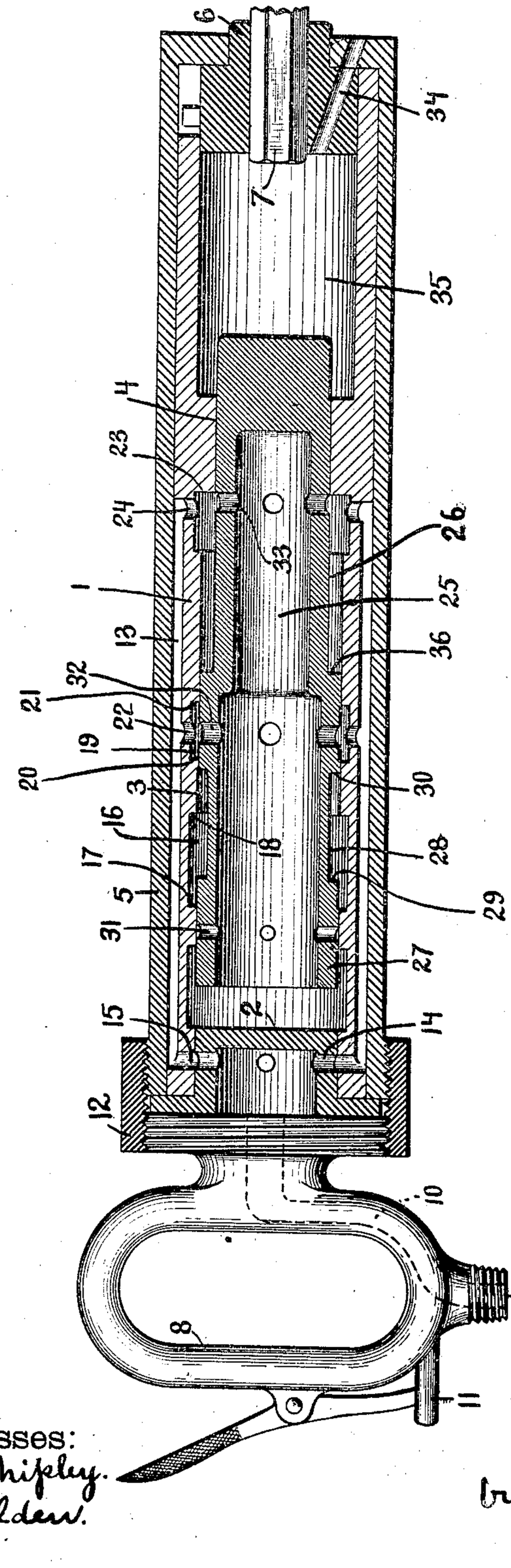
No. 848,255. PATENTED MAR. 26, 1907.

E. LEICHTER.

PNEUMATIC ENGINE.

APPLICATION FILED JAN. 24, 1906.



Witnesses:
Elmer R. Shipley.
M. S. Belden.

Edward Leichter
Inventor
by James W. See
Attorney

UNITED STATES PATENT OFFICE.

EDWARD LEICHTER, OF NEVADA CITY, CALIFORNIA, ASSIGNOR OF ONE-FOURTH TO J. C. CAMPBELL, OF NEVADA CITY, CALIFORNIA, AND ONE-FOURTH TO JOHN BENDER, OF HAMILTON, OHIO.

PNEUMATIC ENGINE.

No. 848,255. Specification of Letters Patent. Patented March 26, 1907.

Application filed January 24, 1906. Serial No. 297,544.

To all whom it may concern:

Be it known that I, EDWARD LEICHTER, a citizen of the United States, residing in Nevada City, Nevada county, California, (post-office address Box 464, Nevada City, California,) have invented certain new and useful Improvements in Pneumatic Engines, of which the following is a specification.

This invention, pertaining to improvements in pneumatic engines designed for general hammering purposes will be readily understood from the following description, taken in connection with the accompanying drawing, which is a longitudinal section of a pneumatic engine embodying my invention in a hand-held device of the class usually spoken of as "pneumatic tools."

While I refer to my invention as a pneumatic engine, it should be explained that some or all of its features are adapted for employment with any working fluid. For convenience of expression I will, however, confine myself in the present description to air as the working fluid; but it is to be understood that such fluid is merely typical.

In the drawing, 1 indicates the cylinder, which has a major and minor bore; 2, the cylinder-head, which is a hollow flanged plug separably inserted in the heel end of the cylinder; 3, the major bore of the cylinder; 4, the minor bore of the cylinder; 5, the shell, which is a cylindrical sleeve snugly inclosing the cylinder structure; 6, the tool-socket, supported in the outer end of the shell with its axis coincident with that of the cylinder; 7, the tool-shank, on which the piston is to hammer; 8, the handle, secured to the rear end of the general structure; 9, the air-inlet, adapted to receive connection from a supply-hose; 10, inlet-passage leading through the handle from the inlet to the cylinder-head 2; 11, the throttle, mounted on the handle and serving to control the inlet of air to the working parts of the structure; 12, a coupling-nut uniting the handle to the shell and serving also to hold the cylinder-head to place; 13, a longitudinal groove in the periphery of the cylinder structure, an outer wall for this groove being formed by the interior surface of the shell, there being a circumferential series of these grooves in order to provide a sufficiency of air-passage, the present description, however, being confined to a single groove or passage; 14, radial ports through the wall of the cylinder-head to lead the supply of air outwardly from the hollow of the cylinder-head, there being one of these ports for each of the grooves 13; 15, a radial port through the wall of the cylinder registering with port 14 and serving to place passage 13 always in free communication with the air entering from the inlet; 16, an annular enlargement of the major bore of the cylinder, the major bore of the cylinder having a normal diameter to the front and rear of this enlargement; 17, an annular shoulder in the cylinder, forming the rear wall of the enlargement 16; 18, an annular shoulder in the cylinder, forming the front wall of the enlargement 16; 19, an annular enlargement in the major bore of the cylinder forward of the enlargement 16; 20, the annular shoulder forming the rear wall of the enlargement 19; 21, the annular shoulder forming the front wall of the enlargement 19; 22, a port through the cylinder-wall, placing enlargement 19 always in free communication with passage 13; 23, the shoulder forming the front wall of the major bore of the cylinder; 24, a port through the cylinder-wall at the forward portion of the major bore of the cylinder, this port placing the forward end of the major bore of the cylinder always in free communication with passage 13; 25, the piston, considered as a whole, the same serving as the striking-hammer and having a major and a minor diameter adapted to fit the differential cylinder, the piston having a central cavity open at its rear to lighten the piston and serve as an air-passage; 26, the forward minor diameter portion of the piston; 27, the rear major diameter of the piston; 28, a neck forming a reduction of the major diameter of the piston at an intermediate point in its length; 29, the shoulder of the piston, forming the rear wall of this neck; 30, the shoulder of the piston forming the front wall of the neck; 31, a radial port in the rear portion of the piston, permitting air entering this port inwardly to reach the rear end of the cylinder; 32, a similar port in the forward portion of the major diameter of the piston; 33, a similar port in the minor diameter of the piston, the ports 31, 32, and 33, thus far described each in the singular, being repeated at circumferential intervals around the piston in order to increase the airway; 34,

the exhaust-outlet through the forward end of the general structure; 35, the forward chamber of the cylinder structure forward of the minor bore of the cylinder, and 36 the forwardly-presenting shoulder of the piston at the juncture of its minor and major diameters.

The engine will be recognized as being of the valveless type—that is to say, without other valves than as furnished by its piston. When air is permitted to enter the structure, its full pressure is in passage 13 and free to exert itself through ports 22 and 24. When the parts are in the position shown in the drawing, the piston is at the rear end of its stroke, subject to trifling variations. The air under full pressure passes freely through ports 22 and 32 and through ports 24 and 33 and through the cavity of the piston and has free access to the rear end of the cylinder, full pressure, therefore, acting forwardly on the major area of the piston. At the same time the full pressure is on the annular area of the piston represented by shoulder 36. The consequence is that full pressure, tending to drive the piston forward, is acting on the major area of the piston, while full pressure, tending to resist the forward motion of the piston, is acting on the annulus 36, or, to state it otherwise, there is a forward urgency on the piston represented by full pressure on an area represented by its minor diameter.

The air flowing to the rear end of the cylinder goes through the two ports 32 and 33, and under the influence of this air the piston is started from a state of rest and driven forward. Early in the advance of the piston the port 31 begins to pass shoulder 17 and port 33 begins to pass shoulder 23, port 33 thus beginning to close, while port 31 begins to open. Very shortly port 33 will be entirely closed and port 31 will be entirely open. In the meantime shoulder 30 of the piston will have passed beyond shoulder 20 of the cylinder, and air from port 22 may flow to and through port 31. At the first stage the inflow of air to the cylinder was through two ports 33 and 32 and correspondingly liberal. In the second stage port 33 has been cut out of action and port 31 substituted. Port 31 is smaller than port 33, the result being that while the flow is still through two ports one of the ports of the pair is smaller than was before the case, the flow having therefore been gradually reduced in liberality after the piston has started upon its atrive stroke.

As the piston further advances port 32 overruns shoulder 21 and becomes closed, whereupon the flow of air to the cylinder is through small port 31 alone, which is amply sufficient to carry the piston forward under its acquired energy, due to the more liberal inflow of air at the earlier stages. In the continued advance of the piston port 31 overruns shoulder 18, whereupon all inflow of air to the cylinder is cut off, the piston now advancing as the result of expanison of the air and the acquired momentum of the piston. Later the port 33 opens to chamber 35 and thence to outlet 34, thus exhausting the cylinder, the stroke being completed and the blow struck under the effect of momentum of the piston. The piston strikes its blow and rebounds and starts upon its return stroke, urged by its rebounding momentum and by the air-pressure against annulus 36. The exhaust through port 33 becomes cut off, the air confined behind the piston becomes compressed to form a cushion, port 31 admits working pressure to the cushioning air, and in due course the original condition for starting on a new active stroke is reached.

In practice I find the machine to be exceedingly efficient. Its blows are forceful, its air economy satisfactory to a superior degree, it is not subject to short strokes, the piston will not cease its motion in any position while the pressure is on, and the piston can be started into motion from any position in which it may have come to rest with the pressure off.

I claim—

A pneumatic engine comprising a cylinder having a major bore and a minor bore and having a first annular enlargement in the major bore contiguous to the minor bore and having a second annular enlargement in the major bore at a further distance from the minor bore and having a third annular enlargement in the major bore at a still further distance from the minor bore, the first and second of said annular enlargements being in free communication with the source of fluid-supply, and a two-diameter piston fitting said bore and having the extremity of its smaller portion projecting out of the minor bore of the cylinder, said piston having an axial cavity extending within it from its larger end to a point near its smaller end, said piston being provided with a set of radial ports placing its axial cavity in communication with the first of the annular enlargements of the major bore of the cylinder and having a second set of radial ports placing said cavity at the same time in communication with the second of said annular enlargements and having a third set of radial ports leading from said cavity and closed by the inwall of the major bore of the cylinder when the first two sets of ports are in said relationship with the first and second annular bores of the cylinder, combined substantially as set forth.

EDWARD LEICHTER.

Witnesses:
H. C. CLOUDMAN,
J. C. CAMPBELL.