

No. 625,324.

Patented May 23, 1899.

J. CRAIG, JR.
VALVE FOR AIR MOTORS.

(Application filed Sept. 16, 1897.)

(No Model.)

2 Sheets—Sheet I.

Fig. 1

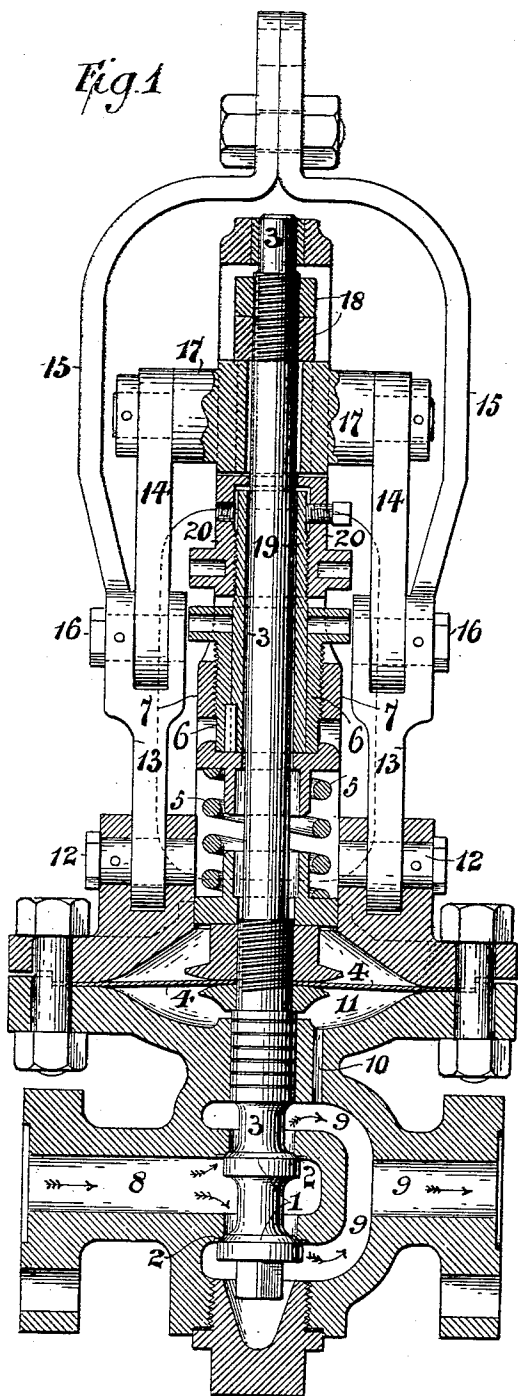
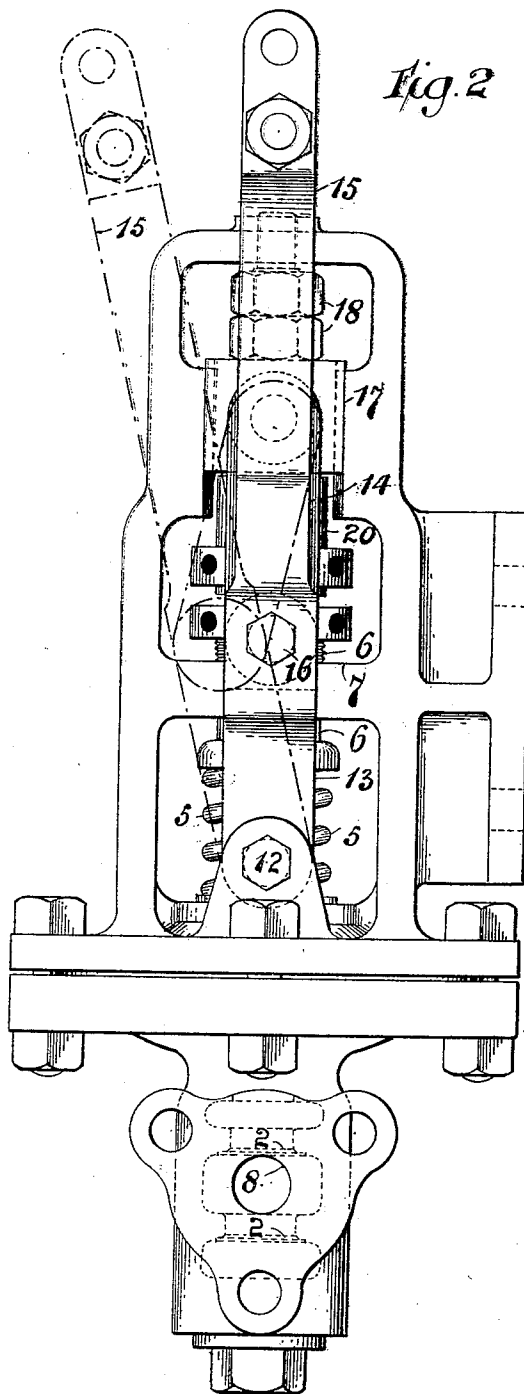


Fig. 2



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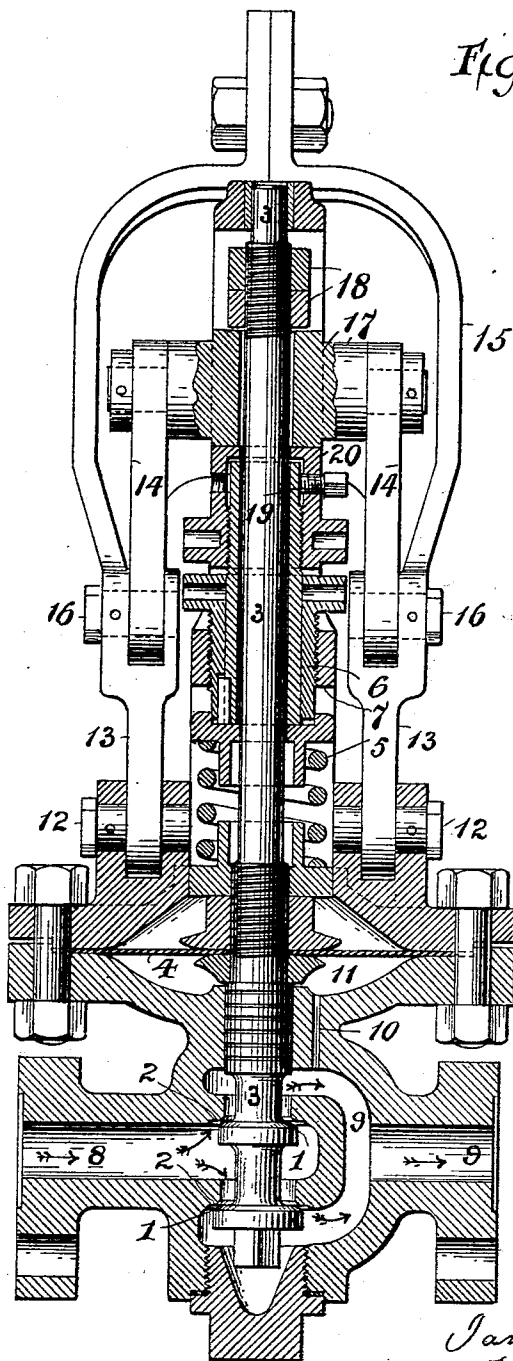
J. CRAIG, JR.
VALVE FOR AIR MOTORS.

(Application filed Sept. 18, 1897.)

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2 Sheets—Sheet 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES CRAIG, JR., OF NEW YORK, N. Y.

VALVE FOR AIR-MOTORS.

SPECIFICATION forming part of Letters Patent No. 625,324, dated May 23, 1899.

Application filed September 16, 1897. Serial No. 651,828. (No model.)

To all whom it may concern:

Be it known that I, JAMES CRAIG, Jr., a citizen of the United States, and a resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Valves for Air-Motors, of which the following is a specification.

This improvement refers particularly to air-motors for propelling street-railway cars, and relates to the reduction or delivery valve by which the air is admitted to the motor from the storage-reservoir on the car. As is well known, in all such motors the air in the reservoir is at a greater pressure than is required to operate the motor, and consequently as the air passes through the valve into the motor its pressure is reduced by the valve itself to the required degree. Heretofore in the operation of these motors the air delivered by this reduction-valve has always been at a fixed uniform degree of pressure; but it frequently happens in the case of railroad traffic that a greater pressure or more power is required in the motor at certain times and on certain portions of the road than the normal pressure delivered by the valve—as, for instance, when the car is to be propelled up a steep incline or around a sharp curve; and the object of this improvement is to produce a reduction-valve in which the pressure of the air in the motor can be increased by the driver or motorman on the car whenever necessary.

This invention consists in certain novel features of construction of the reduction-valve, whereby the pressure of the air delivered by the valve can be readily and quickly increased when desired and afterward returned to the normal pressure and whereby the reduction-valve is caused to act as a throttle-valve for the motor.

In the accompanying drawings, illustrating my improvement, Figure 1 is a side elevation of the valve, partly in section. Fig. 2 is an end elevation of the same; and Fig. 3 the same as Fig. 1, showing the position of the parts when the delivery-pressure of the valve is increased.

1 1 is the double valve, and 2 2 the valve-seats.

3 is the valve-piston, extending upward through the casing, and 4 is the flexible dia-

phragm connected to and moving with the piston. On the upper side of this diaphragm and arranged to press down on the latter is the spiral spring 5, which is set at any degree of pressure by the screw-sleeve 6, screwing into the valve-casing at 7.

8 is the inlet-port, communicating with the reservoir, and 9 the outlet-port, communicating with the motor.

10 is a passage-way between the outlet-port and the chamber 11 beneath the diaphragm 4.

In the operation of the valve as soon as the air in the outlet-port 9 and chamber 11 is at a degree of compression less than the initial tension at which the spring 5 is set the spring forces down the diaphragm 4, and the latter in moving carries with it the piston 3, and thus opens the valve 1 1. The air in the inlet-port 8, which is always at a greater degree of compression than the pressure or tension of the spring, then rushes through the valves into the outlet-port 9 and through the passage 10 into the chamber 11 and pushes up the diaphragm against the pressure of the spring and closes the valves. The valves remain closed until the small quantity of air in the outlet-port and chamber 11 expands and decreases in pressure below the tension of the spring, when the latter again acts on the diaphragm and opens the valves and lets in some more air at the higher degree of compression. As will thus be seen, the air in the outlet-port communicating with the motor is always maintained at a constant pressure slightly less than the initial pressure of the spring, as the moment it falls below this latter pressure the spring opens the valve and introduces more air at the higher pressure of the reservoir into the outlet-port. The force of the air in the inlet-port 8 is so great that when the valve is opened but a very short distance the air rushes through the valve and the passage 10 and, acting on the diaphragm, instantly closes the valve. A very small quantity of air at this high degree of compression thus passes through the valve at any one time, and this readily expands and decreases in pressure in the outlet-port to the required degree. The valves are thus constantly opening and closing and an intermittent stream of air at the high degree of pressure of the reservoir in thus passing from the

inlet-port through the valves into the outlet-port, where it has an opportunity to expand and decrease in pressure to the required degree as it passes into the motor. The air in the outlet-
 5 port is thus reduced by the action of the valve from the higher degree of compression of the reservoir to the lower degree determined by the initial pressure of the spring. As this pressure of the spring may be increased or di-
 10 minished by the screw-cap 6, the spring may be set to open the valve at any pressure desired, and thus reduce the pressure of the air passing through the valve to any required degree. As will thus be seen, the operation
 15 of the reduction-valve is automatic, and the valve is caused to move the instant the air is permitted to pass from the air-reservoir and continues to operate until the passage of the air from the reservoir is stopped. To control,
 20 therefore, the passage of the air from the reservoir, it has been necessary heretofore to employ with the reducing-valve a throttle-valve which when opened will allow the air to pass from the reservoir through the
 25 reduction-valve into the motor and which when closed will shut off the passage of the air and stop the operation of the motor.

With this improvement I am enabled to do away with the separate throttle-valve and
 30 by mechanism connected with the reducing-valve to shut the latter and hold it closed, so that the air cannot pass from the reservoir until the valve is allowed to open, and thus cause the reducing-valve to also act as the
 35 throttle-valve. This mechanism connected with the reducing-valve is as follows: Mounted on the valve-casing by the bolts 12 is a toggle-joint consisting of the members 13 and 14 and the operating-lever 15, connected together by the bolt 16, so as to turn on each
 40 other. The members 14 of the toggle-joint are connected to the cross-head 17, through which the valve-piston 3 passes and in which it freely slides. As will be understood from the
 45 drawings, when the toggle-lever 15 is pulled over to one side the cross-head 17 is drawn down along the piston toward the spring 5. Near the top of the piston and directly above the cross-head 17 when at its highest point is
 50 a nut 18, screwed onto the piston, as shown in Fig. 1. When the toggle-joint is in the position shown in Figs. 1 and 2—that is, with the lever 15 raised and the joint 13 and 14 in line—the cross-head 17 is jammed up tight
 55 against the nut 18 on the piston. The piston is now securely held in its upper position and prevented from moving downward and opening the valves 1 1. The valve is thus closed and the air shut off from passing into
 60 the motor. By moving the lever 15 down a short distance the toggle-joints, acting on the cross-head 17, draw the latter down away from the nut 18, thus liberating the movement of the piston and allowing the spring, acting on the diaphragm, to push down the piston and open the valves. By means of this toggle-joint, therefore, I am enabled to operate this

reduction-valve as a throttle-valve and to instantly close the valve and hold it shut against the action of the spring for any length of time
 70 and as quickly to free the movement of the valve and allow it to be operated, as above described. The nature of the toggle-joint is such that a very slight movement of the lever, operated by suitable mechanism from either
 75 end of the car, is all that is necessary to completely shut off the passage of the air from the motor or allow the valve to open and permit the air to pass at once into the motor.

In the construction and operation of my improvement as thus set forth the valve controlled by the toggle-joint acts as a throttle-valve and as a reduction-valve, allowing the air to come from the reservoir and at one uniform degree of pressure to pass into the motor.
 85

While the pressure of the spring, and hence the delivery-pressure of the valve, may be adjusted by the screw-sleeve 6, it is very desirable to have some other means of quick adjustment of the valve immediately under the
 90 control of the motorman, whereby he can increase the pressure of the air delivered by the reducing-valve, and thus increase the power in the motor, whenever it is desired during the run of the car and while the latter is in motion.
 95 To accomplish this, I employ the mechanism described below.

Loosely surrounding the piston, between the cross-head 17 and spring 5, is an inner sleeve 19. The lower portion of this sleeve is
 100 inclosed by the adjusting-sleeve 6, within which it freely slides. The upper part of the sleeve 19 in the construction shown in the drawings screws into the adjusting-sleeve 20, by means of which the position of the sleeve
 105 with respect to the cross-head 17, and consequently the extent of its movement, is regulated. The bottom of the sleeve 19 rests on the top of the spring 5, as shown in Fig. 1, and as the tension of this spring is regulated
 110 by the adjusting-sleeve 6 the sleeve 19 moves up or down, so as to always be in contact with the upper end of the spring.

In the ordinary operation of the valve when the air delivered at the uniform pressure determined by the initial tension of the spring is all that is required in the motor the sleeve 19 remains in the position shown in Fig. 1, resting on the top of the spring. When, however, greater power is required in the motor,
 115 and hence a greater pressure of the air delivered by the valve, the lever 15 is turned down, as shown in Fig. 3. The toggle-joints now draw the cross-head down on the adjusting-sleeve 20 or on the top of the sleeve 19
 120 and slide the latter sleeve down on the spring 5, compressing the spring, and thus increasing its tension, and thereby increasing the pressure of the air delivered by the valve and passing through the outlet-ports into the
 125 motor.

As will be understood, if the initial tension of the spring is a little over two hundred pounds, so that the pressure of the air deliv-

ered by the valve is two hundred pounds, and the additional tension of the spring caused by its compression by the sleeve 19 is a little over two hundred and fifty pounds, the valve will
 5 act when the air in the outlet-ports has decreased to two hundred and fifty pounds instead of two hundred pounds.

As long as the parts are held in position shown in Fig. 3, with the sleeve 19 compressing the spring, the increased pressure of air is delivered into the motor; but as soon as the occasion for this extra power in the motor is past and the usual pressure of air determined by the normal initial tension of the
 10 spring is all that is required the lever 15 is raised, relieving the pressure of the cross-head 17 on the top of the sleeve 19 and allowing the spring to expand upward and carry the sleeve 19 with it until it bears against the adjusting-sleeve 6. The parts are then in their normal position, as seen in Fig. 1, and the operation of the valve is controlled by the spring at its initial tension and the pressure of the air reduced to the degree required for the usual working of the motor.
 15 As will thus be seen, by a slight movement of the toggle-joint by the driver of the car the pressure of the air, and consequently the power in the motor, can be increased at any time and afterward returned to its original degree. The driver of the car or motorman is thus enabled to apply more power to the motor whenever necessary, and to maintain this increase of power as long as required,
 20 and to effect this by an extension of the movement by which the valve is first started to operate.

It will be seen that this improved valve combines the functions of throttle, reduction, and extension valves and in such a manner
 25 that the valve can be quickly and easily operated.

I do not wish to confine myself to the exact construction shown herewith, as it will be evident that the extension member in structure and operation from the sliding sleeve here described and the toggle may differ from that shown without changing the principle of the invention.

What I claim is—

1. In a reducing-valve apparatus for air-motors the combination of the reducing-valve, valve-stem operating the same, toggle mechanism controlled by the operator, and a member connected with the valve-stem and arranged to engage with the toggle mechanism whereby the reducing-valve is closed and held on its seat, substantially as described.

2. In a reducing-valve apparatus for air-motors the combination of the reducing-valve,

valve-stem operating the valve, nut 18 connected with the valve-stem, and toggle mechanism controlled by the operator and arranged to engage with the nut on the valve-stem, whereby the reducing-valve is closed
 65 and held from opening, and the passage of air from the reservoir is shut off, substantially as described.

3. In a reducing-valve for air-motors having a flexible diaphragm operated by a spring and mechanism for adjusting the spring to its normal pressure; the combination with the valve of additional mechanism, controllable by the operator, adapted to further compress the spring and increase its tension above its
 70 normal adjustment, whereby the delivered fluid-pressure of the reducing-valve is increased, substantially as described.

4. In a reducing-valve for air-motors, having a flexible diaphragm operated by a spring, in combination, the spring; mechanism for adjusting the spring to its normal tension; and additional mechanism, controllable by the operator, for further compressing the spring above its normal tension, whereby the
 80 delivered fluid-pressure of the reducing-valve is increased, substantially as described.

5. In a reducing-valve for air-motors having a flexible diaphragm operated by a spring, in combination, the spring; means for adjusting the spring to its normal tension; other means whereby the spring may be further compressed and its tension increased above its normal adjustment; and toggle mechanism adapted to operate the latter, by which
 90 the delivered fluid-pressure of the reducing-valve is increased, substantially as described.

6. In a reducing-valve for air-motors the combination with the valve of mechanism adapted and arranged when in one position to close the valve and hold it from opening, and when in the other position to act on the valve and increase the pressure at which the reducing-valve opens, whereby the delivered fluid-pressure of the valve is increased, substantially as described.

7. In a reducing-valve for air-motors, in combination, the valve; a spring adapted to regulate the tension of the valve; and toggle mechanism connected with the valve, and arranged when in one position to close the valve and hold it from opening, and in the other position to act on the spring and increase the tension of the latter and the pressure at which the reduction-valve opens, substantially as
 110 described.

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