(No Model.) 2 Sheets—Sheet 1.

H. C. SERGEANT.

REGULATOR FOR AIR COMPRESSORS.

No. 514,839. Patented Feb. 13, 1894.

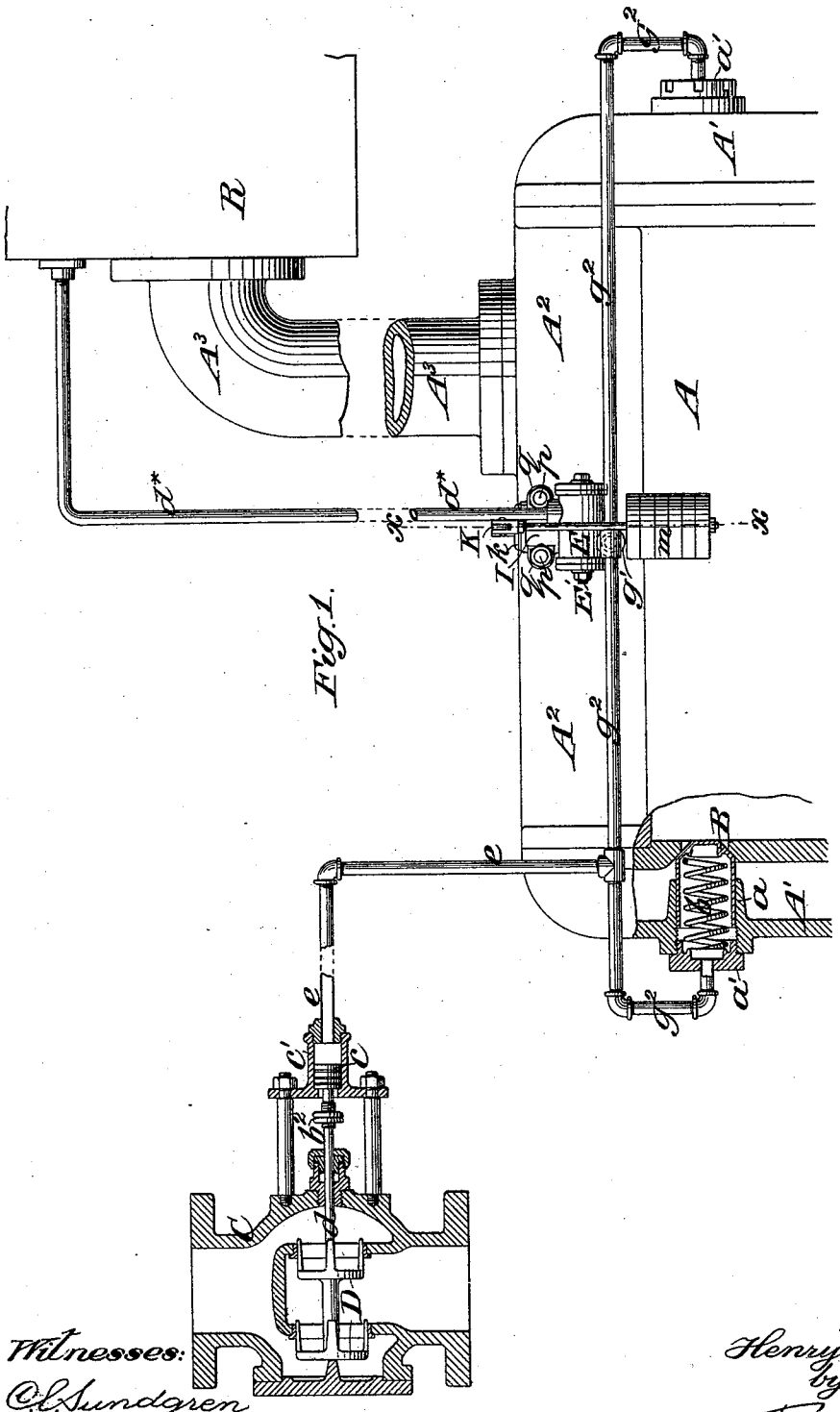

Fig. 1.

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THE NATIONAL LITHOGRAPHING COMPANY,
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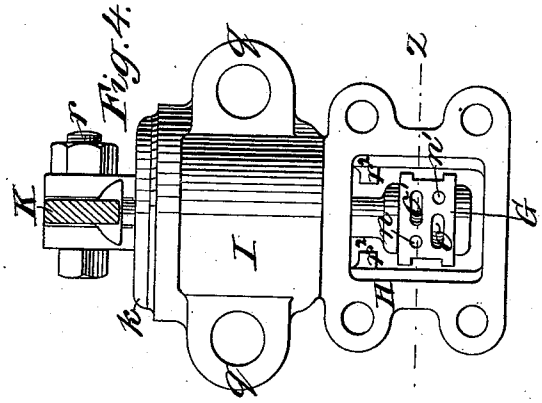

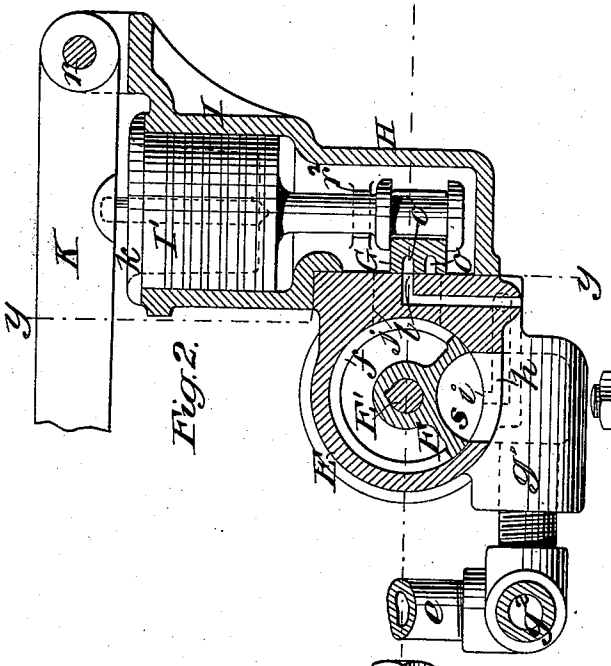

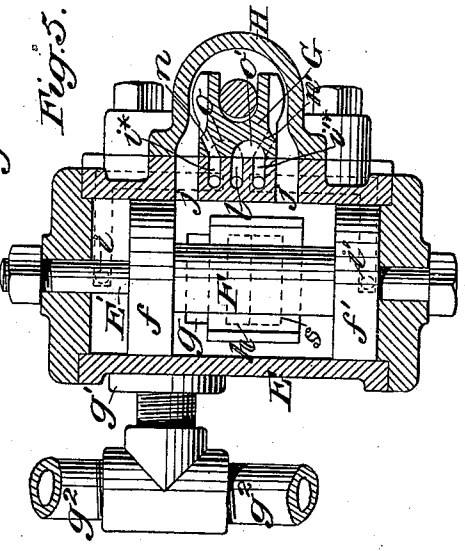

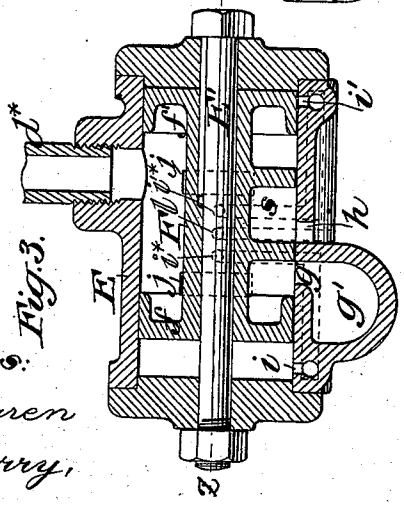

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UNITED STATES PATENT OFFICE.

HENRY C. SERGEANT, OF WESTFIELD, NEW JERSEY, ASSIGNOR TO THE INGERSOLL-SERGEANT DRILL COMPANY, OF NEW YORK, N. Y.

REGULATOR FOR AIR-COMPRESSORS.

SPECIFICATION forming part of Letters Patent No. 514,839, dated February 13, 1894.

Application filed March 6, 1893. Serial No. 464,684. (No model.)

To all whom it may concern:

Be it known that I, HENRY C. SERGEANT, of Westfield, in the county of Union and State of New Jersey, have invented a new and useful Improvement in Regulators for Air-Compressors, of which the following is a specification.

The object of this invention is to prevent the accumulation of an undue pressure in a receiver into which air is delivered by a compressor to be used for motive power or other purposes, and to effect this either by the control of a steam engine which is employed as the motor of the compressor or by the automatic control of the compressor itself independently of the action of its motor, or both by the control of the engine and by the automatic control of the compressor itself.

The nature of the improvement will be described with reference to the accompanying drawings which illustrate the application of my invention both to control the steam engine which drives the compressor and to effect the automatic control of the compressor itself.

Figure 1 represents an elevation partly in section of part of an air compressor cylinder, the throttle valve for its operating engine and a regulator embodying my invention. Fig. 2 represents a central vertical section, taken at right angles to Fig. 1, in the line $x\,x$, of the regulator and its appurtenances which constitute essential elements of my invention. Fig. 3 represents a central vertical section of the regulator valve. Fig. 4 represents a vertical section at right angles to Fig. 2 in the line $y\,y$ of that figure as viewed from the left. Fig. 5 represents a horizontal section in the line $z\,z$ of Figs. 2, 3 and 4. Figs. 2, 3, 4, and 5 are all on one scale larger than that of Fig. 1.

Similar letters of reference designate corresponding parts in all the figures.

A is the compressor cylinder having heads A′ A′ which are made hollow to form discharge chests which are in free communication through a discharge passage A^2 arranged lengthwise of the cylinder with the discharge pipe A^3 through which the compressed air passes to a receiver R, (Fig. 1.) The discharge valves B, only one of which is shown, through which the compressed air is delivered from the compressor cylinder into the discharge chest within the cylinder heads A′, are of the puppet type and close into conical seats in the inner walls of their respective cylinder heads. The said valves are represented as of cylindrical form or having combined with them pistons to work in cylinders a formed or provided in the outer walls of the hollow cylinder heads A′, said cylinders a being closed at their outer ends by removable caps a' which serve as abutments for coil springs b which operate to close the valves.

C is the shell of the throttle valve through which steam is supplied to the operating engine, and D is the throttle valve which should be so nearly balanced as to have only a slight tendency to be closed by the pressure of the steam. To the stem d of this throttle valve is affixed a small piston c which works in a corresponding cylinder c' affixed to the shell C of the throttle valve. Fitted to the screw-thread on the valve stem between the shell C and the cylinder c' is a nut b^2 which forms an adjustable stop for limiting the closing movement of the throttle valve.

The cylinder c' and piston c are so proportioned that a certain pressure within the said cylinder on the outer side of the piston will hold the valve open while a reduction or entire relief of such pressure will allow the unbalanced pressure of steam upon the valve to close the latter as far as permitted by the stop b^2. The cylinder c' and piston c may be considered as a motor for the throttle valve B to be operated by compressed air from the receiver R (Fig. 1) through a pipe e to the outer end of the cylinder c' under the control of the regulating valve.

So far as I have at present explained my apparatus it is the same as that described in my United States Letters Patent No. 415,370, dated November 19, 1889. I will now proceed to describe the regulating valves and their appurtenances which constitute the essential parts of the present invention.

E is a cylindrical valve box containing a slide valve F which constitutes the main valve of the regulator. This main valve F which is fitted to slide without turning on a fixed central spindle E′, is an ordinary short D-valve provided with piston heads $f\,f'$ which fit the

cylindrical box E. The seat of the said main valve is in the cylindrical box E and represented at the bottom thereof, and has in it two ports g and h of which h is open to the atmosphere and g is in communication with an outside passage g' which is always in communication both with the outer ends of the discharge valve cylinders a of the compressor and with the pipe e of the throttle valve motor cylinder c', the communication with the valve cylinders being by two pipes g^2 branching off in opposite directions from said passage g', and one of the said pipes g^2 having the said pipe e connected with it. The said main valve is operated by the pressure on one or other of its pistons $f f'$, of air admitted at the ends of the valve box E, through ports i i' in said box under the control of an auxiliary slide valve G (Figs. 2, 4, and 5) in a box H which is arranged on one side of the main valve box E and which is always open to the latter box between the pistons $f f'$ through passages $j j$ (Fig. 5) and therefore always open to the receiver through the pipe d^*. On the top of the auxiliary valve box H is a cylinder I which is open at the bottom to said box and to this cylinder which is open at the top to the atmosphere is fitted a piston I' at the top of which is a flange k which may rest on the top of the said cylinder to prevent the piston from descending below a certain point. The auxiliary valve box H and cylinder I are represented (see Figs. 2 and 4) as one casting and as bolted to the compressor cylinder A by bolts p p (see Fig. 1) passing through lugs q q (see Figs. 1 and 4) on the sides of the said cylinder I. The main valve box E is represented as bolted to and supported by the auxiliary valve box H.

The piston I' is connected directly with the auxiliary valve G and may be considered as a motor for said auxiliary valve for producing the operation of said valve by which air is admitted through the ports i i' to the main valve chest to act upon the pistons f f' to throw the said valve in either direction. The seat for the valve G is formed on one side of the main valve box E, and has in it as shown in Fig. 5, three ports i^* i'^* and l of which i^* i'^* communicate respectively with the ports i i' hereinbefore mentioned, as may be traced by the dotted lines in Figs. 3 and 5, and l which is an exhaust port communicates with the atmosphere as shown in full outline in Fig. 2 and dotted in Fig. 3. The auxiliary valve G has two ports n n' which run through it and two coves o o' in its face, the upper one o' of which is arranged to bring the port i'^* into communication with the exhaust port l as shown in Fig. 5, and the lower one o is arranged to bring the port i^* into communication with said port l.

The piston I' is loaded in any suitable manner as for instance by weights m (see Fig. 1) hung on a lever K fulcrumed as shown at r in Fig. 2, on the top of the cylinder I, the weights being so adjusted as to hold down the piston until the pressure in the receiver acting on the under side of the piston exceeds a certain determined degree and then to be lifted by said pressure for the purpose of shifting the auxiliary valve and thereby causing the shifting of the main valve to a position in which it opens the pipe e to the atmosphere through the pipes g^2, passage g' and ports g and h (Fig. 3) as will be presently explained, and so relieve the outer side of the piston c of the throttle valve motor of the pressure of the air in the receiver to which it is subject in the normal condition of the said pressure and in the normal position of the motor piston I and the auxiliary and main valves G and F.

The normal condition and positions above referred to are illustrated in the drawings, in which the auxiliary valve is represented as admitting compressed air from the receiver through the port n to the port i^* in its seat (see Fig. 5) and thence through the port i of the valve casing E (see also Fig. 3) the pressure of the air being outside the left hand piston f and the port i' at the right hand end of the casing E being in communication with the atmosphere through the port i'^*, the cove o' of the auxiliary valve (see Figs. 2 and 3) and the exhaust port l. On the pressure rising in the receiver beyond the desired degree, the motor piston I' is raised taking with it the valve G as high as permitted by stops r' r^2 provided for the valve in the chest H and the compressed air, with which it will be understood the valve chests E H are always filled behind their respective valves, will be admitted through the port n' to the port i'^* and thence to the port i' of the main valve chest, the port i being in the meantime brought into communication with the atmosphere through the port i^*, the cove o of the auxiliary valve and the exhaust port l. The main valve then moves to the left and produces communication through its cove s between the ports g and h, thus bringing the passage g', the pipes g^2 g^2 e and the outer end of the throttle valve motor cylinder into communication with the atmosphere. The throttle valve is then caused to close or contract its opening by the unbalanced pressure of steam upon it and the velocity of the motor engine and of the compressor is reduced.

It has been hereinbefore mentioned that the pipes g^2 g^2 which are in communication with the main valve box E communicate with the spaces in the discharge valve cylinders a in rear of the discharge valves. It may therefore be understood that when the compressor is working normally the backs of the said valves will always be subject to the pressure of air in the receiver but when the main valve is shifted as before described to open the communication with the atmosphere through the ports g h, the backs of the discharge valves are relieved from all pressure but that of the atmosphere and the slight pressure of the springs b, and the air which is compressed be-

fore the piston at each stroke and so caused to open and pass said valves passes through said pipes g^2, the passage g' and ports g h to the atmosphere.

In case of the bursting of the receiver and the consequent tendency of the motor engine of the compressor to run away, the pipe d^* being then in communication with the atmosphere, the throttle valve motor piston c being relieved from the pressure on its outer face, will allow the throttle valve to be closed by its unbalanced pressure, the communication between the cylinder c' and the pipe d^* being made through the port g, passage g', pipes g^2 and pipe e just as it is in the normal condition of things first described.

It is obvious that in cases where a steam engine for driving the compressor is provided with an effective governor the throttle valve motor herein described controlled by air from the receiver may be dispensed with.

What I claim as my invention is—

1. The combination with an air compressor, a receiver connected therewith and a throttle valve for supplying steam to the operating engine of said compressor, of a motor cylinder and piston for holding said throttle valve open, a main valve to be actuated by compressed air from the receiver for opening and closing communication of said motor cylinder with the receiver and with the atmosphere, an auxiliary valve for controlling the said actuation of the main valve, and a motor actuated by pressure from the air receiver for operating the said auxiliary valve, all substantially as and for the purpose herein set forth.

2. The combination with the cylinder of an air compressor, of a combined discharge valve and piston, a valve cylinder provided on the compressor cylinder for the reception of said piston, an air receiver supplied by said compressor a main valve to be actuated by air from said receiver for opening and closing communication of said valve cylinder with the atmosphere and with the compressor, an auxiliary valve for controlling the said actuation of the main valve and a motor actuated by pressure from the air receiver for operating the said auxiliary valve, all substantially as and for the purpose herein set forth.

3. The combination with an air compressor, its combined discharge valves and pistons B and valve cylinders a and an air receiver supplied by said compressor, of the cylindrical main valve box E having a communication d^* with said receiver and a port h in communication with the atmosphere, the piston-headed D-slide valve F working in said box E, the auxiliary valve box H in communication with the receiver through the said main valve box, the auxiliary valve G in said box H having two ports n n' and two coves o o', the seat for said auxiliary valve having ports i^* i'^* communicating respectively with opposite ends of said main valve box, the motor cylinder I in communication through said main and auxiliary valve boxes with the receiver, and the loaded piston I′ working in said motor cylinder, all substantially as and for the purpose herein set forth.

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Witnesses:
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