(No Model.)

3 Sheets—Sheet 1.

G. H. REYNOLDS.

AIR COMPRESSING OR PUMPING ENGINE.

No. 262,119. Patented Aug. 1, 1882.

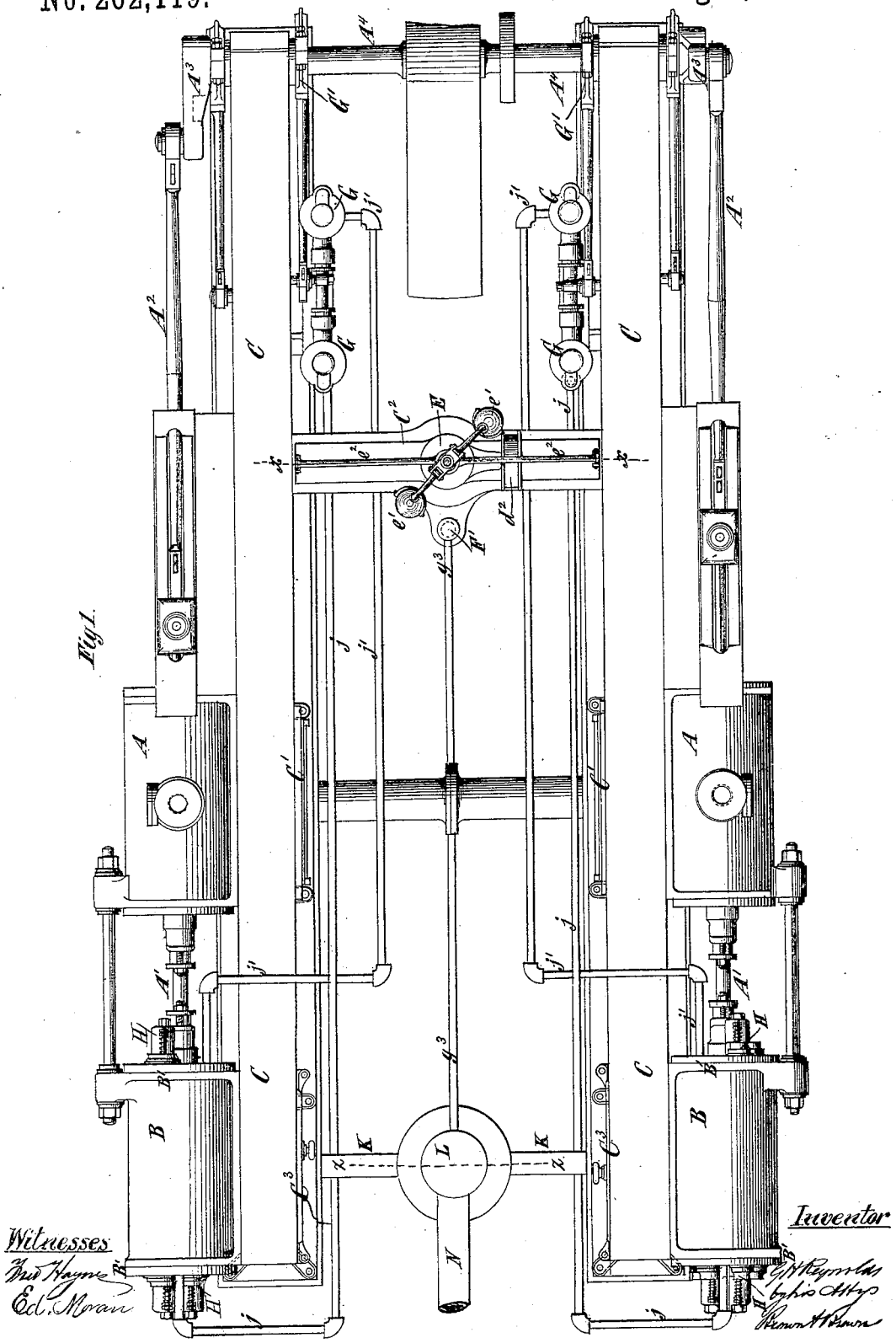

Fig 1.

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(No Model.) 3 Sheets—Sheet 2.

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Fig 2.

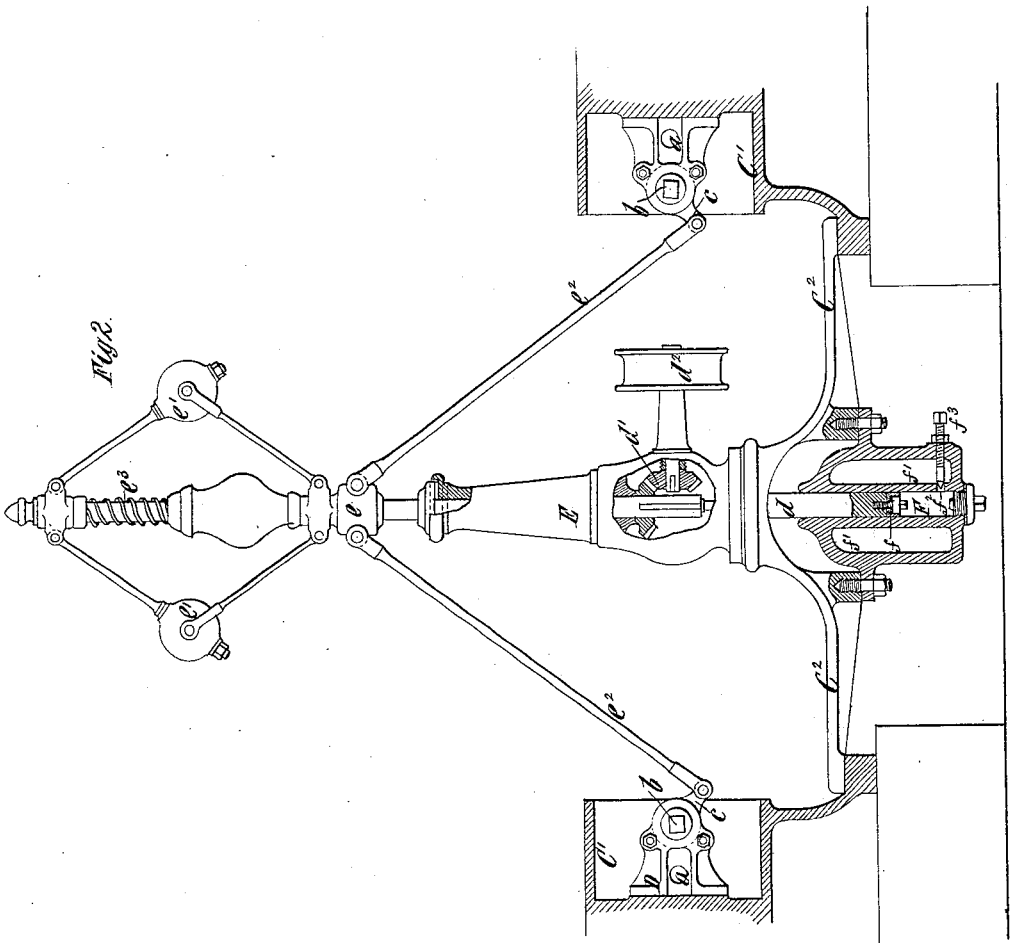
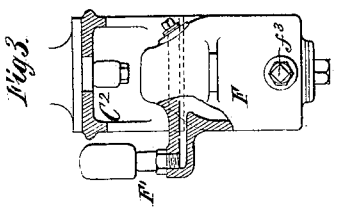


Fig 3.



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(No Model.) 3 Sheets—Sheet 3.

G. H. REYNOLDS.

AIR COMPRESSING OR PUMPING ENGINE.

No. 262,119. Patented Aug. 1, 1882.

Fig5.

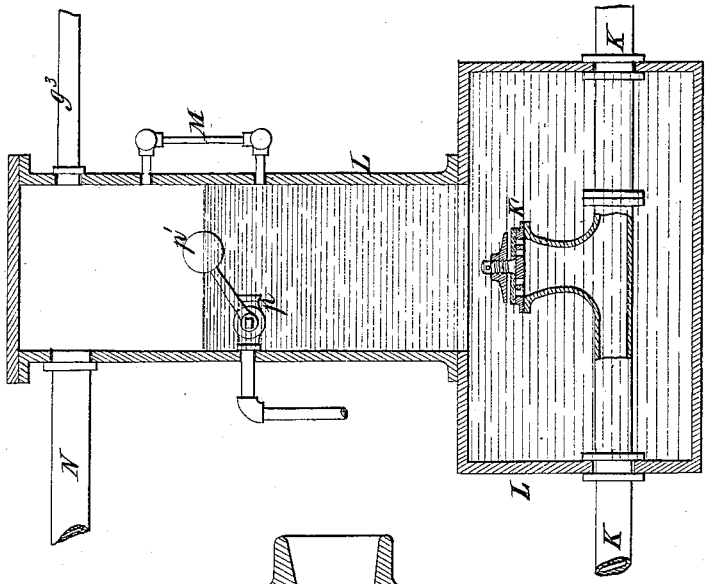


Fig6.

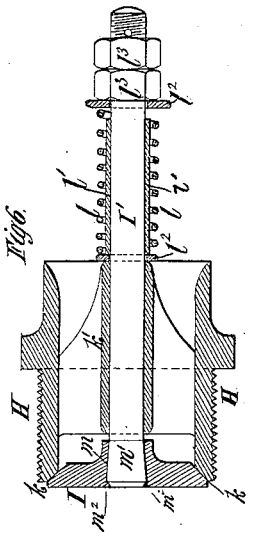


Fig7.

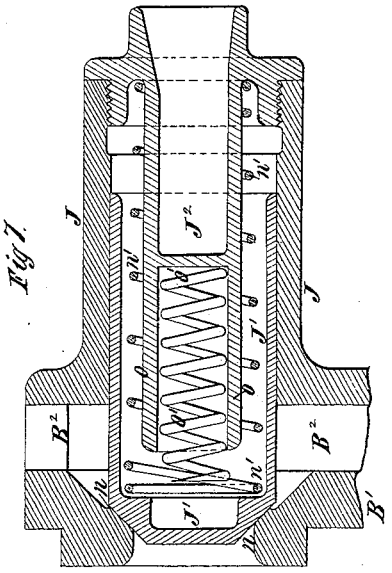
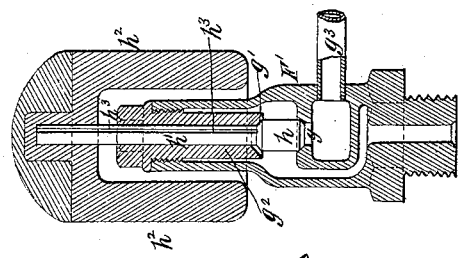


Fig4.



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Inventor
George H. Reynolds
by his Attorneys
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UNITED STATES PATENT OFFICE.

GEORGE H. REYNOLDS, OF NEW YORK, N. Y., ASSIGNOR OF TWO-THIRDS TO CORNELIUS H. DELAMATER AND GEORGE H. ROBINSON, BOTH OF SAME PLACE.

AIR COMPRESSING OR PUMPING ENGINE.

SPECIFICATION forming part of Letters Patent No. 262,119, dated August 1, 1882.

Application filed January 10, 1882. (No model.)

To all whom it may concern:

Be it known that I, GEORGE H. REYNOLDS, of the city and county of New York, in the State of New York, have invented certain new and useful Improvements in Air Compressing or Pumping Engines, of which the following is a specification.

An important object of my invention is to effect in an air-compressing apparatus an economy of operation, and to maintain a uniform pressure of air by regulating the speed of the compressor and its operating-engine at all times to conform to the quantity of air being used.

The invention consists in the combination, with an air-compressing engine provided with a cut-off valve, of a governor connected with the cut-off-valve gear, and a spring which is compressed when the governor rotates with excessive rapidity, and by its resilience serves to return the governor to its normal position, and to open the cut-off valve against the pressure of the motive agent upon it.

The invention also consists in the combination, with the two air-compressing engines, connected together, as above described, and their governor, of a ram-cylinder and a ram, preferably applied directly to the governor-spindle, and a controlling-valve which will open automatically when the air-pressure exceeds that desired to admit air to said ram-cylinder for operating the ram, and through the governor shutting off the supply of steam or other motive agent to the compressing-engines. I also consider a governor for a single engine, having a ram-cylinder and ram applied to the lower end of its spindle, as a part of my invention.

The invention also consists in a controlling-valve of novel construction adapted to be mounted on the ram-cylinder, for use as above described.

The invention also consists in various combinations of parts, hereinafter described and claimed.

In the accompanying drawings, Figure 1 represents a plan of two double-acting air-compressors and their operating-engines constructed, arranged, and connected according to my invention. Fig. 2 represents a transverse section of portions of the engines on the dotted lines *x x*, Fig. 1, upon a larger scale, and including a partly-sectional elevation of the governor and its appurtenances. Fig. 3 represents a partly-sectional side view of the ram-cylinder, including a side view of the controlling-valve mounted on the ram-cylinder. Fig. 4 represents a vertical section of the controlling-valve alone. Fig. 5 represents a transverse section on the dotted line *z z*, Fig. 1, of the chamber into which the water and air are delivered from the two compressors, together with its appurtenances, and upon a larger scale than Fig. 1, the position of the pipes through which compressed air escapes from said chamber being arbitrarily changed. Fig. 6 represents a longitudinal section of one of the suction-valves upon a larger scale, and Fig. 7 represents a similar section of one of the discharge-valves on the same scale.

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

A designates motor or steam cylinders, which are here shown as arranged side by side; and B designates compressor-cylinders, also arranged side by side and in line with the cylinders A, and secured to the same frames or bed-plates, C, as the said cylinders A. The pistons of each steam-cylinder A and its compressor-cylinder B are connected by a common piston-rod, A′, and the piston-rods are connected by means of connecting-rods A^2 with cranks A^3, fixed upon opposite ends of a common crank-shaft, A^4. The cranks A^3 are represented as set nearly at right angles to each other, so that while one engine is on its center the other is exerting its maximum power, and will carry the former over the center.

The engines here represented are supposed to be provided with the ordinary Rider cut-off, and in Fig. 2 I have represented portions of the steam-chests C′ of the two engines and the main valves D, which are adapted to be reciprocated by the main valve-rods *a*, worked by an eccentric in the usual way.

The cut-off-valve stems *b* are represented as square, and have fitted to them levers or arms *c*, whereby they may be oscillated to vary the point of cut-off. The cut-offs of both engines

are controlled by a single governor, the pillar E of which is mounted on a bridge-piece, C^2, extending between the frames C of the two engines.

The governor-spindle *d* is rotated in the usual way through bevel-gears *d'* by a belt over the pulley d^2, and the loose collar *e*, to which the usual rising and falling motion is given by the balls *e'*, is connected by rods e^2 with the arms *c* on the cut-off-valve stems *b*.

Upon the governor-spindle *d*, near its upper end, is a spiral spring, e^3, which is compressed by the outward movement of the balls *e'* as the speed of the engines increases, and when the speed of the engines diminishes the resilience of this spring moves down the loose collar *e* and returns the balls to their normal position, at the same time shifting the cut-off valves against the pressure of steam upon them sufficiently to admit more steam. The governor provided with this spring will act to lengthen the point of cut-off much more quickly than it would without the spring.

Below the governor, and in line with the spindle *d*, is a ram-cylinder, F, and the end of the spindle is represented as fitting in this cylinder, and therefore forms the ram. The end of the spindle has upon it a packing, *f*, which prevents leakage upward between the cylinder and ram.

The ram-cylinder F is surrounded by a jacket, *f'*, which communicates therewith through a hole, f^2, below the ram, and the area of this hole or opening may be controlled by a conical pointed set-screw, f^3, which serves as a valve. The jacket *f'* is intended to be partly filled with glycerine or other liquid, and it will be clearly seen that any increase of air-pressure above the liquid in the jacket will force the liquid through the hole f^2 into the cylinder F, where it will exert its force upon the spindle or ram *d* and raise the latter sufficiently to nearly or quite shut off the steam.

Upon one side of the cylinder F, as best seen in Fig. 3, but also in Fig. 1, is mounted a controlling-valve, the construction of which is best shown in Fig. 4. F' designates the casing or shell of the valve, which is shown as screwed into the jacket *f'* of the ram-cylinder F, and is provided with two valve-seats, *g g'*, the latter of which is formed in a bonnet or plug, g^2. The valve proper, *h*, is arranged between the two seats *g g'*, and its stem *h'* passes through the plug g^2 and has fixed upon it a weight, h^2, which always tends to hold the valve against the seat *g*. Compressed air is conducted to the valve by a pipe, g^3, from the reservoir or other source of supply, and when the pressure of air exceeds the pressure desired, by reason of a less volume of air being used or the use of the air being stopped altogether, the valve *h* will be raised by the pressure below it, and the compressed air will escape through the controlling-valve into the jacket *f'*, and will force the liquid therein into the cylinder F, where it will act on the spindle or ram *d* and raise it so as to nearly or quite shut off the steam. In the stem *h'* of the valve *h* is a longitudinal groove or passage, h^3, through which the interior of the valve and the jacket *f'* may communicate with the atmosphere; but when the valve *h* is first opened it is forced up into the seat *g'*, and consequently the air cannot escape through the groove h^3. When the air falls to or below the desired pressure the valve *h* will close on the seat *g*, and then the air in the shell of the valve and in the jacket *f'* can escape to the atmosphere through the groove h^3, and the spindle or ram *d* is then free to descend for starting the engines or increasing their speed.

The controlling-valve F', being mounted on the cylinder F, enables the parts to be all put together in the shop, and all that is necessary after the apparatus reaches its destination is to make the pipe-connections.

When the use of compressed air is stopped altogether the pressure of the air stored up raises the governor-balls at once and stops the engine much more quickly than it could be stopped if the governor only were employed.

It will be seen that by my invention I enable the speed of air-compressing engines to be so nicely and uniformly regulated that there will be no loss by compressing air which is afterward blown off through the safety-valves, as is now often the case.

An air-compressing engine is nothing more than an air-pumping engine, and my invention may be applied to other pumping-engines with advantage.

Each compressing-engine is provided with a double-acting pump, G, which may be operated by an eccentric, G', and is connected by pipes *j j'* with the compressor-cylinder B, for supplying water thereto for cooling.

In Fig. 6 I have represented a suction-valve, which I may employ to admit air to the compressor-cylinders. H designates the socket or shell of the valve, which is screwed into the head B' of the cylinder B and has a valve-seat, *k*. I designates the valve, and I' the stem, which is fitted to a guide, *k'*. Beyond the end of the guide *k'* the stem I' is surrounded by a sleeve, *l'*, and is provided with washers l^2 and nuts l^3, and the valve is held to its seat by a spiral spring, *l*, surrounding said sleeve between said washers. The valve I is provided with a tapering hole or socket, *m*, and the stem I' with a correspondingly-tapered portion, *m'*, which fits therein, and after the stem has been driven into the valve the latter may be riveted over the stem, as at m^2.

In Fig. 7 I have represented a discharge-valve, which I may employ for the compressor-cylinders B. B^2 designates an air-chest or chamber in the head B', and J designates the socket in which the hollow valve J' works. The head B' has a seat, *n*, on which the valve closes, and it is held to its seat by a spiral spring, *n'*. The socket J is closed at the outer end by a plug or bonnet, J^2, in which is a socket, *o*, con-

taining a stronger spiral spring, o', which forms a stop for limiting the opening movement of the valve. The compressed air is conducted from the two compressor-cylinders B through pipes or conduits K to a chamber, L, located between them, and best shown in Fig. 5, but also in Fig. 1. The air and water enter the chamber L through a check-valve, K′, and the height of water is controlled by a discharge-cock, p, and a float, p'. M designates a water-gage, which may be applied to the chamber L to indicate the level of water therein. The air passes up through the water in the chamber L, and is thereby both cooled and dried, and escapes through a pipe, N. The pipe g^3, which supplies compressed air to the controlling-valve, whereby it is admitted to the ram-cylinder F, may lead from the chamber L, as shown in Fig. 1.

In Fig. 1 the pipes N and g^3 are shown as extending from the chamber L at right angles to the conduits K; but in Fig. 5 I have arbitrarily changed the position of said pipes, so as to more clearly illustrate them.

I do not here claim the method of cooling the compressed air and the compressor-cylinders, nor the means employed to supply cooling-water thereto, nor the construction of the suction and discharge valves for the compressor-cylinders, nor the chamber into which the compressed air and water are delivered, with its appurtenances, as all such features are embraced in a separate application for Letters Patent filed by me May 3, 1882.

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

1. The combination, with an air compressing or pumping engine provided with a cut-off valve, of a governor connected with the cut-off-valve gear, and a spring which is compressed when the governor rotates with excessive rapidity, and serves by its resilience to return the governor to its normal position and to open the cut-off valve against the pressure of the motive agent upon it, substantially as specified.

2. The combination, with two air compressing or pumping engines provided with cut-off valves and connected so that each is adapted to carry the other over the center, of a single governor connected with the cut-off-valve gear of both engines for controlling their operation, substantially as specified.

3. The combination, with two air compressing or pumping engines provided with cut-off valves arranged side by side, and connected so that each is adapted to carry the other over the center, of a single governor arranged between said engines, and rods connecting the governor with the cut-off-valve gear of both engines, substantially as specified.

4. The combination, with two air compressing or pumping engines connected so that each is adapted to carry the other over the center, of a single governor for controlling the operation of both engines, a ram-cylinder, and ram connected with the governor and adapted to act upon the valve-gear through the governor, and a controlling-valve adapted to open automatically to admit the compressed air to act upon said ram when the pressure of air exceeds that desired, substantially as specified.

5. The combination, with two air compressing or pumping engines connected so that each is adapted to carry the other over the center, of a single governor for controlling the operation of both engines, a ram-cylinder, and a ram applied directly to the governor-spindle for operating the cut off-valve gear through the governor, and a controlling-valve adapted to open automatically to admit the compressed air to act upon said ram when the pressure of air exceeds that desired, substantially as specified.

6. The combination, with an air compressing or pumping engine and a governor for controlling its operation, of a ram-cylinder and a ram adapted to act upon the engine through the governor, and a controlling-valve mounted on the ram-cylinder, and adapted to open automatically to admit the compressed air to act upon said ram when the pressure of air exceeds that desired, substantially as specified.

7. The combination, with an air compressing or pumping engine and a governor for controlling its operation, of a ram-cylinder and a ram applied directly to the governor-spindle, and adapted to act upon the engine through the governor, and a controlling-valve adapted to open automatically to admit the compressed air to act upon said ram when the air-pressure exceeds that desired, substantially as specified.

8. The combination, with an engine-governor, of a ram-cylinder and a ram applied to the lower end of its spindle, and a controlling-valve mounted upon said cylinder, and adapted to open automatically to admit compressed air to act upon said ram, substantially as specified.

9. The combination, with a ram-cylinder and a ram, of a controlling-valve adapted to open automatically to admit compressed air to said cylinder to operate upon said ram, and a port or passage leading from the outlet side of said valve to the atmosphere, and adapted to be closed by said valve when the latter is open to admit air to act upon the ram, substantially as specified.

10. The combination of the valve-shell F′, having seats $g\,g'$, the valve h, working between said seats, and the valve-stem h', having a longitudinal groove or passage, h^3, for the escape of air, substantially as specified.

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