No. 793,910. PATENTED JULY 4, 1905.

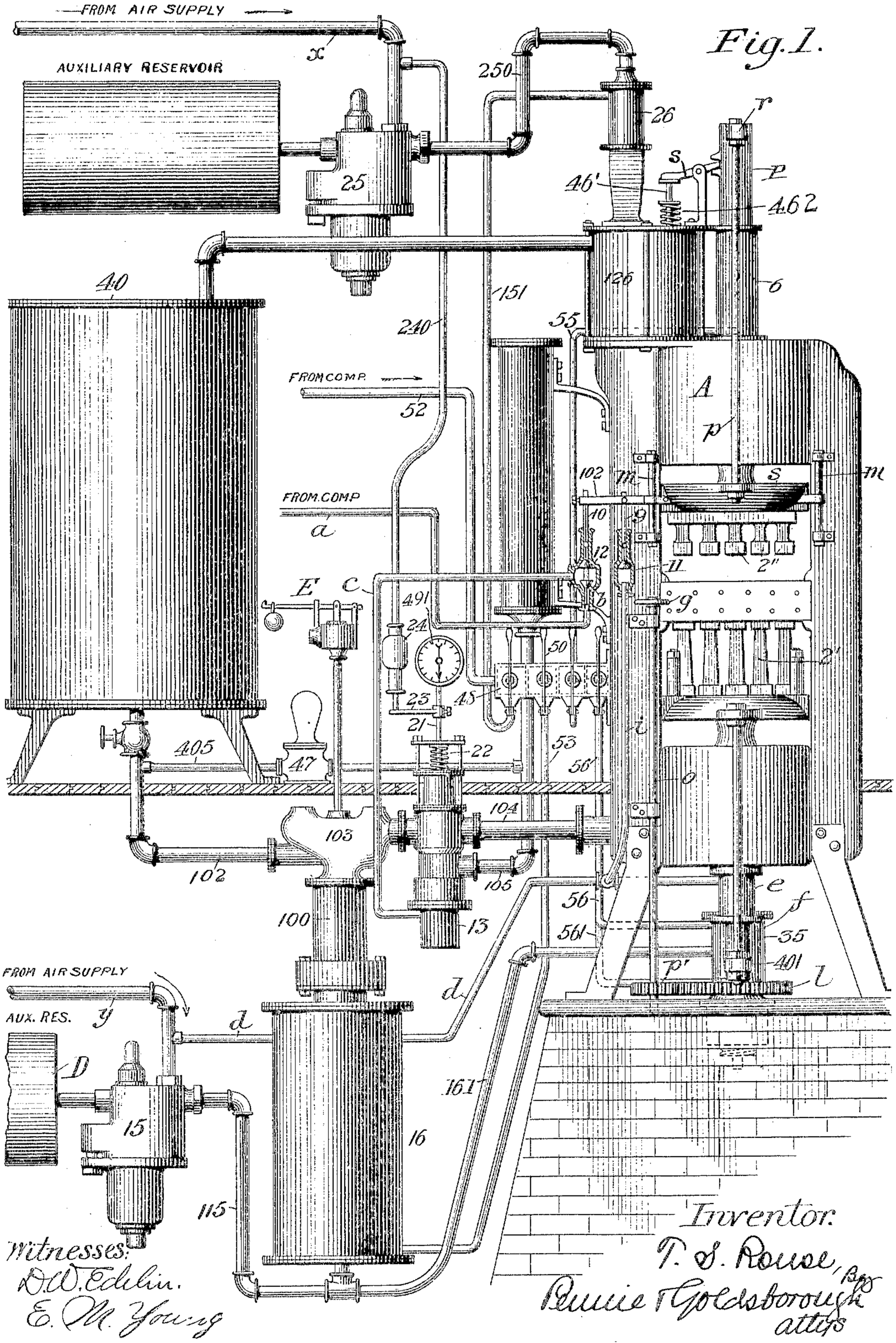
T. S. ROUSE.

COMPRESSED AIR OPERATED HYDRAULIC BRICK MACHINE.

APPLICATION FILED JUNE 5, 1899.

3 SHEETS—SHEET 1.

Fig. 1.



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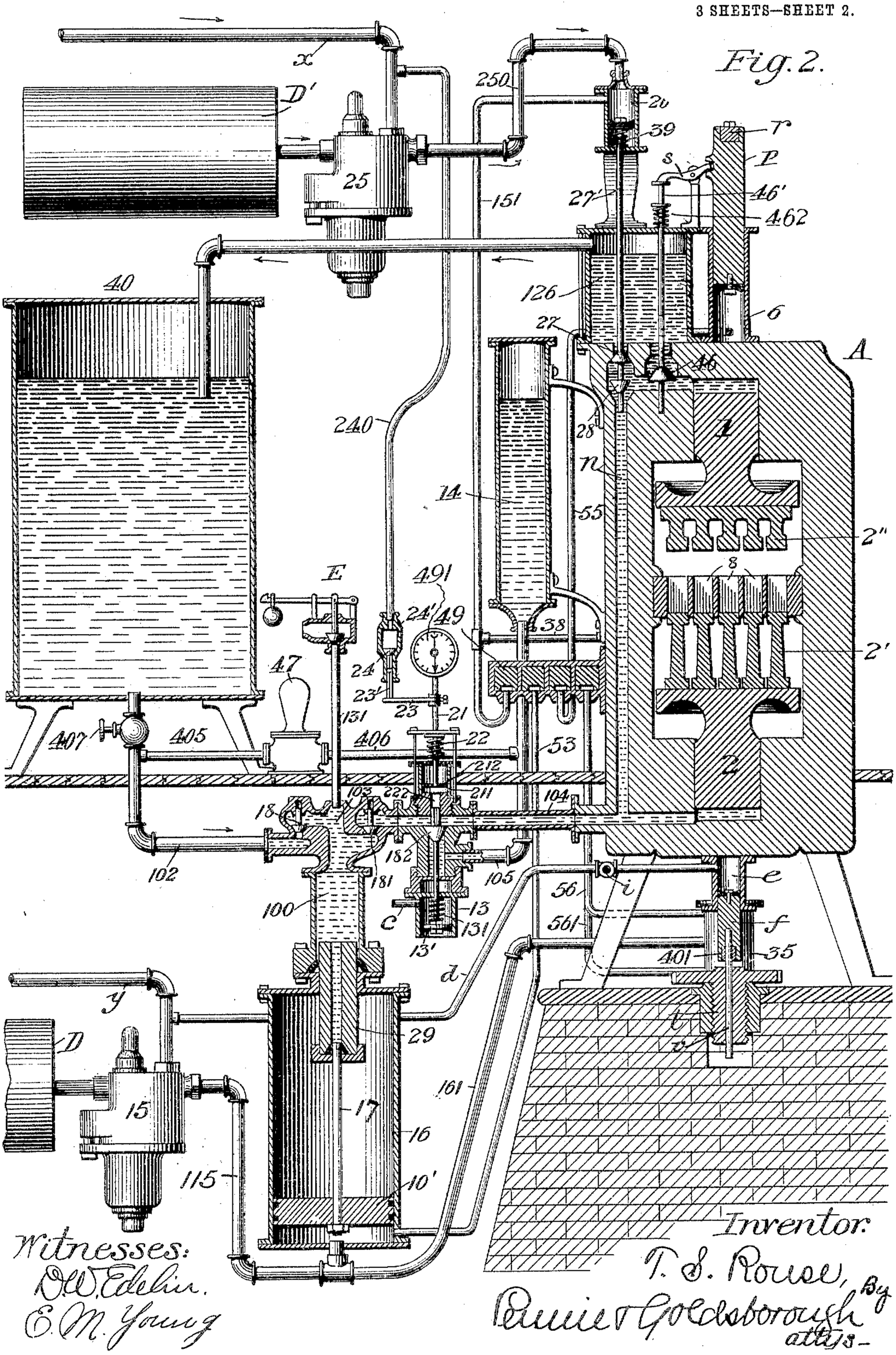
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 5.

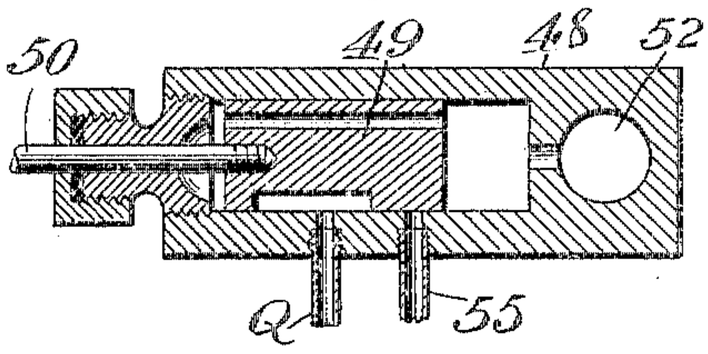


Fig. 4.

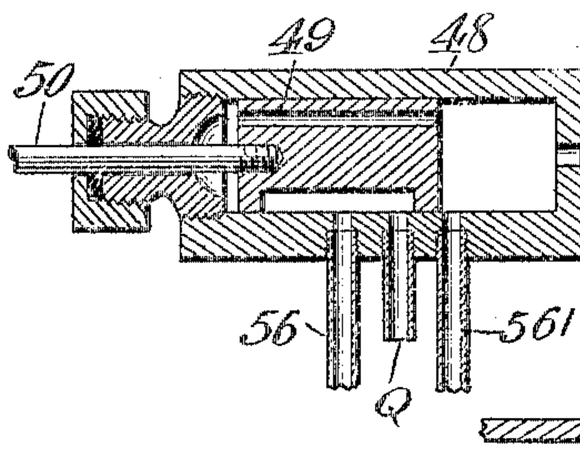


Fig. 6.

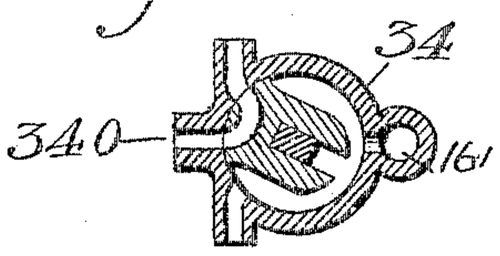


Fig. 7.

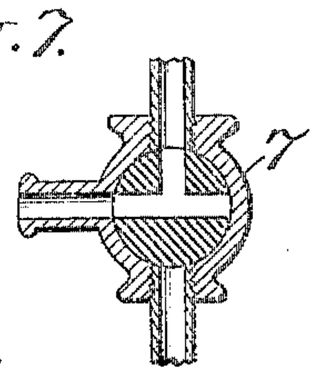


Fig. 8.

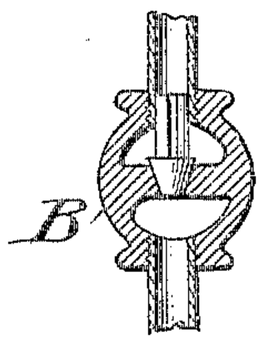
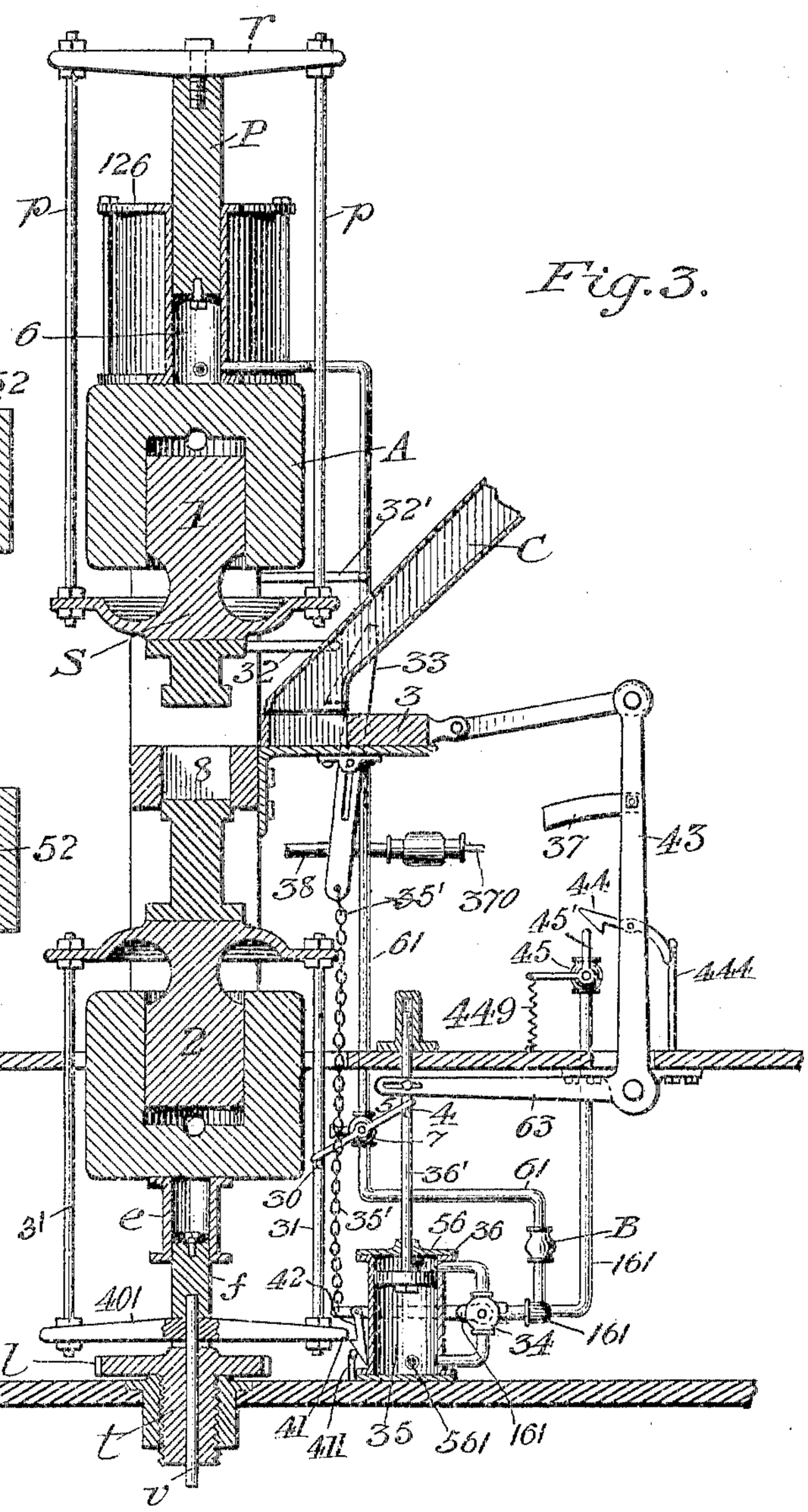


Fig. 3.



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No. 793,910. Patented July 4, 1905.

UNITED STATES PATENT OFFICE.

THOMAS S. ROUSE, OF ALEXANDRIA, VIRGINIA.

COMPRESSED-AIR-OPERATED HYDRAULIC BRICK-MACHINE.

SPECIFICATION forming part of Letters Patent No. 793,910, dated July 4, 1905.

Application filed June 5, 1899. Serial No. 719,466.

To all whom it may concern:

Be it known that I, THOMAS S. ROUSE, a citizen of the United States, residing at Alexandria, in the county of Alexandria and State of Virginia, have invented certain new and useful Improvements in Compressed-Air-Operated Hydraulic Brick-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates especially to machines employed to compress dry clay into bricks; but it is not designed to limit its application in this particular, as it may be used to compress fine coal into briquets and, in fact, whenever it is desired to compress loose material into a hard or portable or otherwise more useful or convenient condition.

One object of the invention is to simplify the heretofore complicated mechanism making up a brick-machine and produce an apparatus which can be readily understood and operated by an ordinary person as distinguished from a skilled mechanic.

Another object of the invention is the production of a machine in which each operation from the advance of the mold-charger through the various functions necessary to make the brick to the finished article is produced successively and automatically primarily by means of compressed air.

A further object is the arrangement of the operating parts in connection with the prime mover, so that each step in making the brick not only follows successively and automatically, but results from the immediately-preceding step.

Still another object is to utilize compressed air as the motive power for producing the hydraulic pressure in the press, and thereby dispensing with the necessity of a continuously-operating pump for that purpose.

With the above objects in view the following description, taken in connection with the accompanying drawings, will enable those skilled in the art to readily understand and practice the invention.

Figure 1 represents a front elevation of the brick-machine and adjunctive devices, a detail being shown in section. Fig. 2 represents an approximately central vertical section of Fig. 1, several parts being omitted for the sake of clearness. Fig. 3 represents a vertical central section of the press, the mold-charger, and operating mechanism. Fig. 4 represents a central longitudinal section of one of the valve-boxes. Fig. 5 is a section similar to Fig. 4 of the compartment of the valve-box which communicates with the pipe 55. Fig. 6 is a cross-section of the valve 34 and its casing and connections in detail. Fig. 7 is a sectional detail of the three-way valve 7, and Fig. 8 is a similar detail of the check-valve B.

Like reference characters refer to like parts throughout the several views.

It is to be understood that the initial power in this press is derived from compressed air; but it has been thought unnecessary to show the compressor, as any suitable source of compressed air may be employed. It has been deemed sufficient to show the pipes *x* and *y*, which lead from the compressor and which communicate with the upper and lower auxiliary reservoirs through the triple valves 25 and 15, respectively, which are preferably of the type shown in the patent to Westinghouse, No. 360,070. These valves may be of any common or approved type, though I prefer and have shown those of the ordinary Westinghouse type.

A indicates the main frame of the press, of any approved construction, having the large opening, in the center of which the molds 8 are secured and in the upper and lower ends of which the plungers 1 and 2, the heads of which carry the subplungers 2′ 2″, enter and reciprocate. The plungers, subplungers, and molds are of ordinary construction, it being essential, however, that the subplungers 2′ be adapted to pass through the mold flush with the upper surface thereof. The plungers 1 and 2 are preferably circular in cross-section, the plunger 1 being guided in its reciprocation by the rods *m*, secured in brackets on the frame A. Since the subplungers 2′ do not leave the molds when the press is in operation, they form a sufficient guide for the plunger 2.

The head S of the plunger 1 is provided with ears to which are bolted tie-rods *p p*, carrying a cross-head *r*. Secured to this cross-head is a piston P, which reciprocates in an air-cylinder 6, mounted on the top of the frame A, the only function of which is to lift the upper plunger. The head of the plunger 2 is connected by tie-rods 31 to a cross-head 401, which has a projecting end 41, for a purpose hereinafter described. Centrally of the cross-head 401 a piston *f* is held, which reciprocates in a cylinder *e*, secured beneath the frame and serving in the manner described later on as an air-cushion to prevent the rebound of the lower plunger.

On the top of the frame A is mounted a relief-tank 126, which communicates with the water-passage *n* and the plunger-cylinder 100 by means of valves 27 and 46, the latter being somewhat larger than the former. The valve 46 has a stem 46′, which extends above the top of the tank 126. This valve is normally held closed by a spring 462, which surrounds the stem 46′ and extends between the top of the tank 126 and a head on the stem 46′. A lever *s* is pivoted to a standard on the head of the tank 126, and one end of this lever engages a notch in the piston P, its other end being provided with a head. When the piston P rises, the head of the lever *s* is thrown down and strikes the stem 46′, thereby thrusting it down against the spring and opening the valve 46. The valve 27 has a stem 27′, which also extends above the top of the tank 126 and into an air-cylinder 26, the stem having a head forming a piston in the cylinder 26, there being a spring 39 between this piston and the bottom of the cylinder. This spring acts to close the valve 27, drawing the same upwardly against its seat. On the stem 27′ below the valve 27 is another valve 28, which when seated closes the opening leading from the water-passage *n* to the upper plunger-cylinder. The relative position of the valves 27 and 28 is such that when one is shut the other is open. The cylinder 26 communicates with the upper auxiliary reservoir through the pipe 250 and the triple valve 25 and normally does not contain air under pressure, so that the spring 39 keeps the valve 27 closed, except when compressed air is admitted into the cylinder, as will be explained later on. The water-passage *n* extends from the top to the bottom of the frame A and forms communication between the water-spaces containing the water, by means of which the plungers 1 and 2 are operated. The water by means of which the pressure is communicated to the plungers is held in a large tank 40, which communicates with a small vertical cylinder 100 through the pipe 102, the valve 18, and the chamber 103. This valve permits the egress of water from the pipe 102, but prevents the return of the same. The bottom of the cylinder 100 is bolted to the top of a larger cylinder 16. The interior of the cylinders 100 and 16 have registering openings, which are filled by a piston 29, having a longitudinal bore. The cylinder 16 is of considerably greater diameter than the cylinder 100 and is designed to receive a large piston-head 10′, which carries at its center a slender but rigid rod-piston 17, which fits closely the bore in the piston 29. Suitable packing is of course employed between the piston 29 and the cylinder 100 and at the lower end of the bore in the piston 29. The pistons 17 and 29 are to be of such cross-section compared to that of the plungers 1 or 2 that the necessary multiplication of pressure will occur. The piston-head 10′ is driven upwardly in the cylinder 16 by means of compressed air, which is admitted into the cylinder through the pipe 115 and the valve 15 from the auxiliary reservoir D. The chamber 103 communicates with the pipe 104, leading to the water-passage *n*, by means of the valve 181, which permits the water to emerge from said chamber, but prevents its return. The pipe 104 communicates with a pipe 105, leading to a closed reservoir 14, held by brackets secured to the side of the frame A. A valve 182 establishes the connection between these two pipes, said valve having a stem provided with a head 13′, which acts as a piston in the air-cylinder 13. A spring surrounding the stem normally keeps the valve 182 closed. The purpose of the closed reservoir 14 is to keep the water-passages of the press full, and in order that this may be accomplished a force-pump 47 is employed, which forces water from the main tank 40 through the pipes 405 and 406 and 105 into the cylinder 14. Being forced into a closed reservoir, the water is constantly under pressure, and when the piston in cylinder 13 is not held down this pressure is sufficient to overcome the spring holding the valve 182 and to raise the same, permitting the water to flow from the reservoir into the water-passages of the press. The valve 182 is held down not only by the spring shown, but by compressed air, which enters the cylinder 13 through the pipe *a*, leading from the main compressor, and by means of the valve *b* reaches the pipe *c*, which enters the cylinder. The valve *b* is on a stem in a properly-supported valve-box, and on the same stem is a valve 12, leading to the atmosphere. The stem of this latter projects into an extension of the valve-box, and normally the pressure of the air in the main compressor keeps the valve 12 closed. It is opened at each operation of the press by a rod 10, adjustably secured by a screw to an arm 102, projecting laterally from the plunger-head S, so that the pressure of water in the pipe 105 under the valve 182 will lift said valve and admit water under pressure from reservoir 14 into the press-passages to replenish any loss of water

by leakage therefrom and incidentally to impart a preliminary pressing to the bricks. The air-pressure in the cylinder 13 is relieved as the upper piston descends, thereby permitting the valve 182 to be opened at the proper time. The tank 126 communicates with the tank 40 by means of a pipe which leads from the upper portion of the former, entering the tank 40 through its top. The purpose of this pipe is to lead the overflow-water, due to the return of the plungers, to the tank, where it may be again utilized in the press.

Above the pipe 104 a cylinder 211 is secured, the piston 212 of which has a stem 21, to which an adjustable arm 23 is attached. The piston 212 is held normally down by a spring 22, and the cylinder 211 communicates with the water-passages of the press below the piston 212 through an opening 222, in which the grooved stem of the valve 182 is guided. The arm 23 has an upwardly-projecting stem 23′, which enters a valve-box 24′, secured at the end of a pipe 240, leading to the main compressor through the pipe *x*. A valve 24 in this box is unseated by the stem 23′, thereby throwing the pipe 240 into communication with the atmosphere and causing the triple valve 25 to open the valve 27 and relieve the pressure in the water-passages of the press. This arrangement is employed for regulating the size of the brick and the point where the compressing action of the plungers ceases, the adjustability of the arm 23 on the stem 21 enabling the opening of the valve 24 to be timed as desired. It will be understood that so long as this valve is closed the triple valve 25 shuts off pressure in the cylinder 26 and the valve 27 is held closed by the spring 39, during which time the hydraulic pressure is being exerted on the plungers to compress the bricks. As soon as the plunger 2 has moved up far enough to make bricks of the required size or to give the desired degree of compression (which will be indicated on the gage 491) the arm 23 strikes the stem 23′ and the valve 24 is opened. The upward movement of the stem 21 is concurrent and commensurate with the corresponding movement of the plunger 2, and before it can be moved at all the pressure of the spring 22 must be overcome.

The mold-charger 3 slides on a table secured to the rear of the frame A flush with the top of the molds 8. The charger is of the usual form, and when retracted its opening rests beneath the mouth of a chute C, by means of which the clay is conveyed thereto. The mold-charger is operated by means of an angle-lever, fulcrumed at a convenient point, one arm 43 of which extends upwardly and is pivotally connected by a link to the mold-charger. The other arm 63 of the angle-lever extends forwardly and is provided with a longitudinal slot which engages a pin on a piston-rod 36′, extending from the piston 36 in the air-cylinder 35. The piston-rod 36′ is properly supported in a guide-box conveniently located. It will be readily perceived that by moving the piston 36 up or down in the cylinder 35 the mold-charger may be retracted or thrust forward to deliver the material to the molds. To accomplish the movement of the piston 36, the cylinder 35 has two ports, one above and the other below the extreme movements of the piston, and the admission of compressed air to the cylinder is controlled by a valve 34, leading from a pipe 161, which communicates with the cylinder 16 and the triple valve 15. The construction of the valve and the arrangement of its pipe connections and exhaust-port are shown in Fig. 6, where 340 denotes a port that alternately vents the cylinder 35 on opposite sides of the piston 36 as compressed air is admitted on the other side. To operate this valve, the following mechanism is provided: The valve-stem has an arm to the end of which is attached a chain 35′, in turn connected with the lower end of a dog 33, which latter has a sliding engagement with a pin attached to the side of the mold-charger table. The head S of the plunger 1 has a rearwardly-projecting arm 32, which when the plunger begins its upward movement engages the dog 33 and operates the valve 34 to open the upper port. The head of the dog 33 has a cam or inclined surface, which engages an arm 32′ on the frame A and releases the dog 33 from the arm 32 when the plunger is at about the limit of its upward movement and the valve 34 has been operated. The arm of the valve 34 has also a depending catch or hook 42, which is engaged by the projecting end 41 of the cross-head 401 when the lower plunger descends, and thus the valve 34 is turned to admit air from the pipe 161 into the cylinder 35 through the lower port. The hook 42 has an inclined surface, which engages a fixed pin 411 when the cross-head 401 has depressed the hook sufficiently to operate the valve, and thereby releases the hook from the cross-head.

As will be understood from the above description, the operations of the mold-charger are controlled by the movements of the upper and lower plungers, the upper plunger on reaching the position where the bricks are discharged throwing the mechanism into action, which carries the charger loaded with clay over the molds, and the lower plunger on reaching the bottom of movement preparatory to compressing the clay just received from the charger reverses the valve 34, causing the withdrawal of the charger from beneath the plungers into position to receive another load. Besides controlling the mold-charger the air-cylinder 35 also controls the admission of air to the cylinder 6, whose function is to lift the upper plunger, and thereby regulates the movements of the piston P. A pipe 61 leads from the lower end of the air-

cylinder 6 to the pipe 161 near the cylinder 35. In this pipe 61 are two valves—a check-valve B and a three-way valve 7. The check-valve B is located between the pipe 161 and the valve 7 and operates to prevent the passage of air downward through the pipe 61, while permitting its upward passage. The three-way valve 7 operates to open to the atmosphere that part of the pipe 61 above the valve, at the same time closing the lower part, and to establish communication between the upper and lower parts of the pipe, at the same time closing the outlet to the air. In this latter position communication is made between the cylinder 6 and the pipe 161. The valve 7 is provided with an arm or cross-piece 5, one end of which extends into the path of a pin 4 on the piston-rod 36′, the other end intersecting the path of a pin 30 on one of the rods 31 of the lower plunger 2. Thus when the rod 36′ rises the valve 7 is turned to the position indicated in Fig. 3, opening the upper part of the pipe 61 to the atmosphere and permitting the compressed air in the cylinder 6 to escape. As the plunger 2 ascends the arm 5 is reversed by the pin 30 striking its other end, thus shutting off the exhaust-passage from pipe 61 and opening the supply from pipe 161 through the valve to cylinder 6, causing plunger 1 to rise. As the pin 30 carries its end of the arm 5 upwardly the opposite end yields slightly and passes the pin 4 on the piston-rod 36′, which at that time is elevated.

The valve 27 is normally held to its seat by the spring 39, and when the press is in operation the pressure of the water also keeps it seated. When air is admitted to the cylinder 26 from the auxiliary reservoir D′, the pressure above the piston will be sufficient to depress the valve 27 and to seat the valve 28, thus closing the opening between the hydraulic-pressure cylinder 100 and the plunger 1 and opening communication between the space above the upper plunger and the relief-tank. In order to release the valve 28 and reëstablish communication between the cylinder 100 and the plunger 1, a pipe 151 is provided, which leads from the cylinder 26 above the piston and has a branch pipe 38, which latter has at its end a relief-valve 370, communicating with the atmosphere. The arm 43 of the bell-crank lever is provided with a projection 37, which when the mold-charger moves forward strikes the stem of the relief-valve 370, and thereby relieves the pressure in the cylinder 26, permitting the spring 39 to seat the valve 27. It will thus be seen that when the mold-charger has moved forward and ejected the bricks and refilled the molds it effects the closure of the valve between the relief-tank and the water-space above the upper plunger and opens communication between this space and the passage *n*, so that hydraulic pressure can be applied to depress the plunger.

The pistons 17 and 29 are driven by compressed air admitted into the cylinder 16 through the triple valve 15 and the pipe 115. In order that these pistons may return for a new stroke, the part 161 of the pipe 115 leading from the cylinder 16 is provided with a valve 45, which is normally held closed by a spring 449, attached to an arm on the valve and to a convenient fixed point. The valve is also provided with an upwardly-projecting arm 45′, which lies in the path of a catch 44, pivoted to the arm 43 of the bell-crank lever. This catch is provided with a beveled head and a curved tail. When the mold-charger moves forward, the beveled head of the catch rides over the arm 45′; but when the mold-charger returns the catch engages the arm 45′ and opens the valve, the catch being disengaged from the arm 45′ after the valve has been fully opened by a tail engaging a releasing device 444, secured in proper position, permitting the spring 449 to close the valve. When the valve 45 is opened, the air in the cylinder 16 is exhausted and the pistons 17 and 29 return to position for a new stroke. The air is supplied to the cylinder 16 from the auxiliary reservoir D by the pipe 115, leading from the triple valve 15 to the bottom of said cylinder. A pipe *d* leads from the main compressor-pipe *y* to the cylinder *e* beneath the frame A, and a branch *i* at the side of the frame terminates in a valve-box in which is a valve 11, opening to the atmosphere. This valve is operated by a stem 9, adjustably secured to an arm 102, attached to the head of the plunger 1. The object of this arrangement is to actuate the triple valve 15, so as to throw the pressure in the auxiliary reservoir D into the cylinder 16 for the purpose of bringing the pressing-plungers together to compress the clay and to make the upper plunger set the pressure-applying mechanism into operation immediately on being lowered to its position in the molds.

The connection between each of the auxiliary reservoirs and the air-compressor through the triple valves 15 and 25 is made in the customary manner, the reduction of pressure in the compressor-pipes *x* and *y* serving to establish communication between the auxiliary reservoirs and the cylinders 16 and 26, respectively. The opening of the valve 11 reduces the pressure in the pipe *i*, and air is then admitted to the cylinder 16 from the auxiliary reservoir D, as just described, and the opening of the valve 24 by the rising of the stem 21 on the piston 212, which occurs at the time that the pressure reaches the predetermined degree, reduces the pressure in the pipe *x* through the pipe 240 and throws the pressure of the auxiliary reservoir D′ into the cylinder 26 for the purpose of closing the valve 28 and relieving the pressure into the space above the upper plunger through the tank 126.

The operation of the machine is as follows, assuming the parts to be in the position shown in Fig. 3, the mold-charger having just returned from filling the molds after having pushed the formed brick onto a table, (not shown:) When the mold-charger went forward on the previous stroke, the arm 37 opened the valve 370 and through the pipes 38 and 151 relieved the pressure in air-cylinder 26 and permitted the spring 39 to raise the valve 28. The opening of the valve 28 permitted the plunger 2 to descend of its own weight, the water escaping through valve 46 (which was opened by the rise of the upper plunger and remains open till the plunger descends) to tank 126 and thence to tank 40. The return of the mold-charger opened valve 45, and thus reduced the pressure in the pipe 161, and consequently in the cylinder 16, thereby permitting the piston 17 and 29 to descend. Immediately that the mold-charger has returned to place beneath the chute C the stem 36′, which has been driven upwardly by piston 36, has turned the arm 5 of the valve into the position shown in Fig. 3 by the pin 4. In this position of the valve 7 the cylinder 6 is open to the atmosphere through the pipe 61 and the vent in the valve, the lower part of this pipe being closed by the valve and the upper plunger being no longer held up is free to descend. The piston P and the plunger 1 therefore drop of their own weight, the descent being limited by the material in the molds 8. In dropping the lever *s* is operated to permit the spring 462 to lift the valve 46. In its descent the head of the plunger 1 carries the stems 9 and 10, and the valves 11 and 12 are therefore opened to the atmosphere. The former reduces the pressure in the pipe *y*, and thereby opens communication between the auxiliary reservoir D and the cylinder 16, and the latter reduces the pressure in the pipe *c*, so that the water under pressure in the cylinder 14 lifts the valve 182 and passes into the press-passages to compensate for any leakage that may have occurred and incidentally to impart a preliminary pressing to the bricks. These valves 11 and 12 remain unseated until the plunger 1 begins its upward movement for the next stroke, when they close automatically. On the closing of the valve 11 the restored pressure in the pipe *y* causes the triple valve to shut off communication between the cylinder 16 and the auxiliary reservoir D, and the cylinder receives no additional air until the valve 11 is again opened by the descent of the plunger, as already explained. It will of course be understood that when the cylinder and the reservoir are not in communication the reservoir communicates with the pipe *y* from the compressor, whereby the reservoir is kept supplied from the compressor according to the well-known action of the triple valve. The point at which the air is cut off from the cylinder 16 occurs when the piston 10′ has made about half a stroke or just before the two pistons begin to move together, and this simultaneous movement of these pistons is produced entirely by the expansion of the air already in the cylinder. As the point of cutting off the air-supply also corresponds with the completion of the brick-compressing operation, this further upward movement of the pistons is for the purpose of ejecting the bricks from the molds. The head 10′ now rises under the influence of the air-pressure, and the small piston 17 communicates the pressure to the water in the cylinder 100. Under this influence the valve 18 remains closed, preventing the return of the water to the tank 40, while the valve 181 opens, and the pressure is thus carried from the piston 17 through the cylinder 100, valve 181, and pipe 104 to the bottom of the plunger 2. The valves 27 and 46 are held closed by this pressure, and the hydraulic pressure is thus exerted on top of the plunger 1 through the passage *n*, the valve 28 being open. As the piston 17 continues to rise the material in the molds 8 is placed under great pressure, dependent upon the relation between the areas of the piston 17 and the areas of the plungers 1 and 2. The upward movement of the piston 17 moves the body of water in the press-passages but slowly, owing to its relatively small area. At the same time the power applied to the plungers through the described hydraulic intermediacy is very great on account of the difference in the areas of the piston and the plungers. As soon as the top of the head 10′ reaches the bottom of the piston 29 the pistons 17 and 29 rise together, and owing to the increased size of the piston area a larger amount of water is displaced and the plungers begin to move more rapidly; but at this juncture the valve 24 is opened, owing to the rise of the piston 212 in the cylinder 211, which is due to the pressure in the water-passages of the press and pipe 104. The opening of this valve reduces the pressure in the main pipe *x*, and the triple valve 25 then admits air from the upper auxiliary reservoir through the pipe 250 to the cylinder 26. This air is under sufficient pressure to overcome the pressure holding the valve 27 to its seat, and said valve is therefore opened and the valve 28 closed. This occurs just as the pistons 17 and 29 begin to rise in unison. The consequence is that as these pistons rise together and the valve 28 is closed the plunger 2 moves rapidly up, carrying with it the brick in the molds and the plunger 1, together with the dog 33, which partly actuates valve 34, the water escaping from above the latter plunger through the valve 27. About this time the valve 46 is depressed by the lever *s* and its additional area permits the free upward movement of the plungers, the water entering the tank 126 and overflowing into

the main tank 40. The rise of the plunger 1 relieves the valves 11 and 12, as already described, and cuts off the air of the cylinder 16 from the reservoir D. It also secures the valve 182 against the pressure in the tank 14. Also as the plunger 1 rises the dog 33 is engaged by the arm 32 on the head S and is drawn upwardly, turning the valve 34 and admitting air above the piston 36 in the cylinder 35. The rise of the plunger 2 operates the valve 7 through the rod 31 and pin 30 to establish connection between the pipe 161 and the cylinder 6. The compressed air in cylinder 16 is thus carried through pipe 161 and the pipe 61 to cylinder 6 and raises the plunger 1 to its upper limit off the molded bricks, thereby releasing dog 33 from arm 32. At the same time or at a very short interval the air which has been admitted to the cylinder 35 above the piston 36 throws the mold-charger 3 forward, the subplungers 2″ being at this time flush with the upper ends of the molds 8 and with the table on which the mold-charger reciprocates. The forward movement of the mold-charger opens the valve 370, thereby closing the valve 27 by opening cylinder 26 to the atmosphere, while the rearward movement opens the valve 45, allowing the pistons 17 and 29 to descend. When the valve 27 closes, the plunger 2 descends, the water escaping through the passage *n* and the valves 28 and 46 to the tank 126. The downward movement of plunger 2 causes cross-head 401 to engage dog 42, thereby shifting the valve 34 to admit pressure to the under side of piston 36 and to open the upper side thereof to the exhaust 340, which forces the piston up and retracts the mold-charger 3. The downward movement of the lower plunger is limited by an adjustable abutment consisting of a circular exteriorly-threaded plug *t*, which screws into an interiorly-threaded sleeve secured to the foundation of the press. This plug is provided with a toothed wheel *l*, which is controlled by means of a shaft *o*, mounted in suitable bracket-bearings on the frame A, and the shaft carries a hand-wheel *g* and a pinion *p′*, which latter meshes with the wheel *l*. By turning the shaft *o* the plug *t* may be raised or lowered and the descent of the plunger 2 adjusted, thus regulating the thickness of the bricks. A rod *v* is secured to and guides the piston *f*.

Extending upwardly from the chamber 103 is a pipe 131, at the end of which is a safety-valve E. This valve is not essential, but is desirable to save the press in case of unusual strain.

The cylinder *e* has direct and open communication with the pipe *d*, leading to the compressor-pipe *y*, and the vacuum which would otherwise form above the piston *f* on the descent of the plunger 2 and cause a rebound of said plunger is obviated, the compressed air acting as a pneumatic cushion.

The molds 8 are made of sufficient depth to make bricks of the maximum size; but the movement of the plungers may be regulated so that bricks of an intermediate or smaller size may be compressed in them. This is effected by the arm 23, which is adjustably secured on the stem 21. As this arm controls the valve 24, it regulates the continuation of the pressure on the material in the molds 8 by timing the opening of the valve, and thus regulates the size of the bricks. It will be understood that the operation of this machine is entirely automatic, each step following and being produced by the preceding one, and the various operations are continuous and endless, dependent only upon the supply of compressed air and independent of manual manipulation. It is often desirable, however, to be able to put in operation certain parts of the machine by hand independently of the other parts and to stop the machine at any point in the operation. For this purpose the valve-box 48 is provided, which is divided into four compartments, each having a slide-valve 49 therein, actuated by a hand-lever 50. The valve-box 48 is in open communication with the air-compressor through the pipe 52, and the several compartments communicate, respectively, with the several parts of the machine which it is desired to operate. As shown, the pipe 151 leads from the first compartment to the air-cylinder 26 above the piston therein, the pipe 53 leads from the second compartment to the cylinder 16 beneath the piston 10′, and the pipe 55 leads from the third compartment to the air-cylinder 6 below the piston. Each of these compartments is provided with a slide-valve 49, as shown in Figs. 4 and 5, and an exhaust-port Q, and the valve is so constructed as to admit air from the pipe 52, leading into the valve-box, to the pipes leading from the same or to establish communication between the pipes leading from the box and the exhaust-ports Q, so as to reduce the pressure in the cylinders to which said pipes lead. The fourth compartment is provided with two pipes leading therefrom, 56 and 561, in addition to the exhaust-opening Q. Details of this valve are shown in Fig. 4, and the valve 49 is adapted in its extreme position to put either one of the pipes 56 and 561 into communication with the main air-compressor pipe 52 and the other with the exhaust. The pipe 56 leads to the air-cylinder 35 above the limit of the upstroke of the piston 36, and the pipe 561 leads to the same cylinder below the limit of the downstroke of the piston. By means of this arrangement of valve-box and pipes it is possible to stop the working of the press at any point or to throw into operation by hand any particular part of the apparatus. For example, it being desired to raise the lower plunger, (the parts being in the position shown in Fig. 2,) the valve putting the pipes 52 and 151 into communication is operated, and the

compressed air then enters cylinder 26 and closes the valve 28. The valve opening the pipe 53 is next operated and the compressed air enters cylinder 16, the pistons 10′, 17, and 29 rise, and consequently the plunger 2. Assuming the upper plunger to be in its elevated position and it being desired to lower it, the valve which corresponds to pipe 55 is so operated as to throw said pipe open, releasing the air in cylinder 6 and permitting plunger 1 to drop of its own weight. In order to return plunger 1 to its elevated position, the valve is operated to throw the pipes 52 and 55 into communication through the valve-box, thus admitting compressed air to cylinder 6. When it is desired to start the mold-charger, the slide-valve which controls the pipe 56 is operated to admit compressed air through the valve-box to the cylinder 35 above the piston 36, thus throwing the mold-charger forward. If it is desired to return the mold-charger, the valve is operated to throw the pipe 56 to the exhaust-opening and the pipe 561 to the box, thus admitting compressed air below piston 36 and retracting the mold-charger. It will be perceived that the mold-charger may be readily operated to throw the clay or other material into the molds. When this has been done and the charger retracted, the machine may be started by operating the valve in the valve-box 48 controlling the pipe 55, and thus releasing the air in cylinder 6. This valve is then returned to normal position and the machine will continue to operate without further manual manipulation.

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

1. In a hydraulic press for bricks and the like, the combination of a plunger, hydraulic apparatus for operating the same, including a cylinder, a main piston working in said cylinder, an auxiliary piston also working in said cylinder, a source of air under pressure, and connections whereby the main piston is operated to actuate the plunger to compress the bricks, and the two pistons are operated together to actuate the plunger at an accelerated speed to discharge the bricks for the molds.

2. In a hydraulic press for bricks and the like, the combination of a plunger, hydraulic apparatus for operating the same including a cylinder, a main piston working in said cylinder, an auxiliary piston of larger diameter also working in said cylinder, a source of compressed air, and connections whereby the main piston is first operated to drive the plunger at one rate of speed to compress the bricks, and the plunger is subsequently driven at an accelerated speed to discharge the bricks.

3. In a hydraulic press for bricks and the like, the combination with the water-passages of the press communicating with the rams, of a supply-tank communicating with the press-passages, a relief-tank also communicating with said passages, a valve closing the relief-tank, and pneumatic means for automatically operating the valve when the pressure in the press-passages reaches a predetermined amount.

4. In a hydraulic press for bricks and the like, the combination with the water-passages of the press, communicating with the rams, of a supply-tank communicating with the press-passages, a relief-tank also communicating with said passages, a check-valve between the supply-tank and the press-passages, a valve controlling the communication of the relief-tank with the press-passages, and pneumatic means for automatically operating the relief-valve when the pressure in the press-passages reaches a predetermined amount.

5. In a hydraulic press for bricks and the like, having upper and lower plungers the cylinders of which have a connecting-passage communicating with a supply-pipe, a relief-tank, a valve in the passage-way, a valve between the upper cylinder and the relief-tank, means to force the water into the passages of the press, an air-cylinder having a piston connected to said valves, means for elevating said piston, an air-reservoir, and means operated by the pressure of the water to place the air-reservoir in communication with the air-cylinder, to operate the valves.

6. In a hydraulic press for bricks and the like, provided with a plurality of plungers, a relief-tank, and a passage-way joining the plunger-cylinders, a valve in the passage-way, a valve between the press and the tank, means connecting said valves to a piston in an air-cylinder, a spring to hold the valves elevated, an air-reservoir, and a connection leading to the air-cylinder, a valve in the connection, a cylinder having a piston in communication with the water in the press, means operated by the piston to actuate the valve in the connection, and means for operating the press.

7. In combination, in a hydraulic press provided with a plurality of plungers, a relief-tank, and a passage-way joining the plunger-cylinders, a valve 28 in the passage-way, valves 27 and 46 between the press and the tank, means connecting the valve 28 to the valve 27 and to a piston in an air-cylinder, elastic means for elevating the piston, a reservoir for compressed air, a valve in a connection between the reservoir and the air-cylinder, means for operating said valve to establish communication between the air-cylinder and the reservoir, means operated by one of the plungers to open the valve 46, and means for applying pressure to the water in the press.

8. In a hydraulic press for bricks and the like, the combination of a hydraulic-pressure reservoir, a pipe connecting the same with the water-passages of the press, a valve in the pipe, an air-cylinder having means to operate the valve, a source of compressed air connected to the air-cylinder, a two-way valve in

the connection, and means carried by a moving part of the press to operate the two-way valve.

9. In a hydraulic press for bricks and the like, a main water-tank, a hydraulic-pressure reservoir, means for automatically forcing water thereinto from the tank, a pipe leading from the reservoir to the water-passages of the press, a valve in said pipe, said valve having a stem connected to a piston in an air-cylinder, a source of compressed air a pipe leading therefrom to the air-cylinder, through a valve-box, a valve in said box, operating to throw the air-cylinder into communication with the atmosphere, and to cut off the air-pressure, or to establish communication between the source of compressed air and the air-cylinder, and close the opening to the atmosphere, and means carried by a moving part of the press for operating the valve in the valve-box.

10. In a hydraulic press for bricks and the like, the combination of upper and lower plungers, a mold-charger, an air-cylinder, a piston therein connected with the mold-charger, a source of compressed air, a three-way valve having an arm, connections leading from said valve to the upper and the lower ends of the air-cylinder, a connection leading from said valve to the compressed-air source, hooks carried by the valve-arm, projections on the plungers, adapted to engage the hooks to shift the valve and operate the mold-charger, and means to disengage the hooks.

11. In a hydraulic press for bricks and the like, the combination of upper and lower plungers, a piston working in an air-cylinder connected with the upper plunger, a source of compressed air, a pipe leading from the same to the air-cylinder, a three-way valve in said pipe, and means carried by the lower plunger to operate the three-way valve, to establish communication between the air-cylinder and the compressed-air source.

12. In a hydraulic press for bricks and the like, the combination of upper and lower plungers, a piston working in an air-cylinder connected with the upper plunger, a source of compressed air, a pipe leading from the same to the air-cylinder, a three-way valve in said pipe, a check-valve in said pipe between the three-way valve and the compressed-air source, a mold-charger, means to actuate the mold-charger and means carried by the mold-charger-actuating means to operate the three-way valve to relieve the pressure in the air-cylinder.

13. In a hydraulic press for bricks and the like, the combination of means for operating the plungers including an air-cylinder and its piston, a mold-charger, and means for operating the same, a compressed-air reservoir and means to intermittently connect it with the air-cylinder, a valve in the connecting means, and means carried by the mold-charger to open the valve, and relieve the pressure in the air-cylinder.

14. In a hydraulic press for bricks and the like, the combination of means for operating the plungers including an air-cylinder and its piston, a mold-charger and means for operating the same, a compressed-air reservoir and means to intermittently connect it with the air-cylinder, a spring-closed valve in the connecting means, and a pivoted dog carried by the mold-charger, adapted to engage and open the valve to relieve the pressure in the air-cylinder.

15. In a hydraulic press for bricks and the like, the combination of coöperating plungers, a valve between the upper plunger and the water-passages of the press, said valve being operated by compressed air, a mold-charger, and means operated by the mold-charger to relieve the valve.

16. In a hydraulic press for bricks and the like, the combination of coöperating plungers, a connecting passage-way, means for applying pressure to the plungers, a valve in the passage-way, a stem on the valve, an air-cylinder having a piston secured to said stem, a compressed-air reservoir connected to the air-cylinder, a valve in the connection, a mold-charger, and means for operating it, means governed by the pressure in the press to open the valve leading to the air-cylinder, and means operated by the mold-charger to relieve the pressure in the air-cylinder.

17. In a hydraulic press for bricks and the like, the combination of coöperating plungers, a connecting passage-way, means for applying pressure to the plungers, a valve in the passage-way, a stem on the valve, an air-cylinder having a piston secured to said stem, a compressed-air reservoir connected to the air-cylinder, a valve in the connection, a pipe leading from the air-cylinder to the path of the mold-charger, said pipe terminating in a relief-valve, a mold-charger having an arm adapted to engage and open the relief-valve, and means governed by the pressure in the press to open the valve leading from the compressed-air reservoir to the air-cylinder.

18. In a hydraulic press for bricks and the like, the combination of a water-cylinder communicating with press-passages and having a piston, an air-cylinder into which said piston extends, a piston-head working in the air-cylinder, a second hydraulic piston, the latter being connected to the piston-head in the air-cylinder and adapted to be projected into the water-cylinder, and means for admitting air into the former cylinder to drive both pistons into the latter, whereby the bricks are compressed by the action of said second-mentioned piston and subsequently discharged from the molds by the joint action of said pistons.

19. In a hydraulic press for bricks and the like, the combination of a water-cylinder communicating with the press-passages and hav-

ing a piston, an air-cylinder into which said piston extends, a piston-head working in the air-cylinder, a second hydraulic piston, the latter being connected to the piston-head in the air-cylinder and extending through a passage in the first-mentioned piston into the water-cylinder, and means for admitting air into the former cylinder to drive both pistons into the latter, whereby the bricks are compressed by the action of said second-mentioned piston and subsequently discharged from the molds by the joint action of said pistons.

20. In a hydraulic press for bricks and the like, the combination of a water-cylinder communicating with the press-passages and having a hollow piston, an air-cylinder into which said piston extends, a piston-head working in the air-cylinder, a second hydraulic piston, the latter being connected to the piston-head and adapted to extend through the bore of the hollow piston into the water-cylinder, and means for admitting air into the former cylinder to drive first one and then both said hydraulic pistons into the water-cylinder whereby the bricks are compressed by the action of said second-mentioned piston and subsequently discharged from the molds by the joint action of said pistons.

21. In a hydraulic press for bricks and the like, having an upper and lower plunger with a connecting passage-way, a relief-tank, a valve in the passage-way, a valve between the relief-tank and the press, and means for operating said valves, with means for applying pressure consisting of independently-movable pistons, and means for moving them simultaneously, means controlled by the water of the press to start said valve-operating means to close the valve in the passage-way and open the other at the time the pistons begin to move simultaneously, whereby pressure is applied to the lower plunger only, the upper one being carried up by it.

22. In a hydraulic press for bricks and the like, the combination of coöperating plungers, means whereby one of the plungers is cushioned, comprising the piston, an air-cylinder, a source of compressed air in constant communication with said cylinder, means connecting the same and the air-cylinder to a valve opening to the atmosphere, and means carried by the other plunger for opening this valve when the pressure is applied to the plungers.

23. In a hydraulic press for bricks and the like, the combination of coöperating plungers, water-passages leading to a pressure-applying piston, a mold-charger and air-operated means for reciprocating the same, an air-cylinder to drive the pressure-applying piston, a compressed-air reservoir, pipes leading therefrom to the air-cylinder and a source of air-pressure respectively, through a triple valve, a pipe leading from the air-cylinder to the means for reciprocating the mold-charger, an exhaust-valve in the pipe leading from the compressed-air cylinder and means operated by the mold-charger to open the exhaust-valve.

24. In a hydraulic press for bricks and the like, the combination of a mold-charger, a relief-tank, a valve leading from the press-passages to the relief-tank, a source of compressed air for operating the mold-charger, a reservoir of compressed air for operating the valve, and mechanism carried by the mold-charger to release the pressure in the valve-actuating means.

25. In a hydraulic press for bricks and the like, the combination of a source of compressed air, coöperating plungers, a water-cylinder and piston communicating with the press-passages for applying pressure to the plungers, a valve for closing the press-passages against the escape of water during the pressing action of the plungers, an air-cylinder for driving the piston of the water-cylinder, an air-cylinder for operating the closing-valve and means for automatically releasing and opening the valve at a predetermined point in the operation of the plungers.

26. In a hydraulic press for bricks and the like, the combination of upper and lower cooperating plungers, a water-cylinder and piston communicating with the press-passages for applying pressure to the plungers, a source of compressed air and means for applying the same to operate the piston of the water-cylinder, a mold-charger, and a valve for relieving the pressure in the press-passages, air-cylinders for operating the mold-charger and the relief-valve, an air-cylinder for raising the upper plunger, a valve-box communicating with the supply of compressed air, valved passages in said box leading to the air-cylinders for operating the mold-charger, the upper plunger and the relief-valve, and means for operating the valves of said passages to throw any one of the cylinders into or out of operation at will.

27. In a hydraulic press for bricks and the like, the combination of coöperating plungers, a valve for relieving the pressure in the press-passages, a source of compressed air, an air-cylinder the piston of which is connected to the valve, and a hand-actuated valve for throwing the pressure into or out of the cylinder for operating the valve.

28. In a hydraulic press for bricks, and the like, the combination with the water-passages of the press, of a supply-tank communicating therewith, a hydraulic cylinder connected with the supply-pipe leading from the tank to the press-passages, a check-valve between the tank and cylinder closing toward the tank, two pistons of different diameters working in said cylinder, one of said pistons working through the other, and pneumatic means for operating the pistons.

29. In a hydraulic press for bricks, and the like, the combination with the water-passages

of the press, of a supply-tank communicating therewith, a hydraulic cylinder connected with the supply-pipe leading from the tank to the press-passages, a check-valve between the tank and the cylinder closing toward the tank, two pistons of different diameters working in the cylinder, one sliding within the other, and pneumatic means for operating the small piston first and the large one next.

30. In a hydraulic press for bricks, and the like, the combination with the water-passages of the press, of a supply-tank communicating therewith, a hydraulic cylinder connected with the supply-pipe leading from the tank, a check-valve between the tank and cylinder closing toward the tank, a check-valve between the cylinder and the press closing toward the cylinder, a closed reservoir having pneumatically-controlled communication with the pipe leading to the press-passages between the check-valve and the press-passages, a piston working in the cylinder and pneumatic devices for actuating said piston.

In testimony whereof I affix my signature in presence of two witnesses.

THOMAS S. ROUSE.

Witnesses:
J. A. GOLDSBOROUGH,
HUGH M. STERLING.