No. 778,289. PATENTED DEC. 27, 1904.

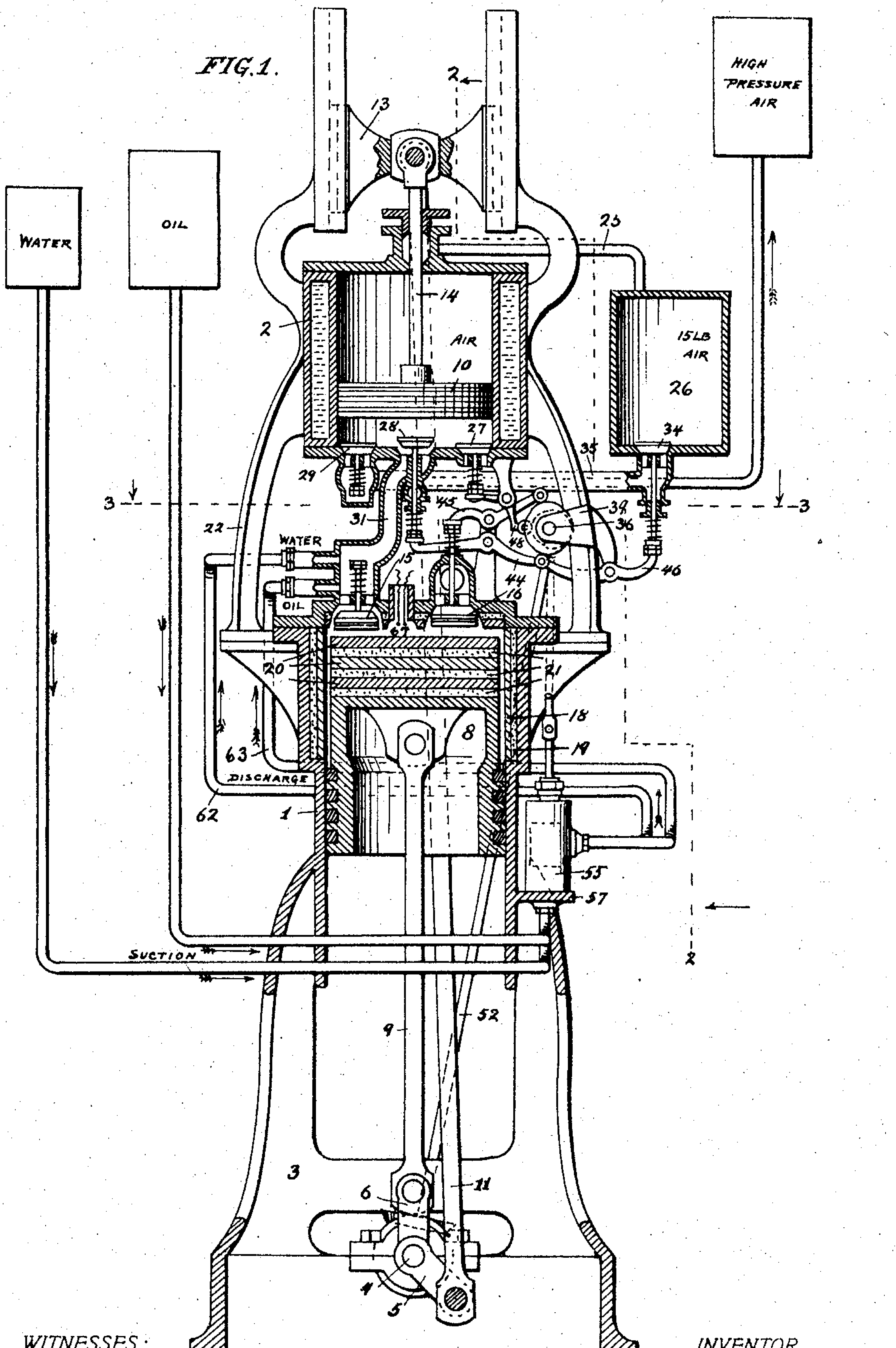
H. F. WALLMANN.

COMBINED INTERNAL COMBUSTION AND AIR ENGINE.

APPLICATION FILED AUG. 21, 1900. RENEWED DEC. 16, 1902.

3 SHEETS—SHEET 1.

FIG. 1.



WITNESSES:

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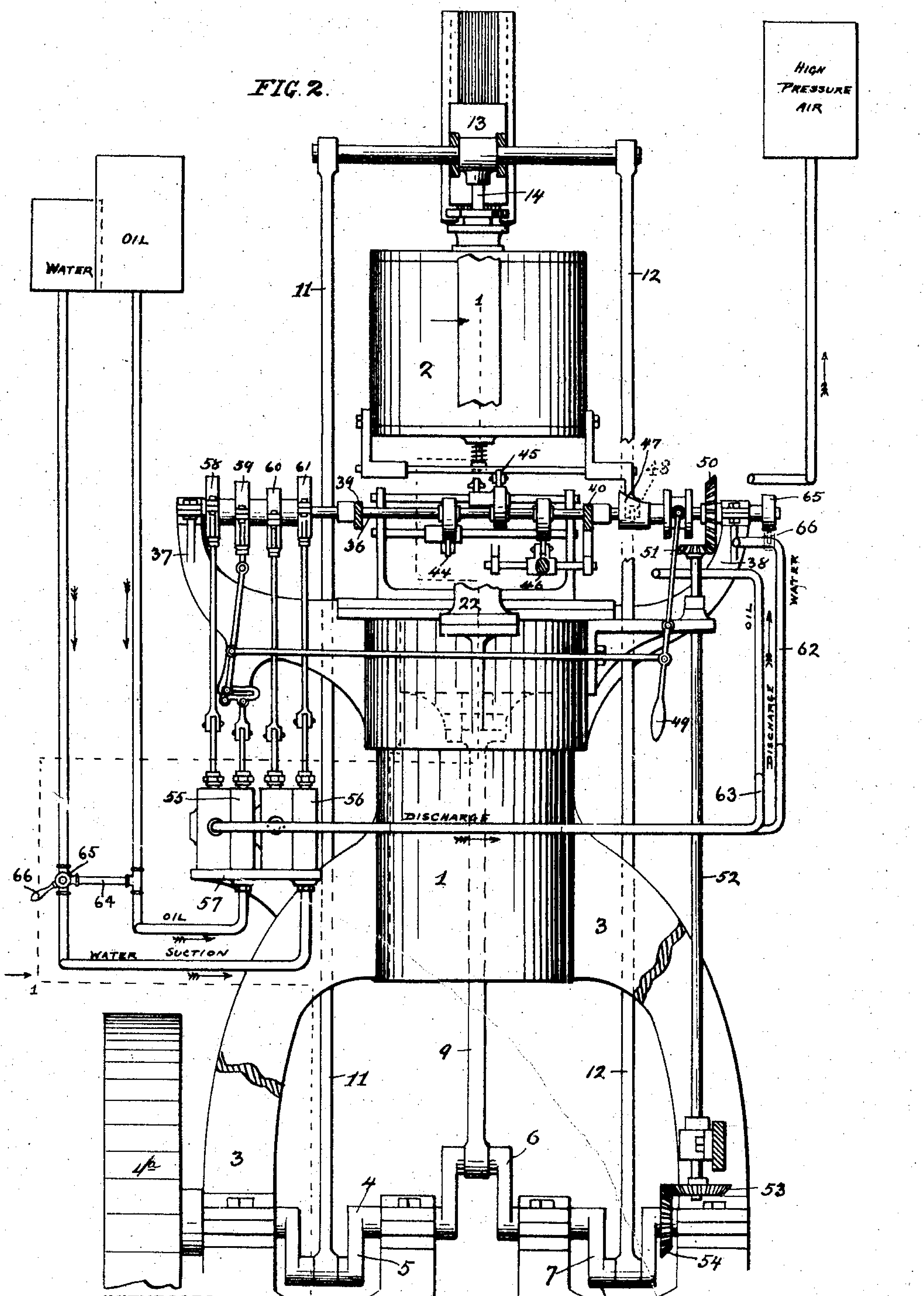
3 SHEETS—SHEET 2.

FIG. 2.



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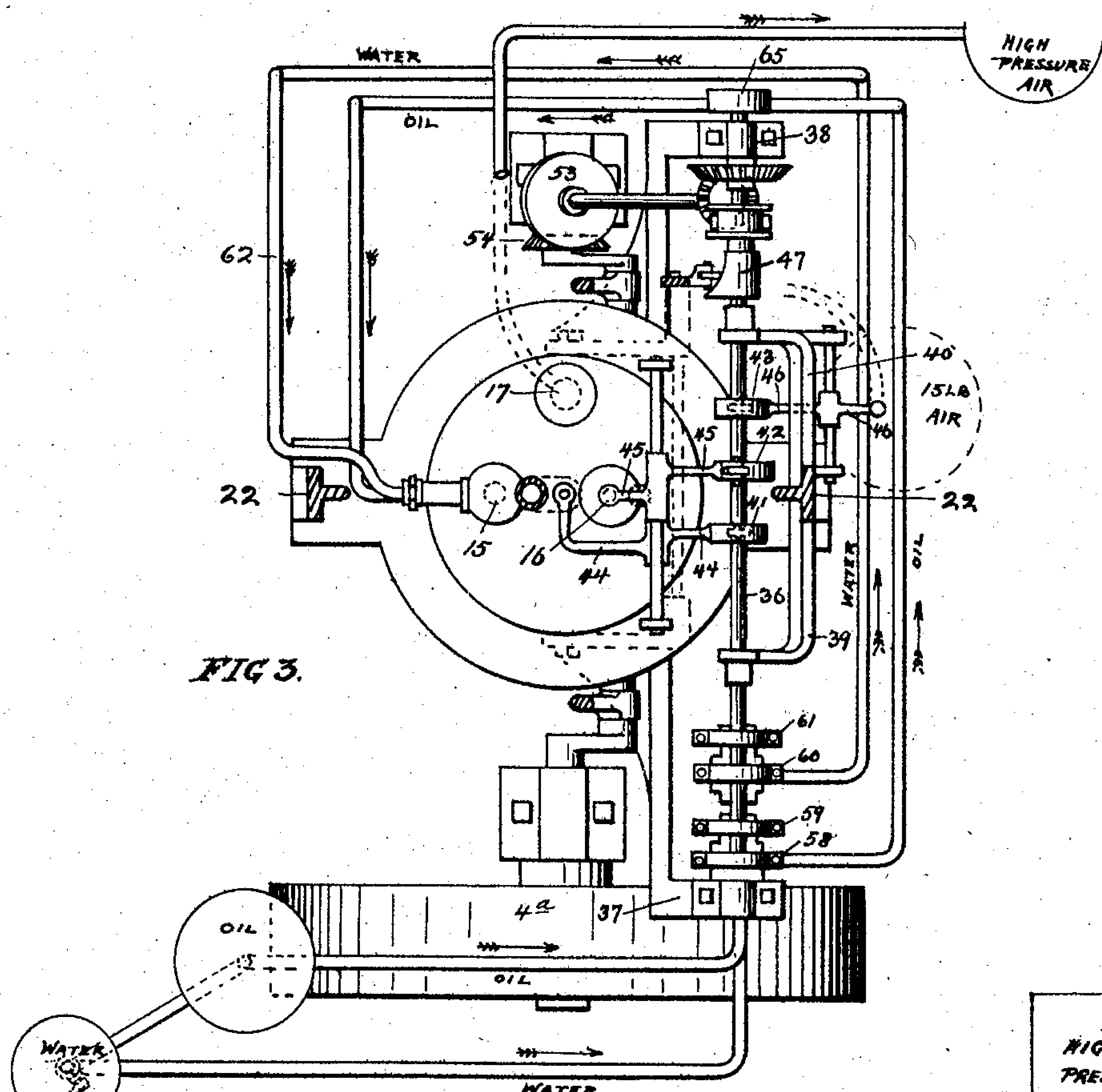

FIG 3.

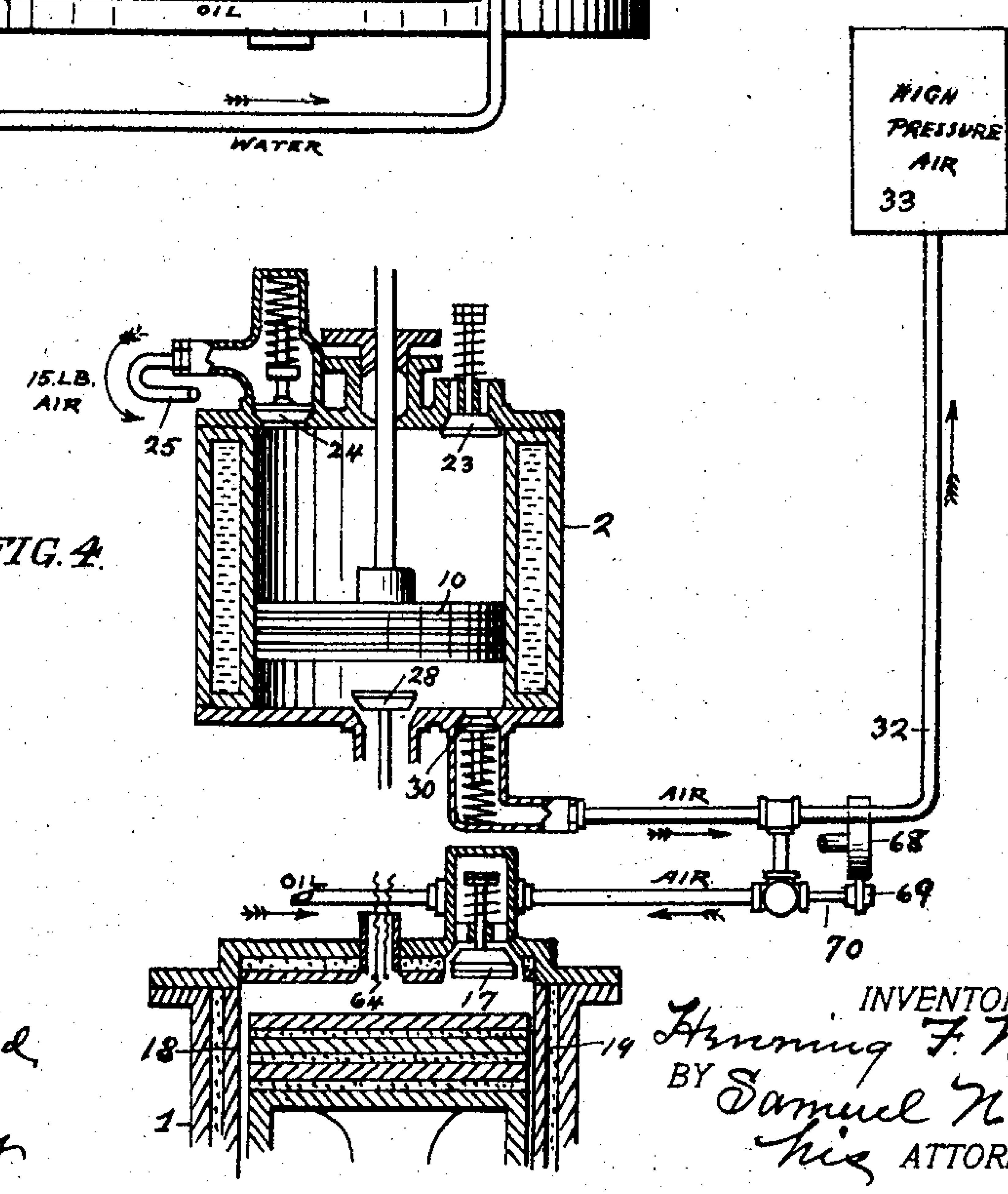

FIG. 4.

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No. 778,289. Patented December 27, 1904.

UNITED STATES PATENT OFFICE.

HENNING FRIEDRICH WALLMANN, OF CHICAGO, ILLINOIS.

COMBINED INTERNAL-COMBUSTION AND AIR ENGINE.

SPECIFICATION forming part of Letters Patent No. 778,289, dated December 27, 1904.

Application filed August 21, 1900. Renewed December 16, 1902. Serial No. 135,462.

To all whom it may concern:

Be it known that I, HENNING FRIEDRICH WALLMANN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in a Combined Internal-Combustion and Air Engine, of which the following is a specification.

My present invention is in the nature of an improvement upon the engine forming the subject-matter of a prior application, filed by me on the 20th day of April, 1900, Serial No. 13,655. In the said application I disclosed a plan for alternately admitting to the working cylinder a combustible body of mixed gas and air and a body of compressed air, the single-acting air-compressor delivering at each compression-stroke a body of compressed air to the working cylinder, first for promoting combustion, and thereby heating the working cylinder, and next for cooling the combustion-cylinder and by the expansion of the heated compressed air converting a part of the heat thus absorbed into power.

My present invention is similar to that disclosed in the foregoing application to the extent that it contemplates the alternate use of combustible and non-combustible charges in the working cylinder, the first serving as the primary motive power and the latter serving both as a cooling and as a power-producing agent; but my present improvements relate more particularly to novel means for creating and introducing to the working cylinder the alternate combustible and non-combustible charges, including a double-acting air-compressor of special construction, which has the triple function of supplying air for the combustible charge, supplying the non-combustible charge, and supplying a body of highly-compressed air for starting purposes and also in some cases for spraying the oil fuel into the combustion-cylinder. This air-compressor for convenience and economy of space is preferably arranged in alinement with the working cylinder, which arrangement is especially advantageous where the engine is used as a motor for self-propelled vehicles, which is one of the principal applications of my present invention contemplated by me, and the piston of the air-compressor is so connected to the crank-shaft as to always maintain a fixed and predetermined relation to the piston of the working cylinder, the two pistons moving inwardly and outwardly almost simultaneously, the working piston having a slight lead over the compressor-piston, whereby the supply of compressed air is constantly maintained and its introduction to the working cylinder is properly timed.

Another feature of my invention resides in the introduction of the liquid-hydrocarbon fuel into the working cylinder by means of an air-blast, whereby it is thoroughly sprayed and vaporized, and the introduction by similar means and in a similar manner of a small jet or spray of water into the non-combustible charge on its way to the working cylinder.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical sectional view on the line 1 1 of Fig. 2 looking in the direction of the arrows of an engine embodying my present improvements. Fig. 2 is an elevation, partly in section, on the line 2 2 of Fig. 1 looking in the direction of the arrows and at right angles to the view shown in Fig. 1. Fig. 3 is a sectional plan view on the line 3 3 of Fig. 1, illustrating principally the valve-operating mechanism; and Fig. 4 is a vertical sectional detail, broken away, of the air-compressor and working cylinder at right angles to the sectional view shown in Fig. 1, illustrating certain valves and air connections which for the sake of clearness are omitted from the other figures and illustrating also a modification in the manner of introducing the oil fuel.

Similar numerals of reference refer to similar parts throughout the several views.

A working cylinder 1 and an air-compressor cylinder 2, preferably arranged in direct alinement with the working cylinder, constitute the principal elements of my present engine. As I have herein illustrated the invention in the form of a vertical stationary engine, I will so describe it; but I wish it to be understood that the mere manner of mounting the engine is not of the essence of my invention.

The working cylinder is supported upon a suitable frame 3, in the base of which is journaled the main crank-shaft 4. In this shaft are formed three cranks 5, 6, and 7, the outside cranks 5 and 7 being set parallel and the middle crank 6 being set at an angle of one hundred and thirty-five degrees to the cranks 5 and 7, as plainly shown in Fig. 1. The crank 6 is connected to and actuated by the working piston 8 through a pitman 9, while the cranks 5 and 7 operate the piston 10 of the air-compressor through a pair of parallel pitmen 11 12, connected to a sliding cross-head 13, in which is secured the upper end of the piston-stem 14. The crank-shaft 4 may be provided with the usual balance-wheel 4^a.

In the head of the working cylinder 1 are located three valves 15, 16, and 17, the valves 15 and 16 being the regular admission and exhaust valves, respectively, for both the combustible and non-combustible charges and the valve 17 being an admission-valve for a high-pressure charge of air for starting purposes and in some cases for spraying the oil into the working cylinder.

The upper half of the inner surface of the working cylinder is provided with a metal lining 18, backed by some suitable bad conductor of heat 19—as, for instance, asbestos wool mixed with silicate of soda—the inner face of the cylinder-head being similarly protected, and the upper half or more of the piston-body is made of slightly less diameter than the cylinder, so as to be out of contact with the walls of the latter, its upper end being formed of a series of metal and asbestos disks 20 and 21, respectively, alternately arranged for the purpose of conserving the heat resulting from the explosions and later imparting it to a body of compressed air subsequently admitted to the working cylinder. I have not shown the working cylinder as equipped with the usual water-jacket, because I employ other and different cooling means; but, if desired, the lower lubricated end of the cylinder may be provided with a water-jacket.

I will next describe the air-compressor 2, which is shown as supported directly above and in line with the working cylinder by a frame 22. This air-compressor is double-acting. In its upper cylinder-head are inlet and discharge valves 23 24, respectively, Fig. 4, the latter communicating through a pipe 25 with an air-tank 26, in which a body of air at about fifteen-pounds-gage pressure is constantly maintained. However, this pressure of about fifteen pounds per square inch may be varied to a considerably higher or lower pressure, as may best suit the conditions. The sole function of the upper end of the air-compressor is to supply compressed air to the air-tank 26. In the lower cylinder-head are four valves 27, 28, 29, and 30, 27 and 29 being air-inlet valves and 28 and 30 being air-discharge valves. The valve 27 is positively controlled in its closing movement by a mechanism hereinafter described, and the valve 28 controls a duct 31, leading to the inlet-valve 15 of the working cylinder. The valve 29 preferably admits low-pressure air from the tank 26 at every other upward stroke of the compressor-piston, and the valve 30 permits a small body of highly-compressed air to pass through pipe 32 to a tank 33 to be stored there for starting purposes. In the bottom of the tank 26 is a positively-operated valve 34, which is connected by a duct 35 with the valve 29.

Referring now to the valve-actuating mechanism which I prefer to employ for properly timing and controlling the several functions of the air-compressor and the working cylinder, 36 designates a cam-shaft, which may be journaled in any convenient way, as in brackets 37 38, secured to the working cylinder, and further in brackets 39 40, secured to or formed integral with the frame 22. On the shaft 36 are keyed three cams 41, 42, and 43. Cam 41 actuates the main discharge-valve 28 of the air-compressor through a bell-crank lever 44. Cam 42 actuates the exhaust-valve 16 of the working cylinder through a bell-crank lever 45, and cam 43 actuates the controlling-valve 34 in the air-tank 26 through a bell-crank lever 46. There is also slidably keyed upon the cam-shaft an adjustable cam 47, which through a bell-crank lever 48 controls the air-inlet valve 27, said cam 47 being adjusted to different positions to vary the amount of atmospheric air supplied for the combustible charge by means of a lever 49, as plainly shown in Fig. 2.

The cam-shaft 36 is connected, by means of beveled gears 50 51, to the upper end of an inclined shaft 52, which is in turn connected at its lower end by means of beveled gears 53 54 to the crank-shaft 4, as shown. Said gears are preferably so proportioned that the cam-shaft turns exactly once while the crank-shaft is turning twice; but the proportion of said gears may be changed to suit the order of alternation ruling the admittance of the combustible and non-combustible charges to the working cylinder.

It remains to describe the means which I have devised for automatically supplying and spraying the oil for the combustible charge and a jet of water for the non-combustible charge.

Connected with the engine in any suitable way to be operated from a moving part thereof are an oil-pump 55 and a water-pump 56. I have herein for convenience shown said pumps as mounted on a bracket 57, connected with the frame 3, their pistons and valve-stems being operated from a series of eccentrics 58, 59, 60, and 61, fast on one end of the cam-shaft 36. These pumps may be of the type of the well-known Brayton oil-pump and need not, therefore, be further described, it being noted, however, that the stroke of the oil-pump plunger is made adjustable from the lever 49 by the simple mechanism shown in Fig. 2. The water-pump at every stroke delivers a small jet of water through pipe 62 to the canal or duct 31, the delivery of each jet being so timed as to occur simultaneously with the passage of a non-combustible charge from the air-compressor to the working cylinder through duct 31. The fuel-pump at each stroke delivers a measured quantity of oil sufficient for the combustible charge through pipe 63 to the duct 31 or to the casing of the valve 17, Fig. 4, as may in practice be found most desirable.

Inasmuch as under certain circumstances (hereinafter explained) it is desirable to cut out the supply of water to the engine and cause both pumps to pump oil, I effect this result in a simple manner by means of a pipe connection 64 between the oil and water suction pipes and an ordinary three-way turning cock 65 in the junction between connection 64 and the water-suction pipe. The cock 65 may be turned by hand by means of a handle 66.

67 indicates an ordinary form of electric sparker.

Referring now to the operation of the engine and assuming that the parts are in the positions shown, I will describe the operations taking place through one complete cycle. Assuming that the working cylinder is receiving a combustible charge, the air-compressor piston 10 is forcing a body of air previously admitted from the atmosphere through valve 27, past the open valve 28, through duct 31, and past open valve 15 into the working cylinder. At the same time a charge of fuel is being forced into the duct 31, which is seized upon by the blast of air and swept by it into the working cylinder, where it is thoroughly vaporized by the heat in the latter and mingling with the air forms therewith a combustible mixture. When now the piston 10 has reached the end of its downward stroke and the piston 8 is forty-five degrees along on its outward stroke, the charge is fired and the piston 8 performs a working stroke. At the beginning of this working stroke of piston 8 the valve 34 is opened by its cam, and during the upward stroke of piston 10 low-pressure air from the tank 26 is drawn into the air-compressor cylinder past valve 29. At the completion of the working stroke the exhaust-valve 16 is opened by its cam, and during the following inward stroke of piston 8 the burned products of combustion are exhausted to the atmosphere, they having previously, however, imparted a large part of their heat to the piston and cylinder-walls. During this exhaust-stroke of the working piston the compressor-piston 10 passes its upper dead-center and, descending further, compresses to a high pressure the body of previously-compressed air taken from tank 26. When now the parts have again reached the positions shown in the drawings, the exhaust-valve 16 has closed, the inlet-valve 28 has opened, and the highly-compressed air beneath piston 10 is delivered through duct 31 into the working cylinder, preferably carrying with it a small jet of water simultaneously supplied to duct 31 through pipe 62. Just before the piston 10 completes its downward stroke the valve 28 is allowed to close and the small body of highly-compressed air remaining in the cylinder is forced past valve 30, through pipe 32, into the high-pressure air-tank 33. The compressed air and water thus admitted to the working cylinder at once absorb heat from the piston and cylinder-walls, with which they come into the most intimate and thorough contact, the water being at once converted into superheated steam, whereby the working cylinder is cooled and at the same time the expansive energy of the compressed air is largely increased. The piston 8 thereupon performs its next outward or working stroke under the energy of the heated compressed air. While this stroke is being performed the piston 10 passes its lower dead-center and once more rises, this time preferably drawing in atmospheric air for the next combustible charge past valve 27, which valve opens by suction, but has the time of its closing regulated by the adjustable cam 47 to control the amount of air supplied for the combustible charge. The succeeding instrokes of the pistons effect the exhaust of the expanded compressed air and steam and the compression of the atmospheric air for the next combustible charge, bringing the parts once more to the positions shown in the drawings, and thus completing the cycle.

In describing the foregoing cycle no mention has been made of the operation of the upper end of the air-compressor; but it is obvious that on every downward stroke of the piston 10 a body of atmospheric air is drawn into the cylinder past valve 23, and on every upward stroke of said piston the same is compressed and forced past valve 24, through pipe 25, into tank 26, the air-compressor 2 thus delivering, preferably, two cylinderfuls of air to the tank 26 for every one that it draws from it. It will also be understood that the cams 41 and 42, which operate the valves 28 and 16, respectively, have preferably each two cam-faces formed diametrically opposite on their peripheries, inasmuch as they are required to actuate their respective valves once for every revolution of the crank-shaft 4 or twice for every revolution of the cam-shaft 36.

In some cases, especially where a heavy hydrocarbon oil is used, it may not be found desirable to introduce both the oil and the water into the duct 31, as shown in Fig. 1, for the reason that the water may have such a cooling effect that the oil will not thoroughly vaporize and be carried into the working cylinder on each combustion-stroke; but a portion of it unvaporized may cling to the walls of the duct and be swept in with the following compressed-air stroke, and thus wasted. This may be obviated, as shown in Fig. 4, by causing the oil-pipe to tap the casing of the inlet-valve 17 and causing it to be sprayed into the cylinder by a blast of high-pressure air from the tank 33, which latter may be timed to suit the operation of the engine by a cam 68, operating on a lever 69, fast on the stem 70 of a valve which controls the admission of high-pressure air from tank 33 to the valve 17. The essential feature in the supply of both the oil and water to the working cylinder which I regard as both novel and important is their introduction by a blast of compressed air, whereby they are thoroughly sprayed and reduced to a finely-divided condition. The particular place or point of their introduction is relatively unimportant.

Any known starting mechanism may be employed for properly admitting high-pressure air from the tank 33 to the working cylinder for that purpose, and as such forms no part of my present invention I have not shown it here. When starting, however, the engine will ordinarily be cold, and hence it will be desirable for a while after starting to operate the engine by combustible charges only until the cylinder-walls and piston of the working cylinder become sufficiently hot to permit the operation by alternate combustible and noncombustible strokes, as hereinbefore described. This can be effected by turning the cock 65 so as to cut off water and admit oil to the water-pump 56, the stroke of which may be made regulable in any desired manner. In this way oil is supplied to the working cylinder by the pumps 55 and 56 alternately, and the engine operates only as an internal-combustion engine until the working cylinder and piston get hot, when it may be changed to its normal operation as a combined internal-combustion and air engine.

The tandem arrangement of the working cylinder and air-compressor, with their pistons connected to nearly opposite cranks on the crank-shaft, whereby the pistons move in opposite directions nearly simultaneously, produces a well-balanced engine free from the shock and jar common in engines of this character. It will be understood, however, that, especially in a stationary engine, the working cylinder and the air-compressor may be arranged side by side, as is shown in my patent for internal-combustion engine, No. 677,048, of June 25, 1901, their cranks being placed at an actute angle of about forty-five degrees. So the cranks may be either at an acute or at an obtuse angle, the object being in either case an arrangement allowing of the two pistons—namely, the piston of the working cylinder and the piston of the compressor—moving at somewhat different instants to a close proximity of the cylinder-heads of their respective cylinders, leaving only a mechanical clearance within the latter. This could not well be done if the cranks were parallel to each other—*i. e.*, either at an angle of zero degree or at angle of one hundred and eighty degrees, both of which angles are such only in a scientific sense, but which in ordinary language are no angles at all. It will therefore be understood that if in the claims the cranks are referred to as being at an angle or as not being parallel the meaning is that the cranks are either at an obtuse or at an acute angle with reference to each other for the purpose of first compressing the charges in the compressor-cylinder and then delivering the same to the working cylinder after the piston thereof has started to leave the proximity of the respective cylinder-head. It will also be understood that the alternation of combustible and non-combustible charges referred to herein does not necessarily mean that every other charge is combustible and every intermediate charge non-combustible, but it is intended to broadly cover any cycle of operations in which combustible and non-combustible charges succeed each other in any predetermined order, which order may possibly be variable during the operation of the engine either by hand or automatically by means of a governor, thermostat, or any other apparatus adapted to regulate the power or speed of the engine or the temperature of some part thereof.

I claim as my invention—

1. In an internal-combustion engine, the combination of a combustion-cylinder, a double-acting compressor, a crank-shaft, pistons in operative connection with said combustion-cylinder, crank-shaft and double-acting compressor respectively, means for delivering air from said double-acting compressor to said combustion-cylinder on the same side of the piston thereof with each successive cycle of said engine, a source of fuel and means for delivering charges thereof during predetermined cycles only to the same side of the piston of said combustion-cylinder and withholding the same during intermediate cycles.

2. In an internal-combustion engine, the combination of a combustion-cylinder, a compressor, a crank-shaft, pistons in operative connection with said combustion-cylinder, crank-shaft and compressor respectively by means of cranks at an angle to each other, means for delivering air from said compressor to said combustion-cylinder on the same side of the piston thereof with each successive cycle of said engine just before the piston of said compressor arrives at one of the ends of its stroke, a source of fuel and means for delivering charges thereof during predetermined cycles only to the same side of the piston of said combustion-cylinder, and withholding the same during intermediate cycles.

3. In an internal-combustion engine, the

combination of a combustion-cylinder, a double-acting compressor, a crank-shaft, pistons in operative connection with said combustion-cylinder, crank-shaft and double-acting compressor respectively by means of cranks at an angle to each other, and means for delivering in some order of alternation combustible charges for certain cycles of said engine and non-combustible charges for intermediate cycles to the same side of the piston of said combustion-cylinder.

4. In an internal-combustion engine, the combination of a combustion-cylinder, a double-acting compressor, a crank-shaft, pistons in operative connection with said combustion-cylinder, crank-shaft and double-acting compressor respectively, of valved conduit adapted to transfer charges from one side of the piston of said compressor directly into said combustion-cylinder, mechanism adapted to effect a compression to higher stage of the charges discharged from the other side of the piston of said compressor before their delivery to the combustion-cylinder, a source of fuel and means for delivering and withholding in some order of alternation charges thereof for predetermined cycles of said engine to the same side of the piston of said combustion-cylinder.

5. In an internal-combustion engine, the combination of a combustion-cylinder, a double-acting compressor, a crank-shaft, pistons in operative connection with said combustion-cylinder, crank-shaft and double-acting compressor respectively, a valved conduit adapted to transfer charges from one side of the piston of said compressor directly into said combustion-cylinder, a receiver, a second valved conduit adapted to transfer charges from the other side of the piston of said compressor into said receiver before their delivery to the combustion-cylinder, or source of fuel and means for delivering and withholding in some order of alternation charges thereof for predetermined cycles of said engine to the same side of the piston of said combustion-cylinder.

6. In an internal-combustion engine adapted to work in a predetermined order of alternation by means of thermodynamic cycles of different character, in combination with a working cylinder, a compressor adapted to deliver in the same order of alternation compressed charges at different relative pressures with respect to each other to the same side of the piston of said working cylinder for said thermodynamic cycles of different character.

7. In an internal-combustion engine a combustion-cylinder adapted to receive in some order of alternation for certain cycles of said engine combustible and for intermediate cycles non-combustible working charges on the same side of its piston, in combination with a compressor adapted to deliver in the same order of alternation compressed charges at different relative pressures with respect to each other to the same side of the piston of said combustion-cylinder.

8. In an internal-combustion engine adapted to work in a predetermined order of alternation by means of thermodynamic cycles of different character, in combination with a working cylinder, a compressor adapted to discharge in the same order of alternation compressed charges of different relative weights with respect to each other to the same side of the piston of said working cylinder for said thermodynamic cycles of different character.

9. In an internal-combustion engine, a combustion-cylinder adapted to receive in a predetermined order of alternation for certain cycles of said engine combustible and for intermediate cycles non-combustible working charges on the same side of the piston, in combination with a compressor adapted to discharge in the same order of alternation compressed charges of different relative weights with respect to each other to the same side of the piston of said combustion-cylinder.

10. In an internal-combustion engine in combination with a power-producing cylinder adapted to expand in a predetermined order of alternation working charges of different relative temperatures with respect to each other, means for supplying expansible charges for each successive cycle of said engine to the same side of the piston of said power-producing cylinder, a source of fuel, a source of water-supply, and means for delivering in the said predetermined order of alternation charges from one and the other of said two sources for increasing the pressure of said expansible charges.

11. In an internal-combustion engine, a combustion-cylinder adapted to receive in some order of alternation for certain cycles of said engine combustible and for intermediate cycles non-combustible working charges on the same side of its piston, in combination with a double-acting compressor adapted to compress on one side of its piston consecutive charges to lower stage and to compress on the other side of its piston charges to lower and to higher stage in the same order of alternation ruling the admittance of said combustible and non-combustible working charges to the combustion-cylinder.

12. In an internal-combustion engine, the combination with a combustion-cylinder adapted to receive in some order of alternation for certain cycles of said engine combustible and for intermediate cycles non-combustible working charges on the same side of its piston, of a double-acting compressor, and a receiver having valved communication with both ends of the compressor, the said compressor being adapted to compress on one side of its piston air for the non-combustible charges into said receiver and to compress on the other side of its piston charges to

lower and to higher stage with respect to each other in the same order of alternation ruling the admittance of said combustible and non-combustible working charges to the combustion-cylinder.

13. In an internal-combustion engine, the combination with a power-producing cylinder adapted to expand in a predetermined order of alternation working charges at different relative temperatures with respect to each other, of an inlet-valve leading into said cylinder, and means for supplying through said inlet-valve in the same order of alternation previously-compressed expansible charges of different relative weights with respect to each other to the same side of the piston of said power-producing cylinder.

14. In an internal-combustion engine, the combination with a power-producing cylinder adapted to expand in a predetermined order of alternation working charges at different relative temperatures with respect to each other, of an inlet-valve leading into said cylinder, and means for supplying through said inlet-valve in the same order of alternation previously-compressed expansible charges at different relative pressures with respect to each other to the same side of the piston of said power-producing cylinder.

15. In an internal-combustion engine, a combustion-cylinder adapted to receive in some order of alternation for certain cycles of said engine combustible and for intermediate cycles non-combustible working charges on the same side of its piston, in combination with means for delivering different weights of compressed air to said combustion-cylinder on the same side of the piston thereof for said combustible and non-combustible charges, and a pump for introducing water into each non-combustible charge for increasing its pressure.

16. In an internal-combustion engine, in combination with a combustion-cylinder adapted to receive in some order of alternation for certain cycles of said engine combustible and for intermediate cycles non-combustible working charges on the same side of its piston, a crank-shaft operatively connected to the piston of said combustion-cylinder, means for supplying compressed air for both the combustible and non-combustible charges, fuel and water pumps and actuating mechanism between said crank-shaft and said pumps for delivering fuel for the combustible and water to the non-combustible charges.

17. In an engine of the class described, a combustion-cylinder adapted to receive on the same side of its piston consecutive combustible working charges as well as combustible and non-combustible working charges alternating in a predetermined order, in combination with an operating device adapted to permit of a changing of the engine from working with consecutive combustible working charges to working with combustible and non-combustible working charges alternating in a predetermined order, and also adapted to permit of a change in the working of the engine in reverse order.

18. In an internal-combustion engine, in combination with a power-producing cylinder adapted to expand in a predetermined order of alternation working charges at different relative temperatures with respect to each other, a receiver containing compressed air, a valved conduit leading from said receiver to said power-producing cylinder, a pump adapted to deliver a charge of liquid into said conduit, and a body of compressed air for carrying and blowing said charge of liquid out of said conduit into said power-producing cylinder for increasing the pressure therein.

19. In an internal-combustion engine adapted to work in a predetermined order of alternation by means of thermodynamic circles of different character, in combination with a power-producing cylinder, two receivers containing compressed air at different relative pressures with respect to each other, a valved conduit leading from the receiver containing the compressed air at higher pressure to said power-producing cylinder, a pump adapted to deliver a charge of liquid into said conduit, and a body of compressed air for carrying and blowing said charge of liquid out of said conduit into said power-producing cylinder for increasing the pressure therein.

20. In an internal-combustion engine, a combustion-cylinder adapted to receive in some order of alternation for certain cycles of said engine combustible and for intermediate cycles non-combustible working charges on the same side of its piston, in combination with means for supplying compressed air and fuel for said combustible and compressed air and water for said non-combustible working charges.

In testimony that I claim the foregoing as my invention I have hereunto signed my name, this 18th day of August, 1900, in the presence of two witnesses.

HENNING FRIEDRICH WALLMANN.

In presence of—

SAMUEL N. POND,

JAMES K. LAMBERT.