

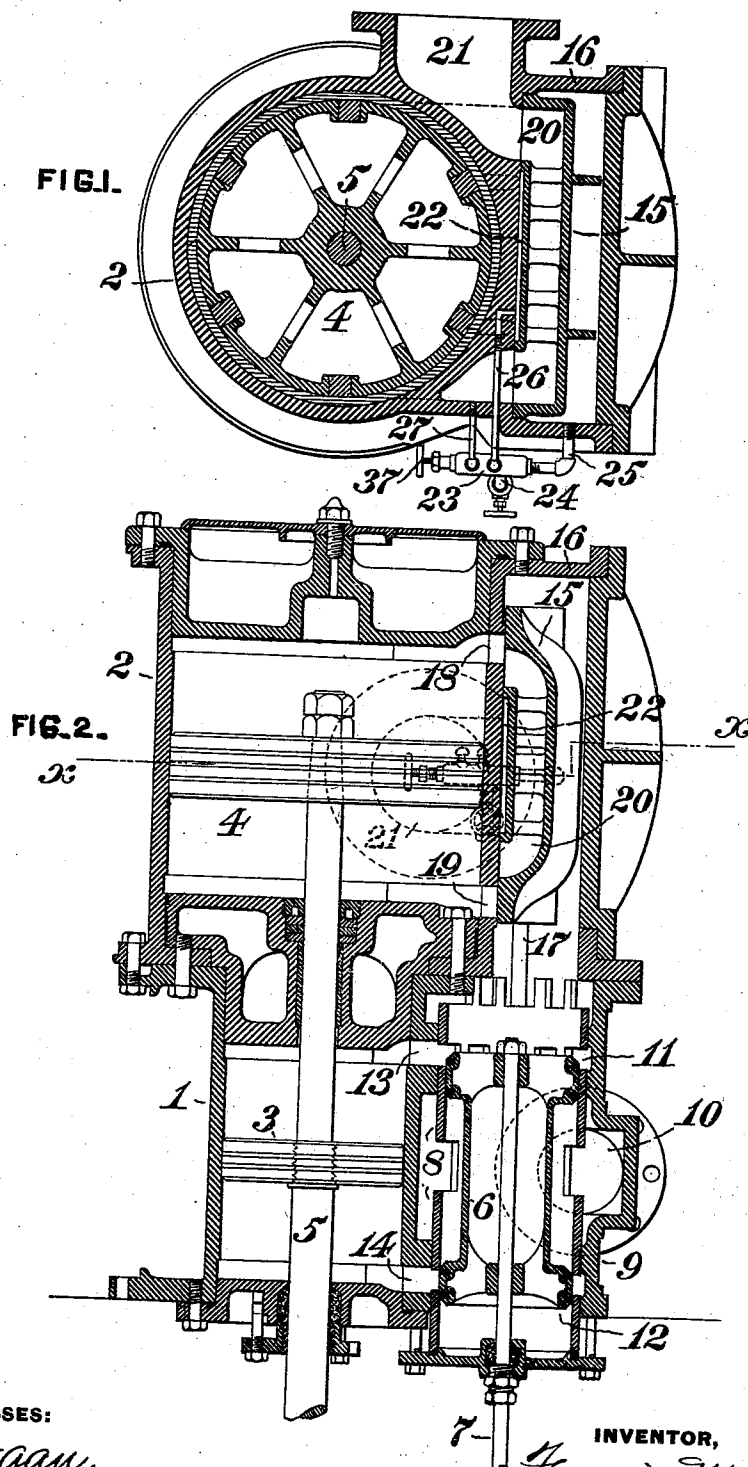
(No Model.)

2 Sheets—Sheet 1.

F. M. RITES.
BALANCED SLIDE VALVE.

No. 501,663.

Patented July 18, 1893.



WITNESSES:
T. J. Hogan.
T. C. Galtner.

INVENTOR,
Francis M. Rites,
by J. H. R. Bell,
Att'y.

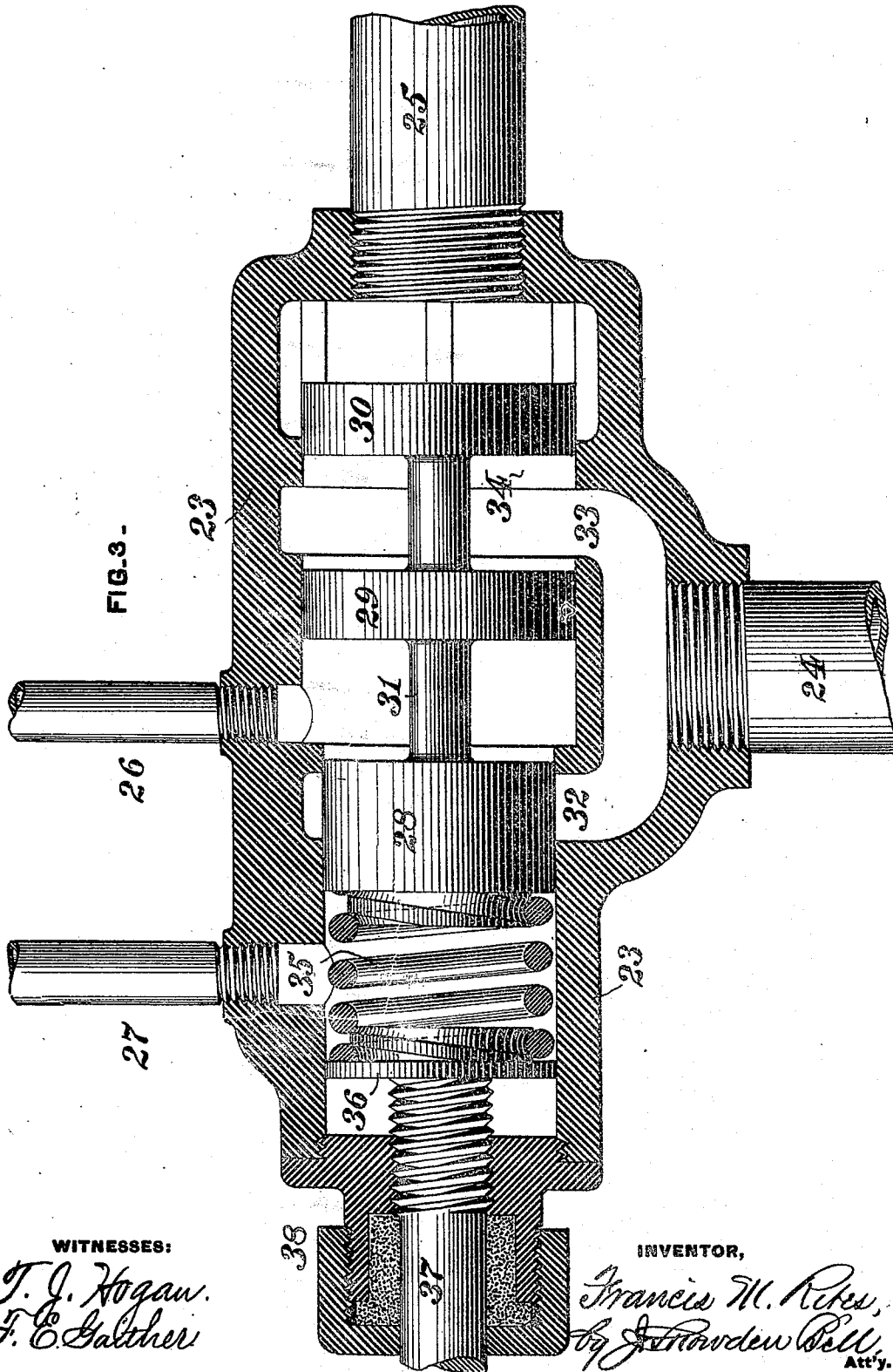
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UNITED STATES PATENT OFFICE.

FRANCIS M. RITES, OF ALLEGHENY, PENNSYLVANIA.

BALANCED SLIDE-VALVE.

SPECIFICATION forming part of Letters Patent No. 501,663, dated July 18, 1893.

Application filed March 13, 1893. Serial No. 466,674. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS M. RITES, a citizen of the United States, residing at Allegheny, in the county of Allegheny and State of Pennsylvania, have invented or discovered a certain new and useful Improvement in Means for Balancing Slide-Valves, of which improvement the following is a specification.

My invention relates to the operation of steam distribution valves of the slide type, in which the back of the valve is ordinarily subjected to the pressure of the steam in the chest or chamber within which the valve moves, such pressure tending, particularly in the case of valves of comparatively large dimensions, to create excessive friction between the sliding surfaces of contact, unless means for its relief or counteraction is provided. Numerous devices for this purpose have heretofore been proposed and applied in practice with varying degrees of success, these being generally in the nature of pressure plates, balancing plates, or inclosed chambers, upon which the steam pressure is exerted, and by which the valve is relieved, to a greater or less extent, therefrom. The character of these appliances has generally been such that they are subject to the objections of interfering with the free passage of steam and of involving complication and liability to derangement of parts.

The object of my invention is to admit of the unrestrained exertion of steam pressure upon the entire area of the back of the valve, and of the free and unimpeded circulation of steam over and around the same, while preventing the objectionable friction of the sliding surfaces in contact before referred to, by counteracting the pressure on the back of the valve, as varied from time to time in its operation, by oppositely acting and correspondingly varied pressure.

The improvement claimed is hereinafter fully set forth.

While my invention is readily and advantageously applicable in single cylinder or simple engines in which slide distribution valves are employed, its practice will be found more particularly desirable in multiple cylinder engines, and will be herein exemplified in an engine of such type, as applied in connection with the slide distribution valve of the last

or low pressure cylinder. In such case, a materially higher pressure than that in the receiver, which acts upon the back of the valve, being directly available from the boiler, which is the source of high pressure supply, only a comparatively small space or recess beneath the valve will be required for the exertion of the requisite balancing pressure.

In the accompanying drawings: Figure 1 is a transverse section, at the line *x, x*, of Fig. 2, through the low pressure cylinder, low pressure distribution valve, valve chest, and exhaust passage of a tandem compound engine, illustrating an application of my invention; Fig. 2, a longitudinal central section through the cylinders, valve chests, receiver, and valves; and, Fig. 3, a similar section, on an enlarged scale, through a valvular appliance employed for effecting and regulating the application of supplemental pressure to the low pressure valve.

My invention is herein illustrated as applied in a tandem compound engine having a high pressure cylinder 1 and a low pressure cylinder 2, fitted, respectively, with pistons 3 and 4, which are secured upon a piston rod 5. The distribution functions of the high pressure cylinder 1 are effected by a hollow or tubular distribution valve 6, of the piston type, which is reciprocated by suitable valve gear, connected to its stem 7, in a bushing 8, located within a high pressure valve chest 9, to which steam from the boiler is supplied through a steam supply connection 10. The high pressure valve 6 is provided with end pistons 11, 12, which control, respectively, induction and eduction ports 13, 14, formed in the bushing 8, and in the adjacent portions of the shell of the high pressure cylinder 1. The low pressure cylinder 2 is provided with a slide distribution valve 15, reciprocated, within a valve chest 16, by valve gear connected to its stem 17. The valve 15 controls induction and eduction ports 18, 19, in the shell of the low pressure cylinder, and its exhaust cavity or recess 20, which is closed at its inner side, or that nearest the cylinder, for the major portion of its length and breadth, communicates continuously with an exhaust port 21, to which is connected an exhaust port leading to the atmosphere or to a condenser, as the case may be. The high pressure and

low pressure valve chest 9 and 16 communicate directly one with the other, and the space within the high pressure chest at the ends of the valve 6 and within the tubular body and
 5 pistons of said valve, together with that within the low pressure chest on the outside of the valve 15, form a receiver, through which steam is expanded from the high pressure to the low pressure cylinder.

10 For the practice of my invention, I form on the inner or face side of the slide valve 15, a balancing chamber or recess 22, which is open to the valve face, and is closed and separated from the exhaust recess 20 of the valve, by its
 15 back, end, and side walls, the inner surfaces of which abut against and slide on the valve face. The area of the inside of the back wall of the balancing chamber must obviously be less than that of the back of the valve, by reason of the length and breadth of the balancing chamber being limited by the necessity of
 20 providing proper ports and lips in the valve for establishing communication between the valve chest and the cylinder ports 18 and 19, and between said cylinder ports and the exhaust port 21, through the exhaust recess 20. The back of the valve 15 will, therefore, be of correspondingly greater length and width than
 25 the balancing chamber. In order to counteract the pressure in the valve chest 16, which acts to press the valve 15 against the valve face, fluid under pressure is admitted to the balancing chamber 22, through a supply pipe 26, the pressure of said fluid acting on the
 30 valve in reverse direction to the pressure in the valve chest, and being greater than that of the steam in the valve chest, in inverse proportion to the areas of the inside of the back wall of the balancing chamber 22 and of the
 35 back of the valve 15 respectively.

40 Inasmuch as the pressure in the valve chest will vary, from time to time, in the operation of the engine, in accordance with variations of the point of cut off, and under some circumstances may be negative, a substantial
 45 equalization of the pressures, acting on the balancing chamber and on the back of the valve respectively, is maintained by varying the former pressure coincidently with and proportionately to variations of the latter, and to maintain the valve in contact with the
 50 valve face, under certain conditions, supplemental pressure is applied to the back of the valve. For example, in an engine of the type
 55 illustrated, as the high pressure cut off is lengthened to meet an increase in the load of the engine, the receiver pressure also increases, and a corresponding greater pressure in the balancing chamber is, therefore, required and furnished to counteract it. Again,
 60 if after the valve has been properly balanced, the degree of vacuum in the exhaust passage is lowered, or back pressure in the exhaust passage is exerted, the supply of pressure to the balancing chamber is correspondingly reduced, or completely cut off, as the case may be,
 65 to maintain equilibrium of pressure upon the

valve. It may, farther, be found, that at rare intervals, and when the load of the engine suddenly becomes very light, the governor will
 70 entirely cut off steam from the high pressure cylinder, in which case a partial vacuum will be formed in the receiver, and the valve will tend to be lifted from its seat. In such case fluid under pressure is admitted to the valve
 75 chest, to exert a pressure therein acting in opposite direction to the pressure in the exhaust recess or beneath the valve, and thereby to maintain, as nearly as may be, an equilibrium of opposing pressures. The service
 80 of the conditions of outward pressure beneath the valve does not involve waste or constant expenditure of steam or other fluid under pressure, as such fluid is not discharged, but acts in the manner of an inner bearing or support for the valve, which may be said to float
 85 upon it. In the isolated instances in which fluid under pressure is supplied to the valve chest, as above noted, such fluid is, of course, used and exhausted.

90 In order to effect and regulate the supplemental supply of steam or other fluid under pressure, as above noted, which is a leading and characteristic feature of my invention, I provide a valvular appliance, an example of
 95 which is clearly shown in Fig. 3, and which is substantially of the following construction. A casing or chest 23, is fitted with three pistons, 28, 29, 30, which are connected, so as to be movable simultaneously in the direction of
 100 the length of the casing, by being formed or fixed upon a central rod or stem 31. The pistons 29 and 30 are of equal diameters, and the piston 28 is of smaller diameter than the pistons 29 and 30. Modifying pressure, tending
 105 to force the pistons either to the right or to the left, may be exerted on the piston 28 by a helical spring 35, the tension of which can be varied as desired by a hand adjusting
 110 rod 37, passing through a suitably packed stuffing box 38 in the left hand end of the casing and having a screw thread engaging
 115 with the cap thereof, said rod abutting against a plate 36, which is connected to the adjacent end of the spring 35. A fluid supply pipe 24,
 120 leading from a source of fluid pressure greater than that in the low pressure valve chest, being, preferably, the boiler, opens into a side passage in the casing, having end ports 32,
 125 33, one of which, 32, opens around the bore fitted by the piston 28, and the other, 33, opens between the pistons 29 and 30. A pipe 25 leading from the receiver, that is to say, from any portion of the receiver space in the valve
 130 chests previously specified, opens into the end of the casing 23 adjacent to the piston 30, which controls communication between said pipe and the port 33, through an opening 34, in which said piston normally fits and which it normally closes. A pipe 26 leads outwardly from the space between the pistons 28 and 29, and discharges into the balancing chamber 22 of the low pressure valve, and a pipe 27 leads from the space at the outer end

of the piston 28 to a point which is constantly in communication with the exhaust recess 20 of the low pressure valve 15.

Under a construction substantially as above described, the spring 35 is so adjusted that the ordinary normal pressure in the receiver, will, by its action upon the piston 30, force the series of pistons to the left, against the resistance of the spring 35, and will cause the piston 28 to open the port 32 sufficiently far to admit pressure steam to the pipe 26 and balancing chamber 22, at such pressure as will counteract the pressure on the back of the valve 15. Increase or decrease of reservoir pressure will effect a corresponding increase or decrease of opening of the port 32 and of supply to the balancing chamber. The reduction of the degree of vacuum in the exhaust passage or the institution of back pressure therein, imposes additional pressure upon the piston 28 and correspondingly acts to reduce or cut off the supply through the port 32 and pipe 26 to the balancing chamber. In each case, however, a determined ratio between the pressures above and below the valve is maintained by the reaction of the latter pressure through the differential areas of the pistons, in unison with the exhaust pressure but in opposition to the receiver pressure, while an excessive reduction of receiver pressure, moves the pistons sufficiently far to the right to close the port 32 and cut off communication with the balancing chamber, and also to open the passage 34 and admit steam from the pipe 24, through said passage, and through the pipe 25, to the receiver.

The provision of the two independent larger pistons 29 and 30, and the intermediate supply port 32, is made for the purpose of causing the automatic admission of high pressure fluid to the low pressure valve chest, when, as before explained, a partial vacuum happens to be formed therein. It will, however, be readily seen that the performance of such function, while necessary to the full embodiment of my invention, may, if desired, be dispensed with, in view of the comparative infrequency of the conditions under which it is called for. A construction therefore, of the valvular appliance, in which a single larger piston is employed in lieu of the two pistons 29 and 30 of the example herein shown, and the port 33 is dispensed with, would be within the spirit and governing principle of my invention, and would perform all the functions of the appliance shown, except that of high pressure admission to the valve chest.

In the application of my invention to sim-

ple or single expansion engines, it will be obvious that the fluid supplied to the balancing chamber must be at a pressure higher than that in the boiler, or the balancing effect be only partial. Such increase of pressure may be readily and conveniently effected by the employment of a device such as a small force pump worked by the engine, and acting to compress any suitable fluid, or to impose pressure upon an inelastic fluid, within the the balancing chamber of the valve.

I claim as my invention and desire to secure by Letters Patent—

1. The combination of a slide distribution valve having a balancing chamber or recess in its face, a valve chest, a valve face, a fluid supply passage having its discharge opening in that portion of the valve face which is continuously covered by the valve when in operation, and a valvular appliance having differential pistons subject to pressure, in one direction from steam in the valve chest, and in the other to pressure from the exhaust steam, and being intermediately subject to pressure from a source of high pressure supply, said pistons controlling communication between said source of high pressure supply and the balancing chamber, substantially as set forth.

2. The combination of a slide distribution valve having a balancing chamber or recess in its face, and a valvular appliance consisting of a casing or chest, a smaller piston and two larger and equal sized pistons mounted on the same stem and adapted to move longitudinally in the casing, a passage leading from the chest, on the outer side of the smaller piston, to the exhaust passage controlled by the distribution valve, ports leading from a high pressure supply into the casing between the two larger pistons and between the smaller piston and one of the larger pistons respectively, a passage leading from the casing, between the smaller and one of the larger pistons, to the balancing chamber of the distribution valve, a passage leading from the casing on the side of the larger piston farthest from the smaller piston to the valve chest, and an opening controlled by said larger piston establishing communication between one of the high pressure supply ports and said valve chest passage, substantially as set forth.

In testimony whereof I have hereunto set my hand.

FRANCIS M. RITES.

Witnesses:

J. SNOWDEN BELL,
R. H. WHITTLESEY.