No. 638,624. Patented Dec. 5, 1899.

G. D. BUMPUS.

ENGINE.

(Application filed Mar. 17, 1899.)

(No Model.) 2 Sheets—Sheet 1.

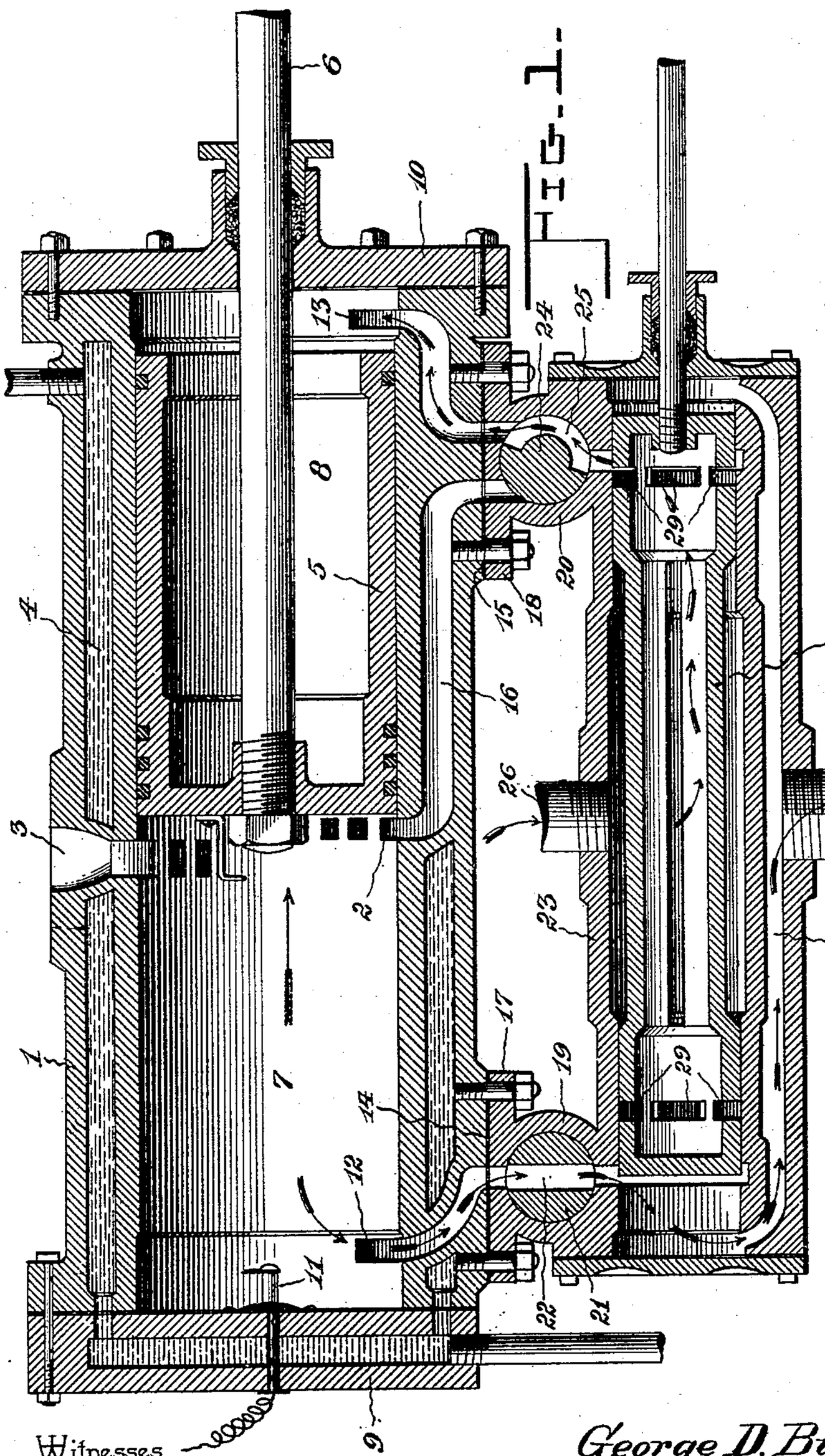

FIG. 1.

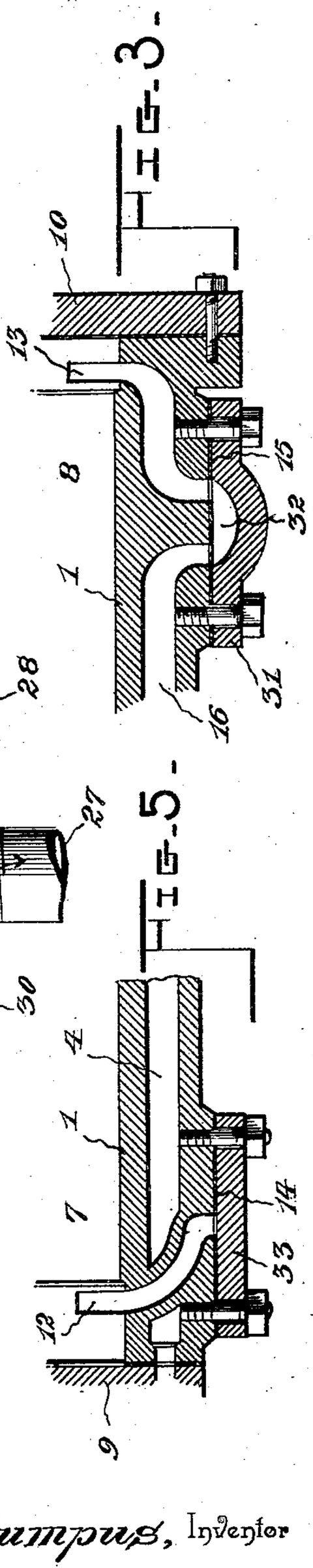

FIG. 3.

FIG. 5.

Witnesses
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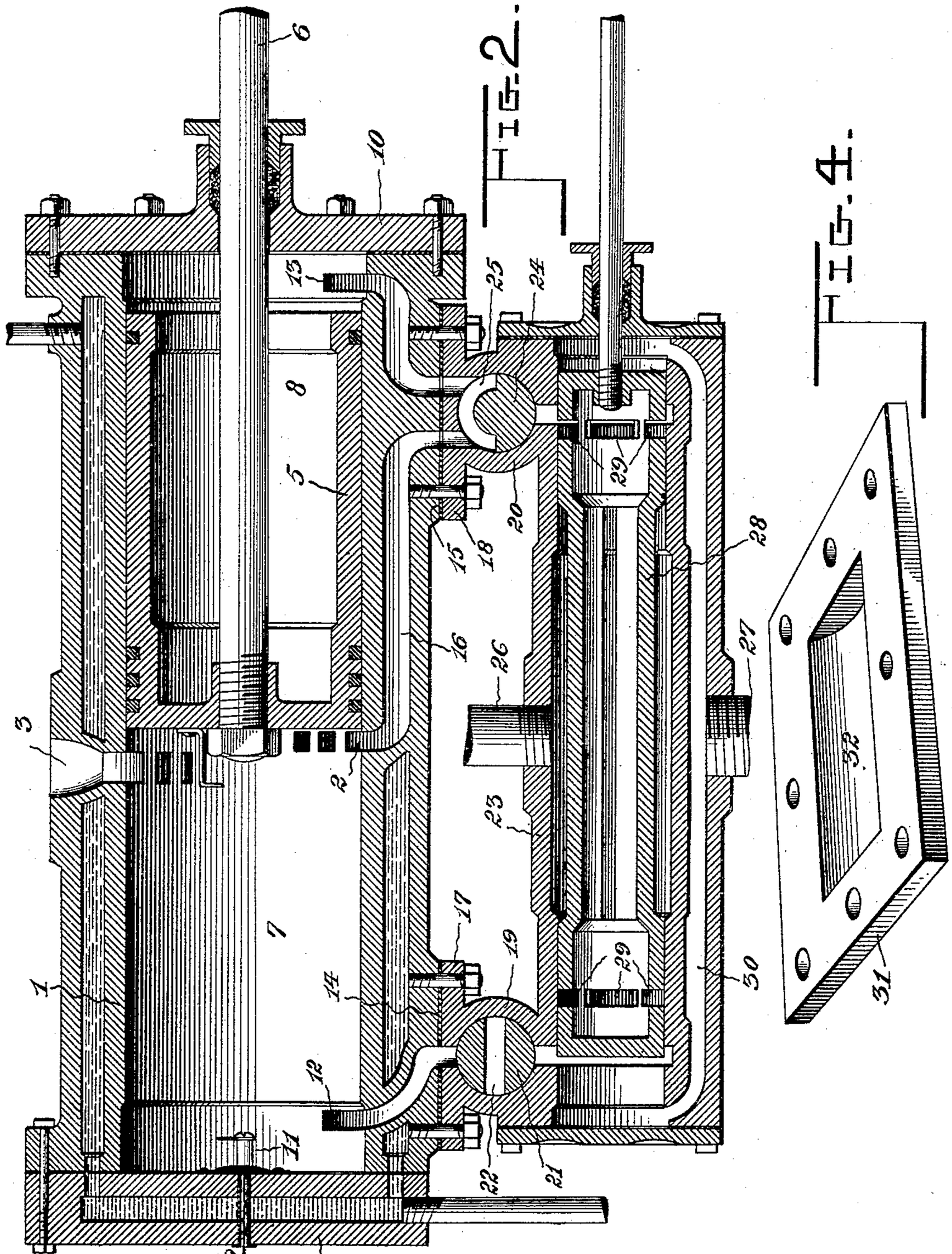

FIG. 2.

FIG. 4.

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UNITED STATES PATENT OFFICE.

GEORGE D. BUMPUS, OF ZELIENOPLE, PENNSYLVANIA.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 638,624, dated December 5, 1899.

Application filed March 17, 1899. Serial No. 709,473. (No model.)

To all whom it may concern:

Be it known that I, GEORGE D. BUMPUS, a citizen of the United States, residing at Zelienople, in the county of Butler and State of Pennsylvania, have invented a new and useful Engine, of which the following is a specification.

My invention relates to engines, and particularly to an attachment for gas-engines, whereby the same may be operated by steam, and hence to provide an engine which may be interchangeably operated either as a gas or as a steam engine, to adapt it for use in the oil-fields either for drilling or for pumping. It is well known that gas-engines have to a great extent been substituted for steam-engines for pumping oil-wells, owing to the economy in the use thereof; but for drilling purposes gas-engines have not been found practicable, and as the outlay incident to providing two engines is considerable and as it frequently occurs that a well must be drilled to a greater depth after the pumping operation has proceeded for a time, thus requiring the return to the steam-engine, I have found it desirable to provide a combined gas and steam engine so constructed as to adapt it to be driven by either power, and particularly to provide improved and simple means whereby the change from one power to the other may be made without the disconnection or substitution of parts. Hence in reducing my invention to practice I have provided a convertible engine adapted to be driven by either gas or steam power, according to the positions of a plurality of controlling-valves which may be reversed instantly by the operator to accomplish the desired adaptation of the mechanism.

Further objects and advantages of this invention will appear in the following description, and the novel features thereof will be particularly pointed out in the appended claims.

In the drawings, Figure 1 is a longitudinal section of an engine constructed in accordance with my invention, the controlling-valves being adjusted to adapt the mechanism to be driven by steam-power. Fig. 2 is a similar view showing the valves in their reversed positions to adapt the mechanism to be driven explosively. Fig. 3 is a sectional view of a portion of the mechanism when adapted for use as a gas-engine, showing one of the cylinder-ports and the gas-passage connected by a recessed cap, which may be substituted for the valve mechanism when it is undesirable to employ the convertible feature of the mechanism. Fig. 4 is a detail view in perspective of said cap. Fig. 5 is a detail section of a portion of the cylinder to show means for closing one of the cylinder-ports.

Similar reference characters indicate corresponding parts in all the figures of the drawings.

In the illustrated embodiment of my invention, 1 represents a cylinder having a gas-inlet port 2 and an exhaust-port 3, and also, when desired, provided with a water-jacket 4. Mounted to operate in the cylinder is a piston 5, having a rod 6, said piston being adapted to divide the interior of the cylinder to form separate explosion and compression chambers 7 and 8, with the former of which communicate said gas inlet and exhaust ports 2 and 3. The cylinder is provided at its ends with the usual heads 9 and 10, in the former of which is arranged any suitable form of igniter, (indicated at 11,) the construction of which forms no part of my invention. Also communicating with the cylinder near its extremities are the cylinder-ports 12 and 13, of which the former communicates with the explosion-chamber and the latter with the compression-chamber and beyond the path of the piston, as in the ordinary practice, and preferably in counterbored portions at the extremities of the cylinder. Both of the cylinder-ports extend to the outer surface of the wall of the cylinder at points in flat-surfaced seats 14 and 15, and in the latter of which also terminates a gas-passage 16, which communicates with the gas-inlet port 2. Thus the gas-passage 16 and the cylinder-port 13 break into the seat 15 at the exterior surface of the cylinder at adjacent points, and by connecting these adjacent extremities of the port 13 and passage 16 compressed explosive mixture in the compression-chamber 8 of the cylinder may be conveyed from a point in advance of the piston to a point in rear thereof or into the explosion-chamber. This construction and arrangement of parts, assuming that the cylinder-port 12 is closed, will constitute a two-cycle gas-engine, wherein the

piston operating under the impulse of an explosion in the chamber 7 will advance in the direction indicated by the arrow in Fig. 1 to compress a charge of explosive mixture inducted during the preceding movement of the piston in the opposite direction, such compression continuing until the inlet-port 2 is exposed, whereupon the piston starting upon its return movement will close the ports 2 and 3 and at the proper time will actuate the igniter to cause an impelling explosion.

Arranged upon the seats 14 and 15 are the base-plates 17 and 18 of valve-casings 19 and 20, the former of which is provided with a port communicating with the cylinder-port 12 and controlled by a valve 21, having in the construction illustrated a diametrical port 22, adapted for registration with the port 12 to open communication between the cylinder and one end of a cut-off-valve casing 23. In the valve-casing 20 is arranged a controlling-valve 24, which is in operative relation with ports communicating, respectively, with the cylinder-port 13 and the gas-passage 16. Said valve 24, however, is provided with a segmental port 25, which is adapted for connecting the cylinder-port 13 with the passage 16, as indicated in Fig. 2, or for connecting the cylinder-port 13 with the cut-off valve-casing 23, as indicated in Fig. 1.

The cut-off-valve casing 23 is provided with a steam-inlet port 26 and an exhaust-port 27, and operating in said casing is a cut-off valve 28, which, as illustrated, is of the sliding type, is hollow to communicate interiorly with the supply-port 26, and is provided at its extremities with openings 29 for alternate communication with the cylinder-ports through the controlling-valve casings 19 and 20. The exhaust-port 27 is in communication by suitable passages 30 with the extremities of the valve-casing 23, and hence is adapted for alternate communication with said cylinder-ports through the controlling-valve casings, such communication being controlled by the cut-off valve, as in the ordinary practice. It will be understood that while I have illustrated a slide-valve for controlling the cylinder-ports, and hence controlling the inlet and exhaust of steam to the cylinder when the engine is actuated by steam-power, I do not desire to be limited to this specific form of valve, as a vibrating cut-off valve of any ordinary form is adapted to perform all of the essential functions thereof, and, furthermore, I have deemed it unnecessary to illustrate any means for communicating motion from the driven shaft of the engine to the cut-off valve, as any of the well-known forms of valve motions may be employed in this connection. It will be seen, on the other hand, that my invention consists, essentially, in arranging controlling-valves in the cylinder-ports of an engine between the cut-off valve and the cylinder and in providing in connection with one of the controlling-valve casings a gas-passage which is adapted in any position of the adjacent controlling-valve to connect one of said cylinder-ports with the gas-inlet port of the cylinder. When the controlling-valves are adjusted, as indicated in Fig. 1, to respectively connect the cylinder-ports 12 and 13 with the feed-ports of the cut-off valve-casing, all communication between the gas-inlet port 2 and the outer end of the compression-chamber of the cylinder is cut off, and hence the engine is adapted to be operated by steam or other expansive motive agent, as in the ordinary practice and as indicated by the arrows in said Fig. 1. In other words, with the cut-off valve in the position indicated in Fig. 1 steam enters through the port 26 and passes through the feed-ports 29 at one end of the valve into the controlling-valve casing 20, through the segmental port 25, and into the cylinder-port 13, while exhaust-steam passing through the cylinder-port 12 and the diametrical passage 22 of the controlling-valve 21 enters the cut-off-valve casing beyond the cut-off valve and thence proceeds through the passage 30 to the exhaust-port 27. On the other hand, when the positions of the controlling-valves are reversed, as shown in Fig. 2, to close the cylinder-port 12 and open communication between the cylinder-port 13 and the gas-passage 16 the operation of the engine under explosive pressure is as hereinbefore set forth in the ordinary practice in connection with gas-engines. Thus by the reversal of the controlling-valves 21 and 24 I am enabled to convert the engine embodying my invention to adapt it to be driven either expansively or explosively. This convertibility enables me to use one engine for both pumping and drilling, and at the same time obtain the advantage of steam-power in drilling and the economy of gas-power in pumping.

I preferably construct the cut-off-valve mechanism and the connected controlling-valves with their casings as an attachment adapted to be applied to a cylinder which is substantially of the ordinary construction, the only important difference residing in the fact that it is provided with terminal cylinder-ports terminating in seats adapted for the reception of the base-plates of the controlling-valve casings, as hereinbefore described, and in the further fact that the gas-passage, by which the explosive mixture under pressure is conveyed from the compression-chamber to the explosion-chamber, is interrupted at an intermediate point or is constructed to form separate passages 13 and 16, which terminate in one of said seats. Obviously this construction requires the use, in connection with the cylinder, of some means for establishing communication between the port 13 and the passage 16, even when the cut-off and controlling valve mechanisms are displaced, and also requires means for closing the other cylinder-port 12. This difficulty is overcome, however, by providing, as shown in Fig. 3, a cap 31 for application to the seat 15 and having a connecting cavity or chamber 32 to

connect the adjacent extremities of the passage 16 and port 13. The plate 33, as shown in Fig. 5, may be employed to close the port 12.

It will be understood that in practice various changes in the form, proportion, size, and minor details of construction within the scope of the appended claims may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having described my invention, what I claim is—

1. A convertible engine having a cylinder provided with terminal cylinder-ports and intermediate inlet and exhaust ports, a piston, a cut-off valve having a casing in communication with said cylinder-ports, controlling-valves intercepting the cylinder-ports between the cylinder and the cut-off-valve casing, and a gas-passage for connecting said inlet-port with one of the cylinder-ports, and also intercepted by one of said controlling-valves, substantially as specified.

2. A convertible engine having a piston-cylinder provided with inlet and exhaust ports, and terminal cylinder-ports, and a gas-passage for establishing communication between said inlet-port and the interior of the cylinder at a point removed from the inlet-port a sufficient distance to allow the arrangement of the cylinder-piston therebetween, a cut-off valve having its casing in communication with said cylinder-ports, and controlling-valves intercepting said cylinder-ports between the cylinder and the cut-off-valve casing, and one of said controlling-valves also being arranged to intercept said gas-passage, substantially as specified.

3. A convertible engine having a cylinder provided with inlet and exhaust ports, terminal cylinder-ports terminating in seats at the exterior surface of the cylinder, and a gas-passage communicating with said inlet-port and also terminating in one of said seats, a cut-off valve having its casing provided with supply and exhaust ports and with feed-ports, and controlling-valves having their casings arranged upon said seats and connecting the cylinder-ports with the feed-ports of the cut-off-valve casing, one of said controlling-valves being adapted to establish communication between said gas-passage and the adjacent cylinder-port, substantially as specified.

4. In an engine, the combination of a cylinder having feed and exhaust ports, cylinder-ports, and a gas-passage in communication with said inlet-port, a cut-off valve having its casing provided with supply and exhaust ports and feed-ports, and controlling-valves having their casings in communication respectively with said feed-ports, and also in communication, respectively, with said cylinder-ports, and one of the controlling-valve casings being in communication with said gas-passage; where, when the controlling-valves are in one position, communication is established between the feed-ports of the cut-off-valve casing and the cylinder-ports; and where, when the controlling-valves are in a reversed position, one of the cylinder-ports is in communication with said gas-passage, and the other cylinder-port is closed, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

GEORGE D. BUMPUS.

Witnesses:
D. R. NEWTON,
IRA S. ZEIGLER.