G. F. STEEDMAN.

FLUID ACTUATED BALANCED HOIST.

APPLICATION FILED MAR. 1, 1909.

**954,401.** Patented Apr. 5, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

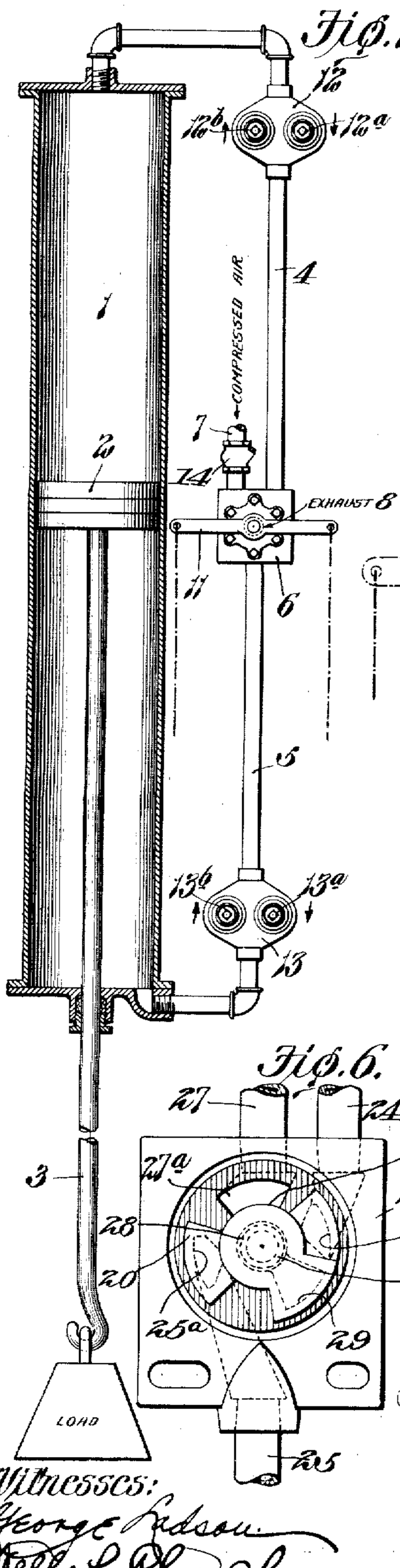


Fig. 2.

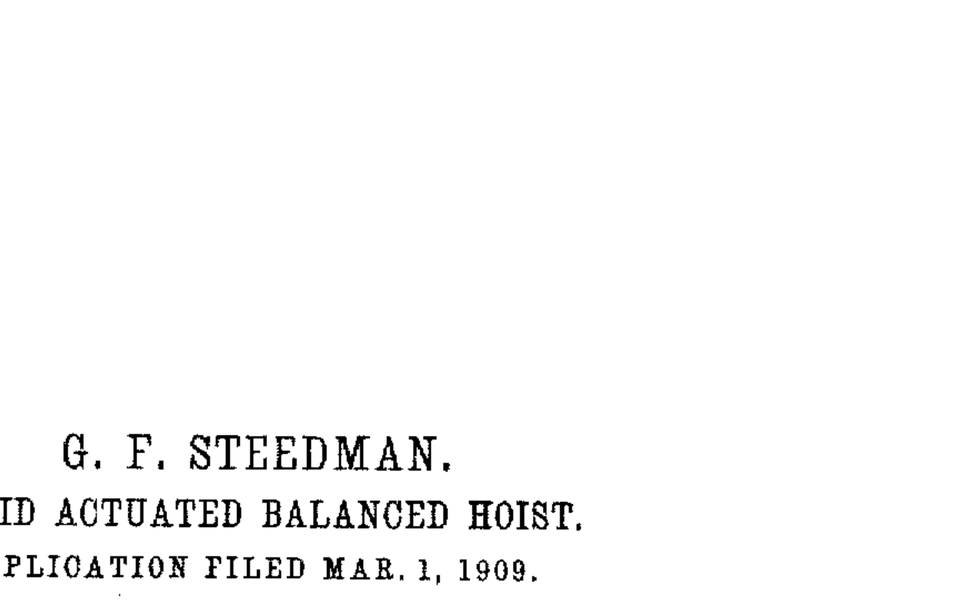


Fig. 3.

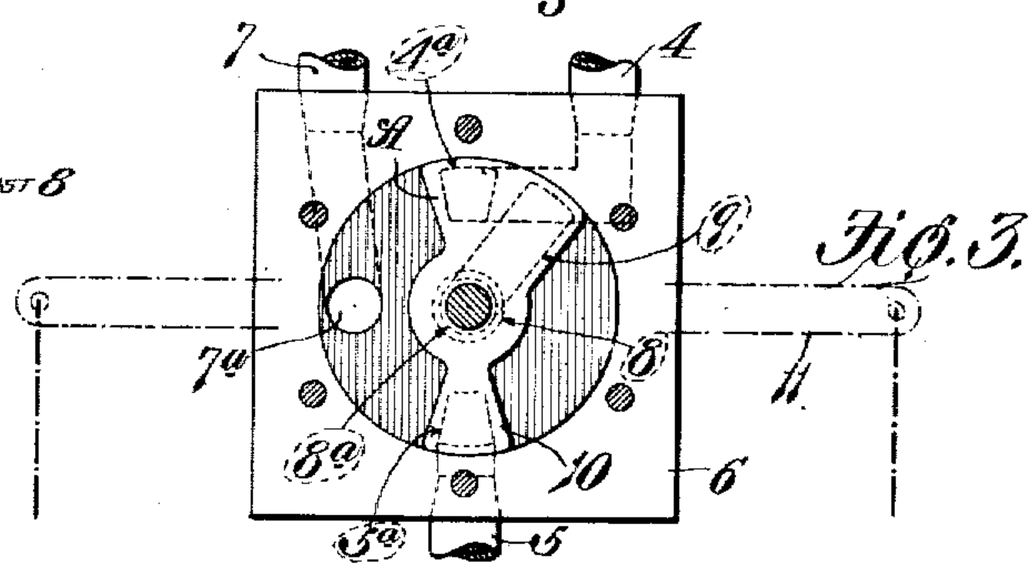


Fig. 4.

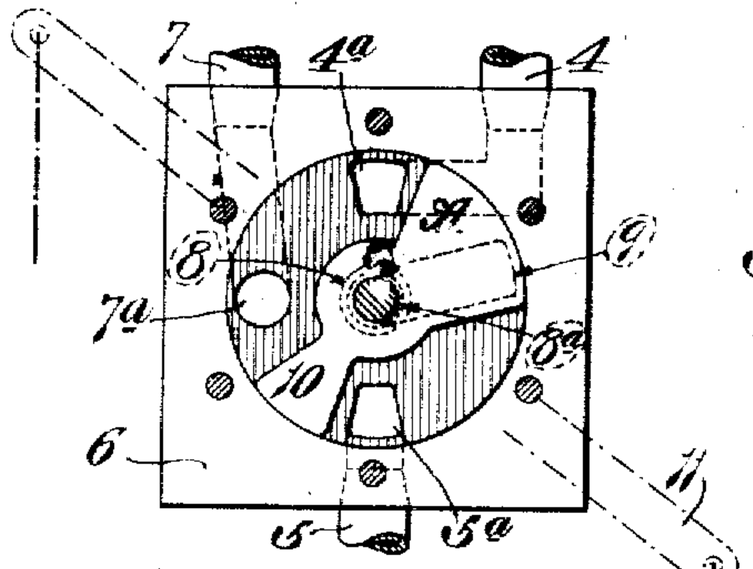


Fig. 5.

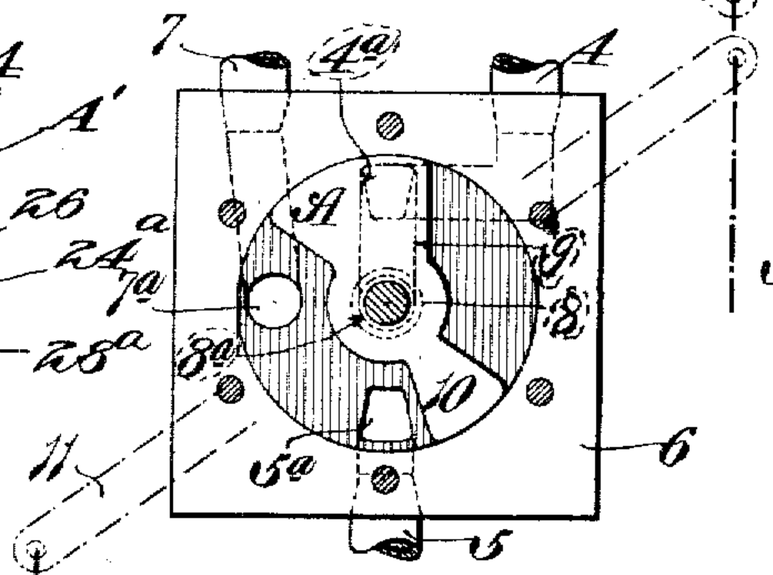


Fig. 6.




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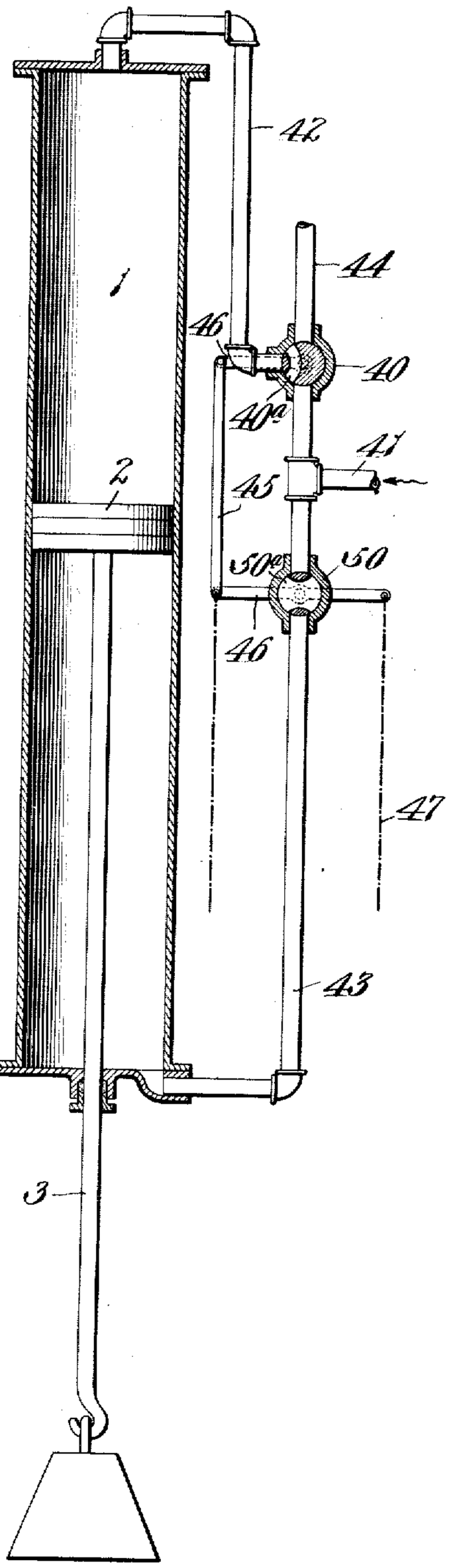
2 SHEETS—SHEET 2.

Fig. 7.

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# UNITED STATES PATENT OFFICE.

GEORGE F. STEEDMAN, OF ST. LOUIS, MISSOURI.

## FLUID-ACTUATED BALANCED HOIST.

954,401. Specification of Letters Patent. Patented Apr. 5, 1910.

Application filed March 1, 1909. Serial No. 480,660.

*To all whom it may concern:*

Be it known that I, GEORGE F. STEEDMAN, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Fluid-Actuated Balanced Hoists, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

Figure 1 is a vertical sectional view of a fluid-actuated balanced hoist embodying my invention; Fig. 2 is a detail vertical sectional view of the controlling valve and the casing for same; Fig. 3 is a vertical sectional view taken on approximately the line 3—3 of Fig. 2, the valve being shown in elevation and in its neutral position; Fig. 4 is a view similar to Fig. 3 showing the valve in its "lowering position"; namely, the position it occupies when the load is being lowered; Fig. 5 is a view similar to Fig. 3 showing the valve in its "hoisting position"; namely, the position it occupies when the load is being raised; Fig. 6 is a detail view of a controlling valve of slightly different form from that shown in Fig. 2, and Fig. 7 illustrates a construction in which two separate valves are employed for controlling the motive medium and balancing medium.

This invention relates to fluid-actuated hoists, and is an improvement upon balanced-pressure air hoists; namely, hoists of that type in which the air pressure is constantly admitted to one side of the piston and is admitted to and exhausted from the opposite side of the piston by means of an operating valve.

In the ordinary balanced-pressure air hoists the compressed air that constitutes the motive force of the hoist is directly and constantly connected to the stuffing-box end of the cylinder, and compressed air, which constitutes the balancing force of the hoist, is admitted to the opposite end of the cylinder to cause the piston to move outwardly and is exhausted to cause the piston to move inwardly. The balanced-pressure air hoist is much more positive in its movement than the single-acting or plain air hoist in which the stuffing-box end of the cylinder is subjected to pressure to cause the piston rod to move inwardly, and pressure is exhausted to permit said piston rod to move outwardly, the opposite end of the cylinder being constantly connected to the atmosphere. In the single-acting air hoists the operating valve controls either the inflow or egress of compressed air from only one side of the piston, the other side of the piston being under no pressure. When the load is raised part way by admitting pressure under the piston and the operating valve is then brought to its central or neutral position, the inward or upward acting force of the compressed air balances the outward or downward acting force on the piston and the piston will remain in this position so long as these two forces remain equal. As soon as the equilibrium of these forces is destroyed, however, the piston will move until the equality of the opposing forces acting on it is again attained. As the upper end of the cylinder is in constant communication with the atmosphere there is no restraining force on the upper side of the piston.

In the single-acting hoist the motion of the piston is under relatively poor control for when the valve is acting it controls but a single force and the load is supported by a single force. Consequently, any change in the load or the pressure that supports the load causes a relatively large and quick motion of the piston and the load. In the balanced-pressure air hoist the constant pressure or motive force on the stuffing-box side of the piston is resisted by a variable pressure or balancing force on the opposite side of the piston so that the load is held between two resisting or balancing pressures. The constant pressure of the reservoir on the stuffing-box end of the cylinder can only enter or leave the cylinder through a moderate-sized pipe and no motion of the piston can ordinarily be made except by the inward or outward flow of this pressure air, and on the opposite side of the piston the valve controls the rapidity of admission or exhaust. Two forces are constantly present, each opposing and balancing the other so that the motion of the balanced-pressure air hoist is much more positive and under better control than the motion of the single-acting air hoist.

In my prior patent No. 840,876, dated January 8, 1907, I have shown means for more positively regulating the motion of air hoists consisting of speed-regulating devices that are independent of the operating valve, and the object of my present invention is to still further perfect the control of balanced-pressure air hoists. I accomplish this by

controlling the ingress and egress of the compressed air that constitutes the motive force, and also controlling the admission and exhaust of the compressed air from the variable pressure side of the piston, gaining thereby great steadiness of motion and good control by governing and controlling the motive force as well as the resisting force or balancing force.

In the balanced-pressure air hoists heretofore in use the constant pressure end of the cylinder is in direct communication with the compressed air supply and any variation in the pressure of the air supply extends to the constant pressure end of the cylinder irrespective of the operating valve so that if the load is suspended intermediate the two limits of movement of the piston and the operating valve is in its central or neutral position any change in the pressure of the compressed air supply will change the force acting on the lower side of the piston and destroy the equilibrium of the hoist forces and the piston will move until the forces are again equalized. This movement of the piston when the operating valve is in its neutral position, due to variations of the air supply pressure, is an objectionable feature of the balanced-pressure hoists heretofore in use, and a further object of my invention is to provide a balanced-pressure air hoist which is so constructed that changes of pressure in the compressed air supply will not cause the piston to move.

Other objects and desirable features of my invention will be hereinafter pointed out.

Referring to the drawings which illustrate the preferred form of my invention, 1 designates a cylinder having a piston 2 reciprocatingly mounted therein, the rod 3 of said piston projecting through the lower end of the cylinder and being adapted to have a load connected thereto. Pipes 4 and 5 lead into the upper and lower ends, respectively, of the cylinder 1, and said pipes are connected to a valve casing 6 in which an oscillating valve A is arranged, the valve seat of said casing being provided with ports $4^a$ and $5^a$ with which the pipes 4 and 5 communicate. A pipe 7 that leads from a supply of fluid under pressure, preferably compressed air, communicates with the port $7^a$ in the valve seat of the casing 6, and an exhaust pipe 8 leads from an exhaust port $8^a$ in said casing, as shown in Fig. 2, the pipe 7 being provided with a check valve 14. The valve A has a chamber or duct 9 that establishes communication between the exhaust pipe 8 and the pipe 4 that leads to the upper end of the cylinder when the valve is in its hoisting position, as shown in Fig. 5; namely, the position it occupies when the load is being raised, and said valve is so designed that a blank portion thereof covers the port $4^a$, with which the pipe 4 communicates, when the valve is in its neutral position, as shown in Fig. 3, said valve also being provided with a blank wing 10 that closes the port $5^a$ when it is in its neutral position. The valve A never closes the port $7^a$ with which the supply pipe 7 communicates so that the interior of the valve casing is always in direct communication with the supply of compressed air.

An operating lever 11 is connected to the stem of the valve A for turning it, and when said valve is in its neutral position, as shown in Figs. 1 and 3, the pipes that lead to the upper and lower ends of the cylinder will be cut off from the supply of compressed air and the piston will be locked or held at rest, the lever 11 assuming an approximately horizontal position at such times. When the lever 11 is shifted in anticlockwise direction from its neutral position, shown in Fig. 3, the piston will move toward the upper end of the cylinder, and when said lever is shifted in the opposite direction the piston will move toward the lower end of the cylinder. When the valve A is in its lowering position, as shown in Fig. 4, the port $7^a$ from the supply pipe and the ports $4^a$ and $5^a$ from the pipes that lead to the upper and lower ends of the cylinder, will be open so that compressed air will be admitted on top of the piston until the downward forces are greater than the resisting forces and the piston is thus caused to move downwardly, the compressed air in the lower end of the cylinder being forced out through the port $5^a$ and into the general supply through the port $7^a$ or into the upper end of the cylinder through the port $4^a$. When it is desired to raise the load the valve A is turned into its hoisting position, as shown in Fig. 5, so as to bring the chamber 9 therein into alinement with the port $4^a$ for the pipe that leads to the upper end of the cylinder and thus permit the air on the upper side of the cylinder to exhaust through the pipe 4 and the pipe 8, the pressure fluid or motive force being admitted to the lower side of the piston through port $5^a$ and pipe 5 and thus causing the piston to move upwardly.

If it is desired to stop the piston at some point intermediate its limits of travel, the valve A is turned into its neutral position, as shown in Fig. 3, so as to simultaneously close the ports $4^a$ and $5^a$ for the pipes that lead to the upper and lower ends of the cylinder. The air on both sides of the piston will thus be trapped or cut off from the source of supply so that the piston will come to rest and remain in this position until the load is changed or the valve A is turned to uncover the ports which it closes. If the load on the piston is diminished the piston will move slowly toward the upper end of the cylinder until the air on the up-

per side of the piston has been compressed sufficiently and the air on the lower side of the piston has expanded enough to again make a balance and thus compensate for the weight of that portion of the load which is removed. For example, if the hoist is being used for raising a ladle of molten metal that is to be poured to form a casting, when the ladle arrives in the position at which it is desired to tilt same, the valve is turned into its neutral position, as shown in Fig. 3, and when the ladle is tilted to discharge some of the metal therein and thus diminish the load on the piston, the piston will move upwardly a slight distance until the air on the upper side thereof has been compressed sufficiently and the air on the lower side has expanded sufficiently to renew a balance or to offset or compensate for the weight of the metal that has been poured out of the ladle, the piston coming to rest and remaining in this position until the load is again reduced or the valve is turned. The load can be raised higher by turning the valve into its hoisting position, as shown in Fig. 5, so as to relieve the balancing pressure or force on the upper side of the piston, and when it is desired to have the piston move downwardly the valve is turned into its lowering position, as shown in Fig. 4, so as to simultaneously open the ports $4^a$ and $5^a$, thus permitting the air to flow into the upper end of the cylinder so as to force the piston downwardly against the pressure under it, and also force the air in the lower end of the cylinder back into the pressure-supply system or into the upper end of the cylinder.

The hoist is preferably provided with speed-regulating valves similar to those described in my prior patent No. 840,876, previously referred to, said valves being mounted in valve casings 12 and 13 arranged in the pipes 4 and 5, respectively. The casing 12 is provided with two check valves $12^a$ and $12^b$ that open in opposite directions, as indicated by the arrow in Fig. 1, and the casing 13 is provided with two check valves $13^a$ and $13^b$ that open in opposite directions, but as said regulating valves form no part of my present invention, a detailed description of same is not deemed necessary.

The main advantage of an air hoist of the principle above described is that the motion of the piston is well controlled while the valve is open, and the piston is not affected by external changes when it is intermediate its ends and the controlling valve is closed.

In order to secure the best control of the speed of hoisting or lowering when the valve is open I prefer to use a valve of the form shown in Fig. 6, wherein the ports are long and narrow. Said valve is of substantially the same construction as the valve shown in Fig. 2, and comprises a movable part A′ that coöperates with ports in the casing 26, said part having a duct 29. A supply pipe 27 communicates with a port $27^a$ in said casing, and pipes 24 and 25 lead from ports $24^a$ and $25^a$ in said casing to the upper and lower ends of the cylinder. An exhaust pipe 28 leads from an exhaust port $28^a$ in said casing, and the movable part A′ of the valve is provided with a blank wing 20 that controls the passage of the motive medium through the port $25^a$. In a valve of this construction a small opening of the port $24^a$ to admission or exhaust is accompanied by a correspondingly small uncovering of the port $25^a$, so that the ingress or egress of air from the upper part of the cylinder is controlled simultaneously with the flow of air from and to the lower end of the cylinder. A larger opening of the upper port $24^a$ would likewise be accompanied by a large opening of the lower port $25^a$.

Another great advantage of the hoist above described over the balanced-pressure hoists heretofore in use is that it is much steadier under variable loads when the valve is closed or in its neutral position, as shown in Fig. 3. In the balanced-pressure air hoists heretofore in use the constant pressure end of the cylinder communicated at all times with the source of air supply that constituted the motive force, and a diminished load would be accompanied by an upper movement of the piston until the air above the piston was compressed sufficiently to restore the balance, the air under the piston remaining at constant pressure. With my improved hoist the movement of the piston under the same conditions would be less because the air is entrapped in both ends of the cylinder and a diminished load would be accompanied by a compression of the air on the upper side of the piston and an expansion of the air on the lower side of the piston, thus causing equilibrium to be established with a less movement of the piston as the moving force decreases as the piston moves, and the opposing force increases simultaneously.

In Figs. 1 to 6, inclusive, I have shown a single valve combining the functions of controlling the exhaust and admission of air to the upper part of the cylinder, and the ingress and egress of the air to the lower part of the cylinder. It is obvious, however, that these two functions can be carried out by separate valves 40 and 50, as shown in Fig. 7. In this construction the supply pipe 41 leads to a pipe that communicates with the casings of said valves, and a pipe 42 leads from the casing of the valve 40 to the upper end of the cylinder, the casing of the valve 50 being connected with the lower end of the cylinder by means of a pipe 43, and the casing of the valve 40 being provided with an exhaust pipe 44. The valve 40 is provided with a duct $40^a$ that establishes communication between the supply pipe

and the pipe 42 that leads to the upper end of the cylinder and also establishes communication between said pipe 42 and the exhaust pipe 44. The valve 50 is merely provided with a port $50^a$ that permits the motive medium to pass into or exhaust from the pipe 43 that leads to the lower end of the cylinder. These valves 40 and 50 can be operated by two men or the hands of one man, or the stems of the valves could be connected, as, for example, by a rod 45 fastened to arms 46 on the stems so that both valves would move when the operating means 47 was actuated. In such a construction it would be preferable to have the valves so connected to the operating means that both valves would move simultaneously to open or cover proportionately the same area of the ports $4^a$ and $5^a$ shown in Figs. 1 to 5, but, if desired, one valve could have a slight lead on the other without departing from the spirit of my invention. I prefer to use the construction shown in Figs. 1 to 4, however, on account of its simplicity, and wherever I have used the term "means for cutting off the fluid that is admitted to opposite sides of the piston", or similar expressions, I mean to include either a construction such as that shown in Figs. 1 to 4 in which a single member is provided with two separate and distinct portions that coöperate with independent ports, or a construction such as that shown in Fig. 7 in which the valves that control the passage of the fluid into the cylinder are mounted on separate stems.

In the constructions herein shown the cylinder 1 is arranged in a vertical position and I have therefore described the piston as moving to the "upper" and "lower" ends of the cylinder, but it will, of course, be obvious that the cylinder could be arranged horizontally or in an inclined position without departing from the spirit of my invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A fluid-actuated balanced hoist, provided with a cylinder, a piston arranged in said cylinder, means for creating a uniform pressure in said cylinder on both sides of the piston to cause the piston to move in one direction and for reducing the pressure on one side of the piston to cause it to move in the opposite direction, and means for cutting off the supply of pressure to both ends of the cylinder so as to hold the piston at rest.

2. A fluid-actuated balanced hoist, provided with a piston that is adapted to move a load, means for creating a uniform pressure on both sides of the piston to cause it to move in one direction, means for reducing the pressure on one side of the piston to cause it to raise said load, and means for cutting off the supply of fluid to both sides of the piston to hold the piston at rest between its two limits of movement.

3. A fluid-actuated balanced hoist, comprising a cylinder, a piston arranged in said cylinder and adapted to move a load, means for introducing a fluid under pressure into one end of said cylinder and simultaneously connect the other end of the cylinder with the atmosphere so that the piston can raise the load, and means for cutting off the supply of fluid to the cylinder and also closing the cylinder to the atmosphere so that the piston will come to rest intermediate its limits of travel.

4. A fluid-actuated balanced hoist, comprising a cylinder, a piston arranged in said cylinder, a conduit leading into one end of said cylinder and communicating with a supply of fluid under pressure, a conduit leading into the opposite end of said cylinder, a valve for permitting the fluid to enter the conduit last referred to, means on said valve for permitting the fluid which it has admitted to the cylinder to exhaust therefrom, and means for preventing the fluid which entered the cylinder through the conduit first referred to from escaping when said valve closes the conduit which it controls, thereby causing the piston in the cylinder to remain at rest.

5. A fluid-actuated balanced hoist, comprising a cylinder, a piston arranged in said cylinder and adapted to move a load, means for connecting the opposite ends of said cylinder with a supply of fluid under pressure to cause the piston to move in one direction, means for permitting the fluid to exhaust from one end of the cylinder without cutting off the supply of fluid to the other end of the cylinder so as to cause the piston to move in a direction to raise the load, means for cutting off the exhaust from the cylinder, and means for closing the port to the other end of the cylinder so as to hold the piston at rest at some point intermediate its limits of movement.

6. A fluid-actuated balanced hoist, comprising a cylinder, a piston arranged in said cylinder and adapted to move a load, a pipe leading from the lower end of said cylinder and communicating with a supply of motive fluid under pressure, a pipe leading to the upper end of said cylinder, a valve for admitting fluid from said supply into the upper end of the cylinder to cause the piston to descend and for permitting the fluid to exhaust from the upper end of the cylinder to cause the piston to ascend, and means for cutting off the supply of fluid to the lower end of the cylinder when said valve is turned into a position to close the pipe that leads to the upper end of the cylinder.

7. A fluid-actuated balanced hoist, comprising a cylinder, a piston arranged in said cylinder, a pipe leading from the lower end

of said cylinder and communicating with a supply of fluid under pressure so that the lower side of the piston will be constantly subjected to pressure, means for equalizing the pressure on the upper side of the piston to cause it to move in one direction and reducing the pressure on the upper side of the piston to cause it to move in the opposite direction, and means for positively cutting off the lower side of the piston from the supply of fluid.

8. A fluid-actuated balanced hoist, comprising a cylinder, a piston arranged inside of said cylinder, a valve casing, pipes leading from the opposite ends of said cylinder to said valve casing, a supply pipe leading into said casing, and means arranged inside of said casing for permitting the fluid from the source of supply to enter the lower end of said cylinder and the fluid in the upper end of the casing to exhaust therefrom, said means also being adapted to permit the fluid from the source of supply to enter both ends of the cylinder simultaneously, or positively close the pipes leading to both ends of the cylinder.

9. In a fluid-actuated hoist of the balanced type, a cylinder, a piston arranged in said cylinder, pipes leading to the opposite ends of said cylinder for introducing opposing forces into said cylinder so as to cause the piston to descend, a valve casing communicating with said pipes, a supply pipe communicating with said casing, and means arranged in said casing for closing the pipes that lead to the opposite ends of the cylinder.

10. In a fluid-actuated hoist of the balanced type, a cylinder, a piston arranged in said cylinder, pipes leading to the opposite ends of said cylinder for introducing opposing forces into said cylinder so as to cause the piston to descend, a valve casing communicating with said pipes, a supply pipe communicating with said casing, and a valve in said casing which closes the pipes that lead to the opposite ends of said cylinder when it is moved into a certain position, said valve having a chamber or duct that establishes communication between the atmosphere and the pipe that leads to the upper end of the cylinder when said valve is in a different position.

11. In a fluid-actuated hoist of the balanced type, a cylinder, a piston arranged in said cylinder, pipes leading to the opposite ends of said cylinder for introducing opposing forces into said cylinder so as to cause the piston to descend, a valve casing communicating with said pipes, and a valve in said casing for opening and closing the pipes that lead to the opposite ends of said cylinder, said valve having means for establishing communication between the upper end of the cylinder and the atmosphere when it is in a certain position.

12. In a fluid-actuated hoist of the balanced type, a hoisting cylinder having a piston arranged therein, means for introducing a motive medium into the lower end of the cylinder to exert upward pressure on the piston and a balancing medium into the upper end of the cylinder to exert downward pressure on the piston, and means for controlling or regulating the ingress and egress of the motive medium into the lower end of the cylinder.

13. In a fluid-actuated hoist of the balanced type, an operating cylinder provided with a piston and having its lower end communicating with a motive medium which exerts upward pressure on the piston, means for admitting and exhausting a balancing medium to and from the upper end of the cylinder to cause the piston to descend and ascend, and means for controlling both the ingress and the egress of the motive medium to and from the lower end of the cylinder.

14. In a fluid-actuated hoist of the balanced type, an operating cylinder provided with a piston that is adapted to move a load, a supply of motive fluid under pressure which is adapted to flow into and out of the lower end of the cylinder, means for regulating or controlling both the inflow and outflow of said motive medium to and from the lower end of the cylinder, and means for admitting fluid into the upper end of the cylinder and exhausting it therefrom to cause the piston to descend and ascend.

15. A fluid-actuated balanced hoist, comprising an operating cylinder that is provided with a piston, a supply of motive fluid under pressure that communicates with the lower end of said cylinder, means for cutting off the lower end of said cylinder from said supply of fluid, and means for admitting and exhausting a fluid of equal pressure to and from the upper end of the cylinder.

16. A fluid-actuated balanced hoist, comprising an operating cylinder provided with a piston, a supply of fluid under pressure, conduits that establish communication between said supply and the opposite ends of said cylinder, devices that govern and control the flow of the fluid through said conduits, and means for actuating said devices simultaneously to cut off both ends of the cylinder from the source of supply.

17. A fluid-actuated balanced hoist, comprising an operating cylinder provided with a piston, a supply of fluid under pressure, conduits that establish communication between said supply and the opposite ends of said cylinder, and means for controlling the ingress and egress of the fluid to and from the opposite ends of said cylinder and simultaneously varying the size of the fluid passageways in said conduits.

18. A fluid-actuated balanced hoist, com-

prising an operating cylinder provided with a piston, a supply of fluid under pressure, conduits that establish communication between said supply and the opposite ends of said cylinder, means for varying the size of the fluid passageway in one of said conduits to permit the fluid to be admitted to and exhausted from one end of the cylinder, and means for simultaneously varying the size of the fluid passageway in the other conduit so as to produce a fluid passageway of approximately the same area as that of the conduit first referred to.

19. A fluid-actuated balanced hoist, comprising an operating cylinder provided with a piston, a supply of fluid under pressure, an operating valve for admitting and exhausting the fluid to and from the balancing end of said cylinder and for admitting and exhausting the fluid to and from the motive end of said cylinder, said valve comprising a movable part provided with two controlling portions, and a seat for said movable part provided with two approximately elongated ports of substantially the same area, with which said controlling portions coöperate.

20. In a balanced pressure air hoist, a cylinder, a piston operating therein and provided with a piston rod, a source of compressed air, a pipe leading from one end of the cylinder to the source of compressed air, a stop valve arranged to stop the flow of air through said pipe at will, a second pipe leading from the other end of said cylinder to the source of compressed air, and a valve for permitting compressed air to pass through said second pipe into the cylinder, or escape from the cylinder to the atmosphere, said valve also being adapted to stop the flow of air through said second pipe in either direction at will.

21. In a balanced pressure air hoist, a cylinder, a piston operating therein and provided with a piston rod, a source of compressed air, a pipe leading from one end of the cylinder to the source of compressed air, a stop valve arranged to stop the flow of air through said pipe, a second pipe leading from the other end of said cylinder to the source of compressed air, and a valve arranged to permit compressed air to pass through said second pipe into the cylinder, or to permit compressed air in said cylinder to escape to the atmosphere, or to stop the flow of air through said second pipe at will, said two valves being operated by a means common to the two, so as to cause them to move simultaneously.

22. In a balanced pressure air hoist, a cylinder, a piston operating therein and provided with a piston rod, a source of compressed air, a pipe leading from one end of the cylinder to the source of compressed air, a stop valve arranged to stop the flow of air through said pipe, a second pipe leading from the other end of said cylinder to the source of compressed air, and a valve arranged to permit compressed air to escape from said second pipe into the atmosphere, or to stop the flow of air through said second pipe at will, said two valves being operated simultaneously by a means common to the two and so arranged that in the central position both valves close the pipes they connect with, and when moved, open their respective pipes in unison.

23. In a balanced pressure air hoist, a cylinder, a piston therein provided with a piston rod, a source of compressed air, a valve casing connected to the source of compressed air, a port in the valve casing leading to one end of the cylinder, another port in the valve casing leading to the other end of the cylinder, and a valve operating in said casing and adapted to open or close one port to the compressed air supply and to open the other port to the compressed air supply, or to close it to the compressed air supply and open it to the atmosphere, the valve and ports being so arranged that when the valve is in central position both ports are closed, and when said valve is moved both ports open in unison.

24. In a balanced pressure air hoist, a cylinder, a piston therein provided with a piston rod, a source of compressed air, and means for simultaneously regulating the flow of the motive pressure to and from the cylinder and the balancing pressure of the hoist.

25. In a balanced pressure air hoist, a cylinder, a piston therein provided with a piston rod, a source of compressed air, and means for regulating the flow of the motive pressure and the balancing pressure of the hoist simultaneously, said means also being adapted to entrap the air pressure existing in both ends of the hoist simultaneously.

26. A balanced pressure air hoist provided with means for simultaneously regulating the flow of the motive pressure and the balancing pressure into and out of the operating cylinder.

27. A balanced pressure air hoist provided with a combined valve that is arranged to regulate the flow of the motive pressure and the balancing pressure simultaneously, and a check valve in the compressed air supply pipe arranged adjacent to the valve body to prevent compressed air from leaving the cylinder of the hoist through the compressed air supply pipe.

In testimony whereof I hereunto affix my signature in the presence of two witnesses, this 25th day of February 1909.

GEORGE F. STEEDMAN.

Witnesses:

RAEBERN H. POST,

GEO. E. HOFFMANN.