No. 798,479. PATENTED AUG. 29, 1905.

G. J. ALTHAM.

VALVE FOR EXPLOSIVE ENGINES.

APPLICATION FILED AUG. 22, 1901.

3 SHEETS—SHEET 1.

FIG. 1.

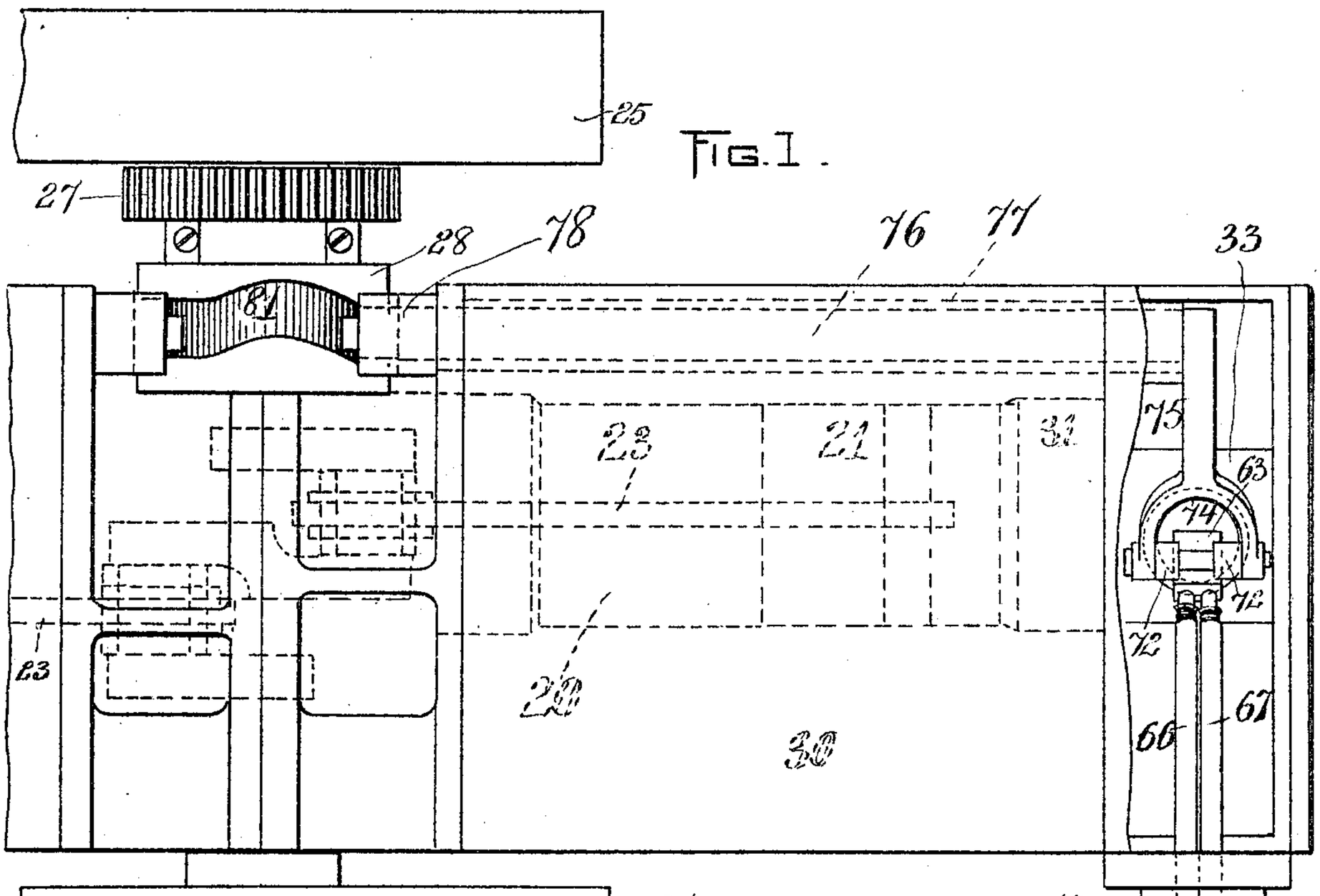
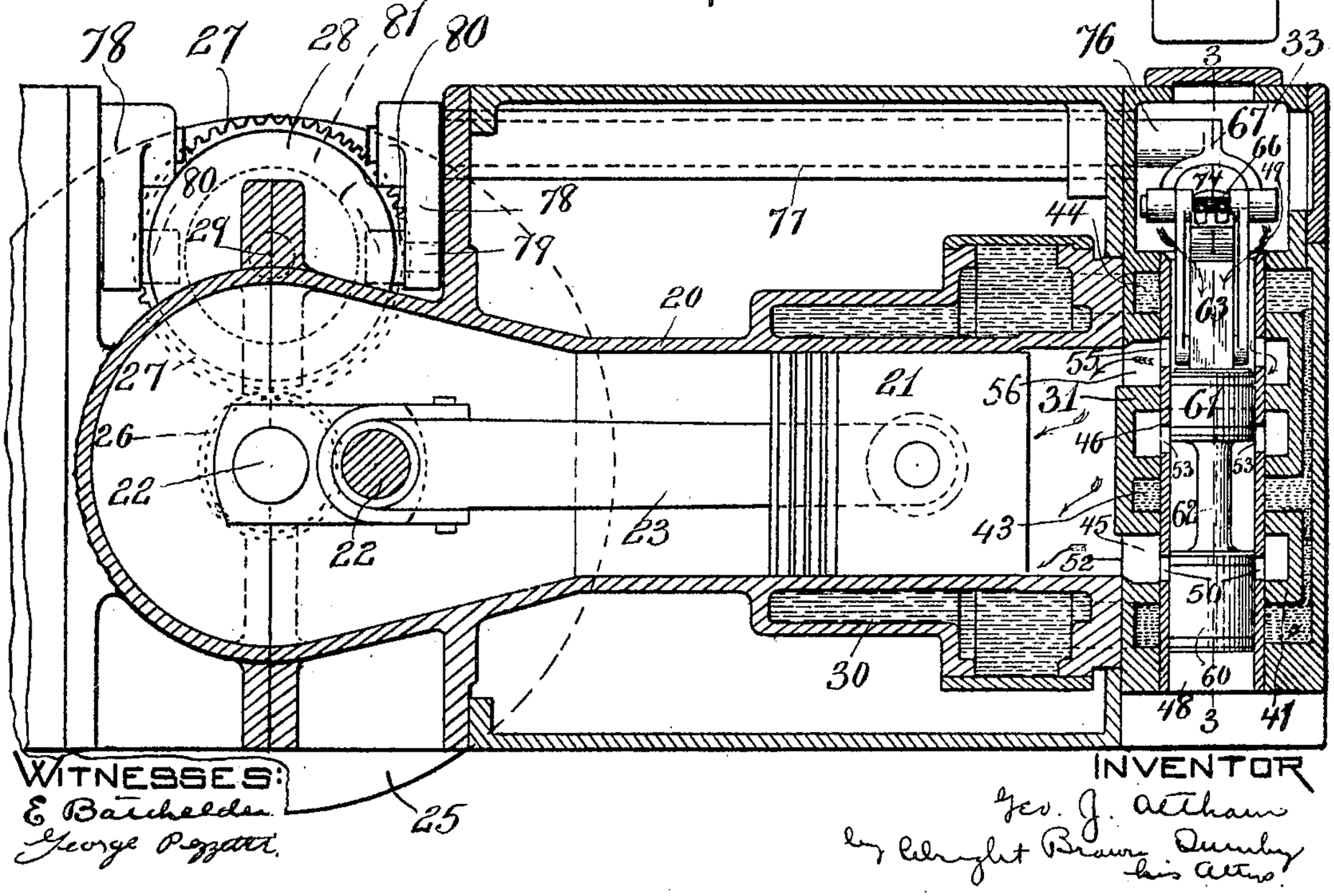


FIG. 2.



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3 SHEETS—SHEET 2.

FIG. 3.

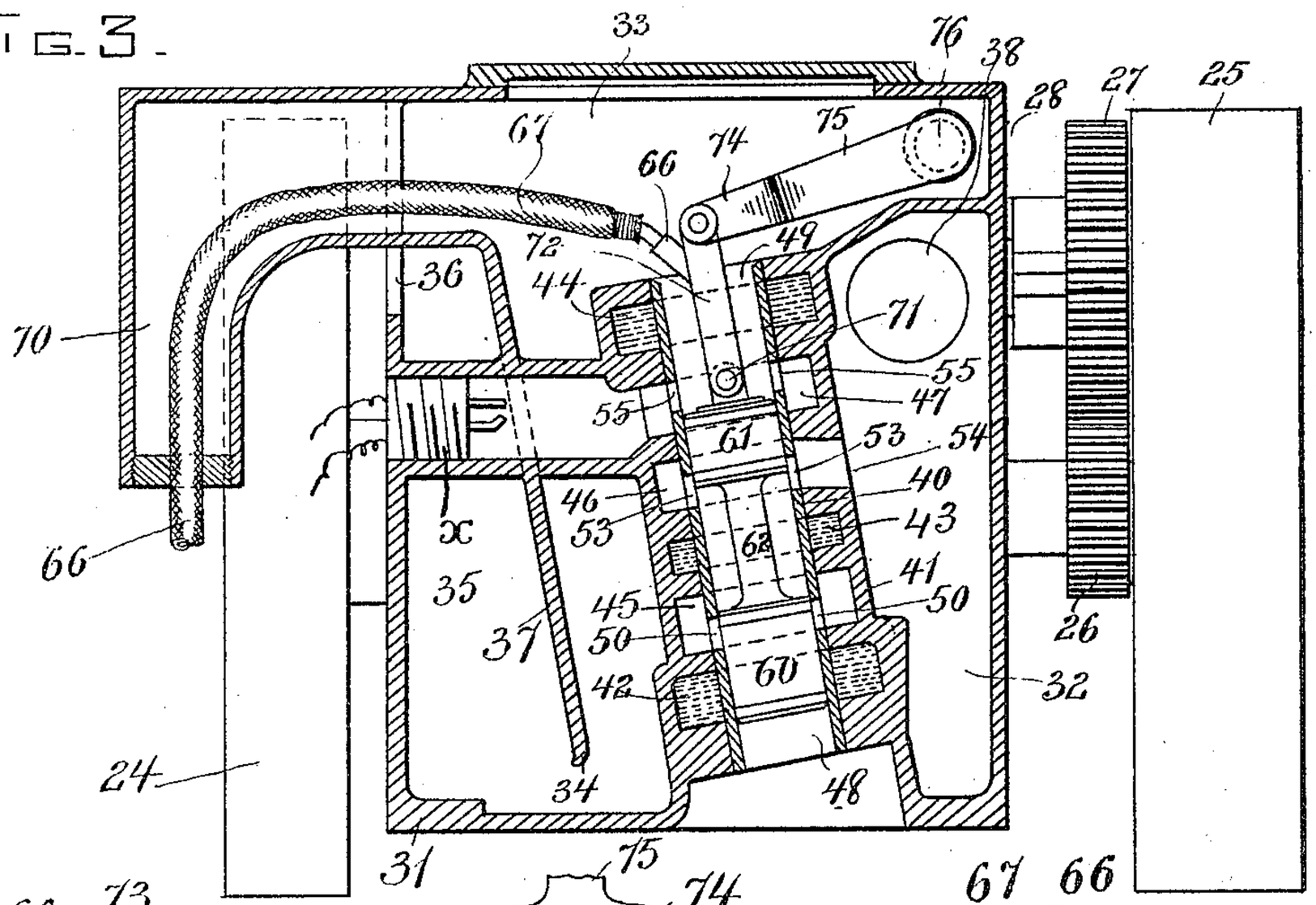

FIG. 6.

FIG. 7.

FIG. 8.

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3 SHEETS—SHEET 3.

FIG. 4.

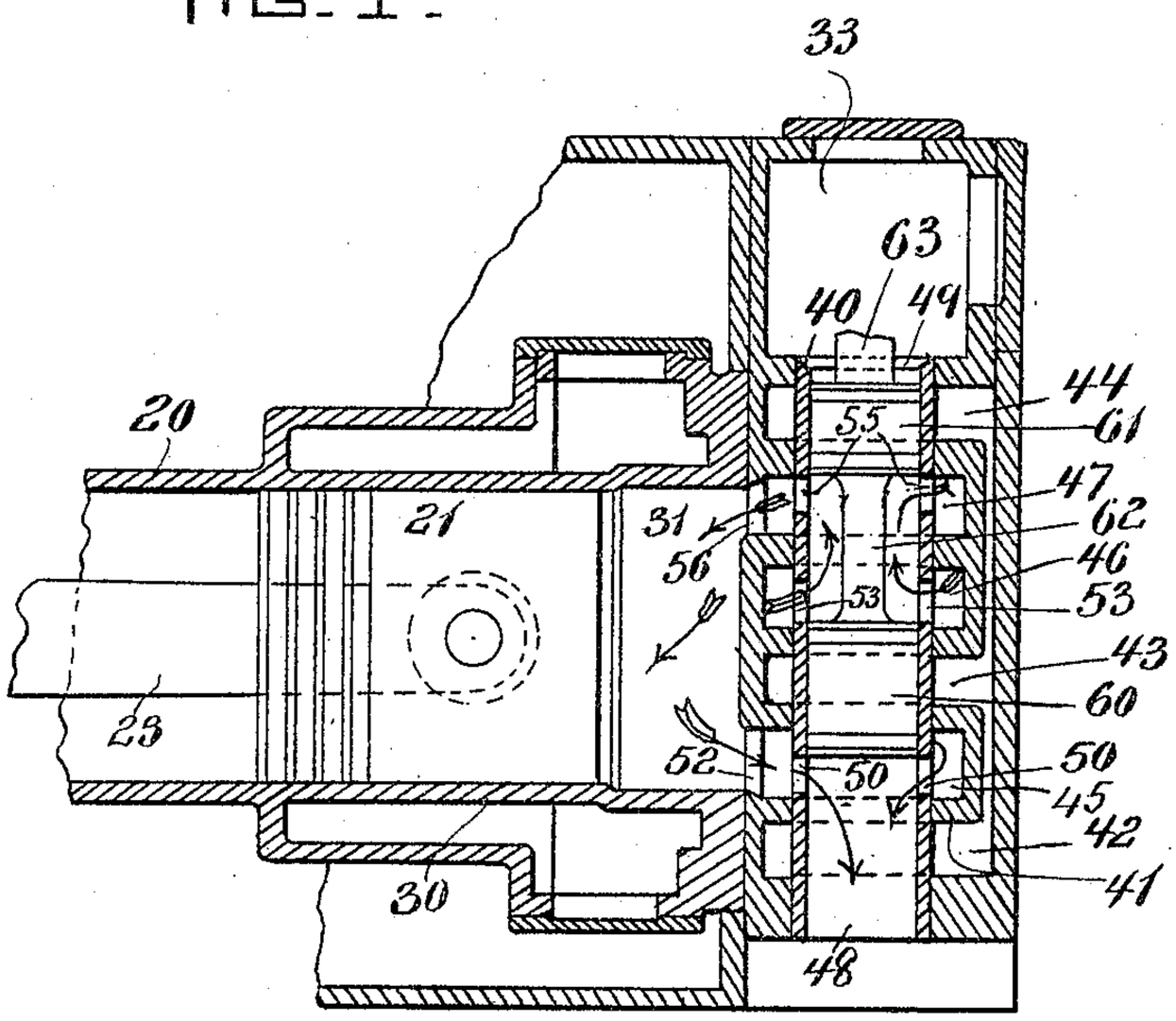
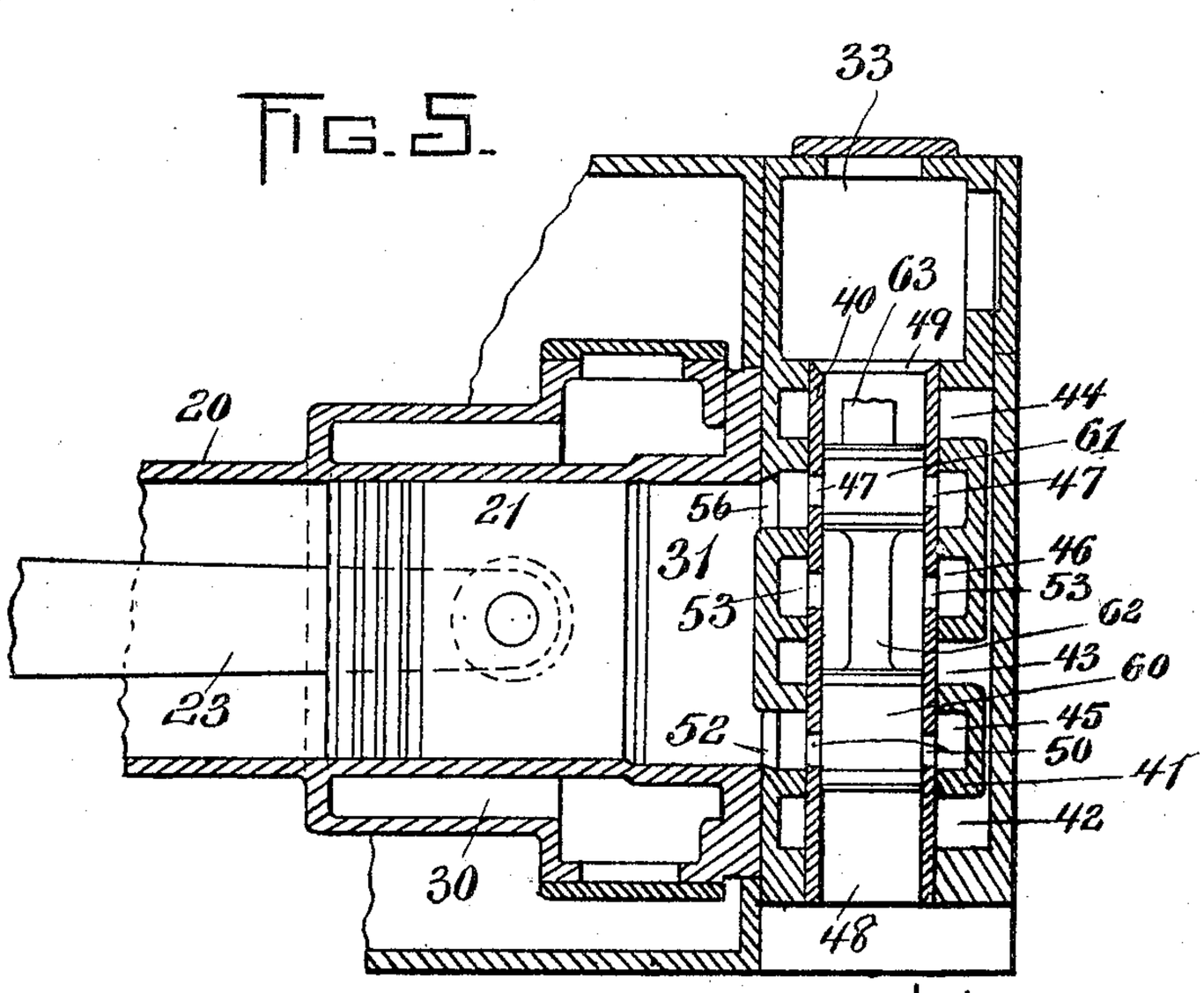


FIG. 5.



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UNITED STATES PATENT OFFICE.

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VALVE FOR EXPLOSIVE-ENGINES.

No. 798,479. Specification of Letters Patent. Patented Aug. 29, 1905.

Application filed August 22, 1901. Serial No. 72,868.

To all whom it may concern:

Be it known that I, GEORGE J. ALTHAM, of Fall River, in the county of Bristol and State of Massachusetts, have invented certain new and useful Improvements in Valves for Explosive-Engines, of which the following is a specification.

This invention has relation to internal-combustion engines, and more particularly to the valve mechanism therefor.

The principal object of the invention is to provide an improved valve mechanism by means of which one single valve controls the supply of the explosive mixture to the engine, the supply of the scavenging current of air, and also the exhaust of the products of combustion with the said last-mentioned current of air. In carrying out this object of my invention it has also been my purpose to render the valve noiseless in operation and to provide a simple and durable construction.

In what the invention consists and the manner of constructing it are fully brought out in the following specification, which may be taken in connection with the accompanying drawings, upon which similar reference characters indicate similar parts or features, as the case may be, wherever they occur.

Referring to said drawings, Figure 1 represents in plan view a portion of a four-cycle internal-combustion engine with the valve-chamber broken away. Fig. 2 represents a longitudinal section through the same and illustrates the valve in position to admit explosive mixture during the induction-stroke of the piston. Fig. 3 represents a section on line 3 3 of Fig. 2, showing the valve in the same position. Fig. 4 is a view similar to that in Fig. 2, but showing the valve in position to supply a current of air for scavenging the cylinder after the explosion and also to permit the exhaust of the air and the products of combustion. Fig. 5 illustrates a similar view and shows the position of the valve during the compression-stroke and the working stroke of the piston. Figs. 6, 7, and 8 represent the valve in detail and illustrate the means which I have provided for keeping the valve cool by a flow of fluid.

Referring to the drawings, and more particularly to Figs. 1 and 2, the engine-cylinder is indicated at 20 and the piston at 21. There may be two of these cylinders arranged opposite to each other; but for convenience I have shown but one of them. The piston is connected to the crank-shaft 22 by the rod 23 in the usual way, said crank-shaft being provided with the momentum-wheel 24 and the driving-wheel 25, arranged on opposite ends thereof. There is also placed upon the crank-shaft a small gear 26, intermeshing with and driving a large gear 27, through which motion is imparted to the valve through the medium of a cam 28 on the shaft 29, to which the said gear 27 is secured. Said shaft may be mounted in any convenient manner. In order to keep the cylinder cool, it is surrounded by a jacket 30, through which a stream of cooling fluid may constantly flow. The cylinder-head 31 is enlarged to form the mixing-chamber and to provide compartments for the compressed air which is employed to force the products of combustion from the cylinder for the explosive mixture and also for the air which is introduced for mixing with the explosive. By reference to Fig. 3 it will be observed that the said head is box-like in form, being provided with the compartment 32 for the compressed air and the compartment 33 for the explosive mixture, the last-said compartment communicating by a mouth or throat 34 with the compartment or chamber 35 for the air which is to be mixed with the explosive and which enters the compartment 35 through a duct 36. The chambers 33 and 35 are partially separated by the partition 37, which compels the air to take a tortuous path in reaching the mixing-chamber 33. The air for scavenging the chamber is supplied under pressure to the chamber 32 through the duct 38 from any convenient source.

The valve-chest is located in the cylinder-head, being formed with the open-ended tube 40, surrounded by a jacket 41, having communicating chambers 42 43 44 for the reception of a cooling fluid. The cooling fluid is introduced in a chamber at one end of the valve-chest and exhausted through the chamber at the other end by any convenient means. The jacket 41 provides smaller annular chambers 45 46 47. One end of the tube 40 communicates directly with the atmosphere, as indicated at 48, while the other end 49 communicates with the mixing-chamber 33. The said tube is further provided with a port 50, leading into the annular chamber 45, the latter communicating with the cylinder by the port 52. Said tube also has ports 53 leading into the annular chamber 46, which communicates,

through the port 54, with the compressed-air chamber 32, there being other ports 55 leading through said tube into the chamber 47, which communicates with the cylinder through the ports 56.

A suitable spark-plug may be employed, as indicated somewhat conventionally at *x* in Fig. 3, said spark-plug serving to close the passage connecting with the port 55.

In the valve-chest is placed a reciprocatory valve consisting of the two end portions 60 61, connected by the reduced intermediate portion or spindle 62. This valve is hollow, as shown in Fig. 8, and to its end 61 is screwed an angular bar 63, having two conduits 64 65, to which are connected the ends of flexible pipes 66 67, respectively. With the conduit 65 communicates a pipe 68, which passes into the hollow valve-head 60, so as to induce cooling fluid thereinto, whence it passes backward through the spindle 62 and the head 61 to the conduit 64. The flexible pipes 66 and 67 project into the cylinder-head through a supplemental chamber 70, communicating with the mixing-chamber 33, and they yield to permit the actuation of the valve. The bar 63 is provided with pivot-studs 71 71, on which are pivoted connecting-rods 72 72, the latter being connected by the pintle 73 with the bifurcated end 74 of an arm 75 on a shaft 76, extending into the mixing-chamber 73. This shaft 76 is journaled in a bushing 77 in the frame which surrounds the engine, and it carries on its other end an arm 78, having a pin 79 and roll 80 entering the groove 81 in the path-cam 28. The rocking of the shaft 76 causes the actuation of the valve, said cam-groove being cut or formed so as to effect the proper movement of the valve when desired.

Referring to Figs. 2, 4, and 5, the operation of the valve will be clearly understood. In Fig. 2 the piston is shown in position to begin its induction-stroke. At this time the valve is shifted so as to close ports 50 and 53, but to open ports 55, so as to permit the explosive mixture to flow from the mixing-chamber through the mouth 49 of the tube into the chamber 47 and thence into the cylinder. The valve remains in this position until the induction-stroke of the piston is nearly completed, whereupon the cam rocks the shaft 76 to shift the valve and move it to the position shown in Fig. 5, in which both the ports 56 and 52 are closed to prevent the entrance of more mixture or the escape of the mixture contained in the cylinder. The valve remains in this position while the piston makes its compression-stroke and during the outward movement of the piston caused by the explosion which occurs when the cylinder reaches the end of its compression-stroke. As soon as the piston reaches the end of its outward stroke caused by the explosion the cam again actuates the shaft 76 and moves the valve into the position shown in Fig. 4. At this time both the ports 56 and 52 are open, but the passage of explosive mixture from the chamber 33 to the chamber 47 is cut off by the valve-head 61. While in this position, compressed air from the chamber 32 flows freely through port 54 into the annular chamber 46 and thence through the ports 53, 55, and 56 into the cylinder. This air forces the products of combustion outward through the port 52 into the annular chamber 45 and thence through the ports 50, through the mouth 48 of the tube, to the open air. The valve remains thus during the scavenging stroke of the piston until it reaches the extreme of its inward movement, when the valve is again shifted to the position shown in Fig. 2, the cycle of operations being thus completed. Any suitable means for introducing the fuel may be employed.

So far as I am aware I am the first to have provided an internal-combustion engine with a reciprocating valve of the character described, by means of which the supply of explosive mixture and the exhaustion of the products of combustion may be accomplished.

Having thus explained the nature of the invention and described a way of constructing and using the same, although without attempting to set forth all of the forms in which it may be made or all of the modes of its use, I declare that what I claim is—

1. In an internal-combustion engine, the combination with a valve-chest comprising an open-ended tube having ports, of a reciprocating valve in said tube, said valve comprising two end portions connected by a reduced intermediate portion, the ports in the valve-chest tube communicating with the cylinder and with the source of the explosive mixture and with a supply of compressed air for scavenging, one of the open ends of the said tube permitting the exhaust of the products of combustion with the scavenging-current of air.

2. An internal-combustion engine having a valve mechanism comprising a tubular valve-chest having an inlet-port for the explosive mixture, an inlet-port for a scavenging-current, an outlet for the products of combustion and the said current, ports 53 and 56 communicating with the engine, and a reciprocating valve governing said ports, the end of said tubular valve-chest being open to the atmosphere to permit the direct escape of the products of combustion when the valve opens the port therefor.

3. An internal-combustion engine having a hollow cylinder-head partitioned to form three chambers, one containing a valve-chest, one forming a mixing-chamber and the other a chamber for compressed air.

4. An internal-combustion engine having a hollow cylinder-head partitioned to form three chambers, one containing a valve-chest, and the other two forming respectively, one a mix-

ing-chamber and the other a chamber for compressed air and a valve in said chest for governing the supply of explosive mixture to the cylinder, and the exhaust of the products of combustion, and for governing the supply of compressed air to the cylinder to scavenge the latter.

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

GEORGE J. ALTHAM.

Witnesses:
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