No. 771,320. PATENTED OCT. 4, 1904.

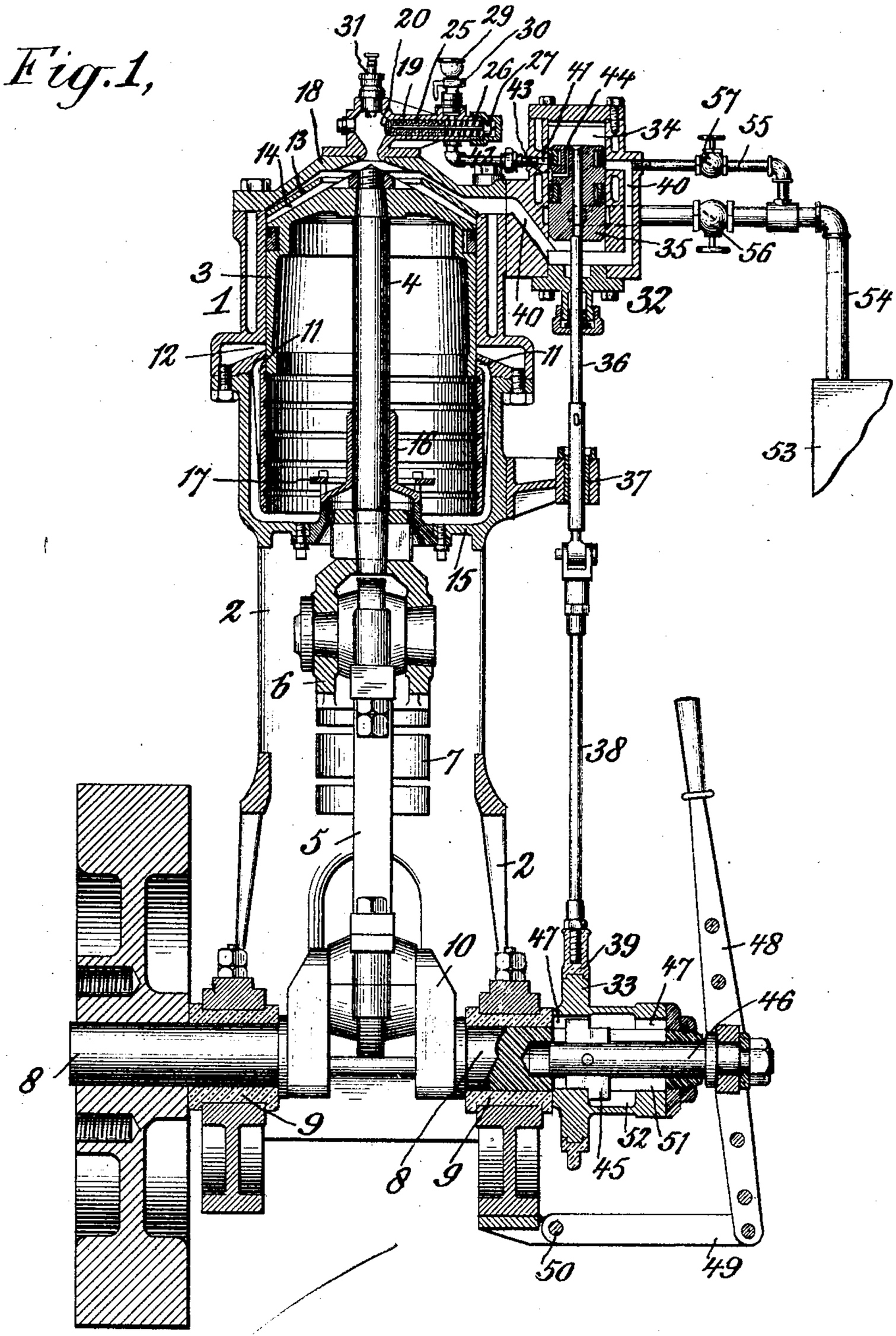
O. P. OSTERGREN.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED OCT. 2, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1,



WITNESSES:

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Chapin Hayward Marble

his ATTORNEYS

PHOTO-LITHOGRAPHED BY SACHETT & WILHELMS LITHO. & PTG. CO. NEW YORK.

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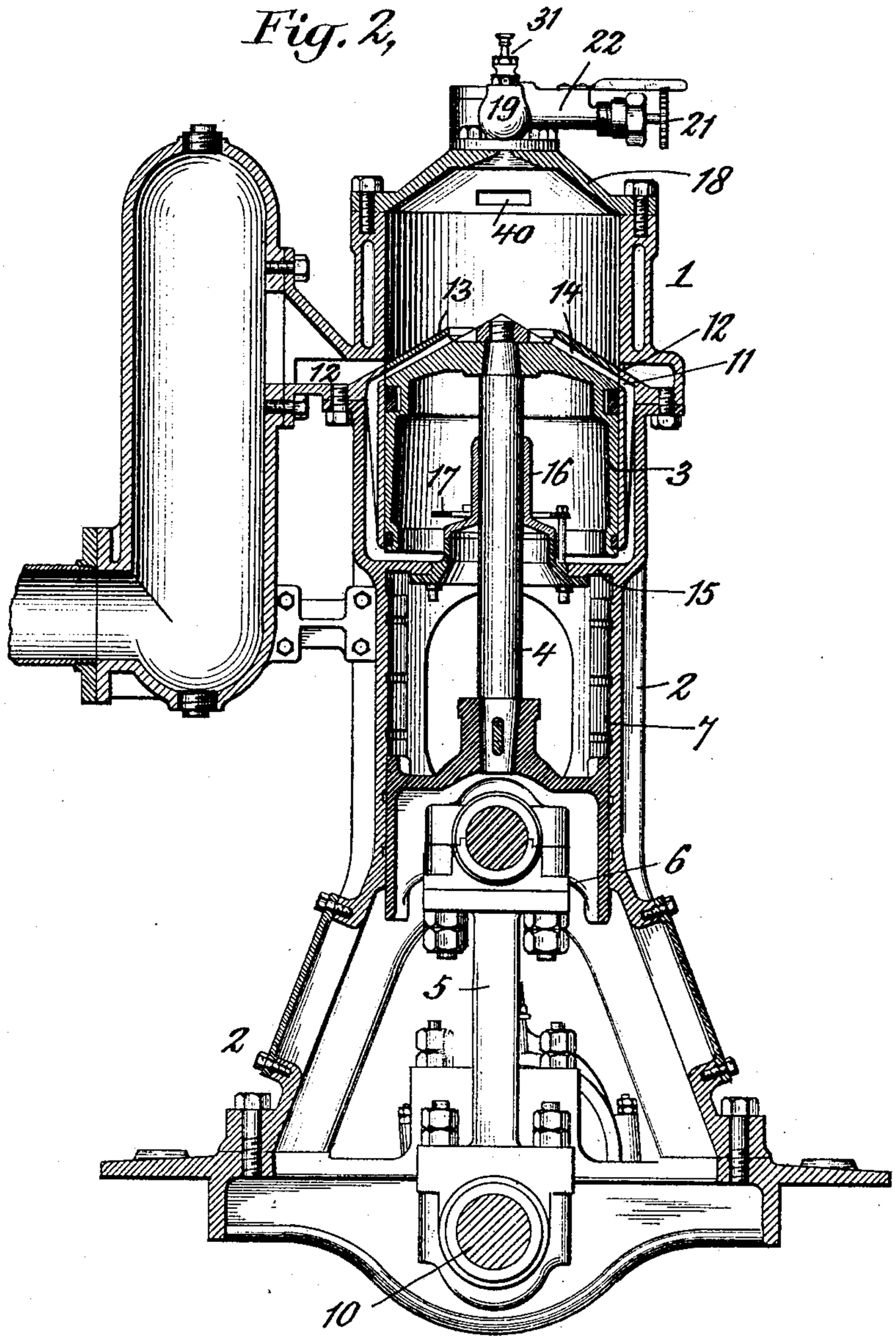
NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2,



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3,

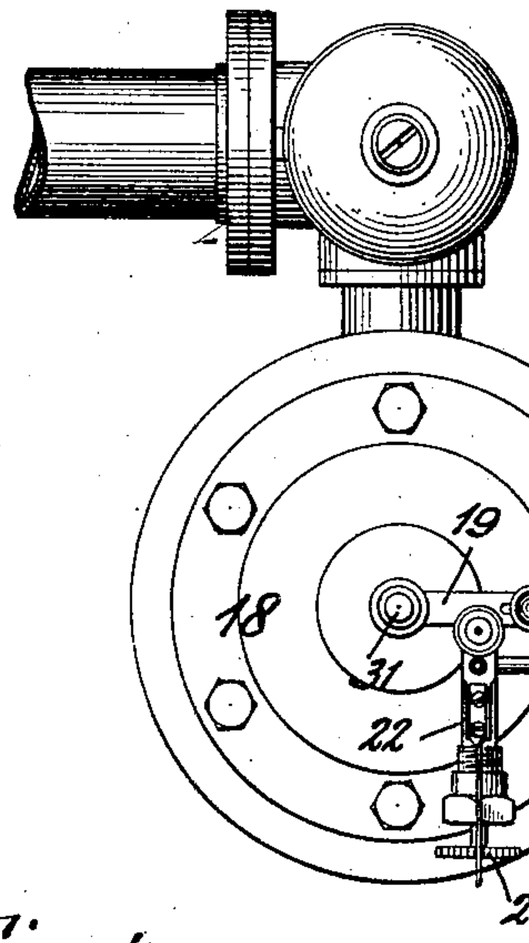


Fig. 4,

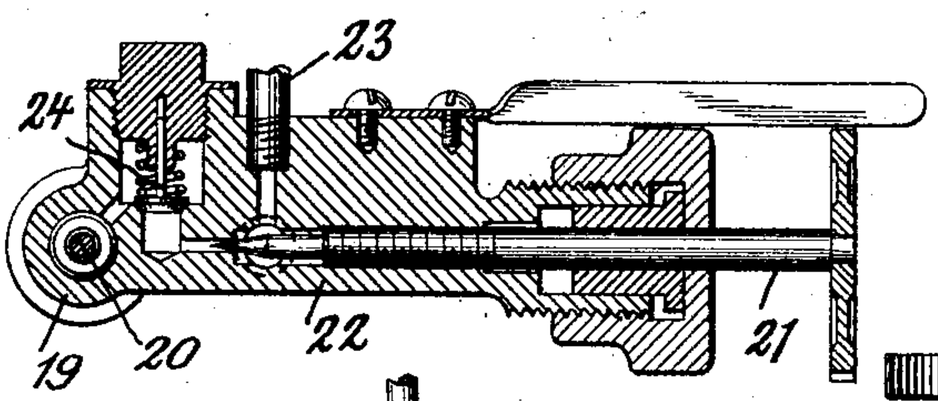


Fig. 5,

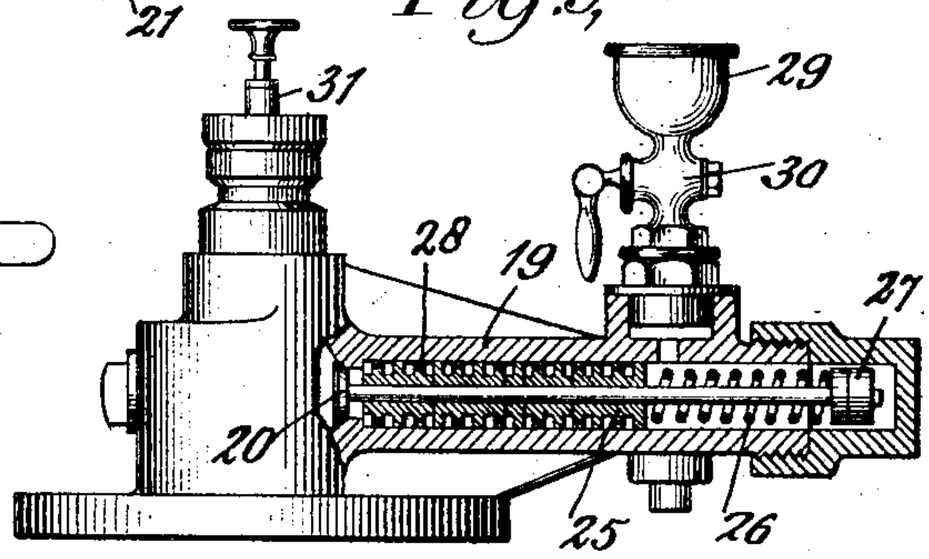


Fig. 6,

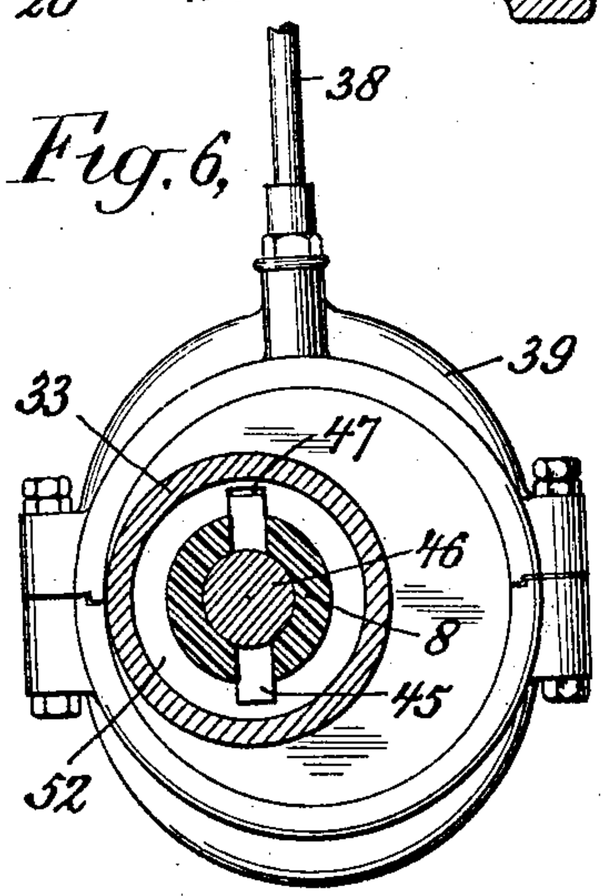


Fig. 7,

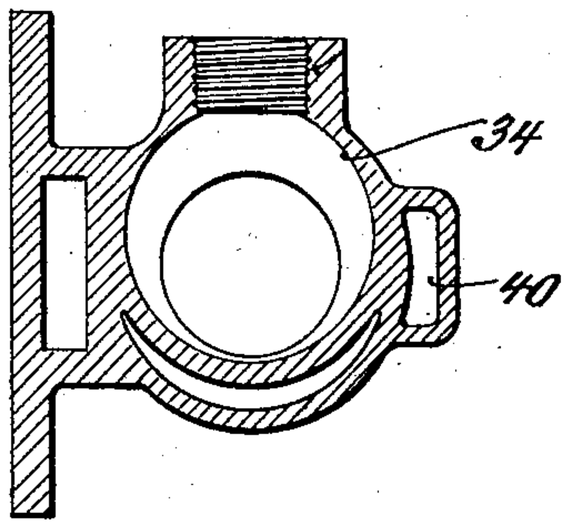
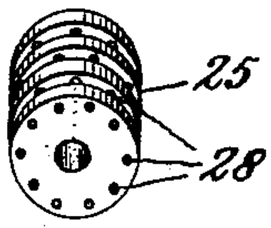


Fig. 8,



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No. 771,320. Patented October 4, 1904.

UNITED STATES PATENT OFFICE.

OSCAR P. OSTERGREN, OF NEW YORK, N. Y., ASSIGNOR TO FUEL OIL POWER COMPANY, OF NEW YORK, N. Y., A CORPORATION OF THE DISTRICT OF COLUMBIA.

INTERNAL-COMBUSTION ENGINE.

SPECIFICATION forming part of Letters Patent No. 771,320, dated October 4, 1904.

Application filed October 2, 1903. Serial No. 175,462. (No model.)

To all whom it may concern:

Be it known that I, OSCAR P. OSTERGREN, a subject of the King of Sweden and Norway, residing at New York city, county and State of New York, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to internal-combustion engines, and particularly to that class of internal-combustion engines operating upon the two-cycle principle.

My invention relates particularly to a novel and improved means for admitting fuel to the engine for motive purposes, and consists in an improved construction of auxiliary compressor and admission-valve and means timing and controlling the operation of the said valve.

My invention also consists in an improved means for storing fluid under pressure and improved means whereby same may be utilized for starting the engine.

My invention also consists in certain novel features and combinations of parts, as will hereinafter more fully appear.

The main objects of my invention are to balance or equalize as to pressure the auxiliary compressing device used in controlling the admission of fuel, to provide for the extra compression of a small quantity of fluid prior to its employment for purposes of forcing fuel into the cylinder, and to so construct and arrange the parts as to make it possible to employ an eccentric drive for the compressor, and, further, to simplify and improve the reversing, power-storing, and starting mechanism.

I will now proceed to describe an internal-combustion engine embodying my invention and will then point out the novel features in claims.

In the drawings, Figure 1 is a view in central vertical section of an internal-combustion engine embodying my invention. Fig. 2 is a view thereof in central vertical section at right angles to that of Fig. 1. Fig. 3 is a top view thereof. Fig. 4 is a detail view, in central vertical longitudinal section, upon an enlarged scale, of a needle-valve employed for regulating admission of fuel-oil. Fig. 5 is a detail view, also on an enlarged scale, partially in central longitudinal section and partially in side elevation, of the casing for the fuel-admission valve and the atomizer, showing the atomizing device in central section and the admission-valve in elevation. Fig. 6 is a detail view, in transverse section across the main shaft of the engine, showing the eccentric mechanism for operating the auxiliary compressor. Fig. 7 is a view in detail transverse section of the casing or cylinder of the auxiliary compressor. Fig. 8 shows a detail perspective view of one of the atomizing-disks.

The engine herein illustrated comprises a cylinder 1, supported by a framework or casing 2, a piston 3, a piston-rod 4, a pitman or connecting-rod 5, connected thereto by means of a cross-head 6, suitably guided in slides 7 upon standards forming part of the casing or framework 2, a main shaft 8, journaled in bearings 9, supported by the casing or framework 2, and a crank 10, to which the lower end of the pitman or connecting-rod 5 is connected.

The cylinder 1 is provided with annular air-admission ports 11 and annular exhaust-ports 12. The admission and exhaust ports 11 and 12 are located at such a point as to be just uncovered by the piston 3 when at its lowermost position. The piston 3 is provided with a deflector 13, arranged above distributing inlet-passages 14. When the piston is at about its lowermost position, the inlet-passages 14 substantially register with admission-ports 11, while the said piston has at such time overridden the exhaust-ports 12—that is to say, the deflector of the piston 14 will be at such time just beneath the exhaust-ports 12. While the piston 3 is moving downwardly it will compress a charge of air between it and the lower cylinder-head 15, so that when the distributing-passages 14 in the piston 3 are brought in registry with the in-

let-ports 11 air thus slightly compressed will flow rapidly into the upper end of the cylinder to discharge the spent gases therein through the exhaust-ports 12 and will replace the said dead gases with fresh pure air. On the upstroke a fresh charge of air will be drawn into the lower end of the cylinder beneath the piston to replace the air with which the upper end of the cylinder has just been charged. An air-admission and check valve is provided at 16, whose stem surrounds the piston-rod 4 and frictionally engages therewith, whereby upon the first upper movement of the piston and its rod the said valve will have a tendency to open, while upon the first downward movement thereof the said valve will be closed. An abutment in the form of a ring 17 is arranged in the path of the valve to limit its movement. In the upward movement of the piston 3 the air admitted to the upper end of the cylinder will be compressed, and as the piston moves up to a position quite close to the upper cylinder-head 18 the air will be compressed to a high degree and its temperature greatly raised.

A valve-casing 19 is secured to the top of the upper cylinder-head 18 and contains therein a fuel-admission valve 20 and a manually-operated needle-valve 21. The manually-operated needle-valve is arranged in a branch 22 of the casing 19, extending at right angles to the main portion thereof. A pipe 23, leading from a source of oil-supply, connects with the branch 22 of the casing 19 and admits oil to within the said casing under the control of the needle-valve 21. A check-valve 24 is provided between the needle-valve 21 and the interior of the main portion of the casing 19 for the purpose of preventing backing up of oil toward the supply-pipe. The stem of the fuel-admission valve 20 passes through a plurality of disks 25 comprising atomizing means, and a spring 26, surrounding the rear portion of said stem and bearing on one side against the said disks and on the other side against a collar 27, carried by said stem at its extreme end, holds the valve normally up to its seat. The atomizing-disks 25 have fine perforations 28 therethrough, the perforations of contiguous disks being preferably out of alinement or register. Oil admitted into the casing 19 must flow through the fine orifices 28 of the disks 25, and hence will be finely broken up or subdivided before it can pass the valve 20 for admission into the cylinder.

An oil-cup 29, controlled by a plug-valve 30, is arranged to connect with the interior of the casing 19 at the rear of the valve 20 and atomizing-disks 25 for the purpose of admitting oil other than the oil admitted through the pipe 23 when desired. An electric plug 31 is mounted in that portion of the casing 19 in advance of the admission-valve 20 and may be employed in starting up the engine for obtaining ignition within the cylinder. After the engine has been running for a short time the heating up of the upper head, together with the temperature attained by the air due to its great compression, will effect ignition without employment of igniting device, such as electric sparking plugs.

So far I have described the fuel-oil-supply means, but no means for forcing the fuel into the cylinder against the pressure of air contained therein. Such means is provided in an auxiliary compressor designated as a whole by the reference character 32 and operated by an eccentric 33 upon the main shaft of the engine. The compressor 32 comprises a cylinder 34 and a piston 35, mounted therein. A piston-rod 36, secured to the piston, is guided in a slideway 37 and is connected at its lower end with an eccentric-rod 38, carried by an eccentric-strap 39, fitted to the said eccentric 33. An equalizing-passage 40 communicates with the interior of the upper end of the cylinder 1 and with the interior of the auxiliary compressor-cylinder 34, near its upper end. Another port or passage 41 leads from the interior of said cylinder 34 and connects with the interior of the casing 19 at the rear of the admission-valve 20 and of the atomizing device 25 through a pipe 42. The piston 35 is provided with a recess 43 on its periphery, and a crossover port or passage 44 communicates with said recess and with the upper end of the cylinder 34. In one position of the piston—that is, in a position toward the lowest end of its movement—the port or passage 41 is arranged to directly communicate with the top of the cylinder 34, the top of the piston having moved beyond the said port or passage, so as to uncover it, while upon its upward movement the piston is arranged to override the port or passage, so as to first entirely close the said port or passage 41 and then later to bring the recess 43 into register therewith, so as to open the upper end of the cylinder 34 into the port or passage 41 through the crossover-port 44.

The operation of admitting fuel to the cylinder for motive purposes and of regulating the supply and correctly timing the admission of same is as follows: Oil is admitted into the casing 19 from a supply-pipe 23 either by gravity or under slight pressure from the supply; and while the piston 35 of the auxiliary compressor is in a position to uncover the port or passage 41 to the upper end of cylinder 34 over the top of the said piston air which is being compressed by the main piston 3 of the engine will be balanced both in front and at the rear of the admission-valve 20 through the equalizing-passage 40. As the auxiliary compressor-piston 35 moves upward and overrides the port or passage 41 it will close communication from the upper end of the engine-cylinder 1 to the upper end of the compressor-cylinder 34, and hence to the casing 19 at the rear of the valve 20. A certain quantity of

compressed air, however, will be locked in the upper end of the auxiliary compressor-cylinder 34, and further movement of the compressor-piston 35 will compress this air to a higher tension. Finally in the further upward movement of the compressor-piston 35 the port or passage 41 will be again opened to the upper end of the cylinder 34 through the recess 43 and crossover-port 44, when the air thus confined in the upper end of the cylinder 34 will be released into the pipe 42 to the casing 19 behind atomizing device 25 and will force oil contained in said casing through the atomizing device past the admission-valve 20 and into the upper end of the cylinder 1 in a finely-divided condition. As before stated, when first starting up the engine ignition of the oil thus sprayed in and combined with the compressed air contained within the cylinder 1 will be effected by means of an electric sparking plug 31; but after the engine has been running a short while the temperature of the compressed air, combined with the heat of the upper head of the cylinder and which is preferably unjacketed, so that it may attain a high degree of heat, will be sufficient to ignite the explosive mixture without employment of the electric spark. It will be noted that when the compressor-piston has moved up far enough to admit the highly-compressed air contained in the upper portion of the auxiliary compressor-cylinder through the crossover-port 44 and recess 43 to the pipe 42 and into casing 19 the equalizing-passage 40 will still be closed by the said piston 35, so that the fluid under pressure admitted behind the valve 20 will predominate that contained in the cylinder in front thereof, and the admission-valve 20 will be readily opened.

In a former application, filed September 11, 1902, Serial No. 122,911, I have shown and claimed means operated and timed in its operation by an auxiliary compressor for admitting fuel through an admission-valve, and hence I do not claim the same broadly herein. In this present construction I have provided equalizing means for substantially equalizing the pressure above and below the compressor-piston and means whereby a certain quantity of fluid is compressed in a confined space before it is admitted to the admission-valve chamber in order to make the operation of the admission-valve quicker and more positive and in order to more exactly time the operation of same. Further, by the arrangement and construction of the auxiliary compressor and the ports and passages controlled thereby I have been enabled to employ a simple form of operating mechanism for the said compressor in the ordinary eccentric 33. For the purpose of providing for the reversing of the engine when desired I have loosely mounted the eccentric 33 upon the engine-shaft 8 and have provided a sliding key 45, carried by a stud 46, mounted to slide in a hollow portion of the said shaft 8, said key 45 adapted, in accordance with its position, to engage with one or other of two recesses 47, with which the hub of the eccentric is provided. An operating-lever 48, fulcrumed to a link 49, in turn fulcrumed upon a stationary portion of the engine, as at 50, engages the stud 46 and moves same longitudinally to cause the key 45 to engage one or other of the slots or keyways 47. The slots or keyways 47 are shown in a line with each other; but the key 45 projects in opposite directions beyond the periphery of the shaft 8, and hence locks the eccentric 33 to the shaft at one hundred and eighty degrees apart, according to its position. While the key 45 is secured to the stud 46, it passes freely through open slots or keyways 51 in the shaft 8, so that while longitudinal relative motion of the stud is permitted with respect to the shaft 8 the two parts are positively rotated in unison. The hub of the eccentric 33 has a central recessed portion 52, and when the key 45 is drawn to an intermediate position it will rotate freely in this recess, so that at such time the eccentric will be entirely disconnected from the shaft. Moving the parts to this intermediate position will therefore stop the engine by stopping the fuel admitting and controlling mechanism. A movement then in one direction or the other of the lever 48 will tend to bring the parts in a position to operate the engine in either one direction or the other. The engine must be initially started, however, and this may be done by hand, as is usual in gas-engines, or may be effected through the employment of an auxiliary starting means now to be described.

A tank or receiver 53 connects through a pipe 54 with the auxiliary compressor-cylinder 34 near the lower end thereof, and a branch pipe 55 is connected through the upper end of the equalizing-port 40 to the cylinder 34 near the upper end thereof. The main pipe 54 is provided with a check-valve 56, which closes toward the receiver 53, while the branch pipe 55 is provided with a check-valve 57, which closes toward the cylinder 34, but opens toward the receiver 53. The check-valves 56 and 57 may conveniently be compound check and globe valves, so that they may be entirely locked in a closed position when desired. In ordinary running and with the receiver 53 fully charged both valves may be closed. In first starting up the engine valve 56 may be unlocked, so that when the auxiliary compressor-piston 35 moves upward to such a point as to uncover the admission from pipe 54 into the lower end of the auxiliary compressor-cylinder 32 admission of compressed fluid will take place from the receiver 53 into the upper end of the main engine-cylinder 1. The eccentric 33 having been locked to the engine-shaft in the proper position in accordance

with which direction the engine is desired to be operated, the engine may be run for two or three strokes in a manner much similar to that of an ordinary steam-engine, the compressor-piston 35 acting as a valve to open and close admission in a similar manner to that of the slide-valve of a steam-engine. After the engine has run one or two strokes the oil-valve may be opened and fuel admitted for the purpose of then running the engine as an internal-combustion engine. After the first explosion the valve 56 may be closed, while the wheel of the valve 57 may be turned so as to permit the said check-valve to operate. Successive strokes of the engine will successively return at each stroke a small quantity of compressed fluid to the tank 53 until it is finally recharged. When recharged, the wheel of the valve 57 may be turned to lock the check-valve to its seat, and the receiver will then be ready to supply motive fluid for again starting the engine when desired. It will of course be understood that the check-valves 56 and 57, being set in opposite directions, will operate the one to prevent backing up of compressed fluid into the tank and the other to prevent passage therethrough in a direction toward the engine. Pipes of different size are provided for the reason that when admission is required it is advantageous to have same through a pipe of large dimensions in order to prevent throttling and wire-drawing, while it is further advantageous to return fluid through a small pipe in order not to drain the engine to too great an extent. When the engine is running under normal conditions, the check-valves themselves will theoretically keep the pipes closed; but for additional safety it is considered better to provide locking means therefor, so as to positively prevent their opening.

It will be obvious that the foregoing is but one embodiment of my invention and that the same is capable of many and varied modifications within the spirit and scope of my invention, and, further, that certain parts may be employed in connection with other parts of different construction. Hence I do not desire to be limited only to the precise details of construction and combination of parts herein.

What I claim is—

1. In an internal-combustion engine the combination with a cylinder and a piston therein, of a fuel-admission valve communicating with the interior of the cylinder, and a compressor comprising a cylinder and a piston, for operating said valve, the piston of said compressor equalized as to fluid-pressure within the said engine-cylinder by admission above and below same of fluid from the working end of said cylinder.

2. In an internal-combustion engine the combination with a cylinder and a piston therein, of a fuel-admission valve communicating with the interior of the cylinder, a compressor arranged in its operation to open the fuel-admission valve and admit fuel therethrough, said compressor containing means for confining and compressing a predetermined quantity of fluid prior to its delivery for the purpose of operating the said valve, and an atomizing-chamber interposed between said compressor and fuel-valve, having means for admitting oil to it and means for dividing oil within it into small masses.

3. In an internal-combustion engine the combination with a cylinder and a piston therein, of a fuel-admission valve communicating with the interior of the cylinder and a compressor comprising a cylinder and a piston therein, said cylinder having a passage leading therefrom to the admission-valve chamber, and said piston arranged in its operation to uncover and then to override the said passage and provided with a crossover-port arranged in the further movement of said piston to again establish communication between the said compressor-cylinder and the fuel-admission-valve chamber.

4. In an internal-combustion engine the combination with a cylinder and a piston therein, of a fuel-admission valve communicating with the interior of the cylinder, and a compressor comprising a cylinder and a piston therein, said cylinder having passages leading from one side of its piston to the engine-cylinder in front of the fuel-admission valve, and from the other side of its piston to the fuel-admission-valve casing at the rear of the said valve, both ends of said compression-cylinder being closed, said piston adapted in its movement to uncover and override both said passages and provided with a crossover-port arranged in the further movement of said piston to again establish communication between the said compressor-cylinder and the fuel-admission-valve chamber.

5. In an internal-combustion engine the combination with a cylinder and a piston therein, of a fuel-admission valve communicating with the interior of the cylinder, and a compressor comprising a cylinder and a piston therein, said cylinder having passages connecting one end thereof both to the engine-cylinder in front of the fuel-admission valve, and to the fuel-admission-valve casing in rear of the said valve, said piston arranged in its movement to uncover and override both said passages and provided with a crossover-port arranged in the further movement of said piston to again establish communication between the said compression-cylinder and the fuel-admission-valve chamber.

6. In an internal-combustion engine the combination with a cylinder and a piston therein, of a fuel-admission valve communicating with the interior of the cylinder, and a compressor comprising a cylinder and a piston therein, said cylinder having passages leading from one end thereof to the engine-cylin-

der in front of the fuel-admission valve, and from the other end thereof to the fuel-admission-valve casing in rear of said valve, and having also a balancing-passage connecting its ends, said piston arranged in its movements to uncover and override both the balancing-passage and the passage leading to the fuel-admission-valve chamber and provided with a crossover-port arranged in the further movement of said piston, after said passages are overridden, to again establish communication between the said compressor-cylinder and the fuel-admission-valve chamber.

7. In an internal-combustion engine the combination with a cylinder and a piston therein, of a fuel-admission valve comprising a valve-chamber and a valve-plug mounted therein, an atomizer in said valve-chamber having a plurality of small perforations or passages adapted to receive oil, and an auxiliary compressor comprising a cylinder and a piston, said compressor having a passage leading from its cylinder to said valve-casing at the rear of said atomizer, and arranged to admit compressed air to said passage at one point in the cycle of the engine.

8. In an internal-combustion engine, the combination with a cylinder and a piston therein, of a fuel-admission valve comprising a valve-chamber and a valve-plug mounted therein, an atomizer in said valve-chamber comprising disks having small longitudinal perforations, the perforations of adjacent disks being staggered, and an auxiliary compressor comprising a cylinder and a piston, said compressor having a passage leading from its cylinder to said valve-casing at the rear of said atomizer, said compressor arranged to admit fluid under pressure to said valve-chamber at one point in the cycle of the engine.

9. In an internal-combustion engine the combination with a cylinder and a piston therein, of a fuel-admission valve communicating with the interior of the cylinder, and a compressor comprising a cylinder and a piston, for operating said valve, said compressor having an equalizing-passage 40, and a port or passage 41 leading to the fuel-admission-valve chamber, said piston adapted in its movement to override both said passages, and provided with a recess 43 on its periphery arranged to register with the port or passage 41, and a crossover-port 44.

10. In an internal-combustion engine the combination with a cylinder and a piston therein, of a fuel-admission valve communicating with the interior of the cylinder, a compressor comprising a cylinder and a piston therein, said cylinder having a passage leading therefrom to the admission-valve chamber, and said piston adapted in its operation to override the said passage and provided with a crossover-port arranged in the further movement of said piston to again establish communication between the said compressor-cylinder and fuel-admission-valve chamber, eccentric mechanism for operating said compressor-piston, and reversing means for reversing the position of the eccentric mechanism.

11. In an internal-combustion engine the combination with a cylinder and a piston therein, a fuel-admission valve, and a compressor comprising a cylinder and a reciprocating piston therein, of a storage-tank connecting with said compressor-cylinder, the said connection arranged to be overridden by the compressor-piston in its reciprocation.

12. In an internal-combustion engine the combination with a cylinder and a piston therein, a fuel-admission valve, and a compressor comprising a cylinder and a reciprocating piston therein, of a storage-tank connecting with said compressor-cylinder, the said connection arranged to be overridden by the compressor-piston in its reciprocation, said storage-tank having a second connection with the said compressor-cylinder, adapted to be overridden by the said compressor-piston when moving in the opposite direction.

13. In an internal-combustion engine the combination with a cylinder and a piston therein, a fuel-admission valve, and a compressor comprising a cylinder and a reciprocating piston therein, of a storage-tank having two connections of different size communicating with said compressor-cylinder at points one above the other, and both adapted to be overridden by the said compressor-piston in its reciprocation.

14. In an internal-combustion engine the combination with a cylinder and a piston therein, a fuel-admission valve, and a compressor comprising a cylinder and a reciprocating piston therein, of a storage-tank having two connections of different size communicating with said compressor-cylinder at points one above the other, and both adapted to be overridden by the said compressor-piston in its reciprocation, said connections provided with check-valves opening in opposite directions.

15. In an internal-combustion engine the combination with a cylinder and a piston therein, a fuel-admission valve, and a compressor comprising a cylinder and a reciprocating piston therein, of a storage-tank having two connections of different size communicating with said compressor-cylinder at points one above the other, and both adapted to be overridden by the said compressor-piston in its reciprocation, said connections provided with check-valves opening in opposite directions, said check-valves having means for positively locking them in a closed position.

OSCAR P. OSTERGREN.

Witnesses:
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CHARLES LAC. HOFF.