F. HYMANS.

SLOW-DOWN ATTACHMENT FOR HYDRAULIC VALVES.

APPLICATION FILED APR. 30, 1906.

955,876.

Patented Apr. 26, 1910.

3 SHEETS—SHEET 1.

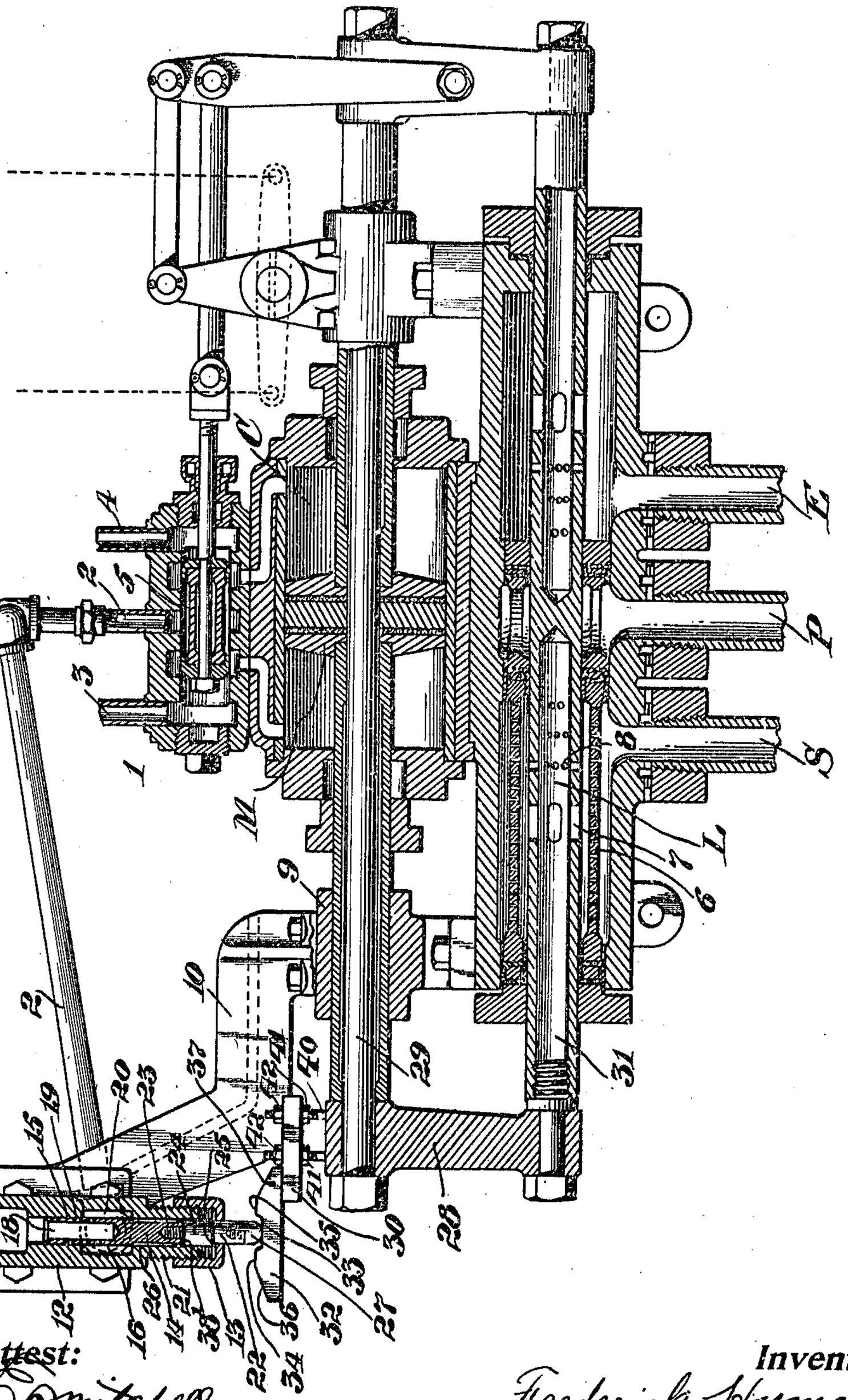

Fig. 1.

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Fig. 2.

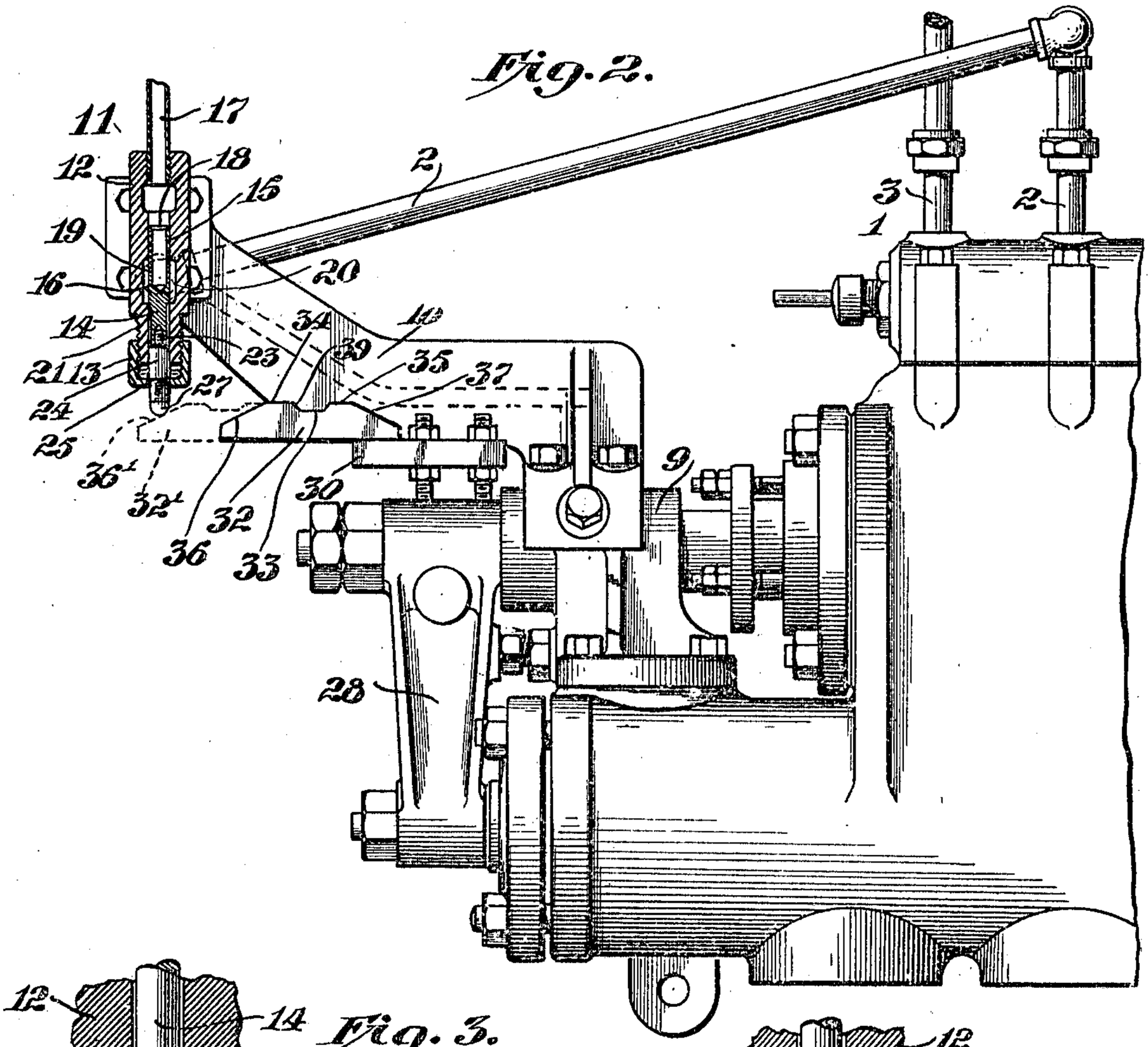


Fig. 3.

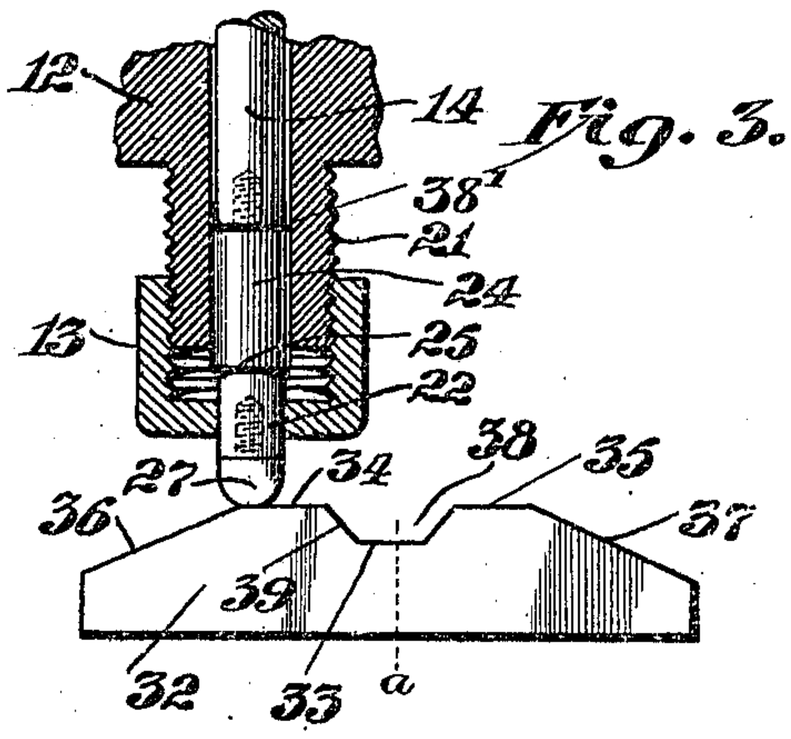
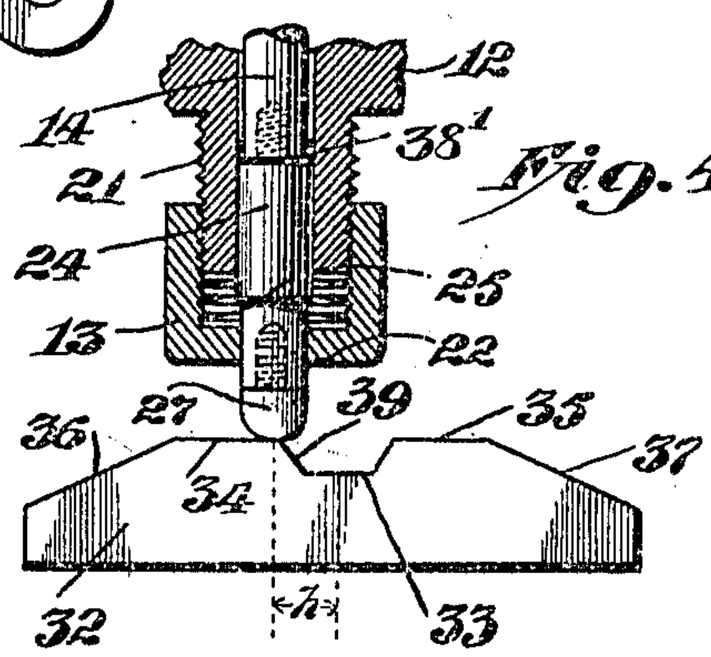


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

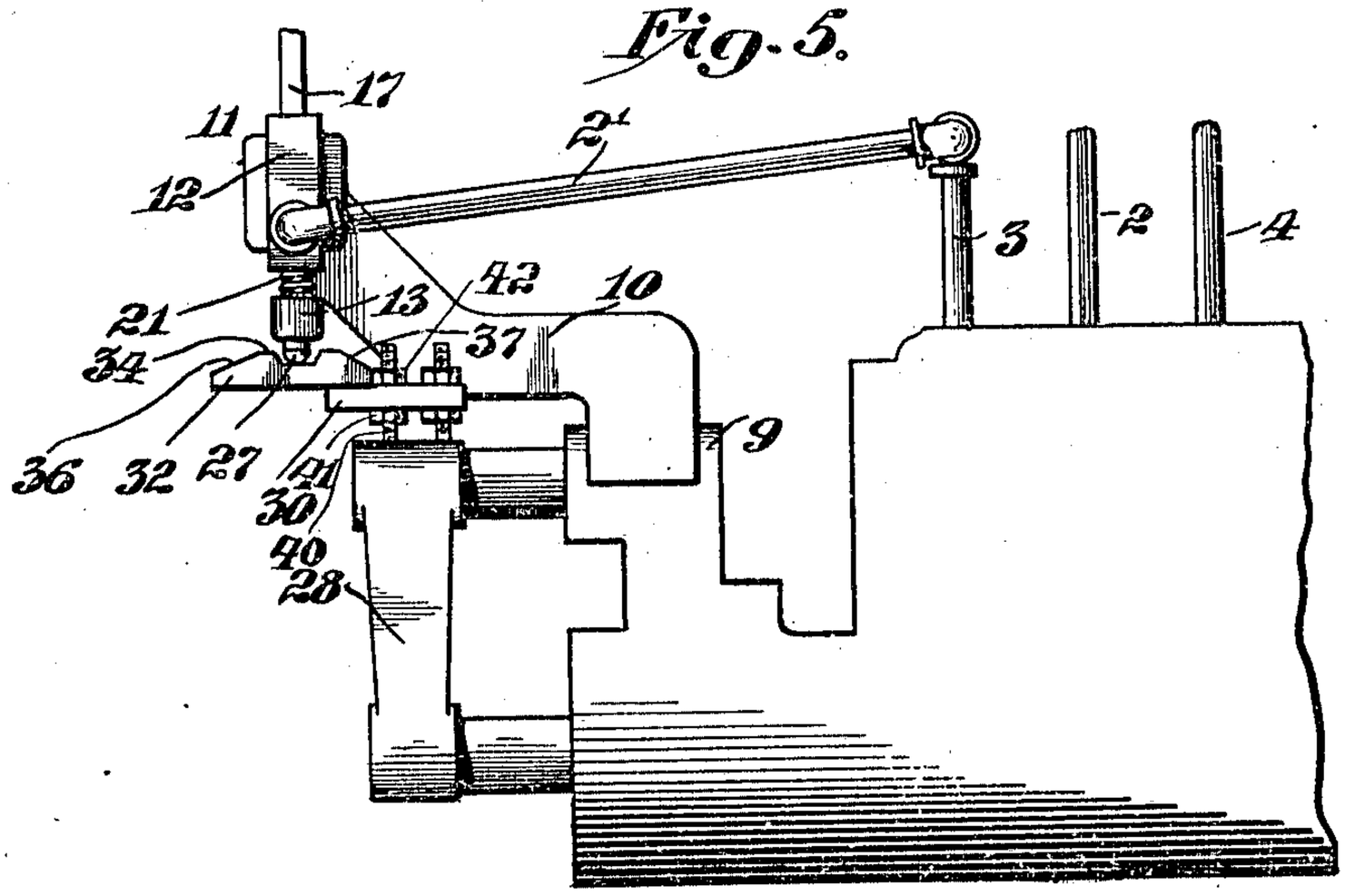
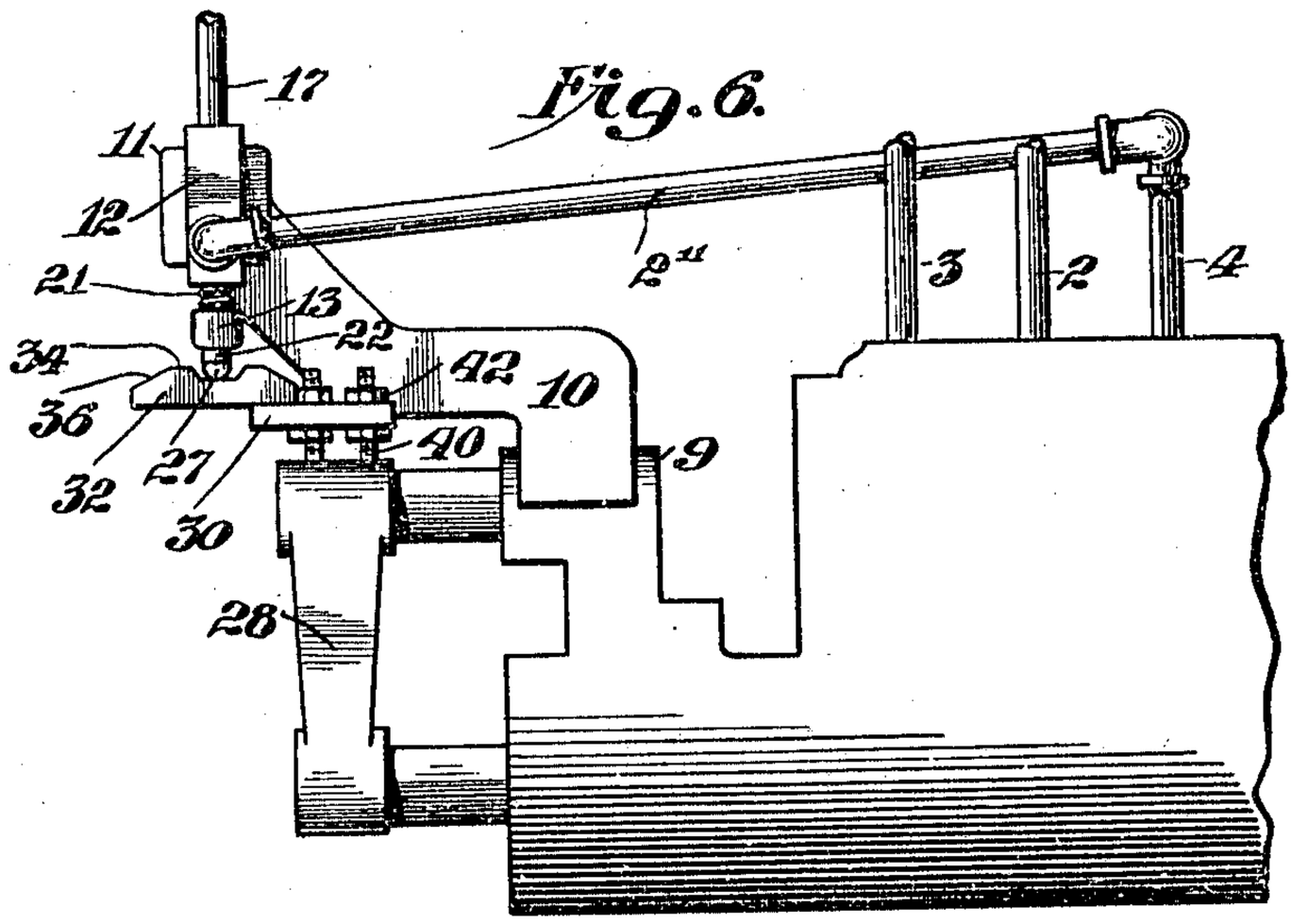


Fig. 6.



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UNITED STATES PATENT OFFICE.

FREDERICK HYMANS, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

SLOW-DOWN ATTACHMENT FOR HYDRAULIC VALVES.

955,876. Specification of Letters Patent. Patented Apr. 26, 1910.

Application filed April 30, 1906. Serial No. 314,378.

To all whom it may concern:

Be it known that I, FREDERICK HYMANS, a subject of the Queen of the Netherlands, residing in Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Slow-Down Attachments for Hydraulic Valves, of which the following is a specification.

My invention relates to means for operating hydraulic valves and is an improvement on the valve mechanism illustrated in the patent to Witte, No. 700,877, May 27, 1902, valve mechanism for hydraulic elevators.

One of the objects of my invention is the provision of an attachment for slowing down the movement of a hydraulic valve at a predetermined point in its travel.

A further object of the present invention is to provide means for correcting any small defect of graduation of a pilot controlled main valve so that a perfect stop from full speed may be obtained.

Another object is to provide means for permitting the operation of a hydraulic elevator car through small distances with accuracy and without teeter or vibration at the stop.

More particularly it is one of the objects of my invention to provide an attachment to a pilot-controlled main valve of a hydraulic elevator apparatus, which will automatically correct any little defect of the graduation of the main valve by increasing or decreasing the valve speed at the proper point and thus allow the car to be operated over small distances with accuracy and without any up and down vibration at the stop, the novel combinations of elements being set forth in the appended claims.

Other objects will appear hereinafter.

Corresponding reference characters designate similar parts throughout the various views.

In the accompanying drawings, Figure 1 represents a vertical longitudinal sectional view, parts being in side elevation, of a hydraulic elevator controlling valve mechanism with my improved attachment connected therewith; Figs. 2, 5 and 6 illustrate modifications, and Figs. 3 and 4 show details.

For ordinary elevator service the graduation of the main valve must take care of a great variety of loads and speeds in starting, as well as stopping, and it has therefore been found extremely difficult to do justice to all conditions. The difficulties naturally increase with the speed and the fluid pressure depended upon for operating the elevator.

The graduation of the main valve, that is, the relation of its parts to effect the desired speed of the elevator car when the valve has been opened can never be correct for more than one given condition, and may produce different results under the same load conditions, as when the valve is only partly opened. A valve arranged to have a predetermined gradual movement, or a predetermined graduation, may therefore bring an elevator car to a substantially perfect stop gradually from full speed, but will dance or vibrate up and down on the stop of small motions. In other words, the ordinary arrangement of main valve, motor and pilot valve may effect a gradual stop of the car without shock or jar from full speed or from full open position of the main valve to closed position. But, when a good landing is not made and it is desired to move the car back or farther on a short distance, a small opening of the main valve and its closure may be so sudden as to cause the car to teeter. It is one of the objects of my invention to provide means for permitting such small movement of the car without causing any shock or jar in the valve apparatus and consequent teetering of the car.

My improved attachment, hereinafter fully described may be used in connection with any pilot-controlled valve, high or low pressure, and is intended to correct any small defect of the graduation of the main valve, so that a perfect stop from full speed may be obtained and also to permit the elevator car to be moved small distances with great accuracy, and without teeter at the stop. As will be explained hereinafter, my

invention which comprises a slow-down valve will correct any little defect of the graduation of the main valve by increasing or decreasing the valve speed at the proper point.

Referring to the drawings, Fig. 1 illustrates a pilot-controlled hydraulic valve which may be used in connection with a hydraulic elevator system, as shown in the patent to Witte, No. 700,877, noted above, my improved slow-down valve being connected with the pilot-valve and arranged to be operated upon movement of the main valve.

Inasmuch as the main valve mechanism is fully disclosed in the patent referred to a brief description here is all that is deemed necessary.

S, P and E designate, respectively, the supply pipe, machine pipe and exhaust pipe of the valve apparatus.

L is the main valve which is rigidly connected to the piston M which is adapted to move in the hydraulic motor cylinder C.

1 designates the pilot valve mechanism which is connected to the motor and main valve and may be operated from the car in the well known manner.

2 designates the supply pipe of the pilot valve mechanism and 3, 4 its exhaust pipes. When the pilot valve 5 is moved in one direction or the other the fluid, preferably under low pressure as compared with the pressure in the main supply pipe S, enters the cylinder C to force the piston M in the proper direction and move the main valve L in the same direction. For example, if the pilot valve 5 is moved to the right the exhaust pipe 4 will be closed and the exhaust pipe 3 opened; also communication will be established between the pipe 2 and the cylinder C to the right of the piston M. The latter will thereupon be moved to the left and so also the main valve L. The pipe P connected to the hydraulic elevator cylinder will then be placed in communication with the exhaust pipe E and the car may descend by reason of its unbalanced load. If the valve L is moved in the opposite direction the supply pipe S will be connected through the strainer 6, elongated openings 7, and graduated openings 8 to the machine pipe P to cause the motion of the car to be reversed and therefore moved upwardly.

Connected to some fixed point of the valve apparatus, as for example, the slide bearing 9, is a bracket 10. To the upper end of this bracket is secured the slow-down valve 11 which comprises a valve body 12, a valve cap 13, a valve plunger 14, and a connection at 16 with the supply pipe 2. The plunger 14 is hollow or cup-shaped at its upper portion, as indicated at 18, and is provided with a plurality of holes 19 to establish communication between the pressure supply pipe 17 and the chamber 20, and thence to the pilot valve, through the pipe 2.

The lower portion of the valve body 12 is screw-threaded at 21 and provided with a screw-threaded cap or cup 13 which acts to limit the downward movement of the plunger 14, and therefore regulates the number of holes 19 opened. The plunger 14 is preferably made up of a number of parts secured together but may be integral if desired. In this instance the upper portion is the valve proper in that it contains the holes 19 whereas the lower portion 24 which fits snugly in the cylindrical passage 26 in the valve body, is secured, as by means of the screw 23, to the said valve. In this instance I have shown a leather 38′ between parts 14 and 24, the screw 23 being the means for securing such leather in position. The cylindrical portion 24 with the leather 38′ is in the nature of a piston and reduces the leakage of the fluid out through the bottom of the slow-down valve to a minimum.

Extending downwardly from the small cylinder 24 is an additional cylinder or stem of reduced diameter so as to leave a shoulder 25. This stem fits into a central opening in the bottom of the inverted cap 13 and is adapted to slide up and down therethrough. It is now obvious that when the valve plunger in its entirety is free to move downwardly, the shoulder 25 will abut against the bottom of the cup 13 to limit the downward travel of the valve proper and consequently also limit the number of holes 19 opened from the pipe 17 to the pipe 2.

The extreme lower end or toe 27 of the valve plunger is made semi-cylindrical in shape and may be integral with the stem 22 or secured thereto in some suitable manner. Connected to some moving part of the main valve mechanism, as, for example, the cross-piece 28, is a bracket 30 carrying a cam 32. This cam is arranged in the path of the toe 27 of the slow-down valve plunger and its upper surface is of such shape as to accomplish the objects of the invention. The cam and bracket are also adjustable vertically on the screw-threaded bolts 40, 40, which are rigidly secured to the cross-piece 28 in this instance. Nuts 41, 41 and 42, 42 are employed for securing the cam in proper position in an evident manner and if desired the holes for the bolts 40, 40 in the bracket 30 may be enlarged so that the cam may also be tilted and secured in adjusted position by the nuts. Preferably, however, I construct the parts so that the cam will be moved vertically to maintain the halves of the cam symmetrical with respect to the slow-down valve.

Fig. 1 shows the relative position of the slow-down valve and the cam 32 when the main valve L is in central position. That is, the toe 27 rests on the central horizontal portion 33 of the cam and the shoulder 25 assumes a position a short distance above the bottom of the cup 13. A number of the holes 19 will therefore be closed, or in other words, the valve is in such a position that the flow of the fluid through the same will be slightly throttled. It should be noted that the fluid pressure acting on the top of the valve plunger 14 forces the latter down against the cam 32, and in such positions of the main valve L when the plunger would not be supported by the cam, said plunger will go down until its shoulder 25 rests on the valve cap 13. If the valve plunger moves downwardly it will be evident that a greater number of the holes 19 are opened, thus increasing the area for flow of fluid from the supply pipe 17 to the pilot valve 1. Consequently the downward motion of the valve plunger 14 corresponds to an increase of the speed of the main valve, and the upward motion to a decrease. If desired, the upper portion of the valve plunger which is shown in the chamber 20 may be of slightly enlarged diameter so that its shoulder will rest on the bottom of said chamber when the plunger is not held up by the cam. It is preferable, however, to permit a free motion of the plunger in the passage 26 and depend on the shoulder 25 and cap 13 entirely as the latter is adjustable. Assuming that the shape of the cam has been properly designed to produce the desired results, the operation of my invention may be explained as follows: In Fig. 2 the main valve and also the cam 32 are shown in their extreme right-hand positions to effect an upward movement of the car. The valve plunger 14 is then entirely free and rests on the cap 13. The maximum number of holes 19 now connect the pipes 17 and 2, and when the pilot valve 5 is moved in the proper direction the main valve L may be moved back to central position with maximum speed. That is, it will move toward the left as viewed in Fig. 2 with a predetermined maximum speed until the cam 32 assumes the dotted line position 32′. This part of the stroke will be made quickly by reason of the slow-down pilot valve 11 being wide open, and will also be made with substantially constant speed. This speed may be regulated by means of the cap 13. Screwing the same up will effect a reduction in speed and screwing the same down will effect an increase of speed. Upon the engagement of the cam with the toe 27 the latter will ride up on the surface 36 or follow the grade thereof. This will force the slow-down valve plunger 14 to move upwardly and the flow of fluid from the pipe 17 to the motor C will be gradually throttled. That is, the upward movement of the plunger gradually cuts down the area of the holes 19 exposed in the chamber 20 or through which the fluid enters the motor pilot valve 1 and thus effects a gradual slowing down of the main valve. When the main valve approaches farther toward its central position the toe 27 assumes a position on the horizontal portion 34 of the cam as indicated in Fig. 3. From this position to that indicated in Fig. 4 the main valve will travel with a slow and constant speed as the slow down valve is held substantially stationary.

When the position indicated in Fig. 4 is reached it is to be assumed that the main valve has just been closed, but to reach its central position there remains a short distance *h* to be traveled. This distance *h* corresponds to the lap of the main valve on its up stroke. This part of the stroke should be traveled as quickly as possible to avoid any loss of time and it is for this purpose the recess 38 is provided in the center of the cam. Upon further movement of the main valve to the left the slow down valve plunger will drop down into the recess 38 and effect a certain opening of the valve 14 depending upon the depth of such recess. The main valve after having been closed will therefore go quickly to center. This also insures a quick reversing of the main valve if the motor pilot valve 5 is immediately to move to its opposite position.

To sum up, it may be noted that the cam as shown in Figs. 2, 3 and 4 will produce the following different valve speeds: first, very quick until the cam engages the valve plunger, then gradually slowing down until the position indicated in Fig. 3 is reached. The main valve now moves slowly until the cam assumes the position illustrated in Fig. 4. After this the plunger drops into the recess 38 and the main valve moves fast again until initial position is reached when the connection between the main valve and the motor pilot valve 1 will have restored the latter to central or closed position, to positively stop the moving parts. By thus changing the speed of the main valve at the proper points any defect of the graduation can be corrected.

If the car is to go up the main valve must travel to the right from central position as viewed in Fig. 1. The said valve will travel quickly until the toe 27 strikes the surface 39 and rides to the position shown in Fig. 4. At this point the main valve is just about to open and admit the water into the elevator cylinder from the supply pipe S and machine pipe P. From the position in Fig.

4 to that in Fig. 3 or while the toe 27 is in engagement with the horizontal surface, the speed of the main valve is very slow, consequently the speed of the elevator car will increase very gradually. It is therefore evident that by reason of this very slow movement which can be obtained on starting, small distances can be traveled with great accuracy. The length of time of this slow starting movement may be varied by changing the length of the horizontal surface 34. Furthermore, because of the slowness of the speed of the main valve the elevator car may be stopped after traveling such short distances after starting without any teeter or up and down vibration.

If it is desired to operate the car upwardly to full speed, it will travel slowly at the start as explained, but this may be for only a brief space of time. When the cam moves to the right from the position of Fig. 3 the toe 27 follows the slant of the cam 36 to gradually expose more holes of the valve 14 and thus effect an increase in the acceleration and the distance the car must travel before full speed is attained may be varied by altering the grade of the surface 36. Finally the cam 32 will leave the valve plunger and the main valve will finish its up-stroke with a quick and constant speed. It will be noticed from the above that the left hand portion of the cam or that portion to the left of the center line *a* of Fig. 3 controls the upward motion of the car, both at starting as well as stopping. In a similar way the other part of the cam controls the downward motion. Inasmuch as both parts can be shaped differently, this arrangement has the distinct advantage that the upward and downward strokes can be treated as two entirely different propositions, as in fact they should be.

If the slow-down valve 11 is connected to the pilot discharge pipe 3 as shown in Fig. 5 the left hand portion of the cam controls the stop on the upward motion of the car only. This is apparent upon inspection of Fig. 1 assuming 2 to remain the supply pipe but the slow-down valve connected to the discharge pipe 3 as indicated in Fig. 5. While the car is moving upwardly, the main valve is in its extreme right-hand position and therefore when it is desired to stop the car the pilot valve 5 is moved from the car to cause the piston M to be moved to the left to its central position and the fluid to the left of the piston would be discharged through the slow-down valve 11. The latter would then operate at the stop to vary the rate of flow of the discharge and thus secure the desired operation of the car as hereinbefore explained. Furthermore, the right-hand portion of the cam controls the start on the downward motion only when connected up as in Fig. 5 for when the pilot valve 5 is moved to the right and consequently the motor piston M to the left the fluid to the left of the piston must again be discharged and its rate of flow may be regulated automatically by the right-hand portion of the cam.

The possibilities of the above device are still further increased by shaping the cam in such a manner that only one portion of the same is effective. For instance, if only the left-hand portion of the cam is made effective, and then depending on the manner of connecting up the slow-down valve, the effect will be as follows: If connected up as shown in Fig. 1 the cam will control the start as well as the stop on the upward motion of the car; if connected as indicated in Fig. 5 it will control the upward stop only, and if the slow-down valve 11 is connected by means of the pipe 2″ to the other pilot discharge or exhaust pipe 4, it will control the downward stop only. The other combinations may be obtained if only the right-hand portion of the cam is used, as illustrated.

Although I have herein shown only one embodiment of my invention, I desire it to be understood that various modifications in the details and arrangement of parts may be made by those skilled in the art without departing from the principle of the invention herein described.

I claim—

1. In hydraulic valve apparatus, the combination with a main valve, of a motor, a pilot valve for controlling said motor, and means co-acting with said pilot valve to effect a slowing down of the main valve upon approach of the same to its central position.

2. In hydraulic valve apparatus, the combination with a main valve and a motor for moving the same, of a pilot valve for controlling said motor to open and close said main valve, an additional valve connected to said pilot valve, and means actuated by the motor for operating said additional valve to effect a retardation or acceleration of the movement of the main valve at any predetermined point in its travel.

3. The combination with valve mechanism and controlling means therefor, of a perforated plunger valve connected to said controlling means, and a device actuated by said valve mechanism to operate said plunger valve in one direction for a decrease of valve speed, and in the reverse direction for an increase of valve speed.

4. The combination with a main valve, of a cam, a connection between the valve and cam for maintaining a fixed relative position of said parts during their movement, an

auxiliary valve, a plunger depending from said auxiliary valve in the path of travel of said cam, a motor for operating the main valve, and means controlled by the auxiliary valve for controlling the operation of the main valve.

5. The combination with valve apparatus comprising a valve and valve stem, of means for operating said valve, an auxiliary valve for modifying the operation of the first-named valve, a cam connected to said valve stem to have the same direction of movement as the latter, and means arranged to be engaged by said cam for operating said auxiliary valve.

6. The combination with a hydraulic operating valve, of controlling and operating mechanism therefor, an auxiliary plunger valve provided with perforations, and means for moving said plunger valve in one direction to effect an increase of speed of the hydraulic operating valve and in the opposite direction to effect a decrease of speed thereof.

7. The combination with a hydraulic operating valve, of an operating motor therefor, a pilot valve controlling said motor, a slow-down valve controlling the supply of fluid to said motor, a cam operatively connected to said operating valve, and connections between the cam and slow-down valve for operating the latter to effect a variation in the speed of the operating valve in accordance with the shape of the cam.

8. In a hydraulic elevator system, the combination with a hydraulic valve apparatus, of a slow-down valve, a cam actuated by said valve apparatus and operatively associated with the slow-down valve and operated upon predetermined movements of the said valve apparatus to control the up and down starts and the up and down stops.

9. The combination with a main valve, of a motor piston connected to said valve, a pilot valve for controlling the movements of said motor piston, a plunger valve, a connection for transmitting fluid between the plunger valve and pilot valve, and a cam connected to said piston and arranged to operate said plunger valve at predetermined points in the travel of said piston.

10. The combination with hydraulic elevator apparatus, of a main valve and a motor for operating the same, a pilot valve for controlling said motor and main valve, an additional valve for throttling the flow of fluid which flows through the pilot valve, and a cam for operating said additional valve at a predetermined point in the travel of the main valve to effect any desired predetermined variation of speed of said main valve over any predetermined distance of travel.

11. In an elevator system, the combination with a motor piston, of a main valve connected to move therewith, a pilot valve for controlling the movements of said piston and main valve, a slow-down valve for throttling the flow of the fluid which flows through the pilot valve, and a cam adjustably connected with the said piston and main valve and operatively associated with said slow-down valve for operating the latter at a predetermined time in a predetermined manner.

12. The combination with a main valve, of a motor for moving the same, a pilot valve for controlling said motor, an auxiliary valve, and a device for operating said auxiliary valve to effect first the slowing down of the main valve when approaching a predetermined position, then the movement of said main valve for a predetermined distance at substantially constant speed, and finally a quicker movement of said valve to such predetermined position.

13. The combination with a main valve, of a motor for moving the same, a pilot valve for controlling said motor, an auxiliary valve connected to said pilot valve and a cam operated by said motor to in turn operate said auxiliary valve to effect first a slowing down of the main valve when approaching central position, then moving said main valve to closed position at substantially constant speed, and finally moving the main valve to such central position with quicker speed.

14. The combination with a main valve, of a motor for moving the same, a pilot valve, an auxiliary valve, and a device controlling said auxiliary valve to effect a gradual movement of said main valve from closed to open position and from open to closed position.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

FREDERICK HYMANS.

Witnesses:
WILLIAM A. COVERT,
H. B. BAILEY.