No. 623,980. Patented May 2, 1899.

F. BURGER.

AUTOMATIC EXPLOSIVE COMPRESSION ENGINE.

(Application filed Mar. 2, 1898.)

(No Model.) 2 Sheets—Sheet 1.

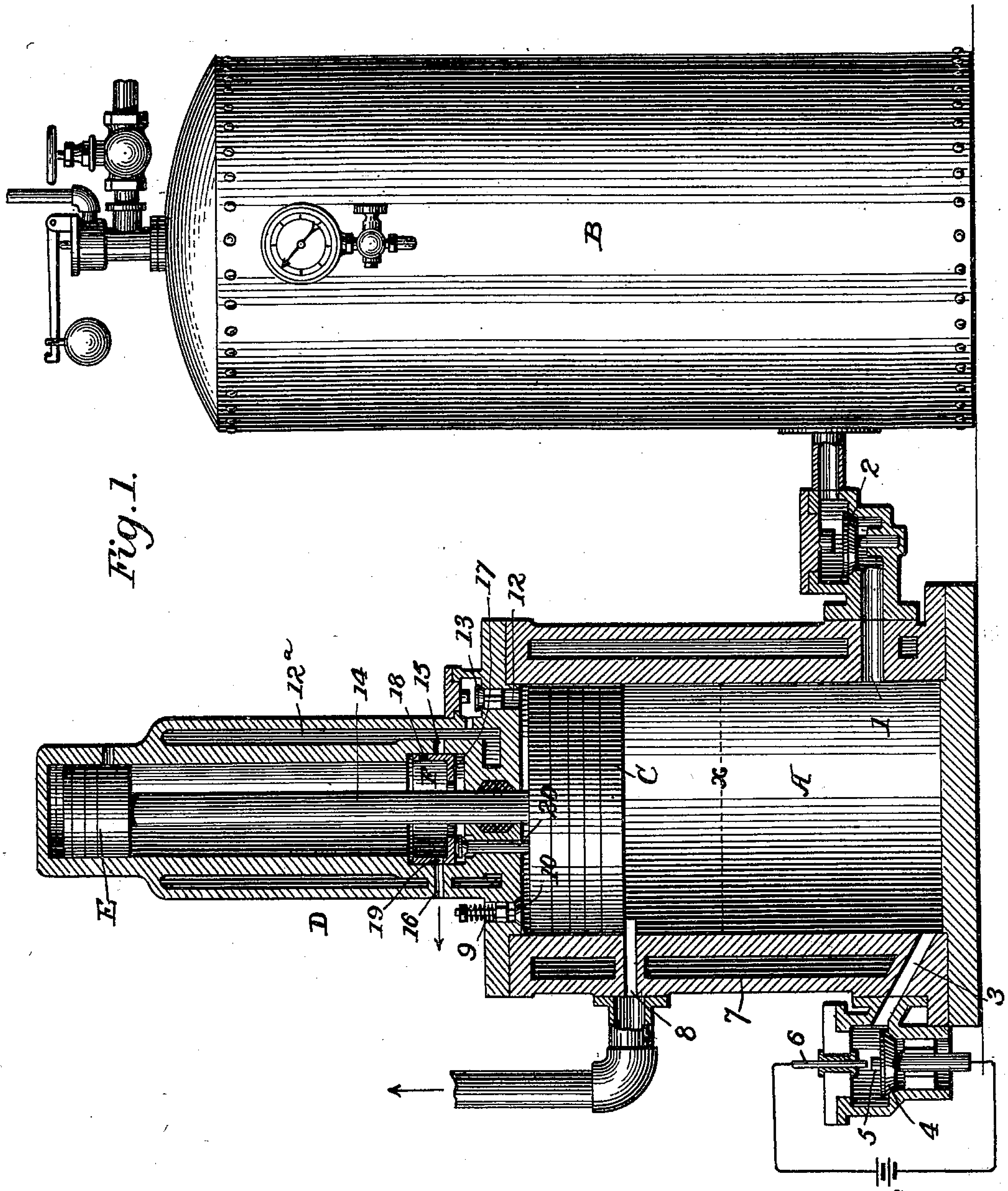


Fig. 1.

Witnesses
J. G. Hinkel
[illegible] Stevens

Inventor
Franz Burger
By Foster Freeman
Attorneys

No. 623,980. Patented May 2, 1899.

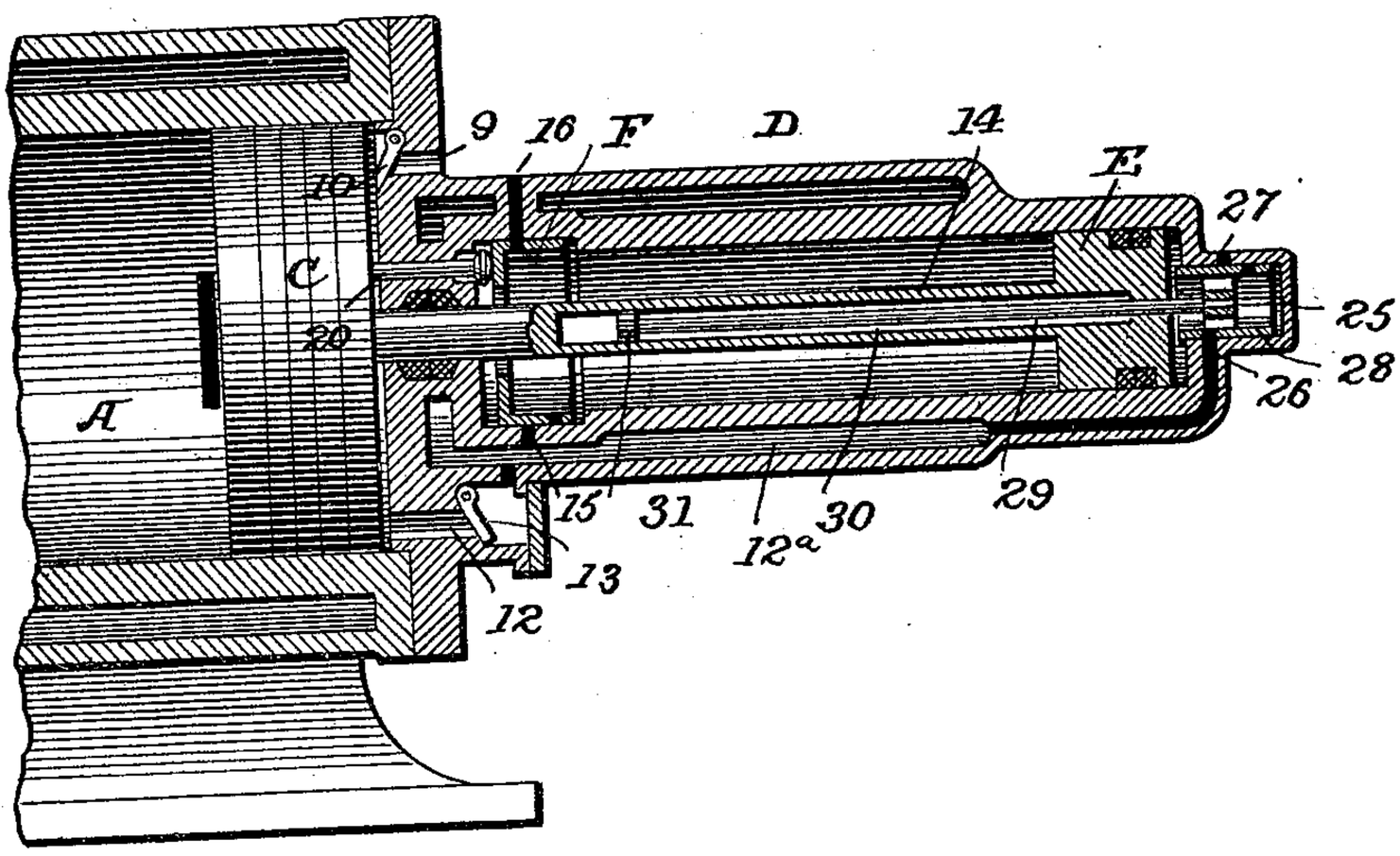
F. BURGER.

AUTOMATIC EXPLOSIVE COMPRESSION ENGINE.

(Application filed Mar. 2, 1898.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 2



Witnesses
J. H. Hinkel
Samuel D. Thomas

Inventor
Franz Burger
by Howson & Howson
Attorneys

UNITED STATES PATENT OFFICE.

FRANZ BURGER, OF FORT WAYNE, INDIANA, ASSIGNOR OF THREE-FOURTHS TO HENRY M. WILLIAMS, OF SAME PLACE.

AUTOMATIC EXPLOSIVE COMPRESSION-ENGINE.

SPECIFICATION forming part of Letters Patent No. 623,980, dated May 2, 1899.

Application filed March 2, 1898. Serial No. 672,262. (No model.)

To all whom it may concern:

Be it known that I, FRANZ BURGER, a citizen of the United States, residing at Fort Wayne, Allen county, State of Indiana, have invented certain new and useful Improvements in Automatic Explosive Compression-Engines, of which the following is a specification.

This invention relates to certain new and useful improvements in apparatus by means of which exploded gas, or hydrocarbon mixed with air, in a highly-compressed state, may be stored up in a suitable reservoir to be subsequently utilized as a motive power for driving various forms of engines.

With this object in view the invention consists in an apparatus embodying the various novel features of construction and arrangement hereinafter more particularly described.

In the accompanying drawings, forming a part of this specification and in which like letters and numerals of reference designate corresponding parts, Figure 1 is a vertical sectional view of one form of apparatus embodying the invention; and Fig. 2 is a similar view of another form of apparatus embodying the invention, parts being broken away.

Referring more particularly to the drawings, A designates a main cylinder in which the gases are exploded and from which they pass in a highly-compressed state through a passage 1, controlled by a check-valve, to a suitable reservoir B. This cylinder is vertically arranged in Fig. 1, and at its lower end it is provided with an inlet-passage 3, which communicates with any suitable source of combustible-fluid supply (not shown) and is controlled by an inwardly-opening valve 4. Arranged in close proximity to the valve, to make contact with an electrode 5, carried thereby, when the valve is opened, is a second electrode 6. These electrodes form the terminals of an electric circuit, and in practice when the valve is lifted to admit a charge to the explosion-chamber they make contact to complete the circuit. When the valve closes, however, this circuit is broken, a spark being generated and the charge ignited within the cylinder.

Surrounding the cylinder A is a water-jacket 7, and at the upper end of the cylinder is an exhaust-port 8, adapted to be uncovered by the piston C when it is at the upper end of its stroke.

Communicating with the space above the piston and with the external atmosphere is an air-inlet port 9, controlled by an inwardly-opening suction-valve 10, and leading from the space above the piston is a passage 12, controlled by an outwardly-opening valve 13. The piston-rod 14 of the piston C extends through the upper end of the cylinder A into an auxiliary cylinder D, mounted centrally upon and in line with the cylinder A, and at its upper end the said rod is provided with a second piston E.

Within the wall of the cylinder D is an annular passage 12^a, which surrounds the cylinder and communicates with the passage 12 and with the interior of the cylinder beneath the piston E through a valve-controlled inlet-port 15. In line with the inlet-port upon the opposite side of the cylinder is an exhaust-port 16, and these two ports are adapted to be controlled by a single valve F. This valve, as shown, comprises a cylindrical shell, the inner diameter of which is slightly greater than the internal diameter of the cylinder D, and this shell is adapted to be received and to be moved vertically within a recess in the lower end of the cylinder. At its lower edge the shell is provided with an annular flange 17, through a central opening in which the piston-rod 14 passes, and in the side of the shell are formed ports 18 19, adapted to be brought to register with the inlet and exhaust ports 15 16, respectively. Engaging the under face of the flange 17 is a head carried upon the upper end of a stem 20, which stem projects through the upper wall of the cylinder A into position to be struck and lifted by the piston C when it approaches the end of its upstroke, the valve F being moved in the opposite direction by the piston E.

Assuming the piston C to be at the lower end of its cylinder, compressed air is forced into the passage 12^a of the cylinder D by any suitable means. The piston E, likewise being at the bottom of its cylinder, has made contact with the valve F, forcing it downward and bringing its port 18 to register with the

inlet-port 15, thereby permitting the compressed air within the passage 12^a to enter the cylinder D beneath the piston to lift the same, as well as the piston C. When the piston C has reached the point indicated by the dotted line *x*, the weight of the two pistons counterbalances the pressure of the air within the cylinder D and the pistons come practically to a standstill. During the upward movement of the piston C the valve 4 is lifted by the vacuum within the cylinder A and a charge of explosive mixture is drawn into the cylinder. When the valve is lifted, the electrodes 5 6 are brought into contact and maintained in engagement until the movement of the piston C is arrested at the point *x*, when the valve drops to its seat. This effects the separation of the electrodes and generates a spark, causing the charge, which has been drawn into the cylinder, to be ignited. The piston C, being heavy and at a standstill, is but slowly affected by the explosion following the ignition of the charge, and consequently the force of the explosion lifts the check-valve 2 and permits the greater volume of the exploded gases to escape through the passage 1 into the reservoir B. After the greater portion of the gases has been trapped in the storing-reservoir the piston begins to rise to the position indicated in Fig. 1, uncovering the exhaust-port 8 and permitting the burned gases remaining beneath the piston to escape. During the upward movement of the piston it engages the end of the stem 20, lifting said stem, and through it the valve F, thereby bringing the ports 16 19 to register and permitting the compressed air beneath the piston E to escape. As the piston C ascends the air above it is compressed and forces its way past the valve 13 into the passages 12 12^a, where it remains until the next upward movement of the piston E is to be effected. The burned gases beneath the piston C and the compressed air beneath the piston E having been exhausted, there is nothing to retain them in their elevated positions, and consequently they return to the lower ends of their respective cylinders by gravity. When the piston E has descended sufficiently far to operate the valve F, the inlet-port 15 is opened in the manner before stated, the compressed air from the passage 12^a rushes into the cylinder, and the operation above described is repeated.

In Fig. 2 the cylinders A and D are shown arranged horizontally, and as in this arrangement it is impossible for the pistons to move from one end to the other of their respective cylinders by gravity it is necessary that some means be employed for effecting this movement. Accordingly the outer end of the cylinder D is provided with a valve-chamber 25, having inlet and exhaust ports 26 and 27, respectively, and in this chamber is adapted to slide a cylindrical valve 28, provided with ports which are adapted to register with the ports 26 27. This valve 28 is provided with a stem 29, which extends into a longitudinal chamber 30 of the piston-rod 14 and is provided with a shoulder or enlargement 31. The valve-chamber 25 communicates with the passage 12^a through its inlet-port 26, and in operation when the pistons have been forced outwardly by the explosion in the cylinder A the piston E makes contact with the end of the valve 28 and moves it until one of its ports is brought to coincide with the inlet-port, when a part of the compressed air within the passage 12^a will rush into the cylinder D behind the piston E and force it and the piston C to the opposite ends of their cylinders. Just previous to the end of this stroke of the piston E, however, the end wall of the chamber 30 makes contact with the enlargement 31 and shifts the valve 28 to bring a port thereof into communication with the port 27, permitting the air back of the piston E to exhaust. The valve F is then operated to admit compressed air upon the opposite side of the piston in the same manner as in the construction shown in Fig. 1, and the pistons are moved in the opposite direction. With the above-noted exception the construction and operation of the parts shown in Fig. 2 are substantially identical with those shown in Fig. 1, and the same reference letters and numerals have been used to designate corresponding parts in both figures.

Without limiting myself to the exact construction and arrangement of the parts shown and described, since it will be obvious that various changes in such construction and arrangement may be made without departing from the spirit or scope of the invention and some features thereof used without others,

What I claim is—

1. In an apparatus for the purpose described, the combination with a cylinder provided at one end with valve-controlled inlet-port, a discharge-port, a reservoir communicating with said latter port an exhaust-port leading from the cylinder, a piston within the cylinder, means without the cylinder for moving the piston through a part of its stroke, and means for igniting a charge upon one side of the piston at a predetermined time, substantially as described.

2. In an apparatus for the purpose described, the combination with a cylinder provided at one end with valve-controlled inlet and discharge ports, a valve-controlled discharge-port for compressed air at the opposite end of the cylinder, an exhaust-port leading from the cylinder, a piston within the cylinder, an engine without the cylinder for moving said piston through a part of its stroke, said engine communicating with the compressed-air-discharge port of the cylinder, substantially as described.

3. In an apparatus for the purpose described, the combination of a main and an auxiliary cylinder arranged in line and having connected pistons, an inlet for an explosive charge and a valve-controlled discharge-

opening at one end of the main cylinder, a valve-controlled discharge-opening for compressed air at the opposite end of said cylinder, an inlet and an exhaust port at one end of the auxiliary cylinder, the inlet-port communicating with the compressed-air-discharge port of the main cylinder, a valve for controlling the inlet and exhaust ports of the auxiliary cylinder, and means for actuating said valve, substantially as described.

4. In an apparatus for the purpose described, the combination of a main and an auxiliary cylinder arranged in line and having connected pistons, an inlet for an explosive charge and a valve-controlled discharge-opening at one end of the main cylinder, a valve-controlled discharge-opening for compressed air at the opposite end of said cylinder, an inlet and an exhaust port at one end of the auxiliary cylinder, the inlet-port communicating with the compressed-air-discharge port of the main cylinder, a slide-valve for controlling the inlet and exhaust ports of the auxiliary cylinder, said valve being arranged to be moved in one direction by the piston of one cylinder and in the opposite direction by the piston of the other cylinder, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANZ BURGER.

Witnesses:
GEO. K. TORRENCE,
J. BURGER.