No. 894,682. PATENTED JULY 28, 1908.

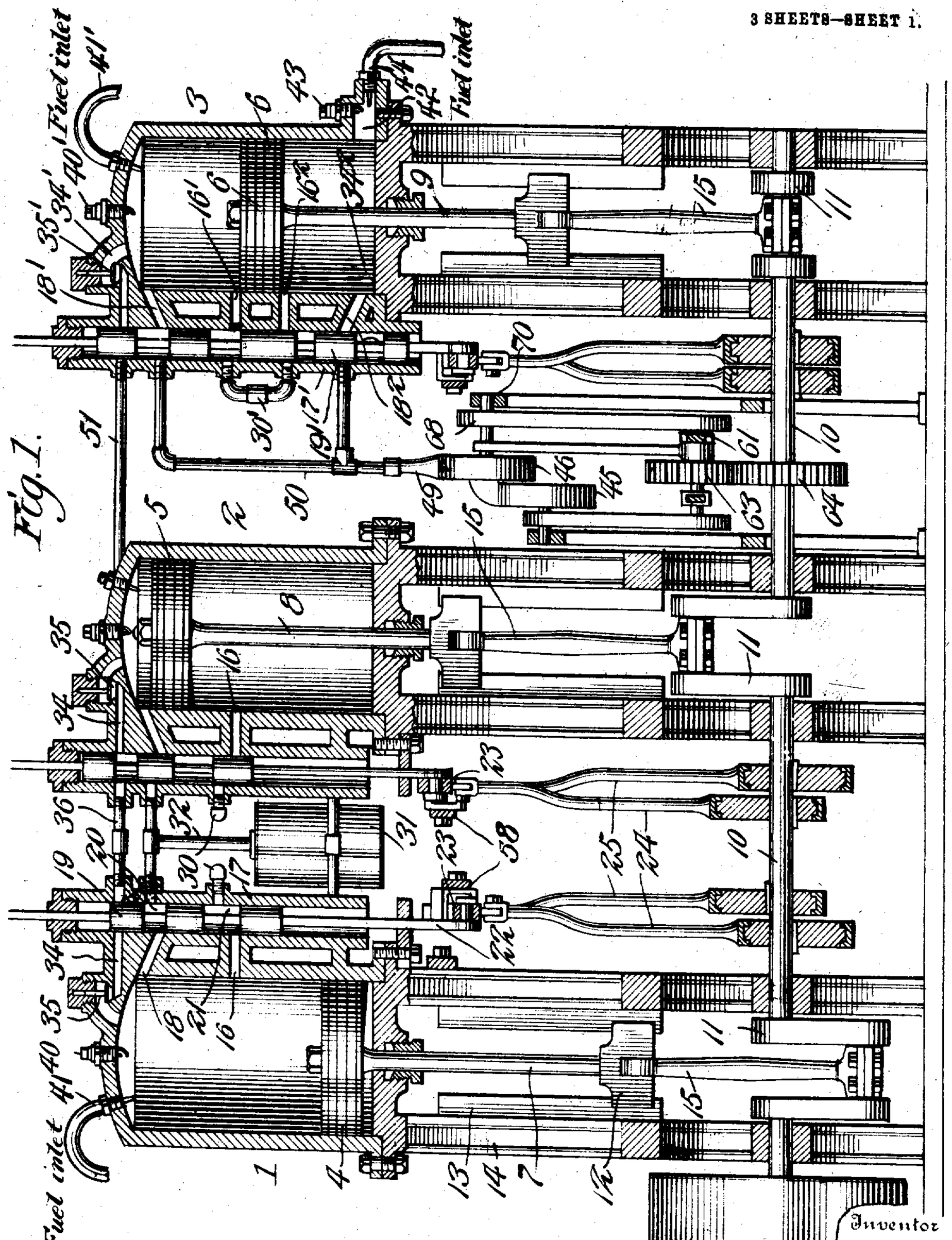
J. MUNDEN.

ENGINE.

APPLICATION FILED DEC. 24, 1907.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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3 SHEETS—SHEET 2.

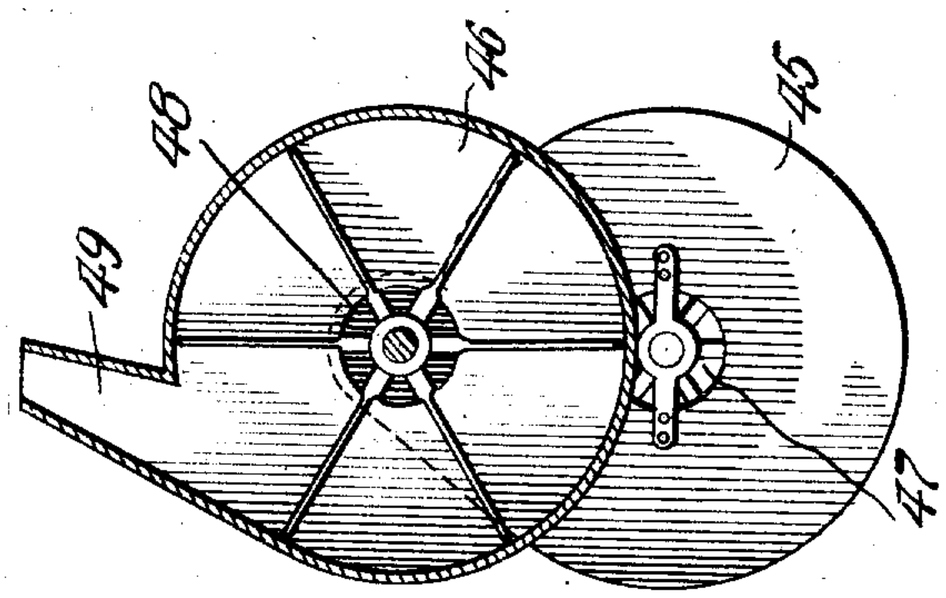

Fig. 6.

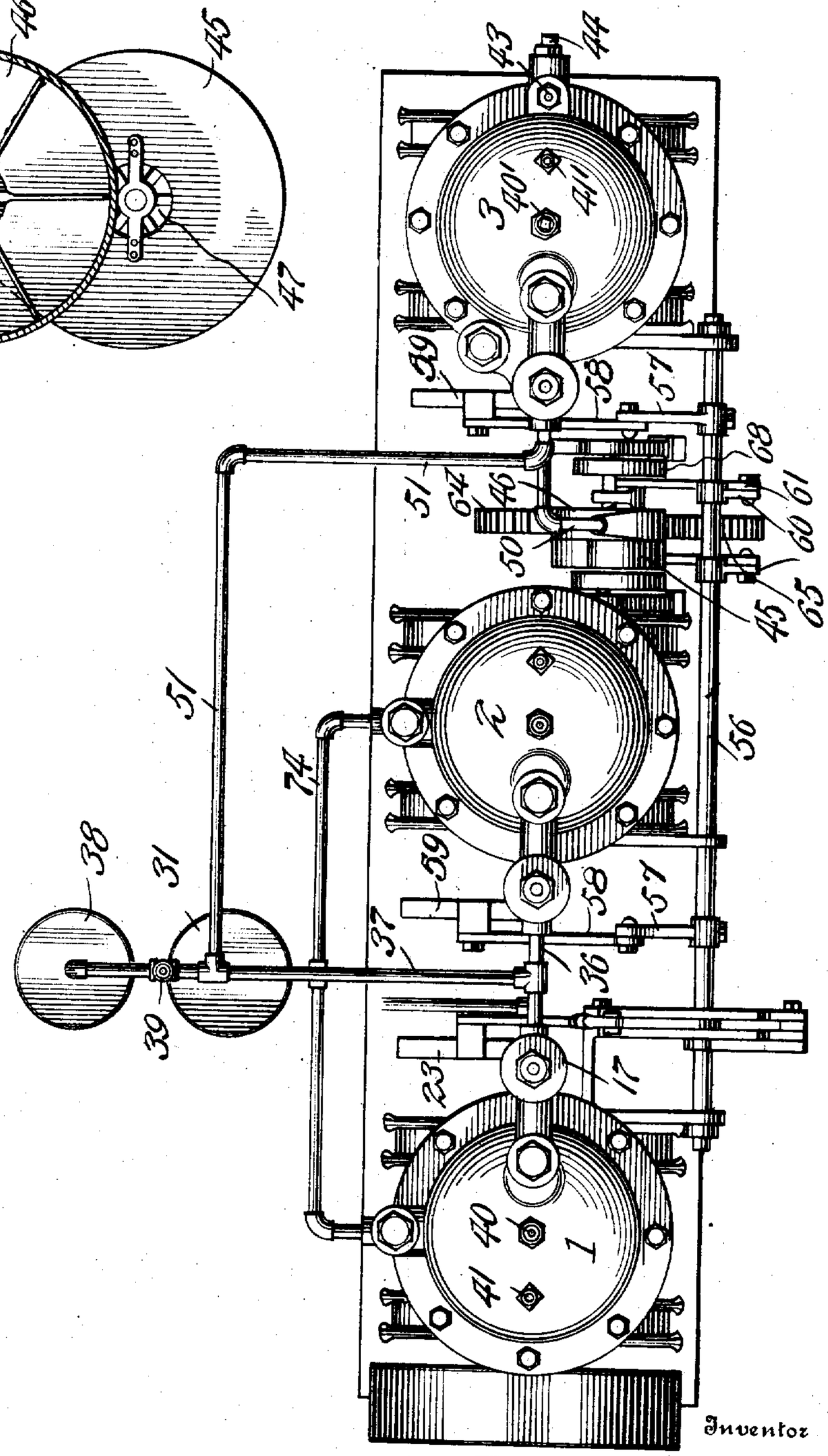

Fig. 7.

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3 SHEETS—SHEET 3.

Fig. 3.

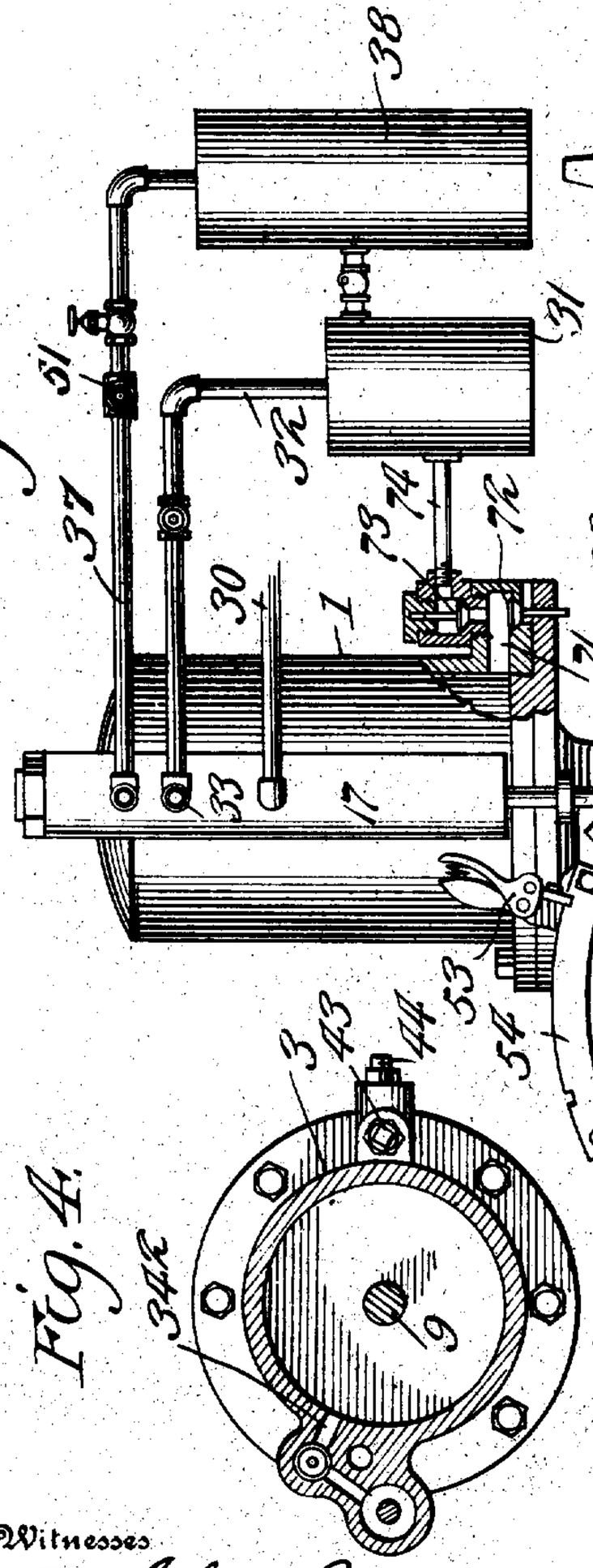

Fig. 5.

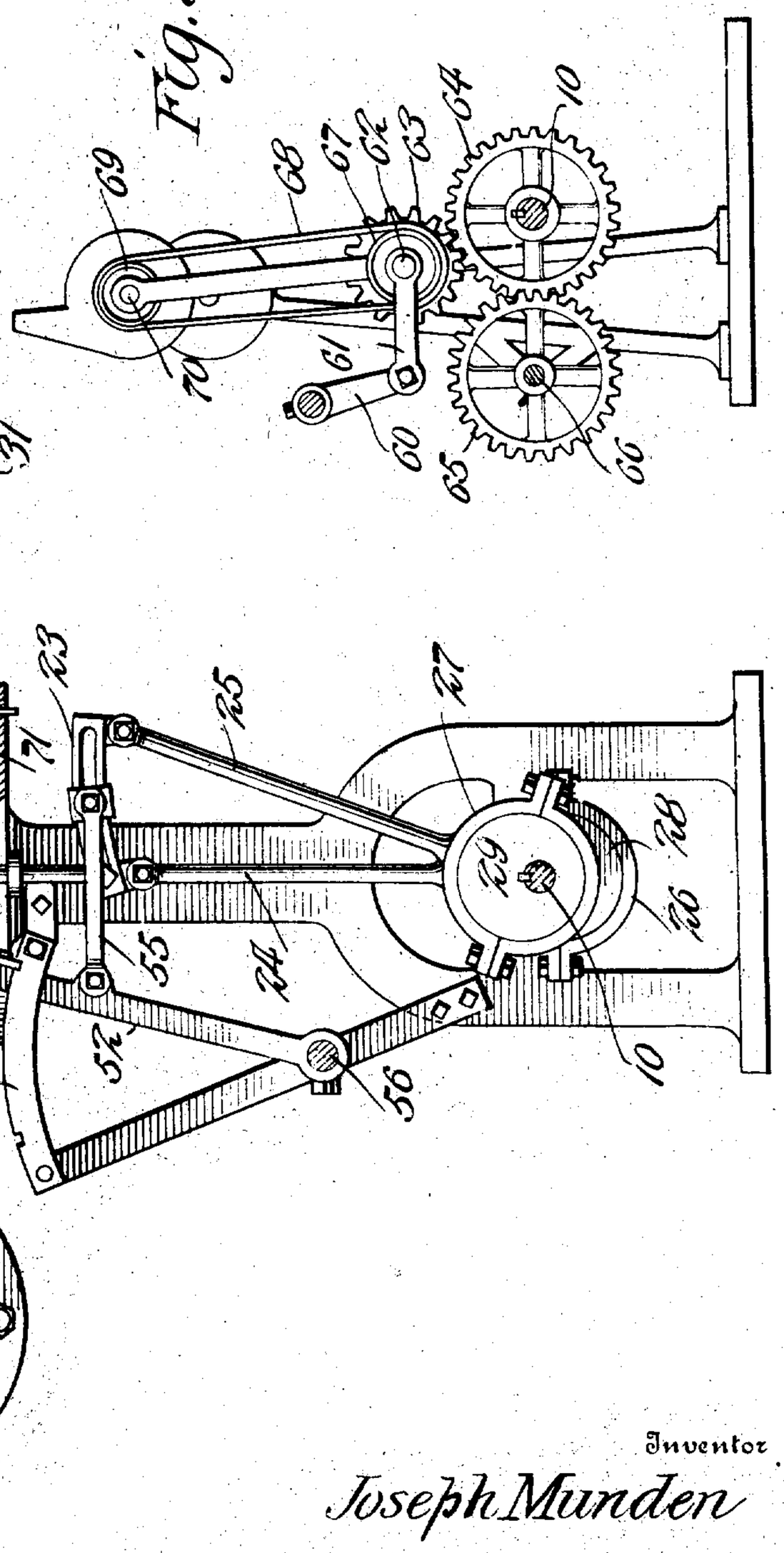

Fig. 4.

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UNITED STATES PATENT OFFICE.

JOSEPH MUNDEN, OF BRADENVILLE, PENNSYLVANIA.

ENGINE.

No. 894,682. Specification of Letters Patent. Patented July 28, 1908.

Application filed December 24, 1907. Serial No. 407,889.

To all whom it may concern:

Be it known that I, JOSEPH MUNDEN, a citizen of the United States, residing at Bradenville, in the county of Westmoreland and State of Pennsylvania, have invented new and useful Improvements in Engines, of which the following is a specification.

This invention relates to internal combustion engines and has for its object the production of an engine having a novel arrangement of ports and valves combined with a supply of air under pressure, whereby the cylinder or cylinders or explosion chambers thereof are thoroughly freed of the burned gases before a new charge is admitted and whereby also a fresh charge of air is introduced into the explosion chamber and compressed together with the incoming gasolene or other hydro-carbon, thus obtaining an explosion for each complete revolution of the crank shaft or each back and forth movement of the piston.

A further object of the invention is to provide for cooling the explosion chamber or chambers internally by passing a body of cold air through the same in each cycle of operation.

A further object of the invention is to provide a construction in which a long stroke of the piston is obtained, permitting the charge to expand almost to atmospheric pressure, thereby dispensing with the necessity of using a muffler.

With the above and other objects in view, the invention consists in the novel construction, combination and arrangement of parts hereinafter fully described, illustrated and claimed.

In the accompanying drawings:—Figure 1 is a vertical longitudinal section through an engine constructed in accordance with the present invention. Fig. 2 is a plan view of the same. Fig. 3 is an end view thereof partly broken out in section. Fig. 4 is a sectional plan view of one of the cylinders. Fig. 5 is an elevation of the reversing gear. Fig. 6 is a sectional elevation of the fans.

The engine contemplated in this invention may comprise any number of cylinders according to the power to be developed. For the purpose of illustration I have shown the engine as comprising three cylinders 1, 2 and 3, the cylinders 1 and 2 containing single acting pistons 4 and 5 and the cylinder 3 containing a double acting piston 6. These pistons are connected by rods 7, 8 and 9 to a common crank shaft 10 having the cranks 11 thereof set at different angles to overcome dead centers and distribute the power of the pistons thereon, at least one of the pistons being engaged in its active stroke in any given point in the rotation of the crank shaft.

It is preferred to connect the piston rods with cross heads 12 which slide along suitable guides on the engine frame 14, the said cross heads being connected with the crank shaft 10 by means of pitmen 15.

The exhaust port 16 is located about centrally of the length of the cylinder as shown in cylinders 1 and 2 whereby the piston passes by said exhaust port once in each stroke or twice in each double stroke or complete revolution of the crank shaft 10. Arranged at one side of each cylinder is a valve chamber 17 with which the exhaust port 16 communicates, said valve chamber being in communication with the cylinder through another port 18 located adjacent to the top of the cylinder. Within the chamber 17 is mounted a slide valve 19 having a plurality of ports 20 and 21, the port 20 being adapted to register with the port 18 and the port 21 being adapted to register with the cylinder port 16. The stem 22 of the slide valve extends downward a suitable distance where it is connected to a sliding link 23 which is connected to rods 24 and 25 having eccentric bands 26 and 27 which embrace eccentrics 28 and 29 on the crank shaft 10, the last named parts being elements of the reversing gear which will hereinafter be fully described. In this way the slide valve of each cylinder is driven by the crank shaft and the eccentrics are set so as to time the slide valves properly with relation to the movements of their respective pistons to obtain the cycle of operation hereinafter set forth.

30 designates an exhaust pipe leading off from the valve chamber 17 and adapted to be placed in communication with the cylinder by means of the slide valve.

31 designates an air tank which is conveniently located between adjacent cylinders, as shown in Fig. 1, and comprises a pipe 32 which is branched at 33 to extend to the adjacently located valve chambers of the adjoining cylinders.

Near the top, each cylinder is provided with an auxiliary air passage 34 in which is arranged a check valve 35 and communicating with the corresponding passages 34 of the adjacent cylinders is an air pipe 36 to

which is connected a pipe 37 which leads to an auxiliary air tank 38, the pipe 37 being controlled by a throttle valve 39. The check valves 35 are arranged to allow air to pass into the cylinders, and prevent the same from being forced outward.

In the head of each cylinder 1 and 2 there is arranged a spark plug 40 and a gasolene spray intake 41 adapted at the proper moment to inject a spray of gasolene or gas into the explosion chamber of the cylinder with which it is associated.

Suppose the piston 4 to be starting on its upstroke with the ports 21 and 20 in communication with the ports 16 and 18. The burned gases above the piston are forced by said piston in its upward movement out through the exhaust 16 and exhaust pipe 30. The port 18 is opened by the slide valve thus permitting the compressed air in the tank 31 to rush in through the port 18 and expel the burned gases through the exhaust port 16. The piston 4 then moves on upward closing the port 16, the latter being closed by the slide valve. During the remainder of its upward movement it compresses the fresh air remaining in the upper portion of the cylinder. During this compression portion of the stroke, gasolene is sprayed through the intake 41 into the explosion chamber and subsequently, just at the proper instant a spark is given by the plug 40 thereby exploding the charge and driving the piston downward. The gas expands during the entire downward movement of the piston and by the time the piston reaches the lower limit of its movement the gas is practically expanded to atmospheric pressure so that there is no need of muffling the exhaust to render the engine noiseless. It will thus be observed that the first operation of the up stroke of the piston has a scavenging action while the remaining portion of the upstroke is the compression portion of the movement of said piston. Therefore, in the complete upstroke of the piston, the latter acts to expel the burned gases and to compress the fresh air which has entered the cylinder and which has been utilized to drive out the remainder of the burned gases.

The cylinder 3 is provided with two exhaust ports 16′ and 16^2 arranged far enough apart to allow the piston 6, at one point in its stroke, to lie between said exhaust ports. The valve chamber 17′ contains a slide valve 19′ which corresponds with the slide valves 19 above described and which is actuated from the crank shaft in the same manner. The exhaust pipe 30′ is branched and leads into the valve chamber 17′ at two points nearly opposite the exhaust ports 16′ and 16^2 and the cylinder is also provided near its top and bottom with air ports 18′ and 18^2 for introducing air under pressure either above or below the piston 6. Furthermore, the cylinder is provided at the top and bottom with auxiliary air ports 34′ and 34^2 each controlled by a check valve 35′ which allows air to enter the cylinder but prevents its egress. At one end the cylinder is provided with a spark plug 40′ and a gasolene intake 41′ and at the opposite end said cylinder is provided with an offset chamber 42 containing a spark plug 43 and a gasolene intake 44 whereby the gasolene is introduced to opposite sides of the piston 6 and provision is made for igniting the gas in the explosion chamber at either side of said piston.

The operation of the piston 6 is precisely the same in principle as that of the pistons 4 and 5 with the exception that said piston is driven in both directions by the explosion of gas, the explosions taking place alternately at opposite ends of the cylinder and on opposite sides of the piston, the piston acting during a portion of its stroke to exhaust the burned gases and during another portion of its stroke to compress the charge, while air is admitted alternately at opposite sides of the piston to drive the burned gases out through the exhaust ports. In connection with the double acting piston, however, it will be necessary to employ an auxiliary air blast and for that purpose, I have illustrated in Figs. 1 and 6, a fan arrangement embodying a pair of fans 45 and 46, the primary fan 45 sucking the air in at the central opening 47 and driving the same out through a peripheral opening which communicates with a central opening 48 in the secondary fan 46, the air driven into said fan being propelled through a peripheral spout 49 which communicates with a blast pipe 50 leading into the valve chamber 19′ as shown in Fig. 1.

51 designates a branch pipe which leads from the air pipe 37 to the valve chamber 17′. The ports of the valves which control the admission of air through the connections 37 and 51 to the several cylinders are so arranged with respect to the movements of the valves that said ports are in registry with the corresponding cylinder ports when the pistons are at the upper ends of their strokes. Therefore, when the air contained in the tank 38 is liberated by opening the throttle valve 39, said air acts on top of such piston and starts the engine, the tank 38 and its connections being especially provided for the purpose of starting the engine. As soon as the engine is started the valve 39 is closed and the air tank 31, and the fan blast pipe 50 will thereafter supply the necessary air for compression and for ejecting the burned gases from the explosion chambers.

52 designates a reversing lever having a thumb latch 53 coöperating with a notched segment 54 suitably connected with the engine.

The lever 52 is attached by means of a connecting rod 55 to the sliding slotted link 23

above described so that by moving said lever to one side or the other the link 23 may be moved lengthwise to bring either one of the rods 24 or 25 into working relation to the stem of the superimposed slide valve. The lever 52 is mounted on a shaft 56 extending along side of the engine and provided with lever arms 57 which are attached by means of connecting rods 58 with their links 59 corresponding with the link 23 and having the same connection with the stems of the superimposed slide valves and also the same connection with the crank shaft 10. This enables all of the engine valves to be simultaneously reversed or shifted for the purpose of reversing the direction of rotation of the engine. The shaft 56 is provided with another arm 60 which is connected by a link 61 with the shaft 62 of a transmission pinion 63 adapted to be thrown into engagement with a gear 64 on the crank shaft 10 or into engagement with a similar gear 65 mounted on a counter-shaft 66, the gear 65 meshing with the gear 64 all as clearly shown in Fig. 5. The shaft 62 has in addition to the transmission gear 63 a belt pulley 67 from which a belt 68 passes over another pulley 69 on the shaft 70 of one of the fans shown in Fig. 6 thereby transmitting motion to said fans. Thus, in either position of the lever 52, the fans are driven through the medium of the gearing illustrated in Fig. 5.

In Fig. 3 is illustrated the valve arrangement by means of which air is forced by the pistons 4 and 5 into the tank 31, each cylinder being provided in its bottom with an offset pocket 71 having an air intake valve 72 and a check valve 73 which controls a pipe 74 which leads to the tank 31. By said arrangement of valves 72 and 73 in the up stroke of the piston, the air is sucked in past the intake valve 72, filling the lower portion of the cylinder beneath the piston. Then in the active down stroke of the piston, the air is forced past the valve 73 into the tank 31 under high pressure so that subsequently when the valve port 20 is moved into alinement with the cylinder port 18, the compressed air rushes into the explosion chamber of the cylinder and expels all of the burned gases through the exhaust port 16.

I claim:—

An internal combustion engine comprising a pair of cylinders, pistons working therein one of which is single acting and the other double acting, one cylinder being provided with an exhaust port intermediate its ends and the other cylinder being provided with a pair of exhaust ports intermediate its ends, means for admitting compressed air into one of the cylinders at one side of the piston, means for admitting air into the other cylinder alternately at both sides of the piston, and valves controlling the air connections of the cylinders and also controlling the exhaust ports thereof, substantially as described.

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

JOSEPH MUNDEN.

Witnesses:
BART SMITH,
LEVI LINT.