No. 689,516. Patented Dec. 24, 1901.

F. RATTEK.

ROCK DRILL.

(Application filed May 2, 1901.)

(No Model.)

FIG. 1.

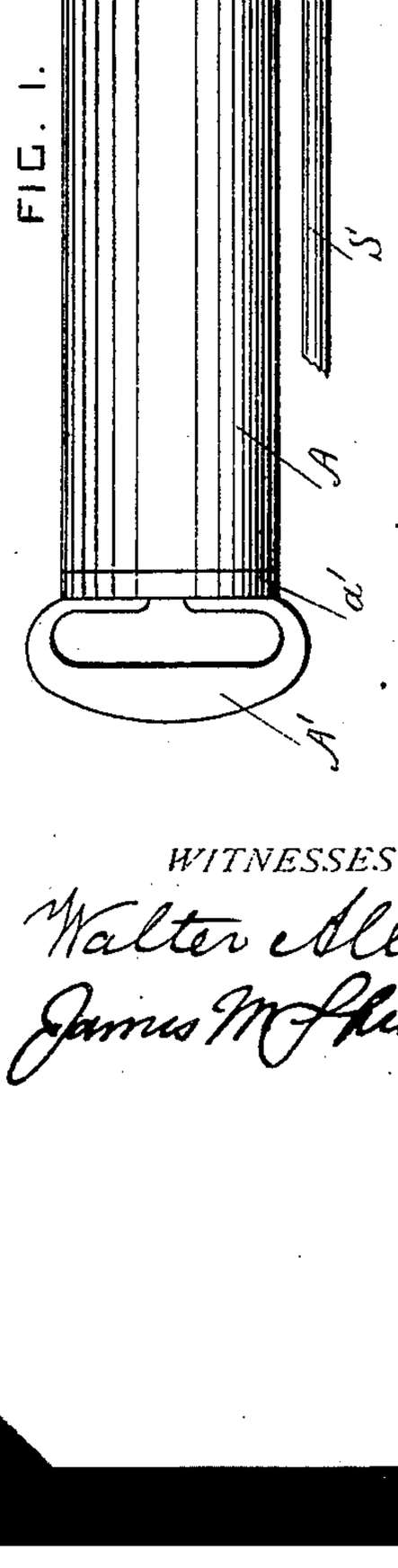

FIG. 2.

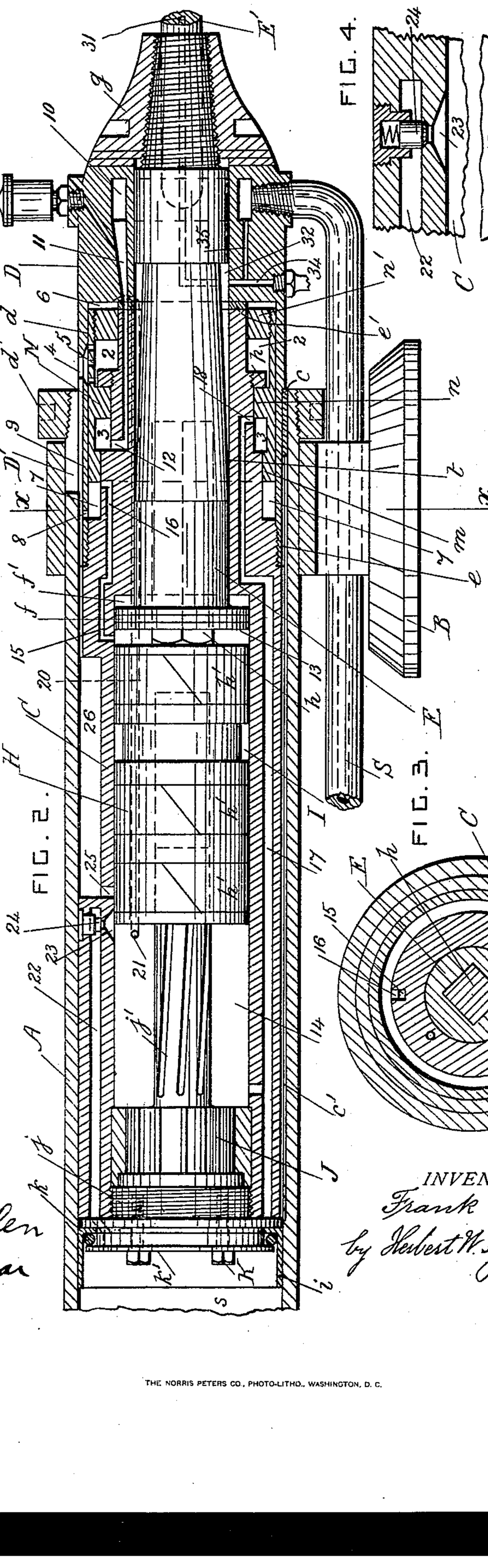

FIG. 3.

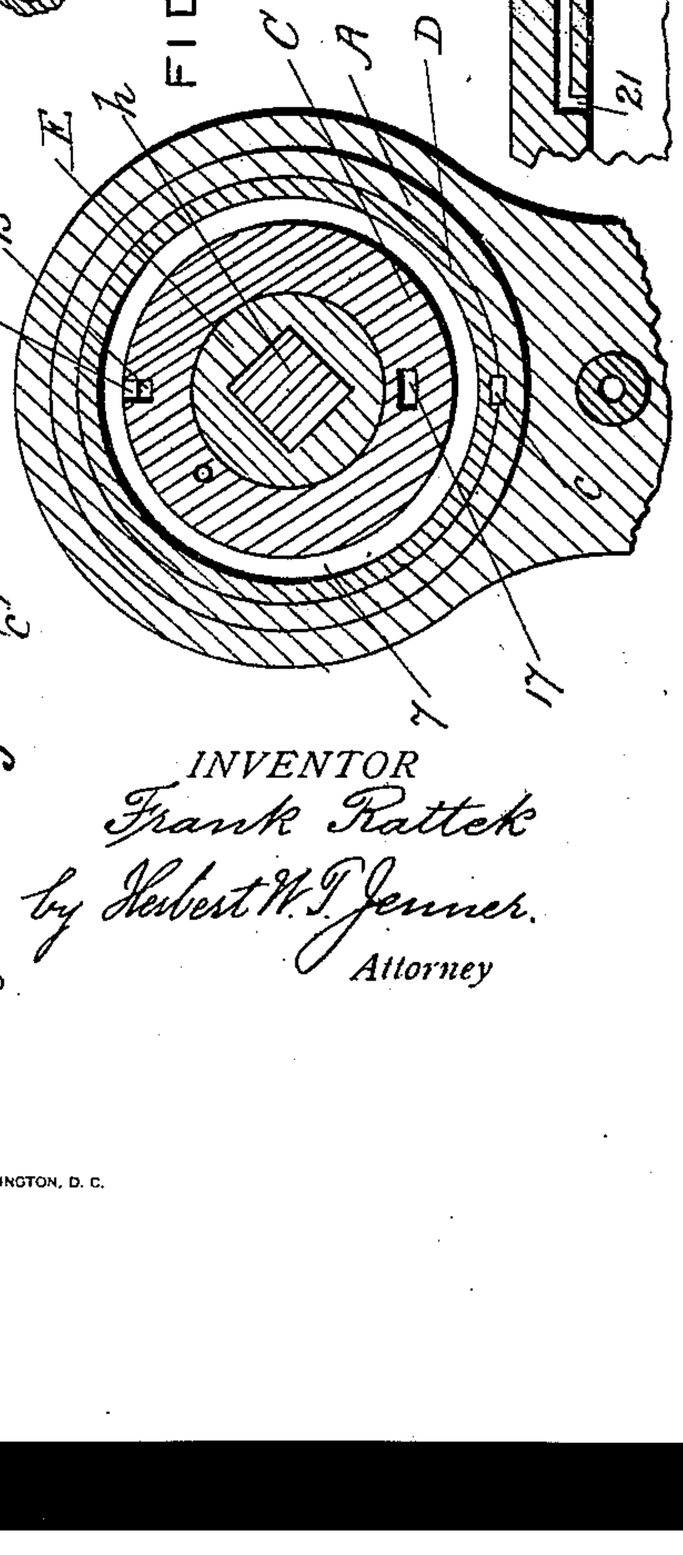

FIG. 4.

FIG. 5.

FIG. 6.

WITNESSES

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ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 689,516, dated December 24, 1901.

Application filed May 2, 1901. Serial No. 58,471. (No model.)

To all whom it may concern:

Be it known that I, FRANK RATTEK, a citizen of the United States, residing at Bridgewater, in the county of Plymouth and State of Massachusetts, have invented certain new and useful Improvements in Rock-Drills; 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 to rock-drills and other similar tools which have a percussive action; and it consists in the novel construction and combination of the parts hereinafter fully described and claimed.

In the drawings, Figure 1 is a side view of the rock-drill. Fig. 2 is a longitudinal section through the principal parts of the rock-drill, drawn to a larger scale. Fig. 3 is a cross-section taken on the line $x\ x$ in Fig. 2. Fig. 4 is a plan view, and Fig. 5 is a section, showing the triangular port drawn to a larger scale. Fig. 6 is a longitudinal section showing the port 21 and passage 20.

A is an outer cylindrical casing provided with a cap or cover a' at its rear end, and A' is a handle attached to the said cap and serving to adjust the direction of the drill.

B is a supporting-disk, which is rigidly secured to the front end portion of the casing A. The disk B is carried by a suitable standard, which is not shown.

C is the power-cylinder, which is slidable in the casing A in the same manner as a piston is slidable in a cylinder. A key c is provided, which projects from the casing into a longitudinal groove c' in the cylinder, so that the cylinder cannot revolve in the casing.

The front part of the cylinder C consists of a cap D, which forms a chamber d for the valve. The front end portion of the casing A has a longitudinal slit D', and d' is a clamping-nut, which is screwed on the tapering front end portion of the casing. When the nut d' is screwed up, it contracts the front end portion of the casing upon the cap D, which forms the front end portion of the cylinder C, and thereby prevents the cylinder C from sliding too freely in the casing A. The cap D is screwed to the cylinder at e, and e' is a packing between the cap and the front end of the cylinder, so that the valve-chamber d may be air-tight.

E is the drill-socket, which is slidable in a longitudinal hole t at the front part of the cylinder C.

The rear end of the drill-socket E carries a piston f, provided with a suitable packing-ring and slidable in the front part of the cylinder C. The piston f forms a compression space or chamber f' in the front end of the cylinder C.

The front end of the drill-socket E is provided with a clamping-nut g for holding the drill E' in it. The front end portion of the drill-socket is split and is provided with a tapering screw-thread, so that it is clamped upon the shank of the drill when the nut g is screwed up.

H is the power-piston, which is slidable and revoluble in the cylinder C. The piston H is provided with an angular piston-rod h, which is slidable in a corresponding hole in the drill-socket. The piston-rod h is preferably square in cross-section; but it may be of any other section which will enable it to slide in the hole in the drill-socket and to revolve the drill-socket. The piston H is provided with suitable packing-rings h', and it has a circumferential groove I, the use of which will be more fully described hereinafter.

J is a ratchet-box secured in the rear end portion of the cylinder C by a screw-plug j, which closes the rear end of the cylinder. A rifled stem j' projects from the ratchet-box and engages with a rifled hole in the piston H. The ratchet-box is of any approved construction, and it is provided with one or more pawls which permit the stem j' to revolve in one direction, but prevent it from revolving in the reverse direction. The rifled stem causes the reciprocating piston H to revolve step by step in one direction.

The rear end portion of the casing A forms a feed-cylinder s. In order that the power-cylinder C may work properly in the cylinder s, it is provided with suitable packing.

This rock-drill may be operated by any approved fluid, such as compressed air or steam; but for convenience its construction is herein described as adapted to work with com-

pressed air. When steam is the motive power, the cylinder C may have metallic packing; but when compressed air is used a cup-leather packing *i* is provided and is secured to the plug *j*. A spring-wire expander *k* is provided inside the cup-leather packing, and *k'* is a cover-plate for holding it in position by means of screws K. The valve N, which is slidable in the chamber *d*, is annular and cylindrical externally and has three internal rings or collars *m*, *n*, and *n'* of different size. The front end portion of the cylinder C is provided with three bearings of different size for the said three rings to slide upon. The cylinder also has a ring *p* secured on it between the front end ring *n'* and the middle ring *n* to form an abutment for the said ring *n*. The space between the rings *n* and *n'* forms an annular exhaust-chamber 2, and the space between the rings *m* and *n* forms an annular chamber 3 for compressed air. An exhaust-port 4 is formed in the side of the cap D, and 5 represents holes which connect the exhaust-chamber 2 with the said exhaust-port. An annular air-chamber 6 is formed in the cap D in front of the ring *n'*, which forms the front end of the valve, and an annular chamber 7 is formed in the cap D, behind the ring *m*, which forms the rear end of the valve. An exhaust-port 8 constantly connects the chamber 7 with the atmosphere by means of a longitudinal groove 9, formed in the side of the cap and cylinder or any other conveniently-formed outlet.

S is the supply-pipe for compressed air. This supply-pipe is constantly connected with the chamber 3 of the valve by means of an annular passage 10 and a longitudinal passage 11 in the cap and cylinder, which passage terminates in a port 12.

The cylinder C has an air-chamber 13 at its front end between the pistons H and *f*, and an air-chamber 14 at its rear end between the piston H and the ratchet-box. When the valve is moved forward, as shown, the chamber 13 is connected to the chamber 7 by a longitudinal passage 15 and a port 16, and the chamber 3 is connected to the chamber 14 by a longitudinal passage 17 and a port 18. The chamber 6 is connected with the chamber 14 by a longitudinal passage 20 and a port 21, which is uncovered by the piston H shortly before it arrives at the front end of its stroke in the cylinder C. The chamber 14 is connected with the feed-cylinder *s* by means of a longitudinal passage 22 and a triangular port 23. The apex of the triangular port 23 is arranged toward the rear, and this port is uncovered to a greater or less extent by the piston H when it arrives at the end of its front strokes. A check-valve 24 is arranged in the passage 22 to prevent the air passing backward through it.

An exhaust-port 25 is provided in the cylinder C in front of the port 21, and the function of the circumferential groove I of the piston H is to place the ports 21 and 25 in communication when the piston H is at the rear end of its stroke in the cylinder C. The exhaust-port 25 is constantly in connection with the atmosphere by any convenient passage, such as a groove 26 in the cylinder which communicates with the groove 9.

The valve N is oiled by means of a lubricator 30 of approved construction which delivers into the passage 11.

In order to lubricate the point of the drill, a hole 31 is formed centrally in it and in the drill-socket, and this hole is connected with a circumferential oil-chamber 32, formed around the drill-socket. The chamber 32 is supplied with oil from any approved lubricator through an oil-passage 34 in the cap D, and 35 is a passage in the said cap which connects the oil-passage 34 with the air-chamber 10, so that the air forces the oil through the various oil-passages to the point of the drill and keeps the latter constantly lubricated.

The operation of the rock-drill is as follows: When the parts are in the positions shown, the air passes from the pipe S to chamber 3 of the valve N through passages 10 and 11. From chamber 3 the air passes through port 18 and passages 17 into chamber 14 and drives forward the piston H. The piston-rod *h* drives forward the drill, striking against the end of the hole in the drill-socket and at the same time partially revolving the drill. When the piston uncovers the ports 21 and 23, a portion of the air in the chamber 14 passes through the triangular port 23 and the passage 22 to the feed-cylinder *s* and moves the power-cylinder forward in its casing A, the point of the drill still remaining in contact with the rock. Another portion of air in the chamber 14 passes through the port 21 and passage 20 into the chamber 6 in front of the valve. The pressure of the air in the chamber 6 reverses the valve. The rear ring *m* of the valve first closes the port 16 and cuts off the communication between the chamber 13 and the exhaust and then places the port 16 in communication with the chamber 3 of the valve. The middle ring *n* of the valve first closes the port 18 and then puts it in communication with the exhaust-chamber 2. The valve being thus reversed, the air rushes from chamber 3 through port 16 and passage 15 into chamber 13 in front of the piston H and drives the piston H rearward in the cylinder C. When the piston arrives at the rear end of its stroke, its groove I places the ports 21 and 25 in communication, and the air in chamber 6 in front of the valve is exhausted. The air in chamber 3 of the valve immediately forces the valve forward to its original position, because the area of the ring *n* is greater than that of the ring *m*. The ring *p* on the cylinder prevents the valve from striking the end of the chamber 6. The cylinder is fed forward automatically at each stroke of the drill. When the drill comes to a hard spot, the piston H is not moved so far forward at each stroke, so that

less of the triangular port 23 is uncovered, and the forward feed of the power-cylinder is consequently decreased automatically to the necessary extent. When the drill comes to a soft spot in the rock and the piston H makes longer strokes, the piston H uncovers more of the port 23 and the feed of the power-cylinder C is increased automatically and in proportion to the requirements of the drill.

What I claim is—

1. The combination, with a casing, and a cylinder slidable in the casing; of a piston slidable in the said cylinder, and a distributing-valve, said cylinder being provided with passages controlled by the said valve and piston whereby the piston is reciprocated in the cylinder and the cylinder is fed forward automatically in the casing when its supply-port is uncovered by the said piston at the end of its outstrokes, substantially as set forth.

2. The combination, with a casing, and a cylinder slidable in the casing; of a drill-socket provided with a piston slidable in the said cylinder, a main piston slidable in the said cylinder independent of the drill-socket and provided with a piston-rod which engages loosely with the drill-socket, and a distributing-valve, said cylinder being provided with passages controlled by the said valve whereby the main piston is reciprocated in the cylinder and the cylinder is fed forward automatically in the casing, substantially as set forth.

3. The combination, with a casing, and a cylinder slidable in the casing and provided with stepped bearings at one end; of a piston slidable in the said cylinder, and an annular distributing-valve provided with rings of different area which slide upon the said stepped bearings, said cylinder being also provided with passages controlled by the said valve and piston whereby the piston is reciprocated in the cylinder and the cylinder is fed forward automatically in the casing when its supply-port is uncovered by the said piston at the end of its outstrokes, substantially as set forth.

4. The combination, with a casing, a cylinder slidable in the casing, and means for preventing the cylinder from revolving in the casing; of a piston slidable in the cylinder, means for constraining the piston to revolve step by step as it slides back and forth in the cylinder, and a distributing-valve, said cylinder being provided with passages controlled by the said valve whereby the piston is reciprocated in the cylinder and the cylinder is fed forward automatically, substantially as set forth.

5. The combination, with a casing, and a cylinder slidable in the casing; of a ratchet-box secured in the rear end of the cylinder and provided with a rifled stem, a drill-socket provided with a piston slidable in the front end of the cylinder, a reciprocating piston engaging with the said stem and provided with a piston-rod which works in a hole in the said drill-socket, and a distributing-valve, said cylinder being provided with passages controlled by the said valve whereby the said reciprocating piston is moved back and forth in the cylinder and the cylinder is fed forward automatically, substantially as set forth.

6. The combination, with a casing, and a non-revoluble cylinder which is slidable longitudinally in the casing and provided with a supply-port and a passage connecting the bore of the said cylinder with the space in the casing at one end thereof; of a drill-socket slidable in the said cylinder, a main piston slidable in the said cylinder independent of the drill-socket and operating to propel the said drill-socket periodically, and means for revolving the main piston and the drill-socket step by step in the cylinder, said main piston operating to uncover the said supply-port periodically so that the cylinder is advanced step by step in the said casing together with the said main piston and drill-socket, substantially as set forth.

7. The combination, with a casing provided with a slit at one end, of a cylinder slidable in the said casing, a reciprocating piston working in the said cylinder, and means for contracting the slit end portion of the casing upon the said cylinder, substantially as set forth.

8. The combination, with a cylinder, and a piston slidable therein and forming a chamber 14, said cylinder being provided with a valve-chamber; of an annular valve slidable in the valve-chamber and forming a chamber 6 at one end thereof, said cylinder being also provided with a passage 20 and a port 21 which connect the chamber 6 with the chamber 14, and a supply-passage which connects the chamber 14 with the said valve, whereby pressure is first admitted by the valve to chamber 14 to operate the piston and is then admitted by the said piston from the chamber 14 to the chamber 6 to reverse the valve automatically, substantially as set forth.

9. The combination, with a feeding-cylinder, and a power-cylinder slidable therein and provided with a port and a passage connecting it with the said feeding-cylinder; of a piston reciprocating in the said power-cylinder and uncovering the said port at one end of its stroke whereby the said power-cylinder is fed forward step by step in the said feeding-cylinder, substantially as set forth.

10. The combination, with a feeding-cylinder, and a power-cylinder slidable therein and provided with a triangular port in its side having its apex arranged toward the feeding-cylinder and having a passage connecting the said port with the feeding-cylinder; of a piston reciprocating in the said power-cylinder and uncovering the said port to a variable extent, and a check-valve arranged in the said passage, substantially as set forth.

11. The combination, with a cylinder provided with an annular valve-chamber; of a piston slidable in the cylinder and forming chambers 13 and 14 at its ends; and an an-

nular valve slidable in the valve-chamber and forming a chamber 7 at one end thereof which constantly communicates with the atmosphere, said valve being provided with a pressure-chamber 3 and an exhaust-chamber 2, and the said cylinder being further provided with a port 16 and a passage 15 which normally connect the chamber 13 with the chamber 7, and having also a port 18 and a passage 17 which connect the chamber 14 with the chamber 3 when the chamber 13 is connected with the chamber 7, said valve operating when reversed to first close the port 16 and then place it in communication with the pressure-chamber 3, and to first close the port 18 and then place it in communication with the exhaust-chamber 2, substantially as set forth.

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

FRANK RATTEK.

Witnesses:

ALICE J. MURRAY,

FREDK. K. DAGGETT.