E. MOORE.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED SEPT. 8, 1908.

948,336.

Patented Feb. 8, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

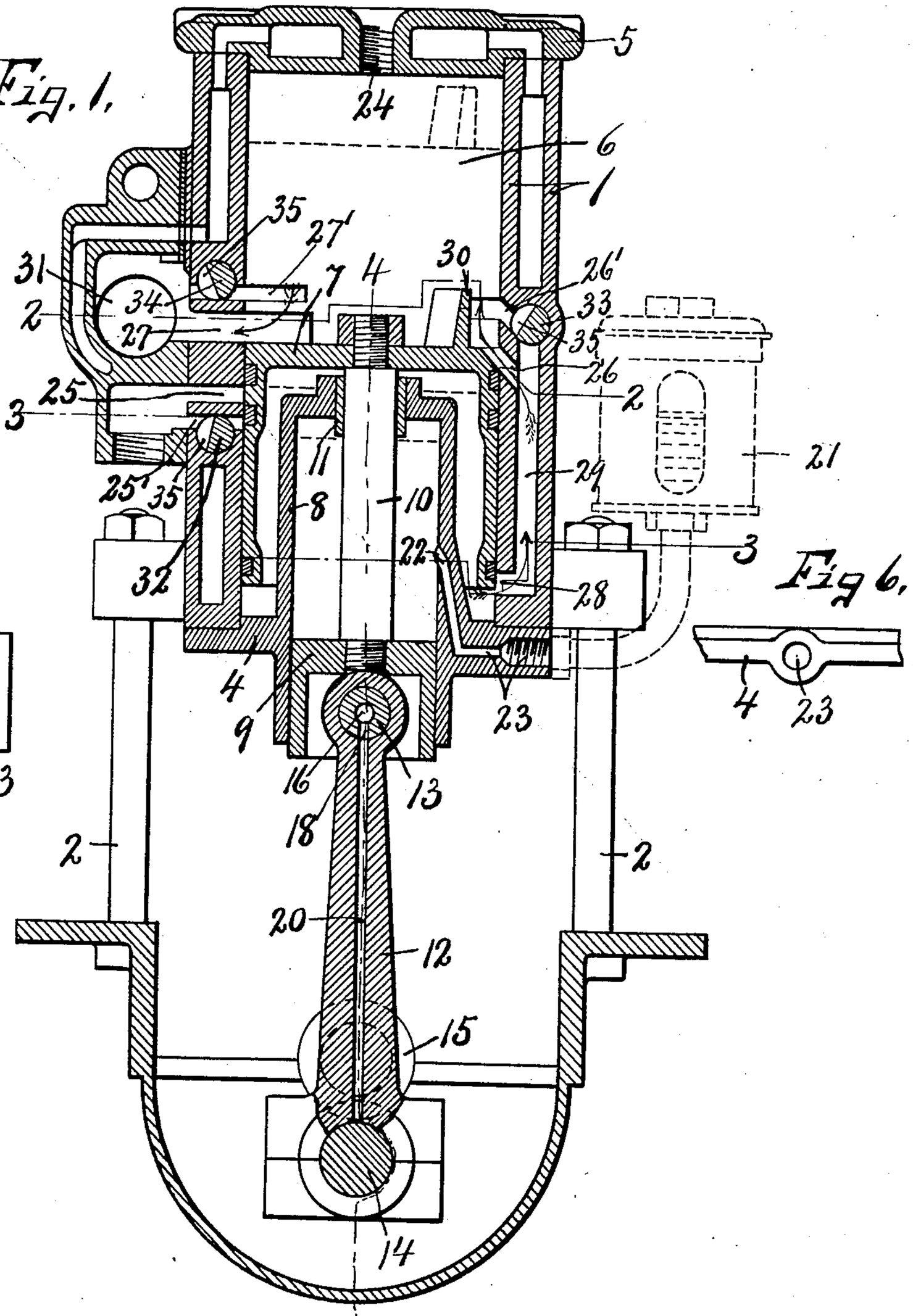


Fig. 5.

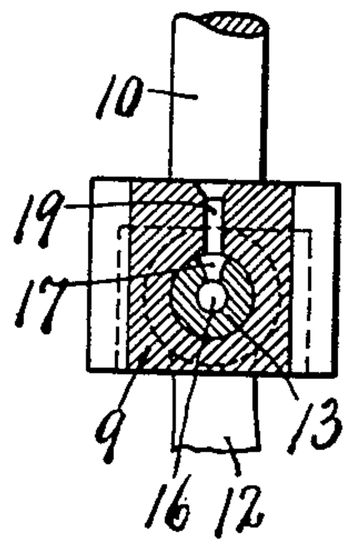
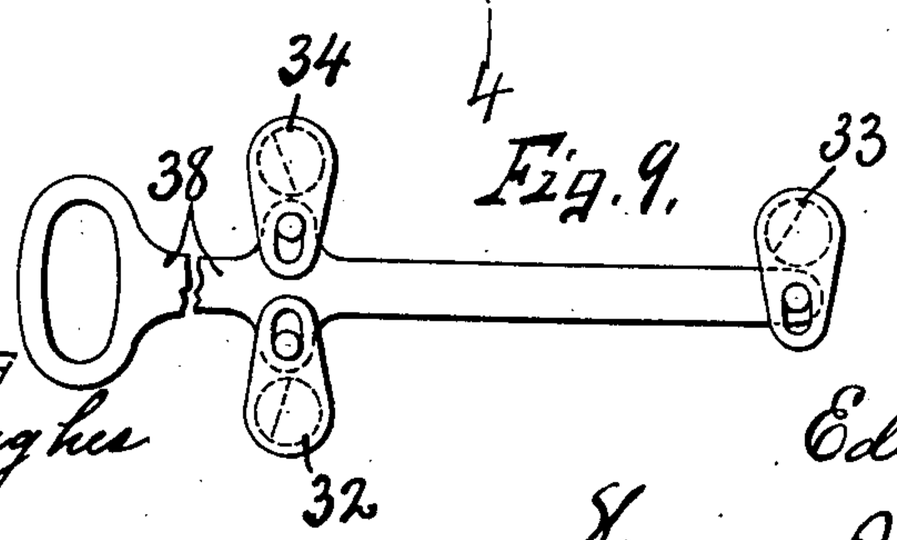


Fig 6.

Fig. 9.



WITNESSES

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2 SHEETS—SHEET 2.

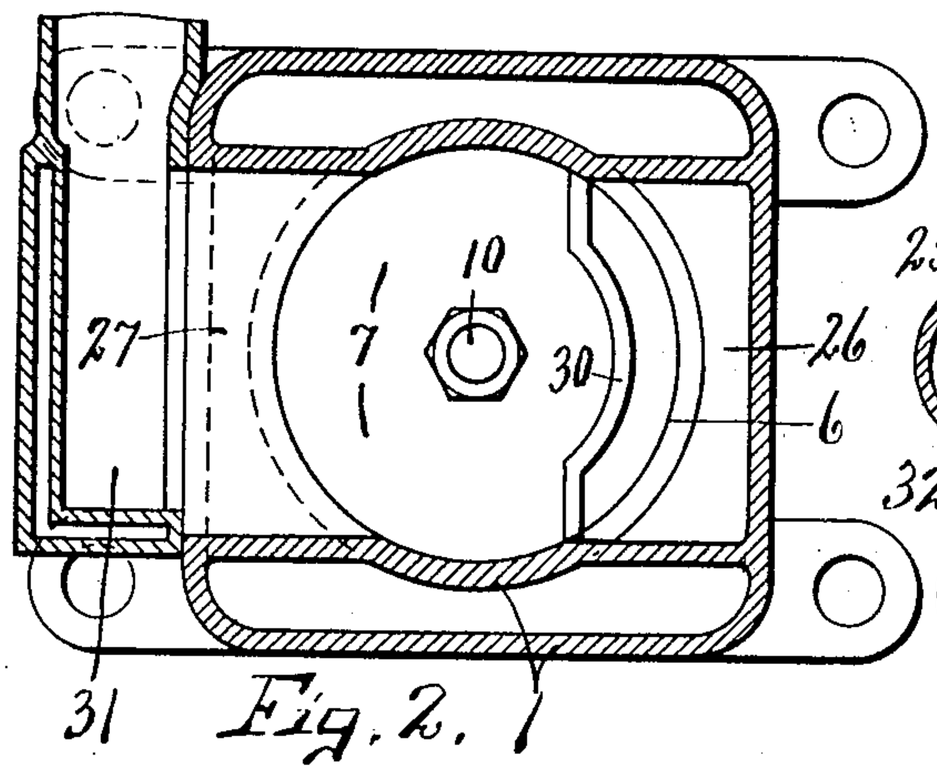


Fig. 2.

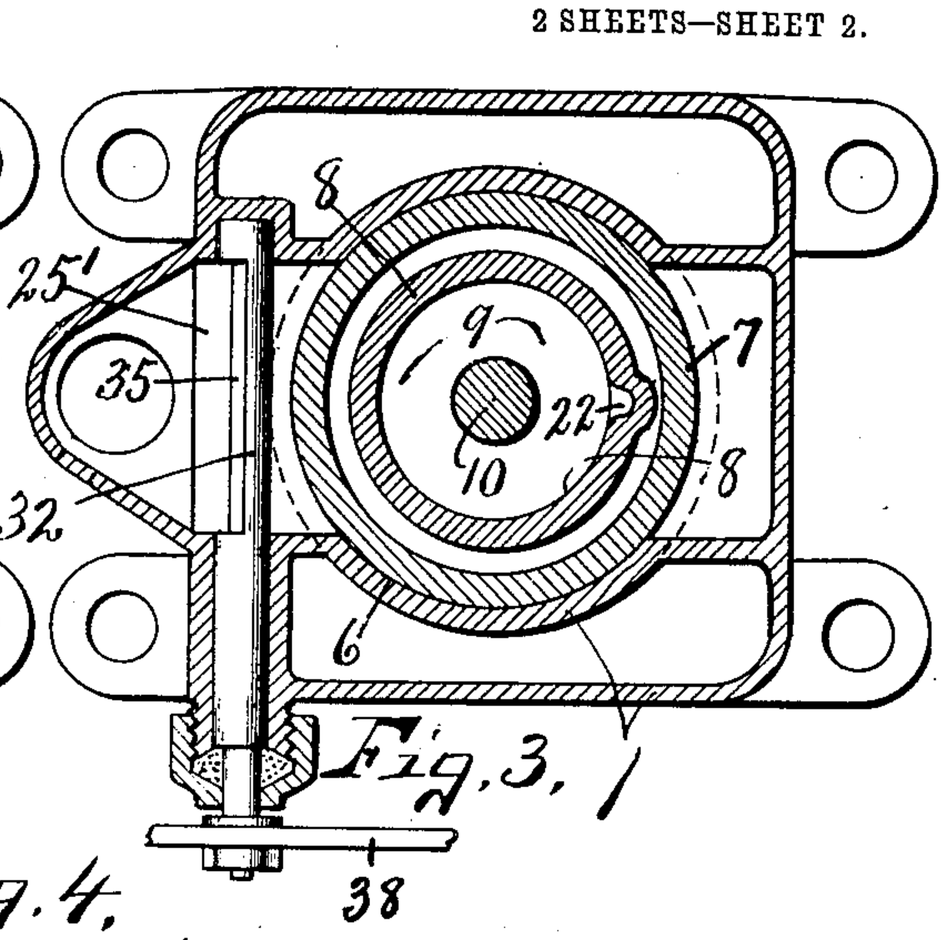


Fig. 3.

Fig. 4.

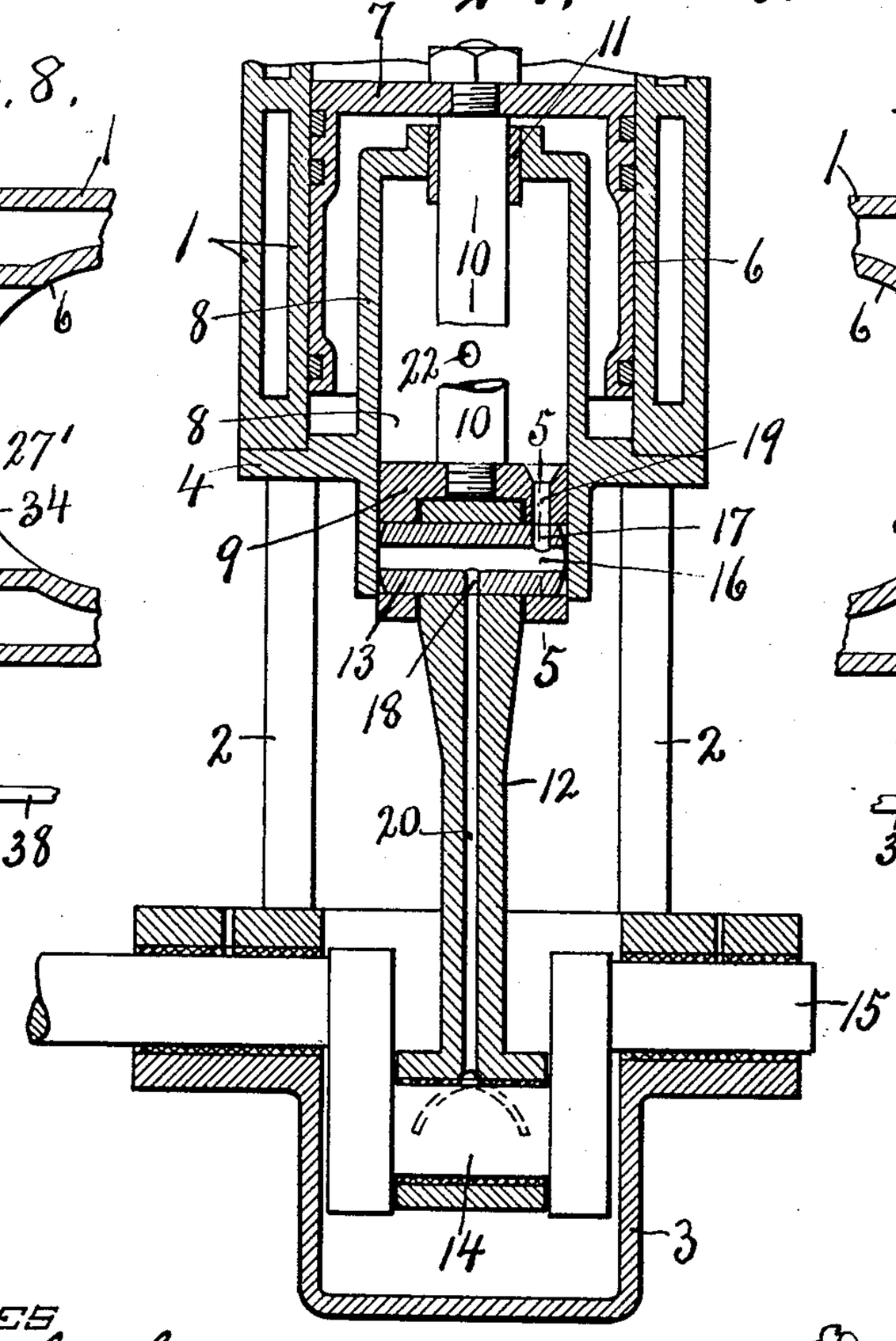


Fig. 8.

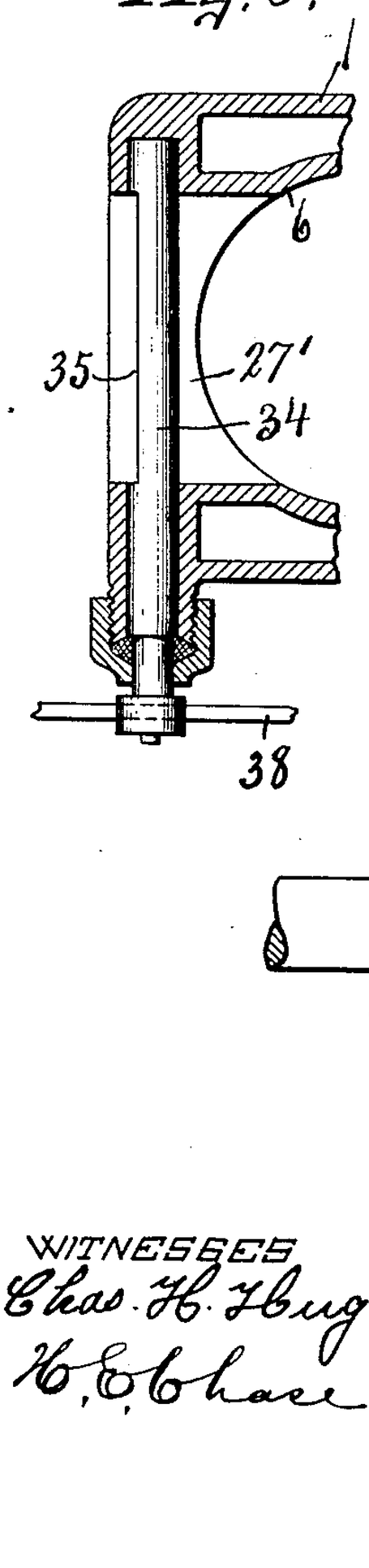
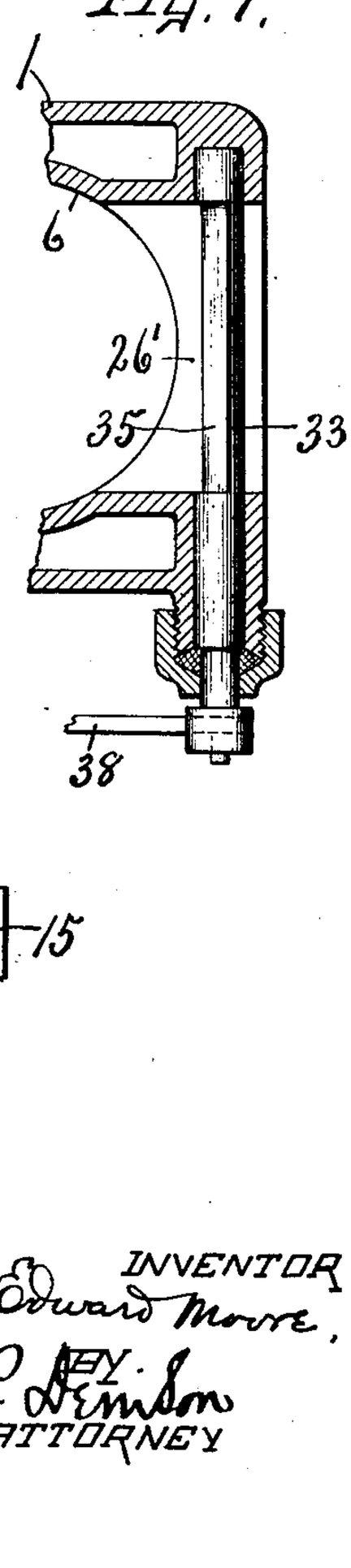


Fig. 7.



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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

948,336. Specification of Letters Patent. Patented Feb. 8, 1910.

Application filed September 8, 1908. Serial No. 452,074.

To all whom it may concern:

Be it known that I, EDWARD MOORE, of Syracuse, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Internal-Combustion Engines, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to certain improvements in internal combustion engines of the reciprocatory-piston two-cycle type in which the combustible fluid is compressed and ignited at the end of each compression stroke and the spent gases are discharged and fresh fuel supplied at the end of the out stroke of the piston. It is, therefore, necessary in this type of engine to admit the explosive charge and discharge the spent gases at each cycle of movement of the piston and although this intake and exhaust is almost instantaneous and practically simultaneous, it, nevertheless, requires an appreciable period of time to permit the cylinder to properly cleanse itself of the spent gases and to admit a proper amount of explosive fuel so that in practice the power decreases as the speed of the engine increases particularly when the speed is such that the interval of time between the opening and closing of the ports by the piston will not allow the entrance of a proper amount of fuel and cleansing of the cylinder from spent gases.

My main object, therefore, is to provide means whereby the leads of the ports may be varied to maintain a more uniform interval of time between the opening and closing of the ports under varying speeds so as to allow the entrance of practically the same amount of explosive mixture, and complete cleansing of the cylinder from spent gases under high speed as under low speed thereby not only increasing the power as the speed of the engine increases but allowing the engine to be run at a very much increased speed over that of the ordinary engine of this type.

Other objects and uses will be brought out in the following description.

In the drawings—Figure 1 is a vertical sectional view of a three-port liquid hydrocarbon engine embodying the various features of my invention. Figs. 2, 3 and 4 are sectional views taken respectively on lines 2—2, 3—3, and 4—4, Fig. 1. Fig. 5 is a sectional view taken on line 5—5, Fig. 4. Fig. 6 is a face view of a portion of the lower cylinder head showing the oil-inlet leading to the cross-head guide. Figs. 7 and 8 are detached transverse sectional views through the auxiliary inlet and exhaust ports showing the auxiliary valves therein. Fig. 9 is a face view of the valve operating mechanism.

This engine comprises a water-jacketed cylinder —1— which is supported by suitable posts or rods —2— upon a suitable supporting base or crank case —3— and is provided with opposite end heads —4— and —5— forming a piston chamber —6— in which is movable a main piston —7—. The lower head —4— is provided with an integral cylinder —8— coaxial with and projecting into the lower end of the cylinder —1— for receiving and guiding an auxiliary piston —9— which is rigidly connected to the piston —7— by a coaxial connecting rod —10— passing through and guided in a bushing —11— in the upper end of the auxiliary cylinder —8— which is otherwise closed at its upper end. This auxiliary cylinder —8— is of somewhat less diameter than the piston chamber into which it projects to allow ample clearance for the piston —7—, in its movement from one end of the cylinder to the other without unnecessarily elongating said cylinder, the piston —7— being chambered out from the bottom upward to provide ample clearance between it and the guide cylinder —8— and at the same time materially lightening the main piston —7—. In like manner the piston —9— is chambered out from its bottom upward for receiving the end of a connecting rod —12—, the latter having its upper end connected to a hollow wrist pin —13— and its lower end connected to a crank arm —14— of a crank shaft —15—. The wrist pin —13— is provided with a central oil passage —16— and branch passages —17— and —18—, the branch —17— communicating with an oil passage —19— extending through the upper portion of the piston —9— while the lower branch passage —18— communicates with a lengthwise passage —20— in the rod —12— and leads to the crank bearing —14—. The guide cylinder —8— is provided at one side intermediate the stroke of the piston —9— with a port —22— which communicates with an oil pass —23—, the latter being connected to an oil cup —21— shown by dotted lines in Fig. 1. The piston —9— serves not

only as a cross head for guiding the main piston —7— in its reciprocatory movement but together with the guide cylinder —8— constitutes a pump for drawing the oil from the source of supply through the port —22— and into the cylinder —8— on the down stroke of the piston —9— and forcibly expels such oil from the cylinder —8— through the ports —19—, —17— and —16— and thence through the passages —18— and —20— to the wrist pin or bearing —14— on the main crank shaft —15—. The upper head of the cylinder —1— is provided with a central opening —24— for the reception of a suitable spark plug, not shown, but which is secured in the usual manner and connected to a source of electrical energy, also not shown, for igniting the explosive mixture at the end of each compression stroke of the main piston —7—.

As best seen in Fig. 1, this engine is what is commonly known as the three-port type and is provided with the usual intake ports —25— and —26— and main exhaust port —27— but in order to carry out the objects of my invention, namely to vary the lead and thereby maintain a more uniform interval of time between the opening and closing of the ports under varying speeds so as to allow the entrance of practically the same amount of explosive mixture and complete cleansing of the cylinder under high speed as under low speed, the cylinder —1— is provided with auxiliary intake ports —25′— and —26′— and an auxiliary exhaust port —27′—. The intake port —25— is located as usual in one side of the cylinder just at the end of the piston —11— when the latter is at the extreme limit of its compression stroke to permit the entrance of the explosive mixture from a suitable carbureter, not shown, to the lower end of the piston chamber —6— beneath the piston —7— which charge is compressed by the down stroke of the piston and forced through a suitable port —28— and by-pass —29— into and through the port —26— above the piston when said port is uncovered by the extreme downward movement of the piston —7—, the inflowing charge being deflected upwardly by a plate —30— on the upper end of the piston —7— at one side of the center of the cylinder thereby aiding in the exhaust of the spent gases through the exhaust port —27— and thence to the atmosphere or to a suitable muffler, not shown, through an exhaust conduit —31—. The auxiliary intake port —25′— is located just below but in close proximity to the main intake port —25— to advance the lead of the intake of the explosive mixture on the upstroke of the piston thereby increasing the interval of time between the period of complete opening and closing of the intake ports, the flow of the explosive mixture through the auxiliary intake port being controlled by a suitable rock-valve —32—. The by-pass intake port —26′— is located just above but in close proximity to the intake port —26— to advance the lead of intake into the explosion chamber and thereby prolong the interval of time between the opening and closing of these ports, the flow of the explosive mixture through the auxiliary port —26′— being controlled by a rock-valve —33— similar to the valve —32—. The auxiliary exhaust port —27′— is located just above and in close proximity to the main exhaust port —27— and also serves to advance the lead of exhaust and to prolong the interval of time between the complete opening and closing of the exhaust port, the exhaust of the spent gases through the port —27′— being controlled by a valve —34— similar to the valves —32— and —33—. These valves —32—, —33— and —34— are provided with recesses in one side thereof and movable into and out of registration with their respective ports —25′—, —26′— and —27′— but when the engine is running at low speed these valves are preferably adjusted to close their respective ports as shown in Fig. 1. On the other hand, as the speed of the engine increases these valves may be gradually adjusted preferably simultaneously by means of a hand piece —38— to open their respective ports so as to advance the lead thereof thereby lengthening or extending the area of the intake and exhaust ports as the speed of the engine increases. That is, under increasing speed of the engine, these valves may be gradually opened as the speed of the engine increases thereby prolonging the interval of time between the maximum opening and complete closing of the intake and exhaust ports and permitting the entrance of practically the same charge of fuel under high speed as under low speed and also maintaining the exhaust ports open a sufficient length of time to permit a thorough cleansing of the cylinder from spent gases. These auxiliary intake and exhaust ports together with their respective valves constitute means for varying the lead or point of cut off of their respective ports and although the auxiliary ports are shown as separate openings into the cylinder each auxiliary port is regarded as a part of the main port or an extension thereof, but for clearness of interpretation the ports —26— and —26′— will be termed in the claims inlet ports as distinguished from the intake ports —25— and —25′— and when the terms intake port, inlet port and exhaust port are used in the claim, they are each to be interpreted as including their respective auxiliary ports.

What I claim is:

1. In a two-cycle internal combustion engine, a cylinder, a piston movable in the

cylinder, said cylinder having an inlet port and an exhaust port so located as to be controlled by the piston, and mechanism for simultaneously extending the effective lengths of both ports.

2. In a two-cycle internal combustion engine, a cylinder and a piston movable therein, said cylinder having an inlet port and an exhaust port, both ports being so located as to be controlled by the piston, and connected valves operable simultaneously for extending the effective lengths of both ports.

3. In a two-cycle internal combustion engine, a cylinder and a piston movable therein, said cylinder having a combustion chamber in one end and a compression chamber in its opposite end, the combustion chamber being provided with an inlet port and an exhaust port, and the compression chamber having an intake port, said ports being so located as to be controlled by the piston, and means including a valve for extending the effective length of the intake port of the compression chamber.

4. In a two-cycle internal combustion engine, a cylinder and a piston movable therein, said cylinder having a combustion chamber in one end and a compression chamber in its opposite end, the combustion chamber having an inlet port and an exhaust port, and the compression chamber having an intake port, said ports being so located as to be controlled by the piston, and mechanism for varying the effective lengths of all the ports simultaneously.

5. In a two-cycle internal combustion engine, a cylinder and a piston movable therein, said cylinder having an inlet port and an exhaust port, both ports being so located as to be controlled by the piston, and connected rotary valves operable manually for simultaneously varying the effective lengths of both ports.

6. In an internal combustion engine, a cylinder and a piston movable therein, said cylinder having a main inlet port and an auxiliary inlet port, and also provided with a main exhaust port and an auxiliary exhaust port, said ports being so located as to be controlled by the piston, and separate connected valves operable simultaneously for controlling the passage of the gases through said auxiliary ports.

7. In a two-cycle internal combustion engine, a cylinder and a piston movable therein, said cylinder having an inlet port and an exhaust port, both ports being so located as to be controlled by the piston, separate rotary valves in said ports for varying the effective lengths of such ports, and means for simultaneously actuating said valves.

8. In a two-cycle internal combustion engine, a cylinder and a piston movable therein, said cylinder having a combustion chamber in one end and a compression chamber in its opposite end, the combustion chamber being provided with an inlet port and an exhaust port, and the compression chamber having an intake port, all of said ports being so located as to be controlled by the piston, and connected valves operable manually for simultaneously varying the effective lengths of all of the ports.

9. In a two-cycle internal combustion engine, a cylinder having a combustion chamber in one end and a compression chamber in its opposite end, a piston movable in said chambers, the combustion chamber being provided with an inlet port and an exhaust port, and the compression chamber having an intake port, said ports being so located as to be controlled by the piston, rotary valves in said ports, and means for simultaneously operating said valves.

In witness whereof I have hereunto set my hand this 5th day of September 1908.

EDWARD MOORE.

Witnesses:

H. E. CHASE,

CAROLINE M. MCCORMACK.