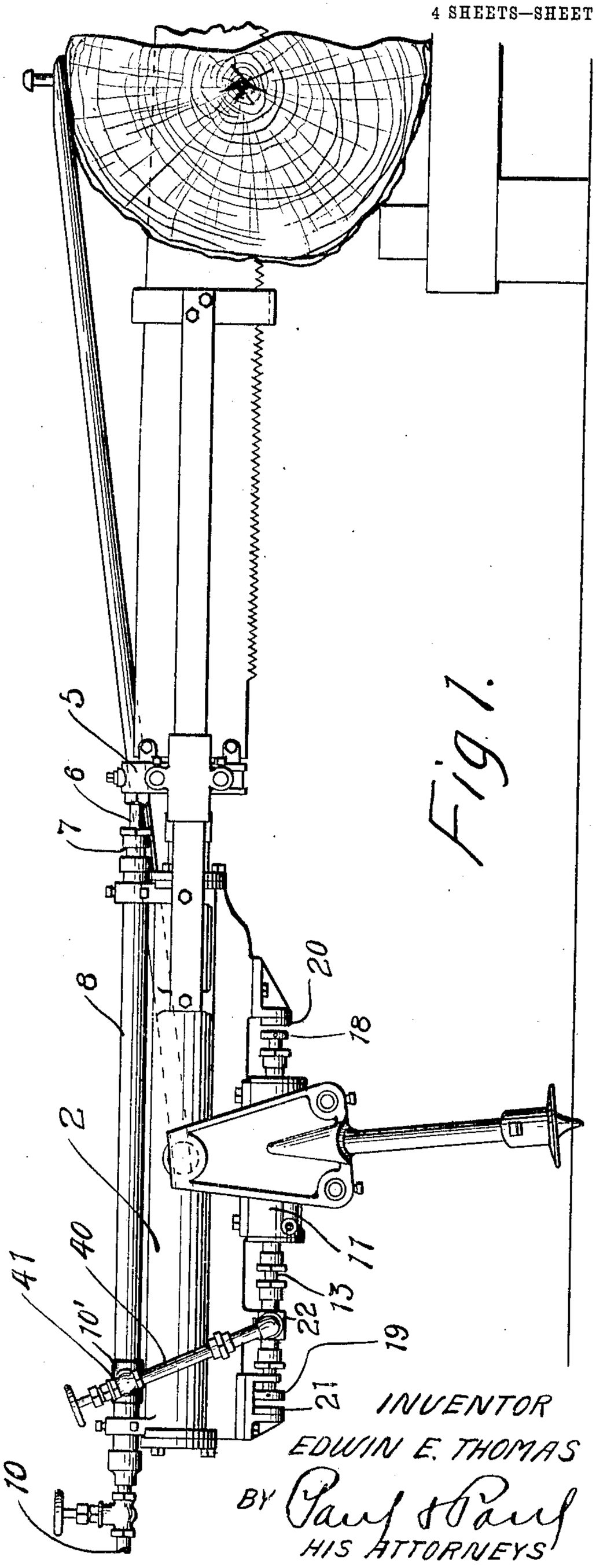

Fig. 1.

WITNESSES
A. M. Walstrom
C. Marmarou

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BY Paul & Paul
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4 SHEETS—SHEET 2.

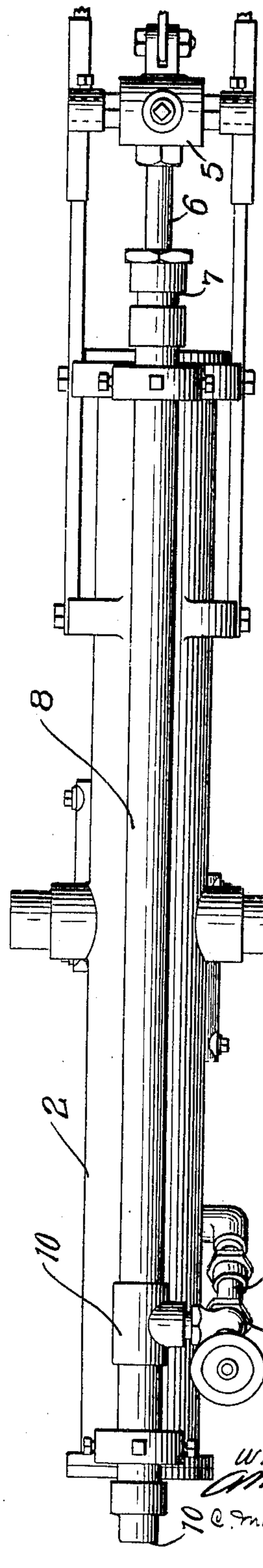

Fig 2.

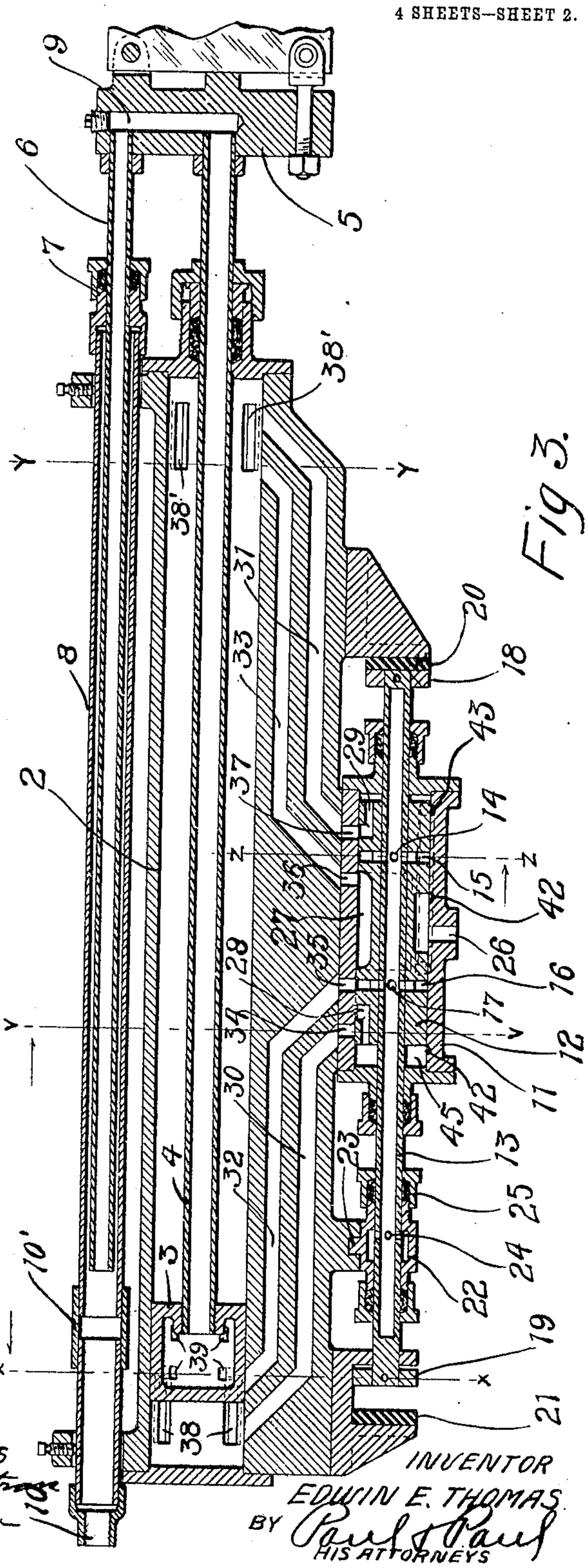

Fig 3.

WITNESSES

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4 SHEETS—SHEET 3.

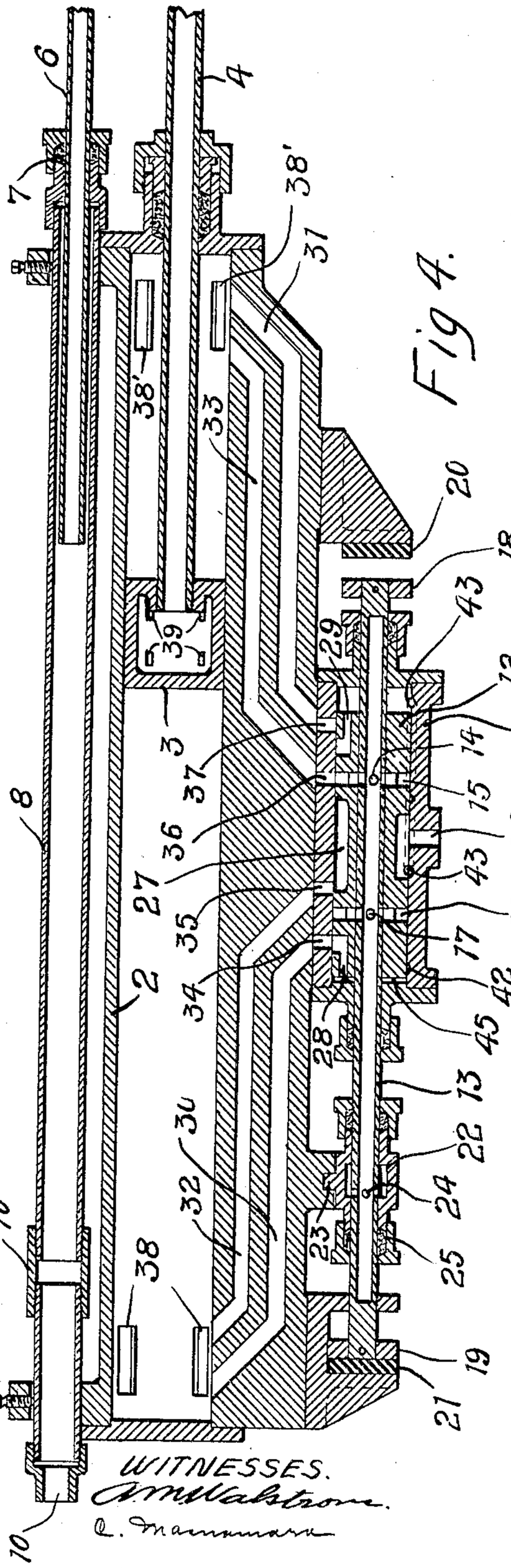

Fig 4.

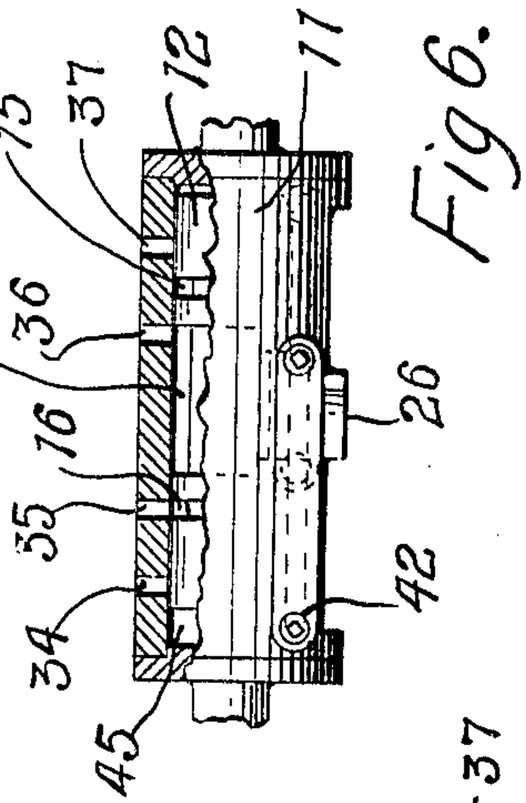

Fig 6.

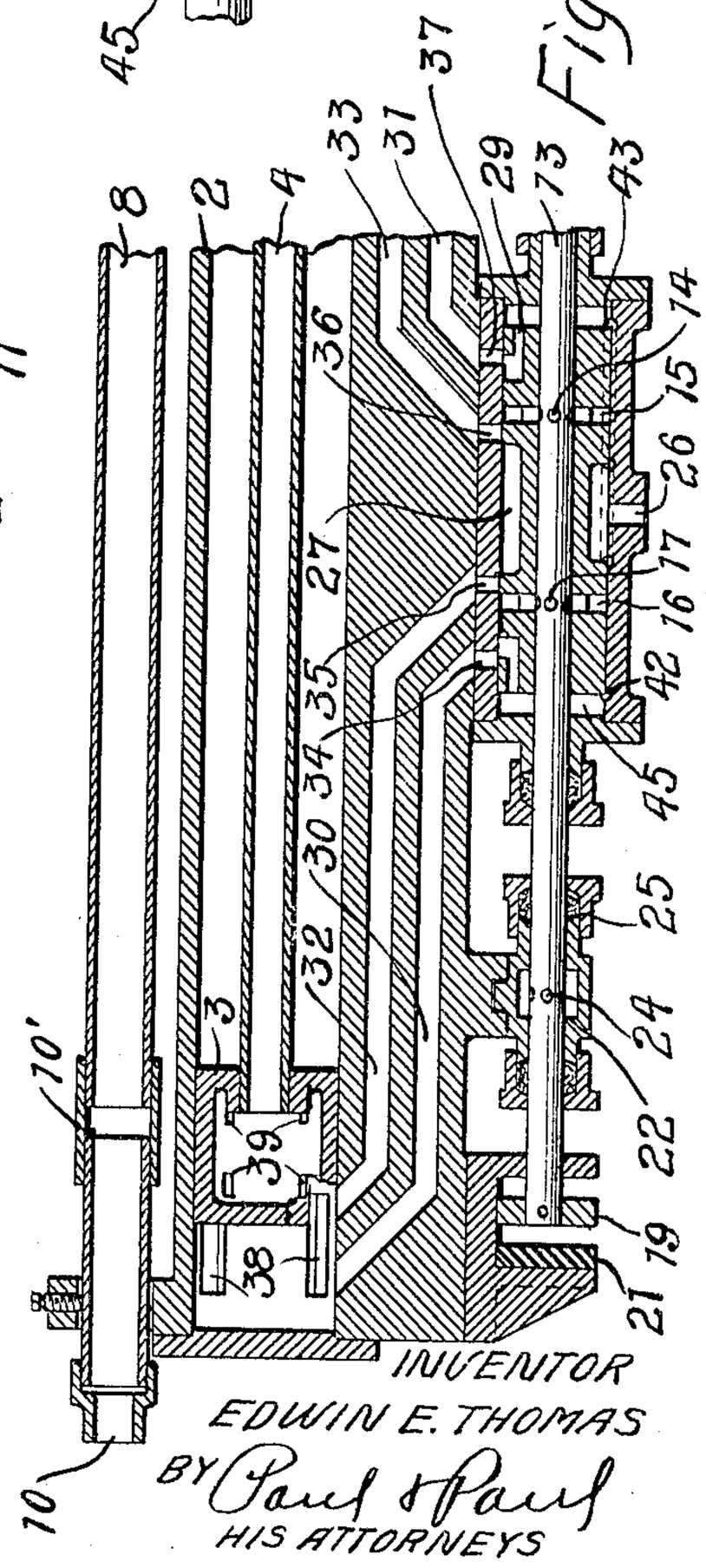

Fig 5.

WITNESSES.

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4 SHEETS—SHEET 4.

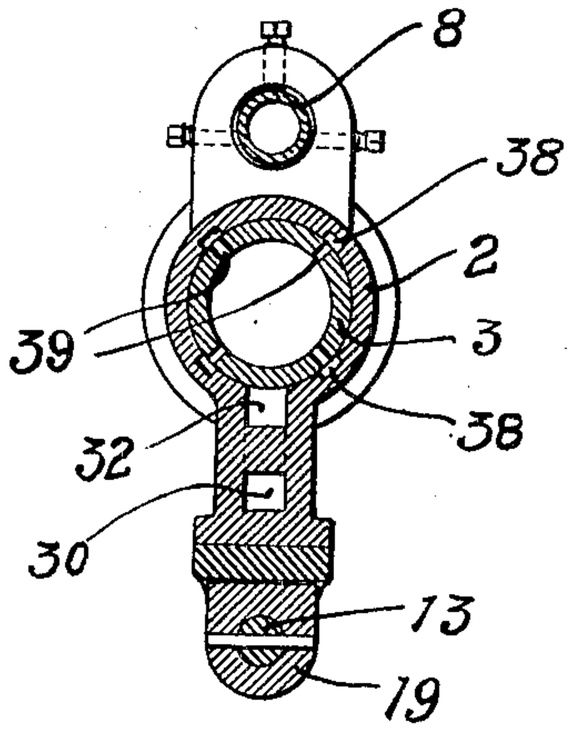

Fig 7.

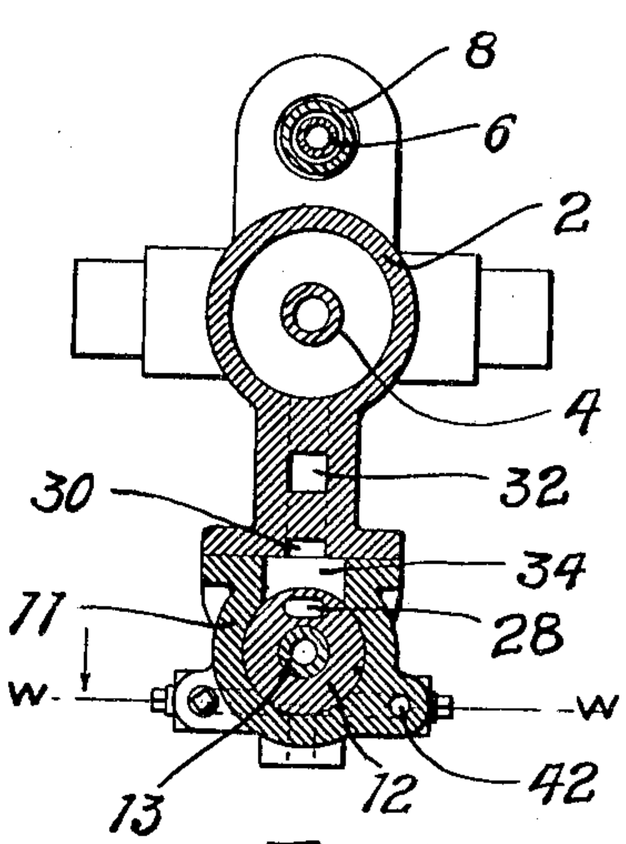

Fig 8.

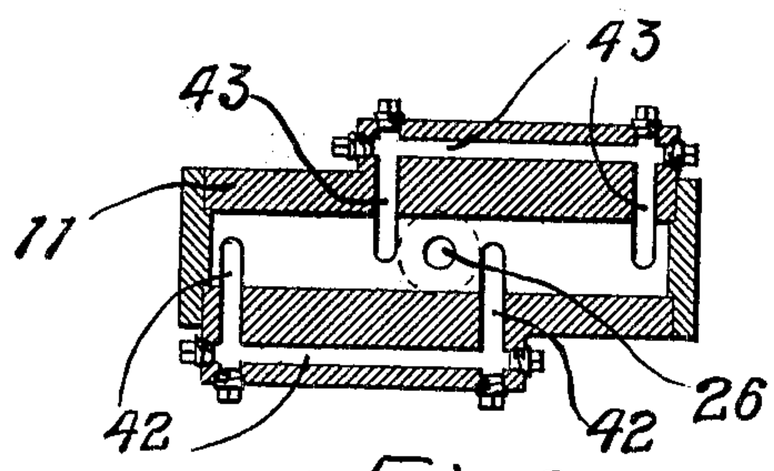

Fig 9.

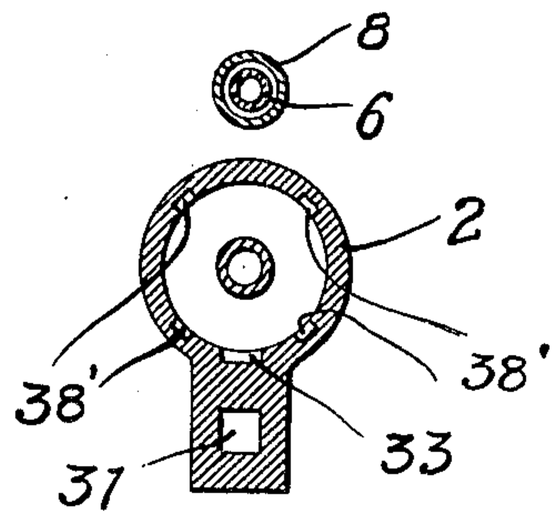

Fig 10.

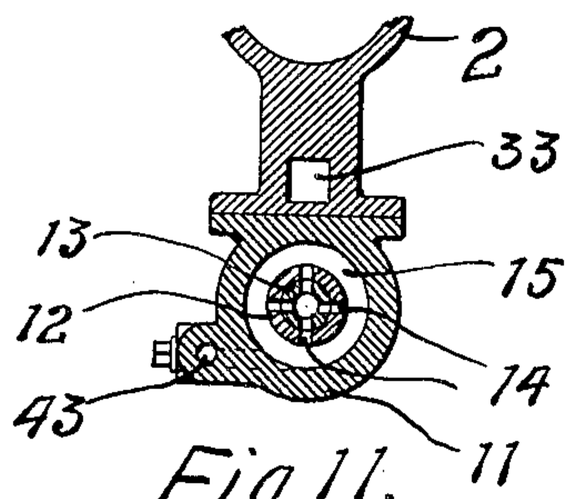

Fig 11.

WITNESSES

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UNITED STATES PATENT OFFICE.

EDWIN E. THOMAS, OF PORTLAND, OREGON.

STEAM-ACTUATED VALVE.

No. 830,811. Specification of Letters Patent. Patented Sept. 11, 1906.

Application filed October 12, 1905. Serial No. 282,385.

To all whom it may concern:

Be it known that I, EDWIN E. THOMAS, of Portland, Multnomah county, Oregon, have invented certain new and useful Improvements in Steam-Actuated Valves, of which the following is a specification.

My invention relates to engines designed particularly for operating drag-saws used in cutting logs for shingles, wood for fuel, bridge-timbers, and generally around timber and logging camps, and is also adapted for use with vertical sawing-machines, drills, &c. Heretofore it has been customary in engines used for this purpose to operate the valve by means of a mechanism carried by the cross-head or piston, which when near the end of its stroke will engage some appliance attached to the valve. Such valve-operating means has been found unsatisfactory, as it is practically impossible to keep the operating parts properly lubricated, and when the machines are handled by inexperienced persons, as frequently is the case, the wear of such parts is very rapid and soon leads to a condition that renders the machine unsuited for the purpose designed. Furthermore, in machines of the ordinary type there is no way of regulating the speed except by the movement of the operator's valve, and in the hands of an inexperienced or careless operator this has been found to be a very undesirable arrangement, often resulting, through the too-rapid or extreme opening of the valve, in serious damage to the machine or its parts.

The object, therefore, of my invention is to provide an engine of extremely simple construction having a minimum number of working parts and joints which are easily kept in proper adjustment and are comparatively inexpensive to manufacture and keep in repair.

A further object is to provide an engine which an unskilled person may operate without danger of damaging the machine; and a still further object is to provide an engine and valve which, though primarily designed for use with a drag-saw, is also adapted for a variety of other purposes.

My invention consists generally in an engine having a piston and a floating or loose valve operated by the fluid-pressure which moves the piston and without the employment of any mechanical appliance whatever between the valve and piston.

Further, the invention consists in providing means for regulating the speed of the engine through the travel of the main floating valve, such control being involuntary on the part of the operator and governed by the speed of the engine rather than by the movement of the stop or operator's valve.

Further, my invention consists in providing means whereby the piston and valve will be cushioned by the fluid-pressure when near the limit of their movement in each direction to prevent them from striking the ends of the cylinder or valve casing.

Further, the invention consists in providing means for equalizing the pressure on the ends of the valve to cause it to remain at rest during the time the piston is traveling nearly the length of the stroke in the cylinder.

In the accompanying drawings, forming part of this specification, Figure 1 is a side elevation of a drag-saw engine embodying my invention, showing the engine attached to a saw and in use. Fig. 2 is a plan view of the engine and cross-head. Fig. 3 is a longitudinal vertical section through the engine-cylinder and valve which controls the movement of the saw. Fig. 4 is a similar view, illustrating the piston and valve in proper position for starting the engine. Fig. 5 is a detail sectional view showing the position of the piston and valve after they have begun their movement toward the cross-head end of the cylinder. Fig. 6 is a detail sectional view illustrating the position of the balancing or equalizing ports in the valve-casing. Fig. 7 is a vertical transverse section on the line $x\ x$ of Fig. 3. Fig. 8 is a transverse vertical section on the line $v\ v$ of Fig. 3. Fig. 9 is a horizontal section on the line $w\ w$ of Fig. 8. Fig. 10 is a vertical section on the line $y\ y$ of Fig. 3. Fig. 11 is a transverse vertical section on the line $z\ z$ of Fig. 3.

In the drawings, 2 represents the cylinder of the engine; 3, a hollow piston having a hollow rod 4 secured to a cross-head 5.

6 is a steam-pipe, also secured at one end to the cross-head and extended through a stuffing-box 7 into the main steam-pipe 8, within which it is adapted to telescope or slide back and forth with the movement of the cross-head. A port 9 in said cross-head connects the pipe 6 with the hollow piston-rod 4. The pipe 8 is provided with a steam-inlet 10 and with a coupling 10′ for a stop-valve, to be hereinafter described.

11 is a valve-casing, 12 a slide-valve therein, and 13 is a hollow stem extending through said valve and having closed ends

and provided with ports 14 and 17, communicating with annular ports 15 and 16, provided in said valve and leading to the outside of the same. Buffer-plates 18 and 19 are mounted on the ends of said stem and contact with plates 20 and 21, of yielding material, such as rubber, to limit the movement of said stem and take up the impetus or momentum of the same. A steam-chest 22 is mounted on said stem and held in place by a lug 23.

24 represents ports leading from the interior of the valve-stem to the steam-chest 22. Stuffing-boxes 25 are provided to prevent the escape of steam from the steam-chest and valve-casing.

26 is an exhaust-port in the valve-casing, and 27 an annular exhaust cavity or chamber provided in the valve near its middle and communicating at all points in the travel of the valve with said exhaust-port.

28 and 29 are ports in the ends of the valve 12, through which live steam enters from the steam passages or ducts 30 and 31 to operate the valve, and 32 and 33 are passages through which live steam passes from the valve to operate the piston.

34, 35, 36, and 37 are ports extending through the valve-casing and communicating, respectively, with the passages 30, 32, 33, and 31.

38 and 38′ are longitudinal grooves provided on the inner surface of the cylinder near each end, and 39 represents ports provided in the walls of the hollow piston 3 and adapted to register with the grooves 38 and 38′ when the piston is near the limit of its stroke in each direction.

40 (see Figs. 1 and 2) is a by-pass pipe provided with a stop-valve 41 and leading from the coupling 10′ in the main steam-pipe 8 to the steam-chest 22, the valve 41 allowing the attendant to regulate the supply of steam admitted to the valve-stem 13 for operating the piston 3.

42 and 43 are steam-passages connecting the exhaust-chamber 27 with the spaces between the ends of the valve-casing and the slide-valve 12, one of said spaces being indicated by numeral 45, the connection of the spaces at the ends of the valve-casing with said passages being made alternately as the valve is moved and the piston reversed.

The operation of the engine is as follows: Assuming the piston and slide-valve to be in the position indicated in Fig. 4, steam is admitted to the pipe 8, from whence it will flow through the pipe 6 and port 9 into the hollow rod 4 and piston 3. The stop-valve 41 is then opened a suitable distance and the steam allowed to flow through the pipe 40 into the steam-chest and from thence into the hollow stem 13 and through the ports 14, 15, and 36 to the steam-passage 33 and to the cylinder in the rear of the piston. The piston will immediately be driven forward, and as it approaches the position shown in Fig. 3 the ports 39 will register with the grooves 38, and sufficient steam will flow out ahead of the piston to act as a cushion therefor between it and the end of the cylinder and prevent it from striking said end and being damaged by the shock or causing injury to the other parts of the engine. The steam-cushion will stop further movement of and reverse the piston, and the steam flowing down through the passage 30 and the port 34 will enter the port 28 and pass into the space 45 between the end of the valve and its casing, whereupon the valve will be moved immediately to the position indicated in Fig. 3, and the steam will flow from the stem 13 through the ports 16 and 35 into the steam-passage 32 and open the rear of the piston to the exhaust. During this time the steam has been flowing through the hollow piston and the ports 39 into the grooves 38 and the end of the cylinder and driving the piston toward the opposite or cross-head end of the cylinder. As soon as the piston has moved a sufficient distance to cut off the ports 39 from communication with the grooves 38 the passage 32 will be uncovered, and the steam flowing therefrom into the end of the cylinder will drive the piston to the other end. As soon as the piston reaches said other end of the cylinder the ports 39 will communicate with the grooves 38′, and steam will flow from the interior of the piston into the stuffing-box or cross-head end of the cylinder and form a cushion for the piston at that end, reversing its direction of movement, as described with reference to the other end of the cylinder. At the same time the steam will flow down through the passage 31 and the ports 37 and 29 into the space between the end of the valve 12 and its casing and move the said valve back to the position shown in Fig. 4. The ports 42 and 43 serve to equalize the pressure of the exhaust on the valve 12 and hold it at rest or stationary during the intermediate movement of the piston. For instance, suppose the piston and valve to be in the position indicated in Fig. 3. The space at the right hand or in the rear of the piston will be on the exhaust through the passage 33, the chamber 27, and the port 26. The passage 31 is also connected with the cylinder and with the space between the end of the valve and the head of the casing through the ports 37 and 29, and the entrance of the exhaust into this space would tend to move the valve prematurely; but the passage 42, leading from the exhaust-chamber 27 to the space 45, allows the exhaust to flow into the said space and exert a sufficient pressure on that end of the valve to equalize or balance the pressure on the other end, and hence keep the valve stationary until the piston reaches a point where the steam will flow into the grooves 38′ and ports 37 and 29 and

move the valve into position to admit steam to the passage 33 of the cylinder for the next stroke of the piston. When the valve 12 is in the opposite end of its casing from that shown, the port 43 serves to equalize the exhaust-pressure on the ends of the valve. The ports 42 and 43 also serve to regulate the speed of the engine by means of the pressure delivered through the stop-valve. When this valve has been opened to a point that will cause the operation of the engine at its maximum speed with a given boiler-pressure, any further opening of the stop-valve will automatically reduce the distance of the travel of the main or floating valve, thereby cutting down the port-openings and the supply of pressure to the cylinder and maintaining the engine at a practically constant speed. With this arrangement it will be impossible for an inexperienced or careless operator to wreck or damage the engine through the too rapid or extreme opening of the stop-valve. The control is positive and instantaneous. If the operator opens the valve wider than is necessary to supply the proper pressure to the piston and valve, the movement of the valve will be lessened and the port-openings correspondingly reduced to compensate for the overplus of pressure admitted to the valve.

In building the engine the ports will be properly proportioned according to the desired speed of the engine. In this engine it will be noted that the fluid-pressure flowing through ahead of the piston at each end of the cylinder will act as a cushion at that point and reverse the movement of the piston and the pressure will flow from the cylinder down into the valve-casing between its end and the valve and move the valve to the opposite end of the casing. This movement will uncover the passage leading to the cylinder, through which pressure will pass to drive the piston to the other end of the cylinder, where the operation described will be repeated. When the pressure is being admitted at one end of the cylinder and the other end is on the exhaust, the equalizing-ports will cause the valve to be balanced and remain stationary while the piston is traveling from one end of the cylinder to the other. If there is any excessive pressure, due to the too-wide opening of the stop-valve, it will flow through the balance-ports ahead of the valve and limit its travel and prevent the full opening of the ports leading to the cylinder. I am thus able to provide an engine which does not require a skilled or experienced person to operate it. The valve is operated entirely by the pressure and neither the piston nor the valve have any moving parts to come in contact with one another and liable to be broken or disarranged. The engine is automatically governed, the ports being partially choked and the area of the passage cut down whenever the stop-valve is opened to deliver more than enough steam to run the engine at its normal speed. A uniform maximum speed for the engine under all conditions is thus insured.

I have shown and described this engine operated by steam-pressure; but it will be understood that any other elastic-fluid pressure, such as air, may be employed with equally good results.

I claim as my invention—

1. The combination, with a cylinder having a piston and two passages leading into each end, of a loose or floating valve having ports communicating respectively with said passages, means for delivering a fluid-pressure to the piston and to said valve and means whereby the pressure delivered to said piston will, when the piston is near the end of its stroke, be conducted ahead of the piston and admitted through one of said passages to said valve to operate it and open the other cylinder-passage at the same end for the admission of fluid-pressure to the cylinder, substantially as described.

2. The combination with a cylinder and its piston having a plurality of passages leading into its ends, of a floating valve having an exhaust-port, and ports communicating respectively with a passage from one end of said cylinder and with a pressure-supply to conduct it into the other end of said cylinder when said piston is near said other end, and said valve being moved by the pressure flowing through said passage from said cylinder to open said one end of said cylinder to the pressure-supply and the said other end to said exhaust, substantially as described.

3. The combination with a cylinder and piston provided with means for delivering fluid-pressure in front of said piston as it approaches the ends of said cylinder, of a slide-valve having a casing and ports communicating alternately with the ends of said cylinder as said piston approaches said ends and with the space between the ends of said casing and said valve, and said valve-casing having ports communicating alternately with the ends of said cylinder and with the pressure-supply, and said last-named ports being normally closed during the initial movement of said valve and open during its final movement, substantially as described.

4. The combination with a cylinder having grooves in its inner surface near each end, of a piston having ports adapted to register with said grooves when said piston is near the end of its stroke in each direction, a hollow piston-rod communicating with said ports and with a fluid-pressure supply, a valve-casing, passages provided in said cylinder and communicating with the ports in said casing and with the ends of said cylinder, and a slide-valve in said casing having ports communicating with said passages and

with the space between the ends of said casing and said valve, substantially as described.

5. The combination with a cylinder provided with interiorly-arranged passages near each end, of a piston having ports to register with said passages when said piston is near the end of its stroke in each direction, a hollow piston-rod communicating with said ports, a fluid-pressure supply communicating with said rod, a valve-casing having ports, passages leading from said ports to the ends of said cylinder, a slide-valve having ports communicating with said passages, a hollow stem for said valve having ports communicating with said valve-ports, a chest communicating with the interior of said stem, and a by-pass pipe having a valve leading from said fluid-pressure supply to said chest, substantially as described.

6. The combination with a cylinder having interiorly-arranged passages near each end, of a piston having ports to register with said passages when near the limit of its stroke in each direction, a hollow piston-rod communicating with said ports and with a fluid-pressure supply, a valve-casing having an exhaust-port, passages 30, 32, 33 and 31 communicating with the interior of said valve-casing and with the ends of said cylinder, a slide-valve provided in said casing and having an exhaust-chamber communicating with said exhaust-port, and ports 28 and 29 communicating alternately as the valve is moved with the passages 30 and 31 and the spaces between the ends of said valve and the ends of said casing, said valve also having ports 15 and 16 communicating alternately with said passages 33 and 32, and means connecting said ports 15 and 16 with the fluid-pressure supply, substantially as described.

7. The combination with a cylinder and piston having means for delivering a fluid-pressure in front of said piston as it approaches the ends of said cylinder, said cylinder having passages 30, 31, 32 and 33 leading into its ends, a valve-casing communicating with said passages 30, 31, 32 and 33 and having an exhaust-port, a slide-valve provided in said casing having ports 28 and 29 communicating alternately with said passages 30 and 31 and with the ends of said casing whereby when said piston-ports register with the passages in said cylinder fluid-pressure will pass through said passages 30 and 31 to operate said valve, and said valve having ports 15 and 16 communicating alternately with said passages 32 and 33 and connected with a fluid-pressure supply, substantially as described.

8. The combination with a cylinder and its piston, of a loose or floating valve having ports communicating with the ends of said cylinder and whereby the approach of said piston to the limit of its stroke in either direction will admit pressure to said valve to operate it also, and means for equalizing the pressure on said valve during the intermediate movement of said piston.

9. The combination with a cylinder and piston provided with means for delivering fluid-pressure in front of said piston as it approaches the ends of said cylinder, of a slide-valve having a casing and ports communicating with the ends of said cylinder and with the space between the ends of said casing and said valve, and said valve having also an exhaust-chamber and ports communicating with the ends of said cylinder and with the pressure-supply, and means for equalizing or balancing the pressure on the ends of said valve during the intermediate travel of said piston, substantially as described.

10. The combination with a cylinder having interiorly-arranged passages near each end, of a piston having ports to register with said passages, and a hollow piston-rod communicating with said ports and with a source of fluid-pressure, said cylinder having passages 30, 31, 32 and 33 leading into its ends, a valve-casing communicating with said passages and having an exhaust-port, a slide-valve having an exhaust-chamber communicating with said port, and ports 28 and 29 communicating alternately with the space between the ends of said valve and said casing and with said passages 30 and 31, said valve also having ports 15 and 16 communicating with a fluid-pressure and alternately with said passages 33 and 32, and ports 42 and 43 communicating respectively with said exhaust-chamber and with the ends of said casing, substantially as described.

11. The combination with a cylinder and piston having means for delivering a fluid-pressure to the ends of said cylinder, of a slide-valve having ports communicating with the ends of said cylinder and operated by the pressure therefrom, means having a stop-valve for delivering fluid-pressure to said slide-valve for said cylinder, and means whereby an excess of pressure delivered by said stop-valve will lessen the travel of said slide-valve and cut off the supply of pressure to said cylinder, substantially as described.

12. The combination with a cylinder and piston provided with means for delivering fluid-pressure in front of said piston as it approaches the ends of said cylinder, of a valve having a casing, and ports communicating with the ends of said cylinder and with the space between the ends of said casing and said valve, and said valve having also an exhaust-chamber and ports communicating with the ends of said cylinder and with the pressure-supply, a stop-valve for controlling the admission of pressure to said valve, and ports connecting the ends of said valve-casing with said exhaust-chamber whereby when said stop-valve is opened too quickly or too far

the excess pressure will flow ahead of said valve and lessen the travel of the same, substantially as described and for the purpose specified.

13. The combination with a cylinder having fluid-pressure passages near one end, of a piston having ports to register with said passages when said piston is near the end of its stroke, and a hollow piston-rod communicating with said ports and with a fluid-pressure supply whereby a cushion will be formed between the piston and the cylinder-head, for the purpose specified.

14. The combination with a cylinder having grooves in its inner surface near each end, of a piston having ports to register with said grooves when said piston is near the end of its stroke in each direction, and a hollow piston-rod communicating with said ports and with a fluid-pressure supply whereby a cushion will be formed in each end of the cylinder between its heads and the approaching piston, substantially as described.

15. The combination with a cylinder and piston provided with means for delivering fluid-pressure in front of said piston as it approaches the ends of said cylinder, of a sliding valve having a plurality of ports at each end communicating with a corresponding number of passages leading to the ends of said cylinder and said valve having pressure-supply and exhaust ports, and one of said valve-ports in each end communicating with a space provided at the ends of said valve and the other valve-ports communicating alternately with the pressure-supply and exhaust ports whereby when fluid-pressure is admitted to one end of said cylinder in the rear of its piston and said piston moves to the opposite end of the cylinder, fluid-pressure will enter the space at one end of said valve and operate it to cut off the fluid-pressure to said one end of the cylinder and open that end to the exhaust and admit pressure to the other end of the cylinder, substantially as described.

In witness whereof I have hereunto set my hand this 25th day of September, 1905.

EDWIN E. THOMAS.

Witnesses:

ELIJAH CORBETT,

G. A. HIBBARD.