(No Model.) 2 Sheets—Sheet 1.

G. A. BARTH.

DIRECT ACTING ENGINE.

No. 384,186. Patented June 5, 1888.

Fig. 1.

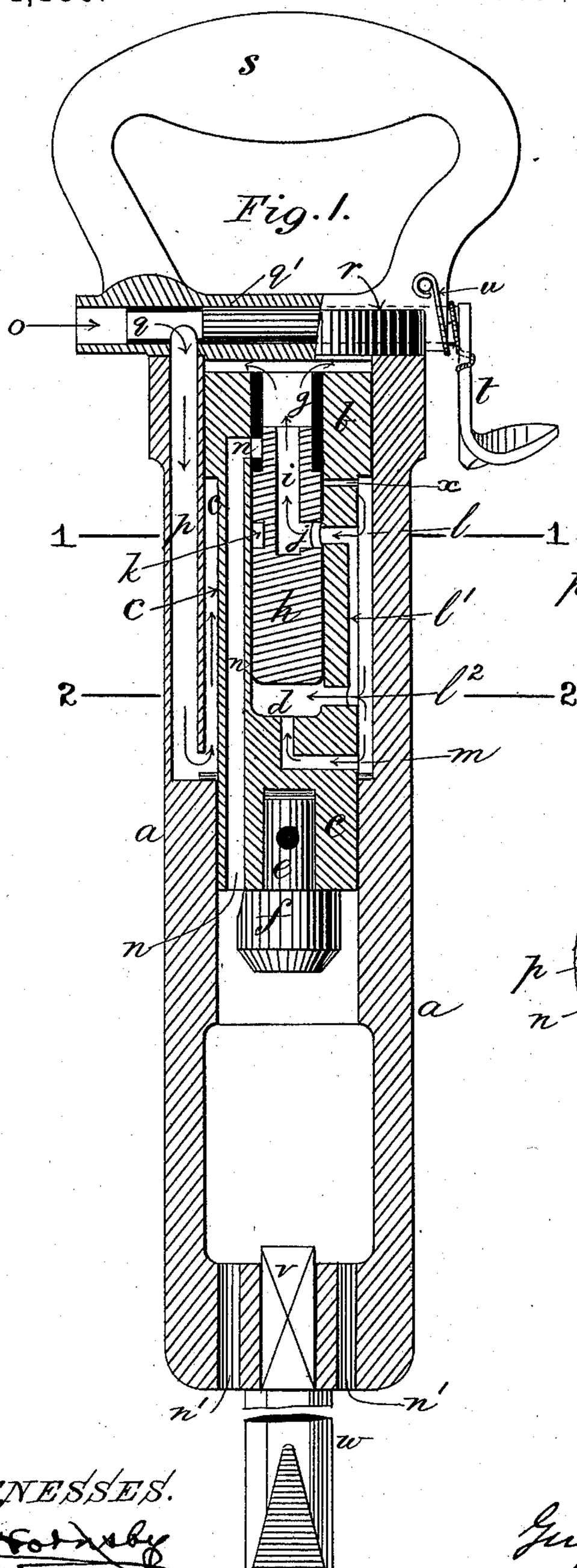


Fig. 3.

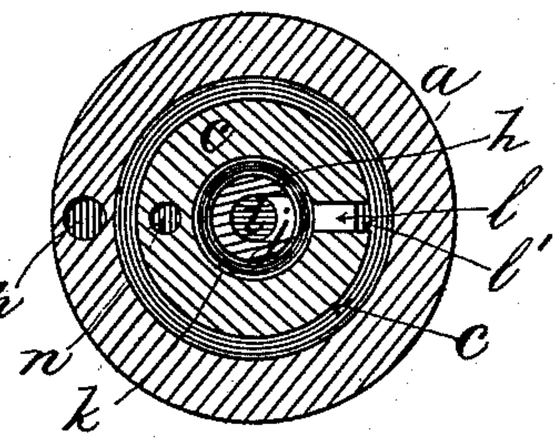
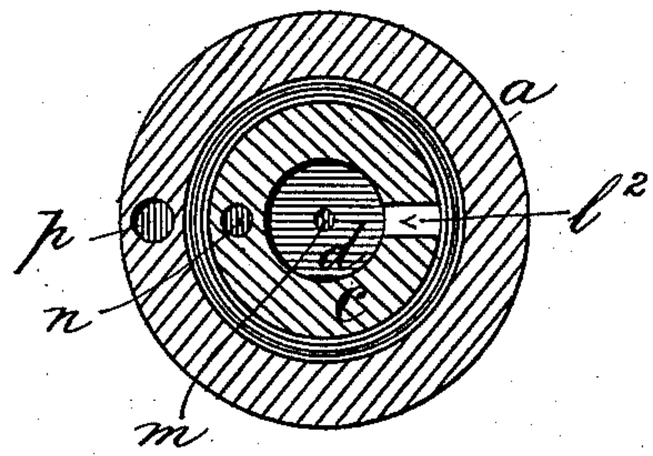


Fig. 4.



WITNESSES.

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INVENTOR.

Gustav A. Barth by Paul Bakewell, his attorney.

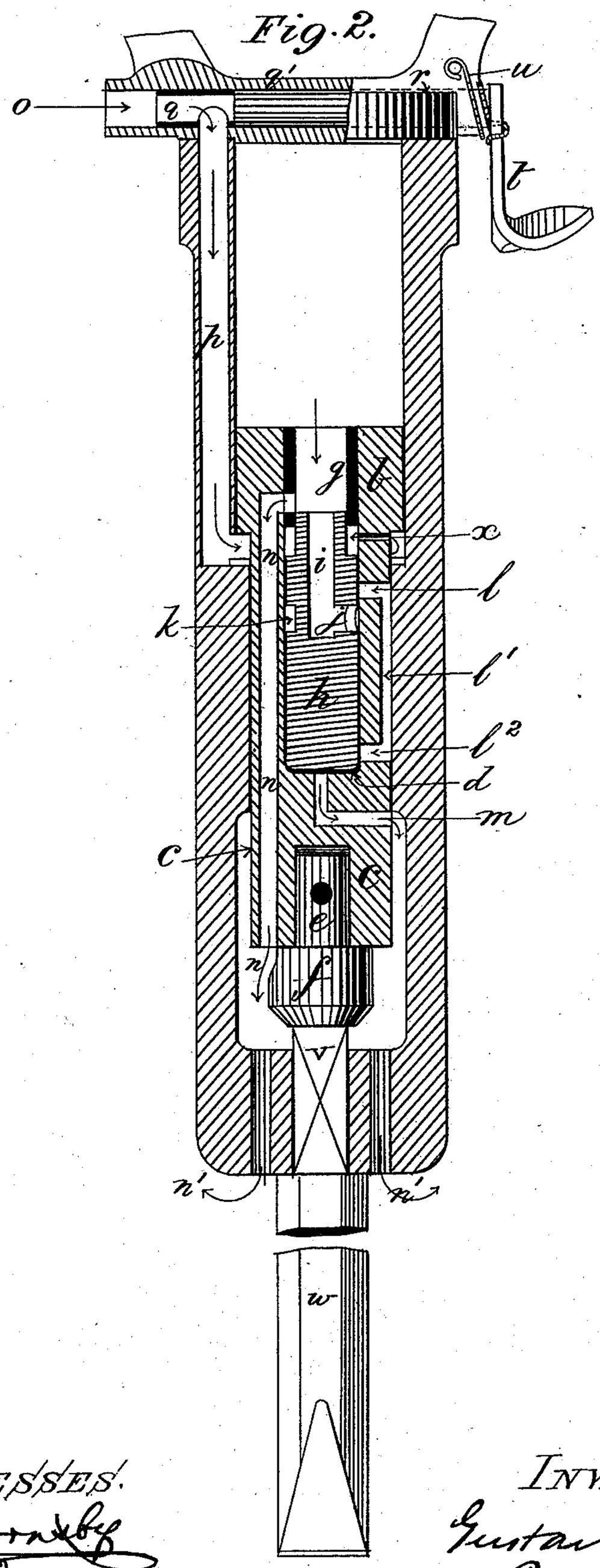
(No Model.) 2 Sheets—Sheet 2.

G. A. BARTH.

DIRECT ACTING ENGINE.

No. 384,186. Patented June 5, 1888.

Fig. 2.



WITNESSES:
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S. L. Schrader.

INVENTOR.
Gustav A. Barth by
Paul Bakewell,
his attorney.

UNITED STATES PATENT OFFICE.

GUSTAV A. BARTH, OF ST. LOUIS, MISSOURI, ASSIGNOR TO PIERRE CHOUTEAU, OF SAME PLACE.

DIRECT-ACTING ENGINE.

SPECIFICATION forming part of Letters Patent No. 384,186, dated June 5, 1888.

Application filed December 16, 1887. Serial No. 258,065. (No model.)

To all whom it may concern:

Be it known that I, GUSTAV A. BARTH, a citizen of the United States, residing at the city of St. Louis, State of Missouri, have invented certain new and useful Improvements in Direct-Acting Steam or Pneumatic Engines, of which the following is a full, clear, and exact description.

My invention relates to improvements in that class of direct-acting steam, pneumatic, or other motive-fluid engines in which the piston is reciprocated in the cylinder by the action of its valve without the intervention of valve-operating mechanism, and has for its object to render such engines more positive and sensitive in action under high and low pressures when used for chipping, calking, riveting, pumping, and other purposes.

My invention consists in the combination of a cylinder bored out concentrically to two different diameters for different portions of its length, a tubular piston-rod provided with an improved arrangement of inlet and discharge passages, a distribution-valve adapted to reciprocate within said piston-rod, a hammer-head fitting in and removably secured to said piston-rod, and a regulating-valve for controlling the supply of the steam or air to the piston, and operated by a lever and spring in conjunction with the handle by which the machine is held to its work.

On the accompanying drawings, Figures 1 and 2 represent vertical longitudinal central sections of my improved direct-acting engine adapted for use as a chipping-machine, the piston being shown at the upper and lower terminations, respectively, of its stroke; and Figs. 3 and 4, transverse sections on lines 1 1 and 2 2, respectively, in Fig. 1, like letters of reference denoting like parts in all the figures.

a represents the cylinder, which is bored out concentrically to two different diameters extending, respectively, in opposite directions from a plane at or near the middle of its length and corresponding with the diameters of its piston *b* and of a tubular piston-rod, *c*, which is formed in one piece with or secured to the piston *b*. The piston *b* and piston-rod *c* are bored out centrally to provide a cylindrical chamber or cavity, *d*, which extends downward from its upper open end, where it is flush with the upper side of the piston *b*, to a suitable depth within the piston-rod *c*, in the lower end of which is inserted the hammer-stock *e*, carrying a hammer, *f*, upon its outer end. In the upper open end of the chamber *d* is fitted and fixed a cylindrical tube or sleeve, *g*, which is flush at its top with the upper side of the piston *b* and extends a certain distance downward within the chamber *d*. Into the lower portion of this tube or sleeve *g* projects the upper diametrically-reduced end portion of a cylindrical distribution-valve, *h*, which, to the extent of that portion of its length below the shoulder of its reduced end, is fitted to and capable of vertical reciprocation within the chamber *d*, and is formed with a vertical central supply-passage, *i*, extending from its upper open end within the tube or sleeve *g* to a suitable depth therefrom, an inlet-passage, *j*, being formed near the lower end of the supply-passage *i*, through the wall of the distribution-valve *h* and communicating with an annular space, *k*, formed by a circumferential recess on the valve *h* in conjunction with the interior surface of the chamber *d*.

l l^2 are inlet-passages leading to the chamber *d* through the wall of the latter from the outside of the tubular piston-rod *c* and communicating with each other by an open groove, l', formed in the outer surface of the piston-rod *c*.

m is an inlet and outlet passage located on the outside of the piston-rod *c*, below the inlet-passage l^2, and extending through the wall of the piston-rod *c* and through the bottom of the chamber *d*, with which it communicates beneath the distribution-valve *h;* and *n* is an exhaust-passage extending from the interior of the tube or sleeve *g* through the wall of the latter and downward through a portion of the piston *b*, and through the wall of the piston-rod *c* to the space between the lower end of the latter and the corresponding end of the cylinder *a*, from which space exhaust-passages n' n' extend through the lower end of the cylinder *a* and open into the external atmosphere.

Steam or other motive fluid is admitted to the machine through a flexible hose or other pipe attached to the nozzle *o*, which communicates with a passage, *p*, opening into the cylinder *a* beneath the piston *b*, the flow of steam being regulated, according to the quantity re-

quired, by a plug (or other) regulating-valve, *q*, which is fitted and works in a casing, *q'*, formed diametrically through the base or flange *r* of the handle *s*, by which the machine is manipulated when being used as a chipper, the flange *r* being secured by screws or otherwise to the head of the cylinder *a* and constituting the cover thereof. On one end of the plug or spindle of the valve *q* is fixed a specially-shaped lever, *t*, between which and the handle *s* is a spring, *u*, attached at one end to the handle *s* and at its other end to the lever *t*, so that when holding the handle *s* the lever *t*, being moved by one of the fingers in one direction against the spring *u*, will partially rotate or move the valve *q*, so as to open and admit steam or air to the passage *p*, and on releasing the finger the reaction of the spring *u* will return the lever *t* and rotate the valve *q* to a corresponding extent in the opposite direction, thereby closing the valve *q*.

Through a central square hole in the lower end of the cylinder *a* is inserted the shank *v* of a chisel, *w*, the upper end of the shank *v* projecting somewhat into the cylinder *a* and its shoulder bearing against the outer end thereof.

In operation, the parts being in the position seen in Fig. 1, the operator holds the machine in the desired position for the work by one hand around the lower end portion of the cylinder *a* and the other on the handle *s*, using one finger to control the lever *t*, which moves the regulating-valve *q* for admitting more or less steam or air to and shutting it off from the passage *p* and cylinder *a* as required. The motive fluid entering the cylinder *a* between it and the piston-rod *c*, as indicated by the arrows, circulates beneath the piston *b* and around the piston-rod *c*, so as to pass through the inlet-passage *l* and around the annular space *k* into and through the inlet-passage *j* and central supply-passage, *i*, of the distribution-valve *h*, through the tube or sleeve *g* to above the piston *b*, which, with the piston-rod *c* and hammer *f*, is thereby forced downward in the cylinder *a* until the hammer *f* strikes the shank *v* of the chisel *w*, as seen in Fig. 2. In the meanwhile the outlet-passage *m*, on passing the lower end of the small portion of the cylinder *a* corresponding with the diameter of the piston-rod *c*, and the inlet-passages *l l' l²* entering the same part of the cylinder *a*, and being thereby closed to the ingress of steam from the passage *p*, the steam which was below and supported the distribution-valve *h* in its raised position is exhausted through the passage *m* and allows the distribution-valve *h* to drop to the bottom of the chamber *d*, so as to close the inlet-passages *l l' l²*, and thereby prevent the subsequent entrance of live steam from the passage *p* to the central supply-passage, *i*, during the upward stroke of the piston *b*.

Simultaneously by the dropping of the distribution-valve *h* its upper reduced end portion uncovers the exhaust-passage *n*, through which and through the exhaust-passages *n' n'* the steam from above the piston *b* is exhausted into the atmosphere, and the steam from the passage *p*, occupying the space beneath the piston *b* between the cylinder *a* and piston-rod *c*, presses upon the lower annular surface of the piston *b*, and thereby raises the latter, with the rod *c* and hammer *f*, until the inlet-passage *m* rises just above the upper end of the said small portion of the cylinder *a*, when the steam from the passage *p* enters the passage *m* and chamber *d* and lifts the distribution-valve *h* to its original position, or with the shoulder of its reduced end bearing against the lower end of the tube or sleeve *g*, as seen in Fig. 1, so as to again open communication between the inlet-passages *j*, *k*, and *l*, for admitting the steam or air to above the piston *b*, and between the passages *l'* and *l²* admitting steam beneath the distribution-valve *h*, for supporting the latter in the raised position during the downward stroke of the piston *b*.

To prevent accidental rising of the distribution-valve *h* in the chamber *d* during the upward stroke of the piston *b*, a slight downward or back pressure is imparted to the valve *h* by a small inlet-passage, *x*, which is located at or near to the under side of the piston *b* and opens from the outside, and through the wall of the piston-rod *c* into the chamber *d* above the valve *h*, between the shoulder of its reduced end and the lower edge of the tube or sleeve, *g*, when the valve *h* is in its lowest position.

I claim—

1. The combination of a cylinder, a piston fitting therein, a tubular piston-rod formed on or secured to said piston and provided with separate inlet and exhaust passage, a distribution-valve fitting within a chamber or cavity in said piston-rod and having a central supply-passage extending from its open end to a lateral port and annular passage adjacent to its opposite closed end, the port and passages being so arranged as to communicate alternately with the said inlet and exhaust passage of the piston-rod, an inlet-passage in the piston-rod communicating with that portion of the chamber therein beneath the distribution-valve and communicating by a connecting inlet-passage with the inlet-passage through the piston-rod to the port and central supply-passage of the distribution-valve, and a combined inlet and exhaust passage in the piston-rod leading to and from the bottom of the chamber therein beneath the distribution-valve, the whole operated to hold and reverse the distribution-valve at the proper times, and so to govern the supply and exhaust of motive fluid to and from the piston and distribution-valve, substantially as set forth.

2. The combination of a cylinder, a piston fitting therein, a tubular piston-rod formed on or secured to said piston and provided with a separate inlet and exhaust passage, a distribution-valve fitting within a chamber or cavity in said piston-rod and having a central supply-passage extending from its open end to a

lateral port and annular passage adjacent to its opposite closed end, the port and passages being so arranged as to communicate alternately with the said inlet and exhaust passage of the piston-rod, an inlet-passage in the piston-rod communicating with that part of the chamber therein beneath the distribution-valve and communicating by a connecting inlet-passage with the inlet-passage through the piston-rod to the port and central supply-passage of the distribution-valve, a combined inlet and exhaust passage in the piston-rod leading to and from the bottom of the chamber therein beneath the distribution-valve, and an inlet-passage in the piston-rod communicating with the chamber therein above the upper shoulder of the distribution-valve when in its lowest position within the said chamber, the whole operating to positively hold and reverse the distribution-valve at the proper times, and so to govern the supply and exhaust of motive fluid to and from the piston and distribution-valve, substantially as set forth.

3. The combination, with a cylinder, a piston and rod working therein, a distribution-valve, and a regulating or controlling valve working in a casing formed diametrically through the base of the handle of the machine for governing the supply of motive fluid to the distribution-valve, of a specially-shaped lever, *t*, connected with the regulating or controlling valve and coupled by a spring with the handle used for directing and holding the machine to its work, substantially as and for the purpose described.

In testimony whereof I affix my signature, in presence of two witnesses, this 12th day of December, 1887.

GUSTAV A. BARTH.

Witnesses:
S. L. SCHRADER,
PAUL BAKEWELL.