No. 702,375. Patented June 10, 1902.

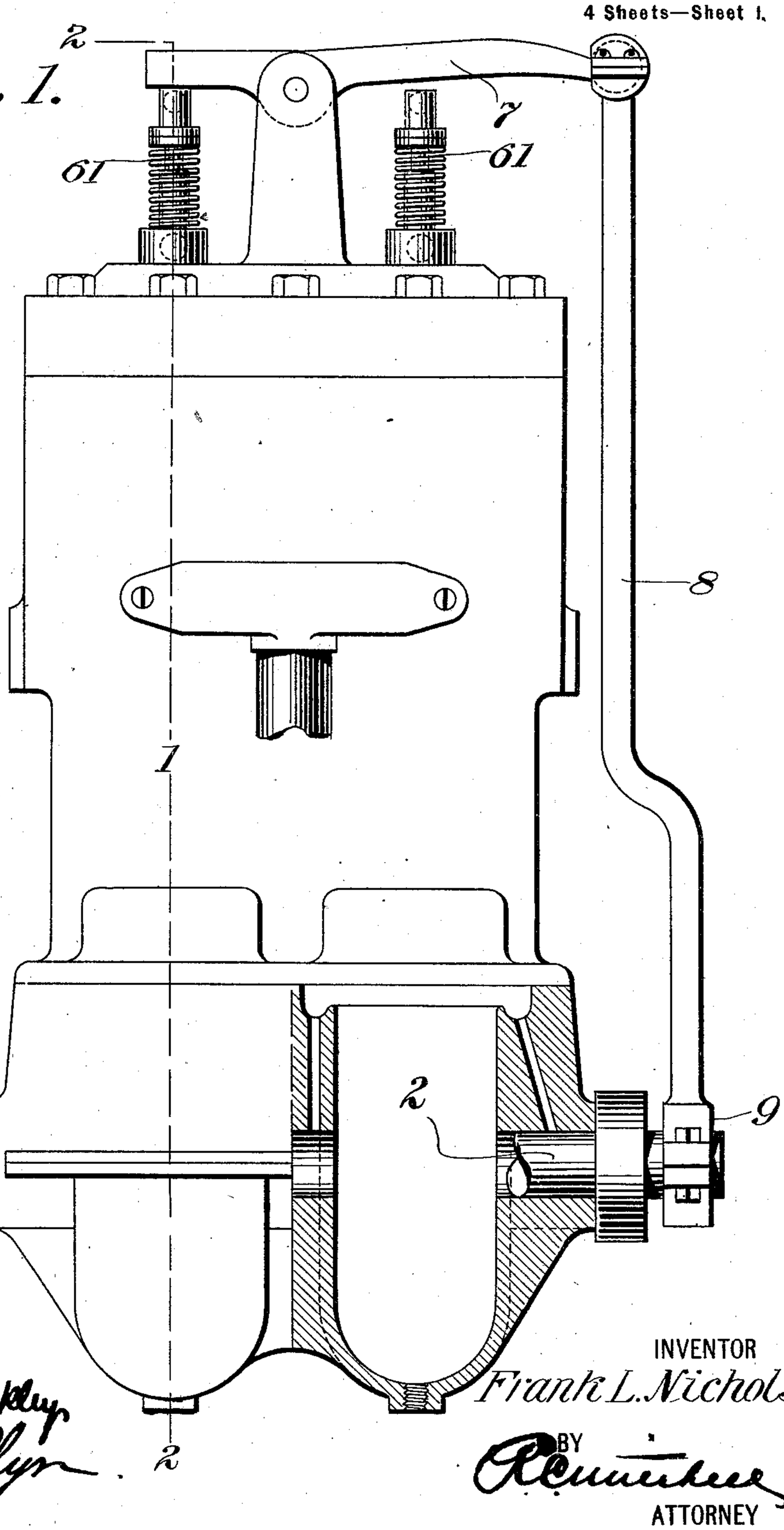
F. L. NICHOLS.

GAS ENGINE.

(Application filed Oct. 13, 1900.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



WITNESSES:
George T. Hackley
Robt. S. Allyn

INVENTOR
Frank L. Nichols.
BY
A. Cummings.
ATTORNEY

No. 702,375. Patented June 10, 1902.

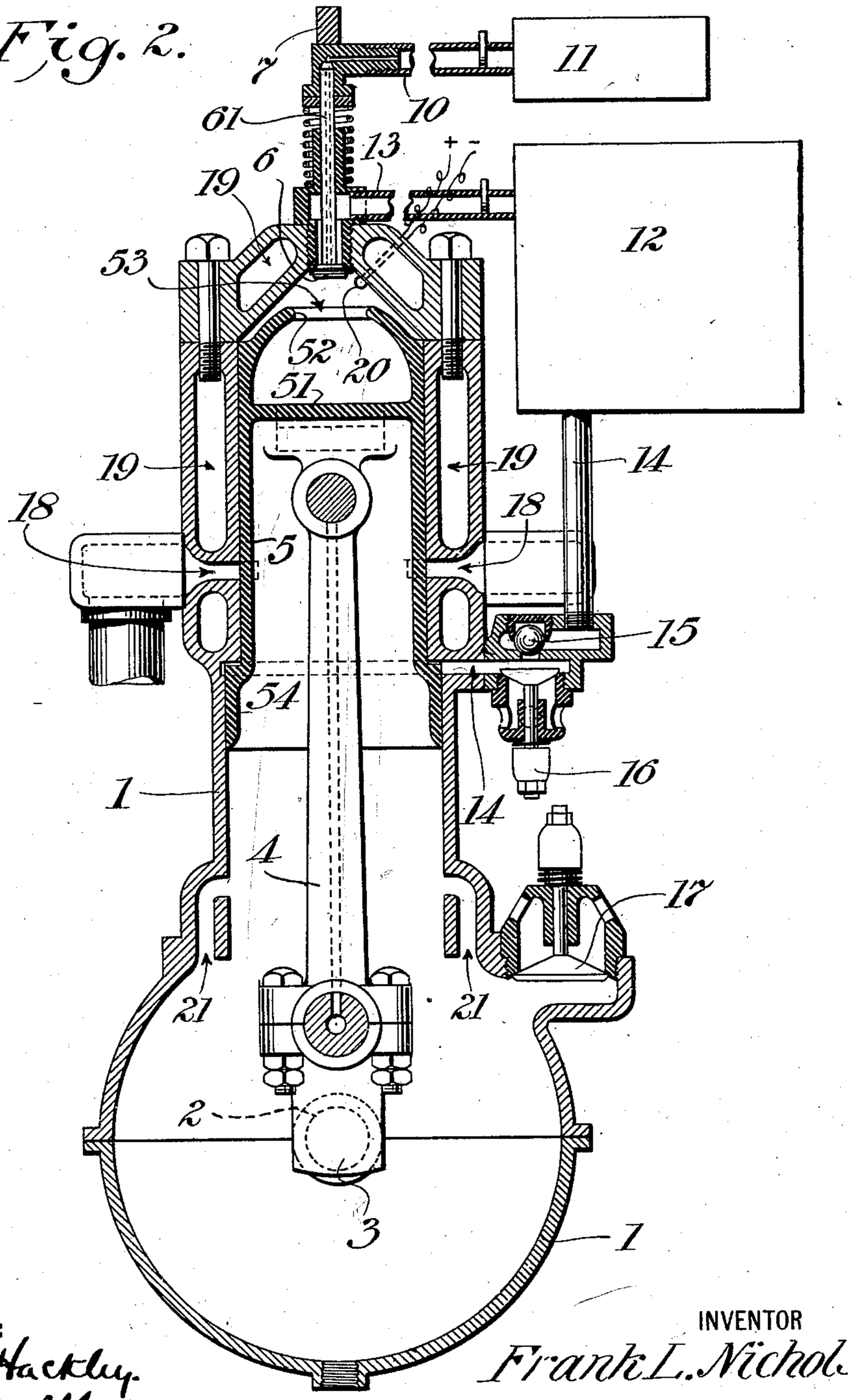
F. L. NICHOLS.

GAS ENGINE.

(Application filed Oct. 13, 1900.)

(No Model.) 4 Sheets—Sheet 2.

Fig. 2.



WITNESSES:

George T. Hackley.

Robt. S. Allyn.

INVENTOR

Frank L. Nichols.

BY

R. Cunliffe.

ATTORNEY

No. 702,375. Patented June 10, 1902.

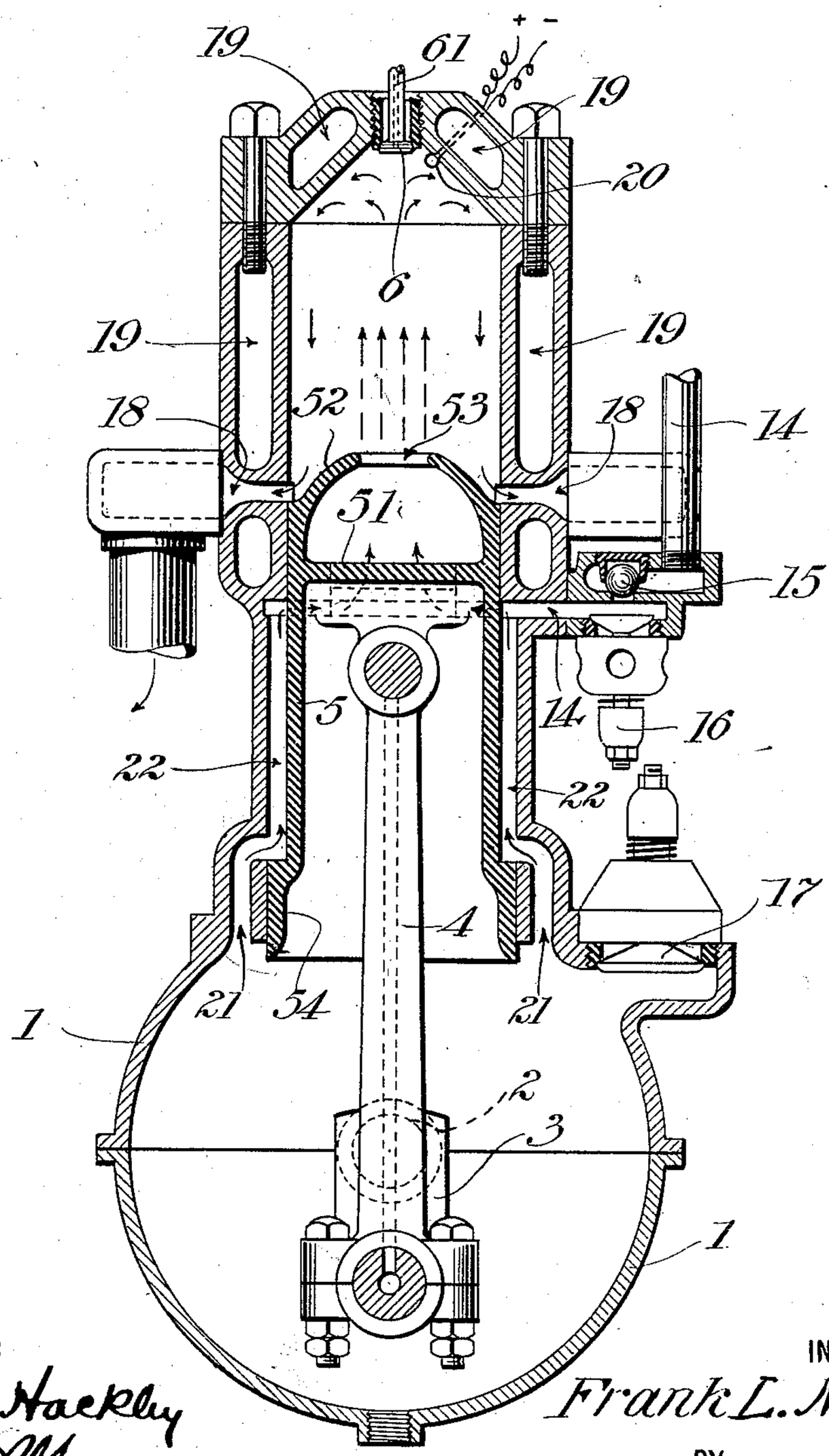
F. L. NICHOLS.

GAS ENGINE.

(Application filed Oct. 13, 1900.)

(No Model.) 4 Sheets—Sheet 3.

Fig. 3.



WITNESSES:

George T. Hackley

Robt. S. Allyn

INVENTOR

Frank L. Nichols.

BY R. C. Mitchell.

ATTORNEY

No. 702,375. Patented June 10, 1902.

F. L. NICHOLS.

GAS ENGINE.

(Application filed Oct. 13, 1900.)

(No Model.) 4 Sheets—Sheet 4

Fig. 4.

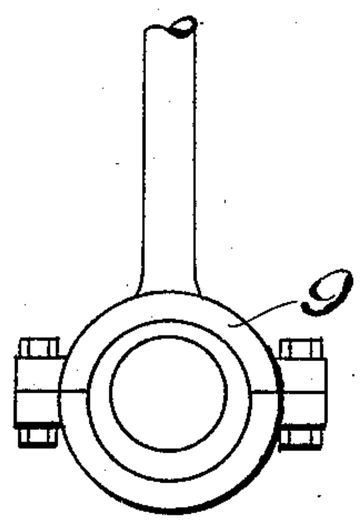
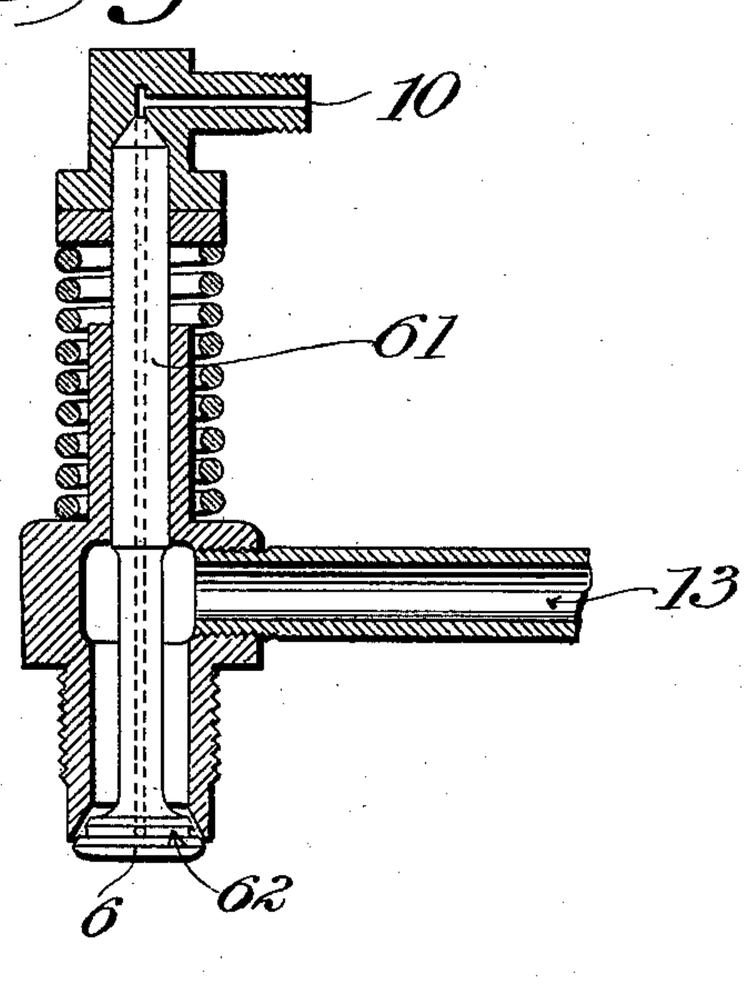


Fig. 5.



WITNESSES:

George T. Hackley.

Robt. S. Allyn.

INVENTOR

Frank L. Nichols.

BY

ATTORNEY

UNITED STATES PATENT OFFICE.

FRANK L. NICHOLS, OF BROOKLYN, NEW YORK, ASSIGNOR OF ONE-HALF TO WALTER W. BOSTWICK, OF BROOKLYN, NEW YORK.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 702,375, dated June 10, 1902.

Application filed October 13, 1900. Serial No. 32,912. (No model.)

To all whom it may concern:

Be it known that I, FRANK L. NICHOLS, a citizen of the United States, residing at Brooklyn, New York, have invented certain new and useful Improvements in Gas-Engines, of which the following is a full, clear, and exact description.

My invention relates to motors, particularly of the type termed "internal-combustion motors."

The main objects of my invention are simplicity, effectiveness, safety, durability, and economy.

The engine is of the two-cycle type of construction and is such that it may be easily started and its speed may be regulated to a nicety during operation. Other advantages will be apparent to the mechanic skilled in the art. In the drawings I have shown a twin-cylinder engine, although it will be obvious that the number of cylinders employed is not essential to the invention. One of the stated objects is economy. The engine is both economical and safe, because a low-grade oil may be employed—such as, for example, kerosene, although of course other oils might be used.

In the drawings, Figure 1 is a side elevation of a gas-engine embodying my invention, a portion of the same being shown in section. Fig. 2 is a vertical section on the line 2 2, Fig. 1. Fig. 3 is a similar view, the movable parts, however, being shown in a different position. Figs. 4 and 5 are each illustrative of details of construction.

1 is an engine-casing, in the upper part of which is located the expansion chamber or cylinder in which the piston moves, and in the lower part of which is located the main shaft and cranks.

2 is the main shaft, and 3 is a crank thereon.

4 is a connecting-rod.

5 is a piston suitably connected with the crank 3 by means of rod 4, which piston is the working piston.

6 is an admission-valve, one of these valves being provided for each cylinder employed.

7 is a mechanically-controlled means—for example, a lever—arranged to operate the valve 6. Inasmuch as the engine shown in the drawings is of the twin-cylinder type and there are two admission-valves 6 6, the lever 7 may be arranged to rock so that it will alternately actuate said valves at the proper time to open them and allow a charge to be injected into the expansion-chamber. This lever 7 may be controlled by an eccentric mounted upon the main shaft 2, in which event a connecting-rod 8 might be employed which is suitably attached to an eccentric 9.

10 is an oil-passage leading to the admission-valve 6.

11 is a diagrammatic view of a suitable oil pump or supply.

12 is an air-tank, and 13 is an air-passage leading to the seat of the valve 6 from the tank 12.

14 is an air-passage leading from a point within the engine-casing to the tank 12. In the passage 14 is located a suitable check-valve 15, the function of said valve being to hold up the air-pressure within tank 12.

16 is a puppet-valve adjacent to the air-passage 14 and so arranged as to admit air into the engine-casing at a point adjacent to the piston and between the working section and the pump-section of said casing.

17 is a valve similar to valve 16, but located in the engine-casing adjacent to the crank-section thereof, its function being to permit air to enter the lower portion of the engine-casing at the proper time and for the purpose hereinafter described.

18 is an exhaust-port, each cylinder being provided with one or more of the same.

19 is a water-jacket of the ordinary type located within the casing, through whose spaces a circulation of water may be maintained in the well-known manner and by which circulation of water the temperature of the casing is kept down to a harmless point. The head of the casing, which may be termed the "cylinder-head," is removable, and in its inner side it is domed for the purpose hereinafter described.

20 is an ignition device of any suitable type, preferably a platinum wire, capable of being heated by means of an electric current. This ignition device 20 may be located in the upper part of the cylinder and is employed for the purpose hereinafter described.

A single air-tank 12 may be employed for

all of the cylinders; but it is preferable that one oil-pump 11 should be provided for each of the admission-valves employed. This pump 11 is so connected with the engine as to be operated thereby and in such relation to the speed thereof that the fuel will be supplied at the proper time and in the proper quantities. As this application relates principally to the construction of the motor, the pump has been shown merely by a diagrammatic sketch, inasmuch as any pump of a suitable construction may be employed. The piston is of such construction that it performs several functions. It is a working or driving means when it is moved by the expanding gases in such manner as to transmit motion to the main shaft. It is a valve, in that it controls the opening and closing of the exhaust-ports and also in that it opens and closes certain other ports hereinafter described and referred to as "by-passes." It is a pump in compressing air to be utilized in clearing the cylinder of inert gases, as hereinafter described, and also in storing air within the tank 12. In order to facilitate a clear understanding, the piston will be described in detail.

51 is the piston-head, which is of a sufficient size to permit the forming therein of an air-passage which leads from the upper part of the head out through the side of the piston below the head, so that when the piston is in the position indicated in Fig. 3 an air communication will be established between the crank-casing and the ignition-chamber.

52 is a thin web-like contraction at the upper portion of the piston, and 53 is a central opening bounded by the edge of said web 52.

54 is an annular enlargement at the lower end of the working piston 5, the function of which is that of a pump, and for want of a better term will be referred to hereinafter as the "pump-piston."

22 is the space between the enlarged diameter of the casing and the small diameter of the working piston, in which space the pump-piston 54 moves. The air-passage 14 communicates, as before indicated, with that portion of the casing (now termed the "space" 22) in which the enlargement 54 of the piston moves.

21 21 are by-passes in the casing 1, which afford air communication between the crank-chamber and the space 22.

Before starting the engine the device 20 is caused to glow. The shaft 2 is then turned, which causes the reciprocation of the piston. When the piston is on its upward or return stroke, the by-passes 21 are closed by the pump-piston 54 and the air within the space 22 is compressed and forced past the check-valve 15 in the passage 14 and into the air-tank 12. This is kept up until sufficient air has been stored in the tank 12 to give the desired pressure. The pump 11 may then be thrown into gear with the engine, so that it will work practically in unison with the admission-valve 6. The valve 6 is opened when the piston reaches the upper end of its stroke. This valve 6 is shown in an enlarged sectional view, Fig. 5, and in this view it will be seen that the stem 61 of the valve has a central bore to form an oil-conduit. This conduit conducts the oil to an annular groove 62, formed in the face of the valve. When this valve 6 is opened, the compressed air rushing by the valve atomizes the oil contained in said groove and feeds it in a spray into the cylinder and above the piston. The amount of oil in each charge may be varied by varying the stroke of the oil-feed pump 11. Suitable valves may be provided for the oil-passage 10 and the air-passage 13, whereby the mixture of oil and air to make the charge may be varied to meet the requirements. In this way the speed of the engine may be regulated to a nicety. When the charge of fuel has been introduced into the cylinder, the valve 6 is closed by suitable means—for example, a spring—and the charge is ignited, which ignition may be effected at the outset by means of the device 20. The ignition of the gas causes an expansion which drives the piston downwardly from the position indicated in Fig. 2 to the position indicated in Fig. 3. This downward stroke of the piston causes the rotation of the main shaft, and it also compresses the volume of air contained below the piston and within the crank-casing. This compressed volume of air is utilized in the scavenging process as follows: When the piston is just nearing the position indicated in Fig. 3, the enlargement 54 at the inner end of the piston uncovers the by-passes 21. At the same instant the opening previously referred to in the head 51 of the piston registers with the space 22. At the same time also the upper end of the piston uncovers the exhaust-ports 18. When this condition prevails, the compressed air within the crank-casing and below the piston is free to take the course indicated by the arrows in Fig. 3, passing upwardly through the by-passes 21 and space 22, thence through the opening in the piston-head 51 and through the opening 53, whence it is projected upwardly against the dome in the inner side of the cylinder-head, by which it is deflected outwardly and caused to flow downwardly adjacent to the side walls of the cylinder to and through the exhaust-ports 18. This quick and powerful injection of pure air causes the expulsion of the inert gases contained within the cylinder almost instantaneously. The function of the web at the upper end of the piston is that of an igniter. After the engine has been in operation a few moments this web is heated, so that, if desirable, the use of the device 20 as an igniter may be discontinued. The function of the valve 16 is to admit air to passage 14, back of the check-valve 15, on the down-stroke of the piston, while the function of the valve 17 is to admit air into the crank-casing when the piston is on the upstroke,

thereby filling the space below the piston with air at the atmospheric pressure to be compressed on the downward movement of the piston. To stop the engine, the supply of liquid fuel may be cut off. In starting the engine, if there is pressure within the air-tank 12, as is ordinarily the case, (unless the use of the engine has been abandoned for a very long period,) the motor may be started almost instantaneously.

What I claim is—

1. In an internal-combustion motor in combination, a casing, an admission-valve, an air-supply, a fuel-supply, a working piston, exhaust-ports adjacent thereto and controlled thereby, an annular compression-chamber within the casing and around the working piston, an air-passage from said chamber through the piston-head and to the exhaust-ports, and means to control the same.

2. In an internal-combustion motor in combination, a casing, an admission-valve, an air-supply, a fuel-supply, a working piston, exhaust-ports adjacent thereto and controlled thereby, an annular compression-chamber within the casing and around the working piston, an air-passage from said chamber through the piston-head and to the exhaust-ports, the working piston being the valve therefor.

3. In an internal-combustion motor in combination, a casing, an admission-valve, an air-supply, a fuel-supply, a working piston, exhaust-ports adjacent thereto and controlled thereby, an annular compression-cylinder, a piston within said cylinder carried by the working piston, and a passage from the compression-cylinder through the working piston through the combustion-chamber to the exhaust-ports, and means to control the same.

4. In an internal-combustion motor in combination, a casing, an admission-valve, an air-supply, a fuel-supply, a working piston, exhaust-ports adjacent thereto and controlled thereby, an annular compression-cylinder, a piston within said cylinder carried by the working piston, and a passage from the compression-cylinder through the working piston through the combustion-chamber to the exhaust-ports, the working piston being the valve therefor.

5. In an internal-combustion motor in combination, a casing, an admission-valve, an air-supply, a fuel-supply, a working piston, exhaust-ports adjacent thereto and controlled thereby, an annular compression-cylinder, a piston within said cylinder carried by the working piston, a compression-chamber formed by the crank-casing, an air-passage from the inside of said chamber around the compression-piston to the annular compression-cylinder to and through the working piston, combustion-chamber and exhaust-ports, and means to control the same.

6. In an internal-combustion motor, in combination, a casing, an admission-valve, an air-supply, a fuel-supply, a working piston, exhaust-ports adjacent thereto and controlled thereby, an annular compression-cylinder, a piston within said cylinder carried by the working piston, a compression-chamber formed by the crank-casing, an air-passage from the inside of said chamber around the compression-piston to the annular compression-cylinder to and through the working piston, combustion-chamber and exhaust-ports, the pistons acting as a valve therefor.

7. In an internal-combustion motor, a casing, exhaust-ports and air-passages therein, means comprising a working piston and a pump-piston integral therewith and of larger diameter, said means coacting with said ports and passages as a valve therefor.

8. In an internal-combustion motor in combination, a closed casing, exhaust-ports and air-passages therein, means comprising a working piston, a combustion-chamber in the head thereof, and a compression-piston, an air-passage through the working piston, said means coacting with the casing as a valve for the several ports and passages.

9. In an internal-combustion motor in combination, a closed casing, exhaust-ports and air-passages therein, means comprising a working piston, a combustion-chamber in the head thereof, and a compression-piston, an air-passage through the head of the working piston communicating with the combustion-chamber therein, said means coacting with the casing as a valve for the several ports and passages.

10. In an internal-combustion motor in combination, a casing, exhaust-ports and air-passages therein, a working piston movable therein and controlling said exhaust-ports, an air-passage through the piston communicating with an annular cylinder around the piston, means for compressing the air in the space below the piston, an air-passage from said space communicating with the annular cylinder, and a valve for said air-passage.

11. In an internal-combustion motor in combination, a casing, exhaust-ports and air-passages therein, a working piston movable therein and controlling said exhaust-ports, an air-passage through the piston communicating with an annular cylinder around the piston at each end of the piston, means for compressing the air in the space below the piston, said means acting as a valve for said air-passage.

12. In an internal-combustion motor in combination, a working cylinder, a compression-cylinder, an air-compressing space formed by the crank-casing, a working piston, a compressing-piston said piston acting as a valve controlling the ports from the crank-casing and also as a means for compressing air within the compressing-cylinder.

13. In an internal-combustion motor in combination, a working cylinder, a compression-cylinder, an air-compressing space formed by the crank-casing, a working piston, a compressing-piston said piston acting as a valve controlling the ports from the crank-casing

and also as a means for compressing air within the compressing-cylinder, an air-storage tank and an air-passage between said tank and compressing-cylinder, and a check-valve in said passage.

14. In an internal-combustion motor, in combination, a crank-casing, a working cylinder, a compression-cylinder of larger diameter with their corresponding pistons, ports from the compression-cylinder to the working cylinder and to a fuel-supply, and a port from said compression-cylinder to the crank-casing whereby said compression-cylinder in conjunction with the ports forms the means of communication between the crank-casing and the working cylinder and also the means for compressing air to supply the engine with fuel.

15. In an internal-combustion motor in combination, a casing comprising, with their respective ports and passages, a working cylinder, a compressing-cylinder, a crank-casing, movable means within said cylinders for controlling said ports, an admission-valve in the head of said working cylinder and located in the path of both the fuel and compressed-air supply and controlling the admission of the same into the working cylinder.

16. In an internal-combustion motor in combination, a casing comprising a working cylinder, a compressing-cylinder, a crank-casing with their several ports and passages, a compound piston common to both cylinders, a combustion-chamber formed in the head thereof, an admission-valve located in the head of the working cylinder and communicating directly with the combustion-chamber and in the path of both the fuel and air supply and controlling the admission of the same to the combustion-chamber.

17. In an internal-combustion motor, the combination of the casing, the cooling device, the working piston, the combustion-chamber in the head thereof, an igniter, means for admitting fuel, an air-storage tank connected to said means, and means by which the piston furnishes air to said tank and for removing the spent charge.

18. In an internal-combustion motor in combination, a casing, a cooling device, means for admitting fuel-supply, an ignition device, a combustion-chamber formed in the head of the working piston, means within the casing for compressing air, means within the casing for removing the spent charge, means within the casing for pumping air to a supply-tank for supplying fuel to the engine, means for supplying air for the compression and for the pump.

19. In an internal-combustion motor in combination, a casing, a cooling device, means for admitting fuel-supply, an ignition device, a combustion-chamber formed in the head of the working piston, combining means for compressing air and for pumping air to a supply-tank for supplying fuel to the engine, a means for removing the spent charge, and a means for supplying air for the compression and for the pump.

20. In an internal-combustion motor in combination, a casing, a cooling device, a fuel-supply, means for injecting and atomizing fuel, an ignition device, a combustion-chamber formed in the head of the working piston, means for compressing air, means for removing the spent charge, means for pumping air to a supply-tank for supplying fuel to the engine, means for supplying air for the compression and for the pump.

Signed at New York, N. Y., this 9th day of October, 1900.

FRANK L. NICHOLS.

Witnesses:
GEORGE T. HACKLEY,
L. VREELAND.