No. 705,460. Patented July 22, 1902.

C. M. W. SMITH.

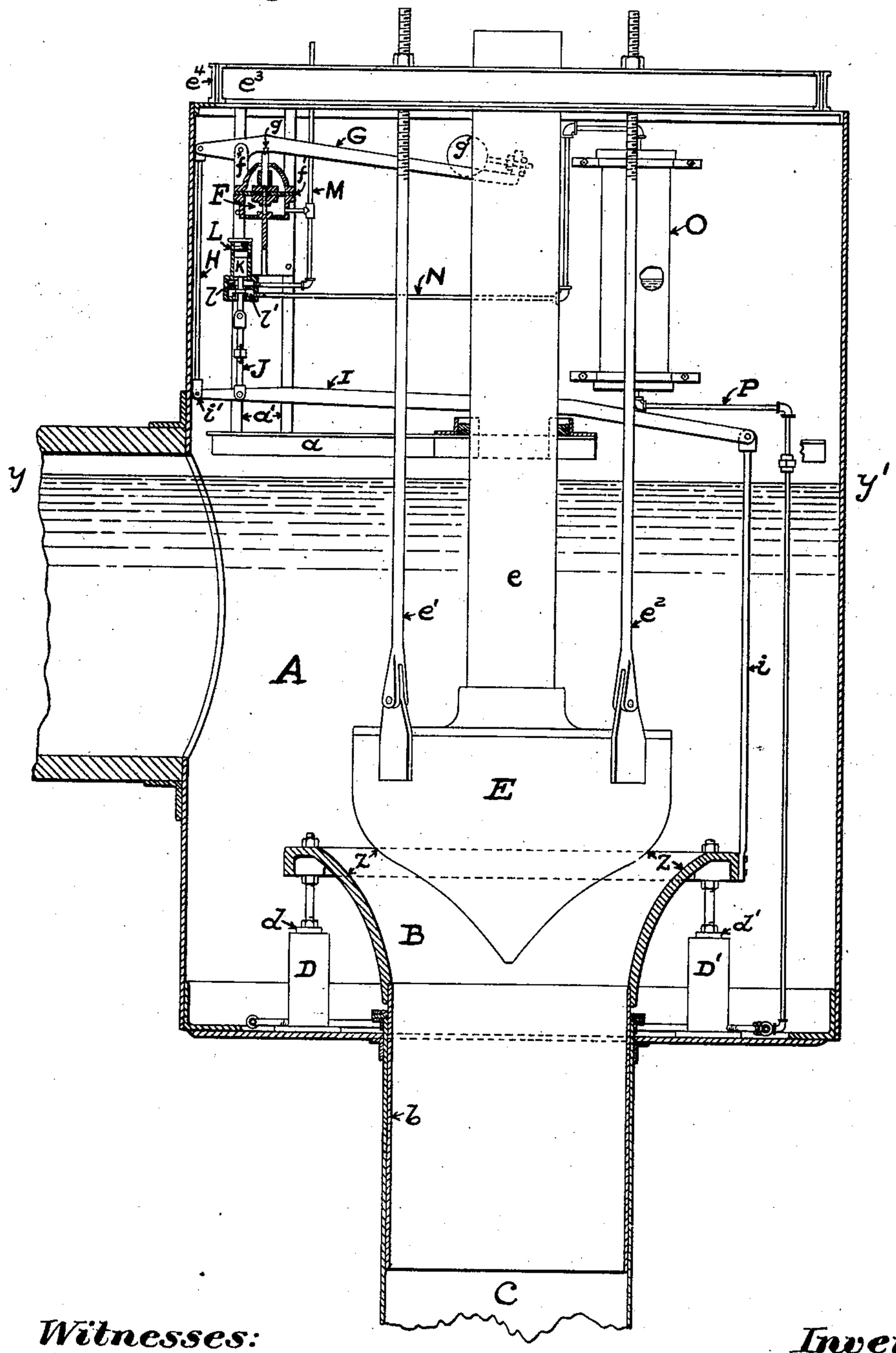
AUTOMATIC REGULATOR FOR HYDRAULIC AIR COMPRESSORS.

(Application filed Mar. 20, 1901.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.



Witnesses:

Walter E. Lombard.

Amy F. Williamson.

Inventor:

Charles M. W. Smith.

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Fig. 2.

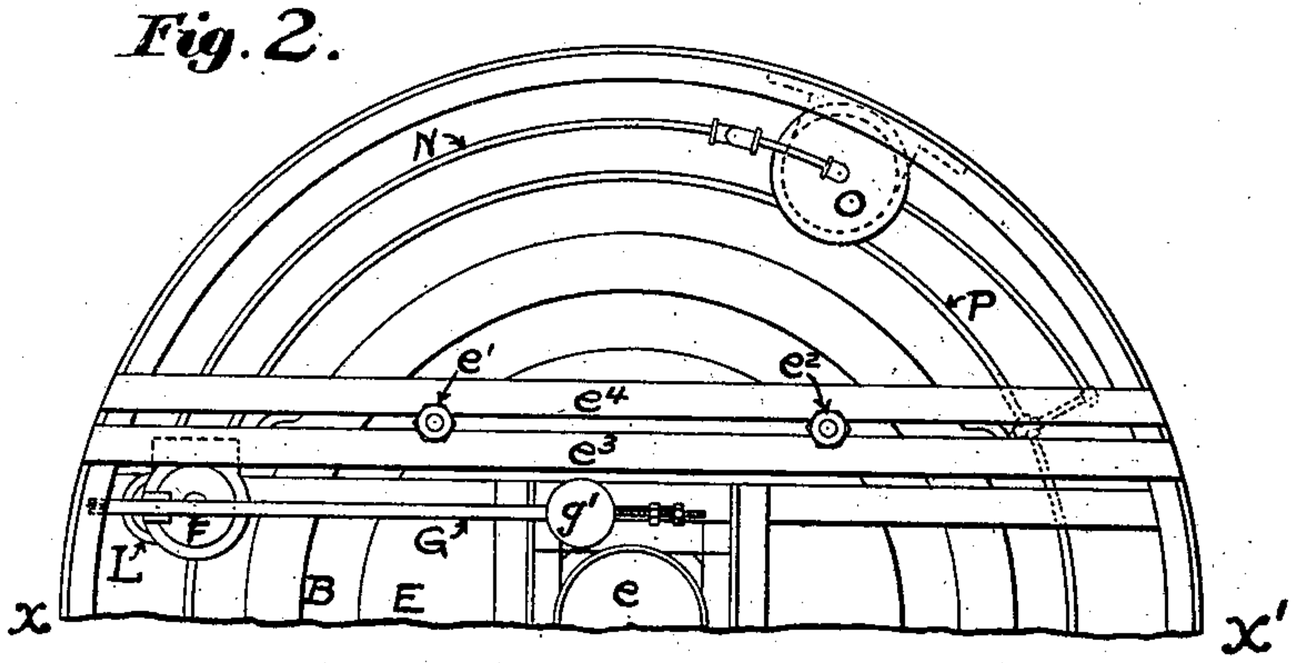


Fig. 3.

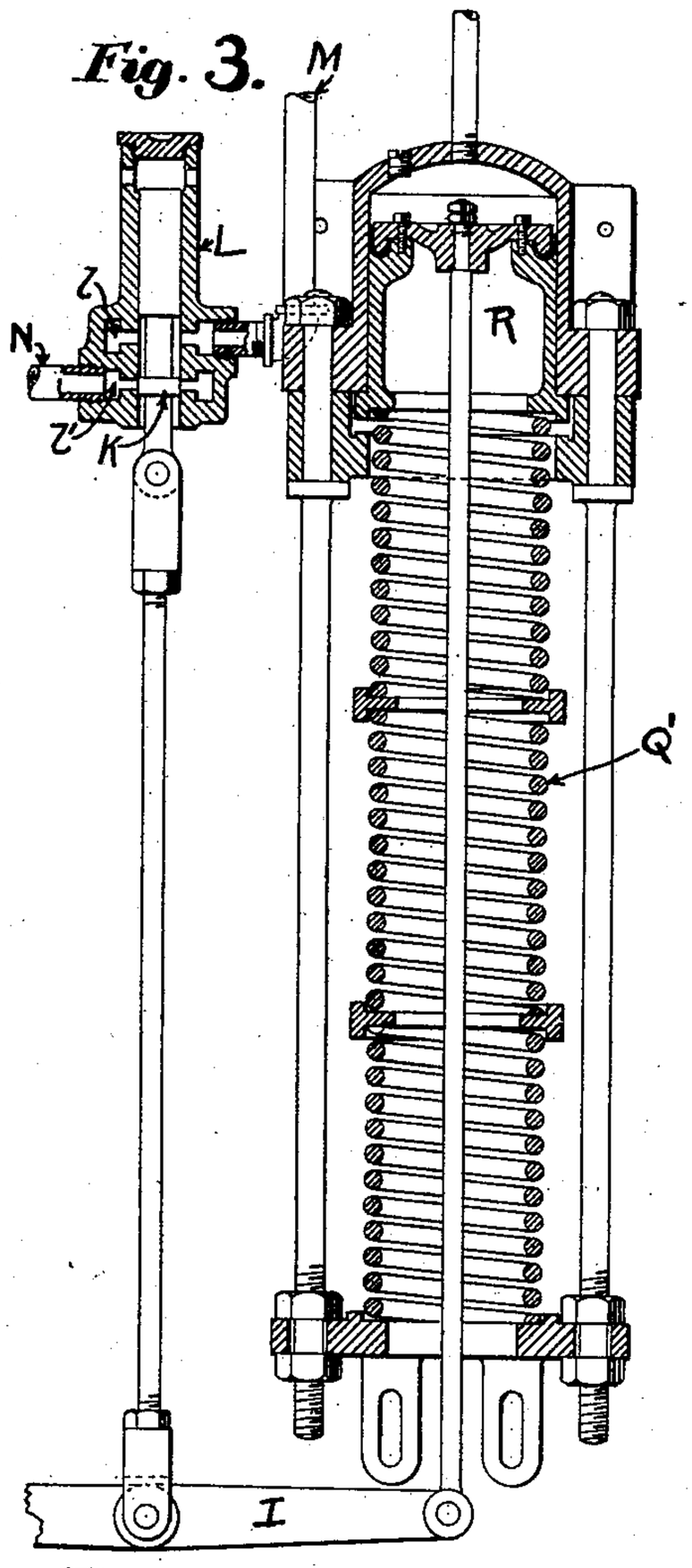
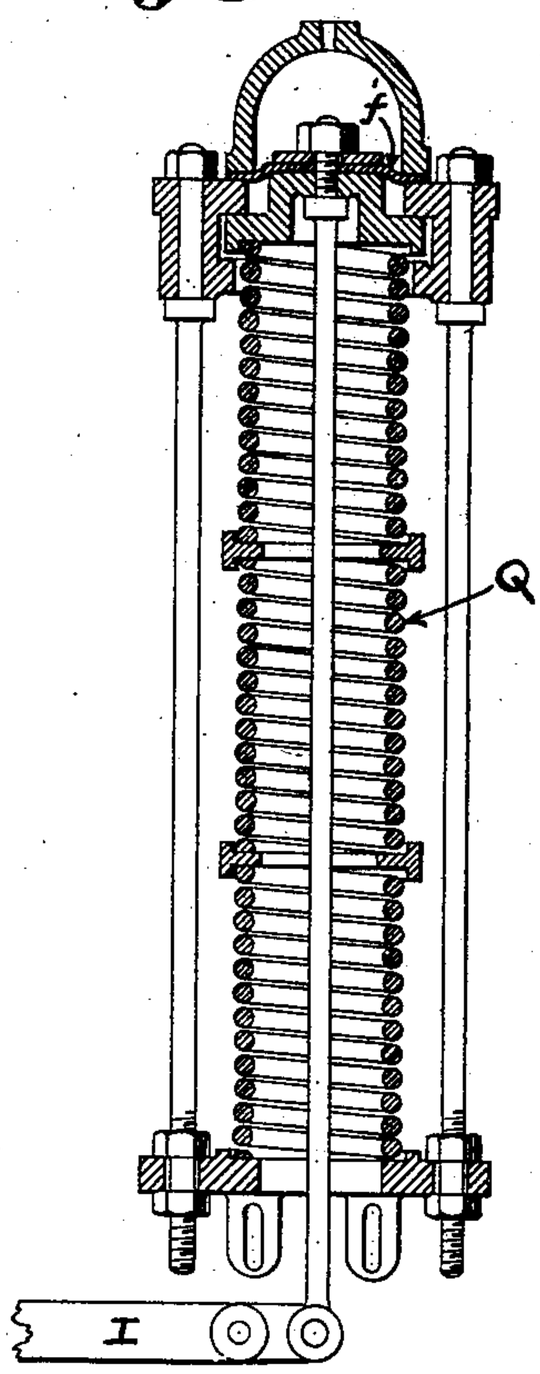


Fig. 4.



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Inventor:

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UNITED STATES PATENT OFFICE.

CHARLES M. W. SMITH, OF CAMBRIDGE, MASSACHUSETTS.

AUTOMATIC REGULATOR FOR HYDRAULIC AIR-COMPRESSORS.

SPECIFICATION forming part of Letters Patent No. 705,460, dated July 22, 1902.

Application filed March 20, 1901. Serial No. 52,090. (No model.)

To all whom it may concern:

Be it known that I, CHARLES M. W. SMITH, of the city of Cambridge, county of Middlesex, and State of Massachusetts, have invented an Automatic Regulator for Hydraulic Air-Compressors; and I hereby declare that the following is a clear, full, and exact description of the same.

This invention relates to an automatic regulator for hydraulic air-compressors, and has for its object the automatic controlling of the amount of water, and consequently the amount of air, which will be taken into a hydraulic air-compressor, these amounts being regulated by the pressure of the compressed air in the compressed-air reservoir or storage element of a hydraulic air-compressor.

Figure 1 is a vertical section through the head of inlet-tank of a hydraulic air-compressor on the line $x\ x$ in Fig. 2 and shows a cross-section of the head-tank, mouthpiece of the downflow-pipe, diaphragm-chamber, and controlling-valve, the oil-reservoir, air-inlet head, liquid-jacks, piping, and levers being in vertical elevation. Fig. 2 is a half-vertical plan of the headpiece, Fig. 1. Fig. 3 is a vertical section of the regulating-valve chamber and an alternative form, in section, of the automatic regulator in which a packed piston and spring are substituted for a diaphragm, lever, and weight. Fig. 4 is a vertical section of the automatic regulating-cylinder with a spring substituted for the lever shown in Fig. 1 in connection with the diaphragm.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters represent corresponding parts in all the views.

A is the head-tank.

B is a vertical adjustable throat-piece which by means of the downwardly-projecting pipe b forms a slip-joint with the upper end of the downflow-pipe C. This throat-piece B is operatively raised and lowered by the liquid-jacks D and D′. The inlet-head E is located in the vertical axis of the throat-piece B, with the main air-inlet pipe e projecting upward therefrom. The inlet-head E is adjustably suspended by rods e' and e^2 and I-beams e^3 and e^4, which are supported on top of the head-tank A. This inlet-head E can therefore be adjusted to a proper height in relation to the water-line $y\ y'$.

In the upper part of the head-tank A, above the water-line $y\ y'$, at any convenient point, is located the regulator-cylinder F, which is supported by angle-irons a and bars a'. This regulator-cylinder is composed of two castings forming an upper and lower chamber, with a flexible diaphragm interposed between the two chambers.

A weighted lever G is fulcrumed at the point f in lugs forming part of the upper casing of the regulator-cylinder F and press downward by means of a knife-edge g upon the diaphragm f'. On the longer end of this weighted lever G is an adjustable weight g'. The shorter end of the lever G is operatively connected to a rod H, which is in turn connected to the shorter end of floating lever I. This floating lever I is operatively connected to the vertically-movable rod J, which controls the position of the piston-valve K, vertically movable in the valve-cylinder L. The longer end of the floating lever I is connected, by means of the rod i, to the upper end of the throat-piece B.

Connected with the lower chamber of the regulator-cylinder F is an air-pressure pipe M, which is connected to the supply of air under pressure. This pipe also communicates with the upper port l of the valve-cylinder L. From the lower port l' of the valve-cylinder L air-pressure pipe N is led into the upper part of the oil-reservoir O, which is partially filled with oil or other non-compressible liquid not easily affected by change of temperature. From the lower part of the oil-reservoir O a pipe P is operatively connected to the lower part of the liquid-jacks D and D′ and transmits the pressure upon the oil to the under side of the pistons d and d' of these jacks.

The operation of this device is as follows: In a state of rest there will be maintained a certain distance between the outer periphery of the inlet-head E and the inner periphery of the throat-piece B, making an annular opening at the point Z of some determined area, which will allow a certain amount of water to be admitted through the throat-piece B, due to this area and the vertical height of the water-line $y\ y'$ above it. As soon as the

air-pressure accumulates in the air-reservoir of the compressor above a certain predetermined pressure the air-pressure passing through the pipe M enters the lower part of the regulator-cylinder F, causing the longer end of the lever G to rise, the shorter end of the lever G to fall, carrying down with it the shorter end of the floating lever I, thus causing the valve K to uncover the port l', which admits air under pressure through the pipe M, the port l, the port l', and the pipe N into the oil-reservoir O, forcing the oil out of the lower part of this reservoir through the pipe P into the jacks D and D', lifting the plungers of these jacks d and d', which in turn raise the throat-piece B, decreasing the area at Z, at the same time, by means of the rod i, raising the longer end of the floating lever I, which is now fulcrumed at i', causing the valve K to rise and cut off further movement due to the air-pressure through the port l' into the oil-reservoir O, and therefore causing the plungers d and d' of the jacks D and D' to remain stationary. If there is no outlet or demand for compressed air accumulating in the air-reservoir of the compressor, the lifting of the throat-piece B will continue until the outer periphery of the inlet-head E and inner periphery of the throat-piece B come into juxtaposition, and the passsage of water through the downflow-pipe C is thereby entirely cut off. If there is a constant draft or demand upon the compressed air from the compressor, the position of the inlet-head E to the throat-piece B will be adjusted so as to maintain a sufficient passage of water through the downflow-pipe C necessary to maintain that demand at the predetermined pressure. As long as the demand is constant the parts of the regulating device will remain stationary. As soon as there is an increased demand for compressed air the pressure will fall slightly, thereby reducing the pressure under the diaphragm f', causing the longer end of the weighted lever G to fall, the shorter end to rise, in turn lifting the rod H, the short end of the floating lever I causing the valve J to rise, uncovering the port l', allowing the air on top of the oil in the oil-reservoir O to escape into the atmosphere, thus reducing the pressure under the plungers d and d' of the jacks D and D', and thus lowering the throat-piece B and increasing the area Z, and consequently the passage of water into the downflow-pipe C.

While I have described the use of a weighted lever G, bearing upon the diaphragm f', it is obvious that a spring Q, Fig. 4, under compression could be employed, and it is also obvious that a spring Q' and a packed piston R, as shown in Fig. 3, would produce similar results. I therefore do not wish to be restricted to the use of a lever and weight or diaphragm; but

What I desire to claim and secure by Letters Patent is as follows:

1. In a hydraulic air-compressor, a regulating device consisting of a constantly-loaded movable part, actuated by air-pressure from the main reservoir thereof, operatively connected by links and levers to a controlling-valve, alternately admitting and allowing the escape of pressure to and from plungers operatively connected to means for varying the area of the water-inlet passage thereby controlling the quantity of water admitted into the compressor, substantially as described.

2. In a hydraulic air-compressor, a regulating device consisting of a constantly-loaded movable part actuated by air-pressure from the main reservoir thereof, operatively connected by links and levers to a controlling-valve, alternately admitting and allowing the escape of pressure to and from plungers operatively connected to an adjustable throat-piece for controlling the amount of water admitted into the compressor, by varying the area of the water-inlet passage thereof, substantially as described.

3. In a hydraulic air-compressor, a regulating device consisting of a constantly-loaded movable part under pressure from the main reservoir thereof, operatively connected to a controlling-valve, controlling the pressure in a secondary reservoir containing a non-compressible liquid, which in turn operates plungers operatively connected to means for varying the area of the water-inlet passage, substantially as described.

4. In a hydraulic air-compressor, a regulating device consisting of a constantly-loaded movable part under pressure from the main reservoir thereof operatively connected to a controlling-valve controlling the pressure in a secondary reservoir containing a non-compressible liquid, which in turn operates plungers operatively connected to means for varying the area of the water-inlet passage, also causing the controlling mechanism to come to a state of rest under a constant pressure, substantially as described.

In testimony whereof I have hereunto affixed my signature in the presence of two subscribing witnesses.

CHARLES M. W. SMITH.

Witnesses:

JOHN MURRAY MARSHALL,

WM. O. WEBBER.