No. 827,998.

PATENTED AUG. 7, 1906.

L. SCHUTTE.

PRESSURE REDUCING VALVE.

APPLICATION FILED JULY 7, 1904.

2 SHEETS—SHEET 1.

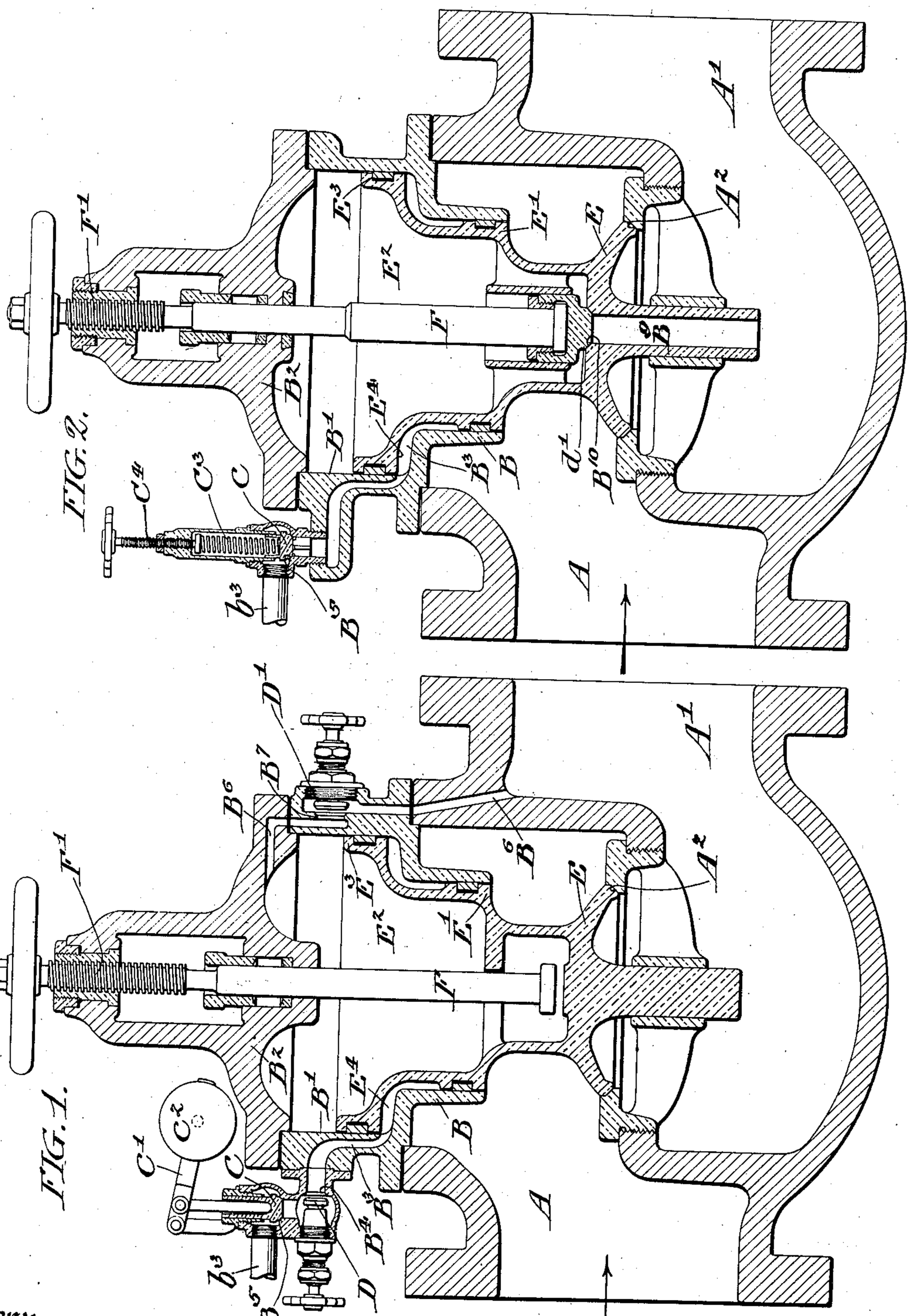

FIG. 2.

FIG. 1.

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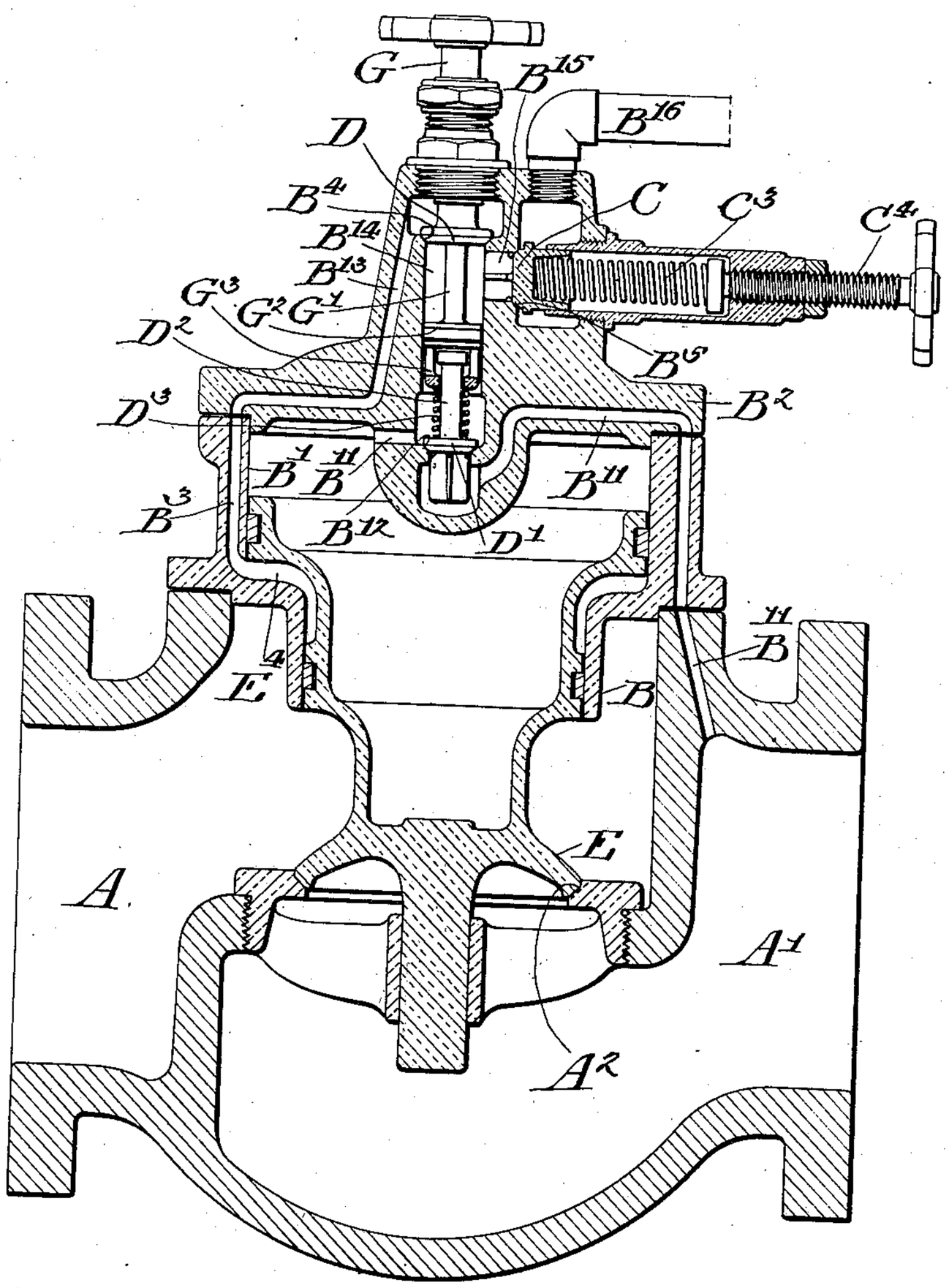
2 SHEETS—SHEET 2.

FIG. 3.



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PRESSURE-REDUCING VALVE.

No. 827,998. Specification of Letters Patent. Patented Aug. 7, 1906.

Application filed July 7, 1904. Serial No. 215,640.

To all whom it may concern:

Be it known that I, LOUIS SCHUTTE, a citizen of the United States of America, residing in the city and county of Philadelphia, in the State of Pennsylvania, have invented a certain new and useful Improvement in Pressure-Reducing Valves, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

My invention relates to what are known as "pressure-reducing valves," and has for its object to provide a valve of this character of simple, efficient, and generally improved construction.

The nature of my improvements will be best understood as described in connection with the drawings which illustrate my invention, and in which—

Figure 1 is a vertical sectional elevation of a pressure-reducing valve constructed in accordance with my invention; Fig. 2, a similar elevation of a modified form of valve also embodying my improvements, and Fig. 3 a similar elevation showing another and preferred modification.

A and A′ indicate, respectively, the high and low pressure sides or chambers of the valve-casing, which are in communication through the valve-seated port indicated at A^2.

B B′ represent a differential cylinder situated directly in line with the valve-port and the smaller section B of which should be of practically the same internal diameter as the effective outer diameter of the pressure-reducing valve.

B^2 indicates the top or cover of the valve-casing, which in this construction forms the closed head of the differential cylinder.

B^3 is a port communicating with the lower end of the larger cylinder-section B′ and having, as shown in Fig. 1, a valve-seat B^4 formed in it and also nearer to its outer end a second valve-seat B^5.

b^8 indicates an exhaust-pipe leading from the upper end of port B^3.

In the construction indicated in Fig. 2 a single valve-seat B^5 is made to serve the purpose of the two seats in Fig. 1.

In Fig. 3 the port B^3 connects with a port B^{13} in head B^2, which opens into a cylinder-port B^{14}, having a lateral port B^{15}, which connects with an outlet-conduit B^{16}, the seat B^4 being formed on the end of cylinder B^{14} and seat B^5 on port B^{15}, as shown.

B^6, Fig. 1, is a port leading from the upper end of the larger cylinder-section B′ and communicating with the low-pressure side A′ of the valve-casing. The valve-seat B^7 is provided in this port.

In Fig. 2 I have shown a second alternative, in which the port indicated at B^9 and having a valve-seat B^{10} is formed through the reducing-valve.

In Fig. 3 the equivalent port opens from the cylinder, as shown at B^{11}, including a valve-chamber at the base of cylinder B^{14} and a valve-seat B^{12}.

C, Figs. 1, 2, and 3, indicates a pressure-regulating valve, which in the construction shown in Fig. 1 is held to the seat B^5 in the port B^3 by the action of the adjustable weight C^2, acting through the lever C′, while in the construction shown in Figs. 2 and 3 the valve C is held to the seat B^5 by the action of an adjustable spring, (indicated at C^3 C^4,) indicating an adjustable screw for regulating the tension of the spring. D, Fig. 1, indicates a hand-operated valve adapted to seat itself on the valve-seat B^4 of the port B^3. D′, Fig. 1, is a hand-operated valve adapted to seat itself on the seat B^7 of the port B^6. In Fig. 2 the valve indicated at d' is adapted to seat itself on the seat B^{10} of the port B^9, and in this construction the valve is operated by the threaded rod F F′, a similar rod being shown also in Fig. 1, but having no connection with a similar valve.

In the construction of Fig. 3 the arrangement of the ports is such as to bring the valves D and D′ in line, so that they can both be operated by a single hand-wheel G, a rod G′ extending down through cylinder-port B^{14} and having a piston G^2 secured to it, which prevents communication between the two ports, while below the piston is secured a cage G^3, which embraces the head of a rod D^2, as shown, permitting some freedom of movement, said rod being attached to valve D′ and normally pressed down to its limit of movement by a spring D^3, the construction being such that the valve D′ preferably closes slightly in advance of valve D.

E is the pressure-reducing valve, adapted to seat itself on the port A^2 and firmly secured to the differential piston indicated at

E′ E³, the piston-section E′ fitting in the cylinder-section B, while the piston-section E³ fits in the cylinder-section B′. E² indicates the hollow body of the differential piston, which is preferably formed integral, as shown, with the valve E, the piston-section E′ having, essentially, the same area as the effective area of the valve E. At E⁴, I have indicated a space or chamber intervening between the piston and the cylinder, and with which space or chamber the port B³ communicates.

Referring first to the construction shown in Fig. 1, I would state that under normal operative conditions the valves D and D′ are both opened and the counter-weight holding the valve C to its seat adjusted so that said valve is held to its seat by a pressure slightly greater than the desired pressure on the low-pressure side of the valve-casing, the difference being such as would compensate for the weight of the valve and piston. Under these conditions the pressure on the upper side of the differential piston will be equal to that on the low-pressure side of the casing, which is in free communication with the top of the cylinder-section B′ through the port B⁶. The fluid on the high-pressure side of the piston will find its way past the loosely-fitting piston E′ and into port B³ and will exert on the lower side of the larger section of the differential piston the pressure provided for by the adjustment of the valve C. Whatever leakage occurs through the piston E³ will not vary the pressure on the upper side of that piston, since the top of the cylinder is in free communication with the low-pressure side of the valve. Under these conditions it will be obvious that the piston and the attached reducing-valve E will be moved up whenever the pressure on the low-pressure side of the valve-casing falls below that provided for, while any increase above the determined low pressure would result in moving the piston and valve downward. When it is desired to close the pressure-reducing valve E, I close the valve D′ in the port B⁶, thus cutting off the communication between the upper side of the differential cylinder and the low-pressure side of the casing and permitting the pressure in the cylinder by leakage through the piston E³ to become equal to that existing in the chamber E⁴. Under these conditions the pressure-reducing valve will be moved to and held to its seat, and the energy with which the valve is held to its seat is further increased by closing the valve D, which causes the pressure at the top of the differential cylinder to gradually become equal with that on the high-pressure side of the valve-casing and also prevents loss of pressure fluid through the port B³.

In the modified construction of Fig. 2 the normal adjustment is one in which the valve *d′* is raised, leaving the port B⁹ open and placing the top of the differential cylinder in free communication with the low-pressure side of the valve-casing, while the normal adjustment of the valve C is that in which it is held to its seat by pressure corresponding to a fluid-pressure in the port B³ slightly greater than that desired in the low-pressure side of the valve-casing. Under these conditions the valve will work exactly as in the construction of Fig. 1, and when it is desired to close the valve the stem F is moved downward, carrying with it the valve *d′*, until it seats itself on the port B¹⁰. Thereupon, as before, the pressure at the top of the differential piston will increase until it equals that of the chamber E⁴ and the pressure-reducing valve will move down to its seat. The valve *d′* of course is to be pushed down as the reducing-valve moves toward its seat. The further increase of pressure at the top of the differential cylinder is secured and a loss of pressure fluid avoided by screwing down the spring-adjusting device C⁴, so that the valve C will be held to its seat by a pressure exceeding that of the high-pressure side of the casing.

In the construction of Fig. 1 the threaded stem F is simply useful to clamp the reducing-valve to its seat and to press it to its seat in case of resistance tending to hold it above its seat and to enable the engineer to determine whether the valve is properly seated.

To provide against carelessness or ignorance, which might lead to the closing of valve D, leaving valve D′ open, thereby raising valve E to the full limit of the amount of the differential piston, I prefer to provide mechanism for opening and closing said valves practically simultaneously, the valve D′ closing, preferably, slightly in advance of valve D, and this is very conveniently done by the construction illustrated in Fig. 3 and already described so far as it differs from the other modifications illustrated.

The main advantage of my construction consists in the devices by which the reducing-valve is closed or brought into operative condition by the use of small, inexpensive, and easily-handled valves controlling the ports in communication with the differential cylinder, as above described.

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

1. A pressure-reducing valve having in combination a valve-casing divided by a valve-seated port into high and low pressure sections, a differential cylinder B, B′, secured in line with the valve-seat in the high-pressure section of the casing, having a port B³, connecting with the lower end of the larger section of the cylinder and a port connecting the upper end of said cylinder-section to the low-pressure side of the casing, a differential

piston E′, E³, working in the cylinder B, B′, a reducing-valve E, secured to said piston, a pressure-regulating valve controlling pressure in port B³, and a valve for closing the port leading from the top of the differential cylinder to the low-pressure side of the casing.

2. A pressure-reducing valve having in combination a valve-casing divided by a valve-seated port into high and low pressure sections, a differential cylinder B, B′, secured in line with the valve-seat in the high-pressure section of the casing, having a port B³, connecting with the lower end of the larger section of the cylinder and a port connecting the upper end of said cylinder-section to the low-pressure side of the casing, a differential piston E′, E³, working in the cylinder B, B′, a reducing-valve E, secured to said piston, a pressure-regulating valve controlling pressure in port B³, a valve for closing the port leading from the top of the differential cylinder to the low-pressure side of the casing and independent means for positively closing port B³.

3. A pressure-reducing valve having in combination a valve-casing divided by a valve-seated port into high and low pressure sections, a differential cylinder B, B′, secured in line with the valve-seat in the high-pressure section of the casing, having a port B³, connecting with the lower end of the larger section of the cylinder and a port connecting the upper end of said cylinder-section to the low-pressure side of the casing, a differential piston E′, E³, working in the cylinder B, B′, a reducing-valve of substantially the same area as that of the smaller piston-section E′, of the differential piston secured to said piston, a pressure-regulating valve, controlling pressure in port B³, and a valve for closing the port leading from the top of the differential cylinder to the low-pressure side of the casing.

4. A pressure-reducing valve having in combination a valve-casing divided by a valve-seated port into high and low pressure sections, a differential cylinder B, B′, secured in line with the valve-seat in the high-pressure section of the casing, having a port B³, connecting with the lower end of the larger section of the cylinder, and a port connecting the upper end of the differential cylinder with the low-pressure side of the casing, a differential piston E′, E³, working in the cylinder B, B′, a reducing-valve E, secured to said piston, a pressure-regulating valve regulating the pressure in port B³, other means for positively closing both ports leading from the differential cylinder and actuating mechanism whereby the said ports are closed and opened practically together.

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Witnesses:
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