

L. ILLMER, JR.
GAS ENGINE.

APPLICATION FILED JULY 26, 1906.

Patented Aug. 12, 1913.

6 SHEETS—SHEET 1.

1,069,785.

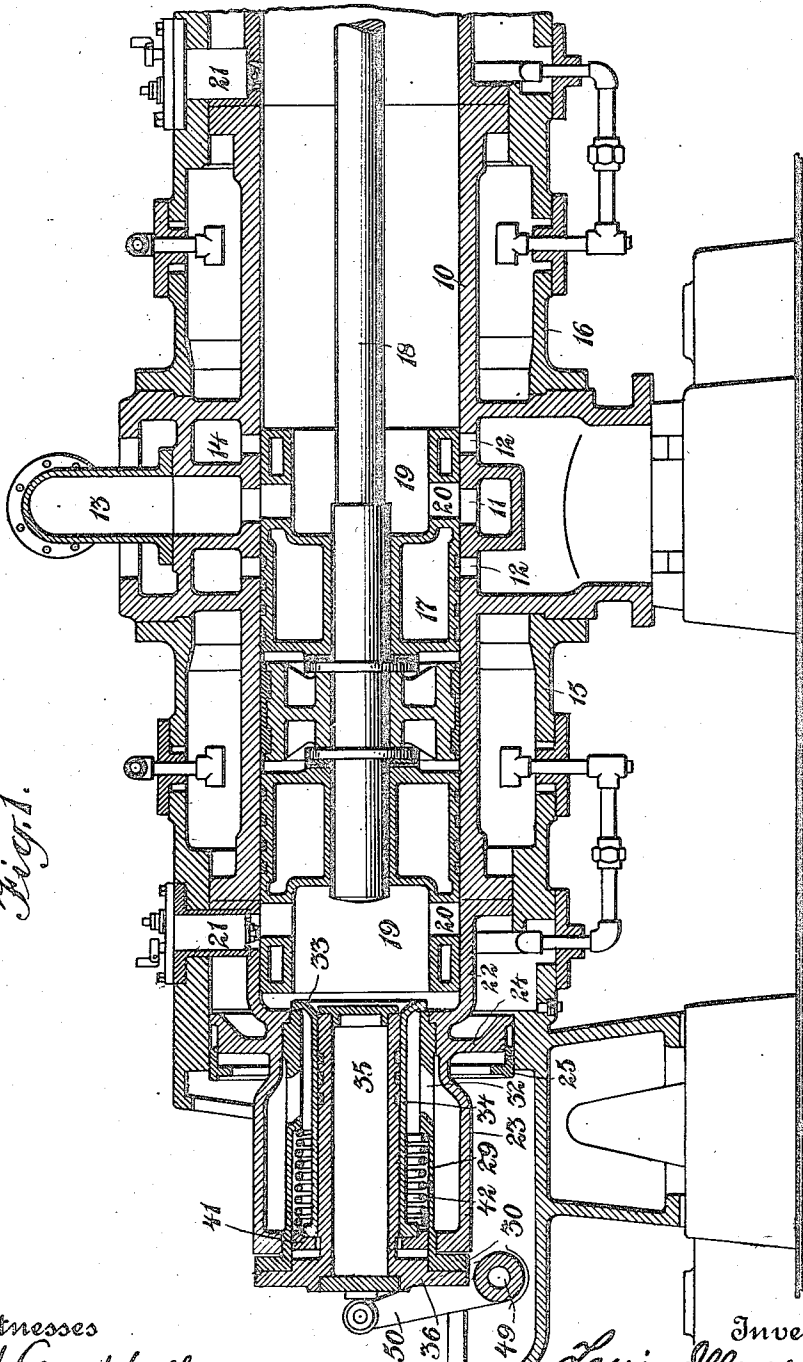


Fig. 1.

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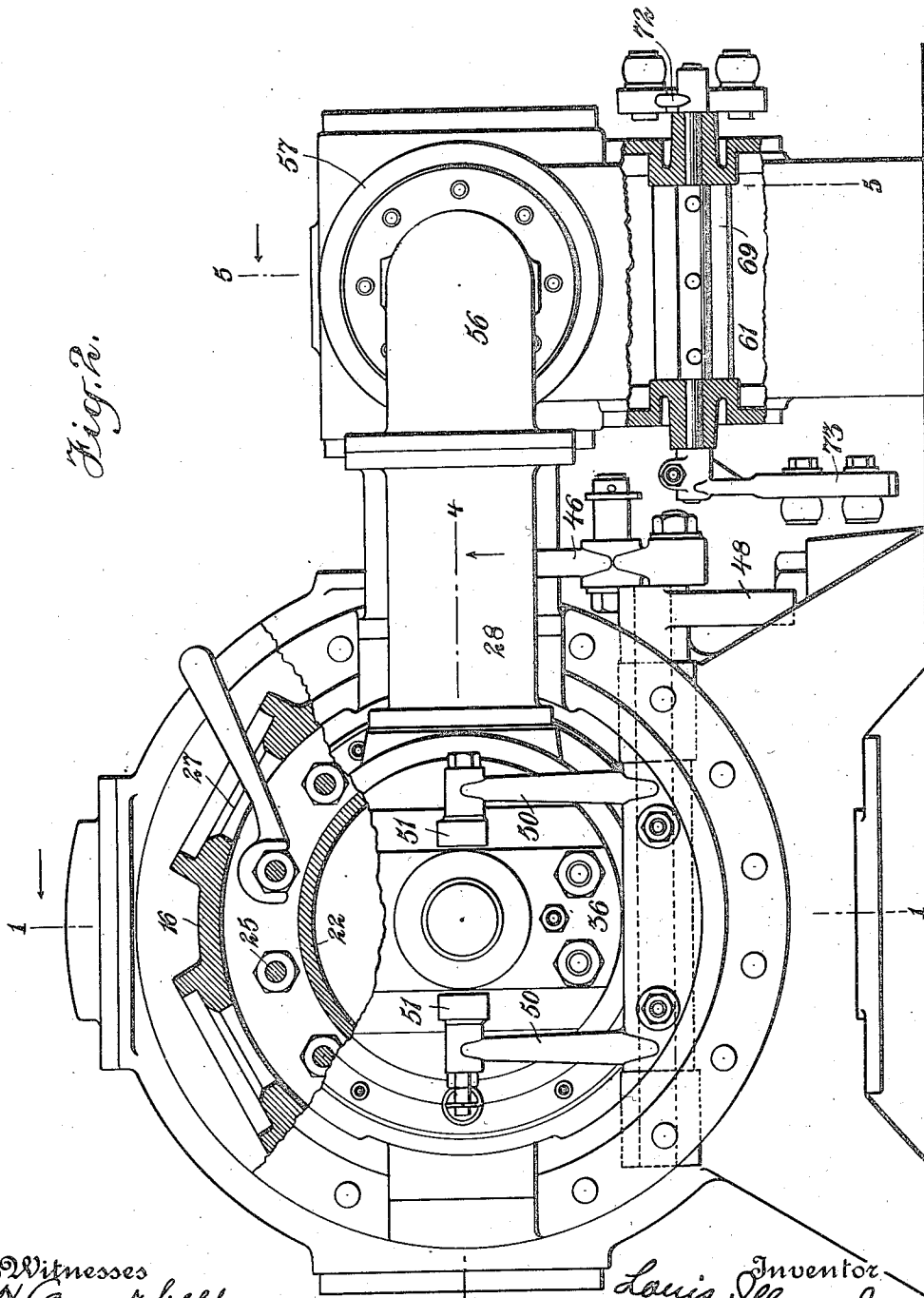
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5 SHEETS—SHEET 2.

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Fig. 2.



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5 SHEETS—SHEET 3.

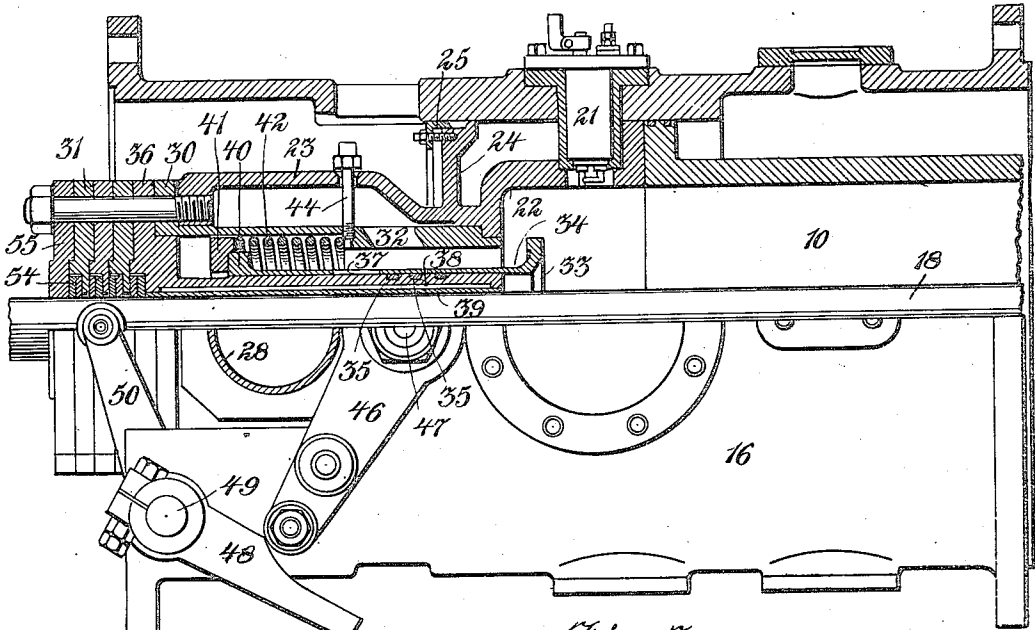


Fig. 3.

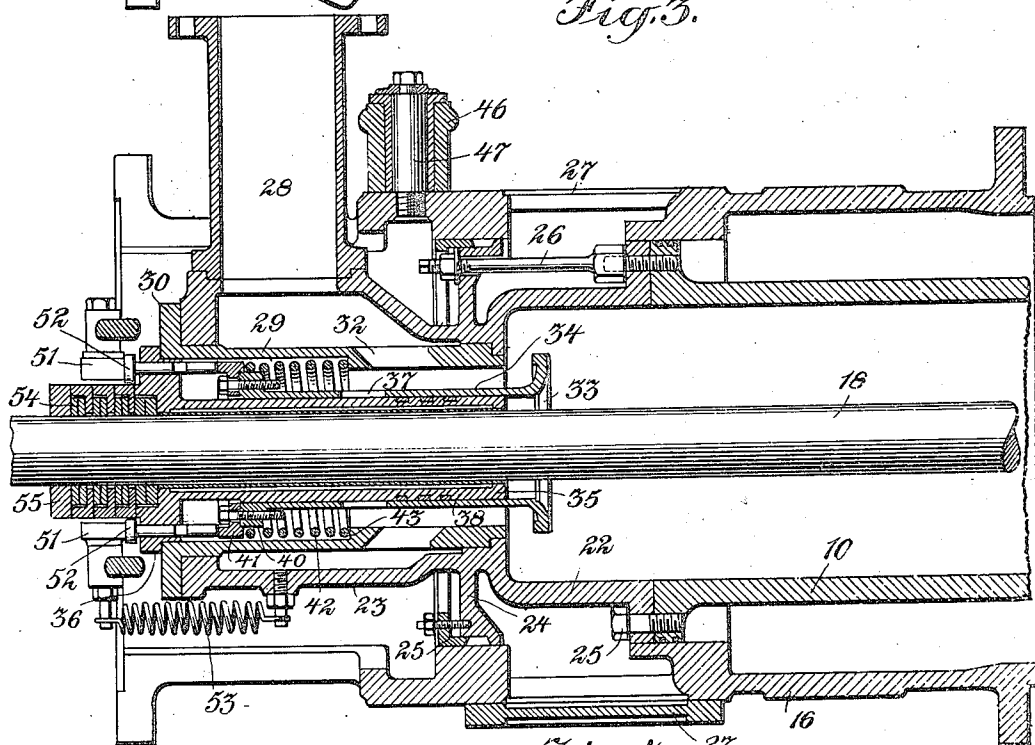


Fig. 4.

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Fig. 5.

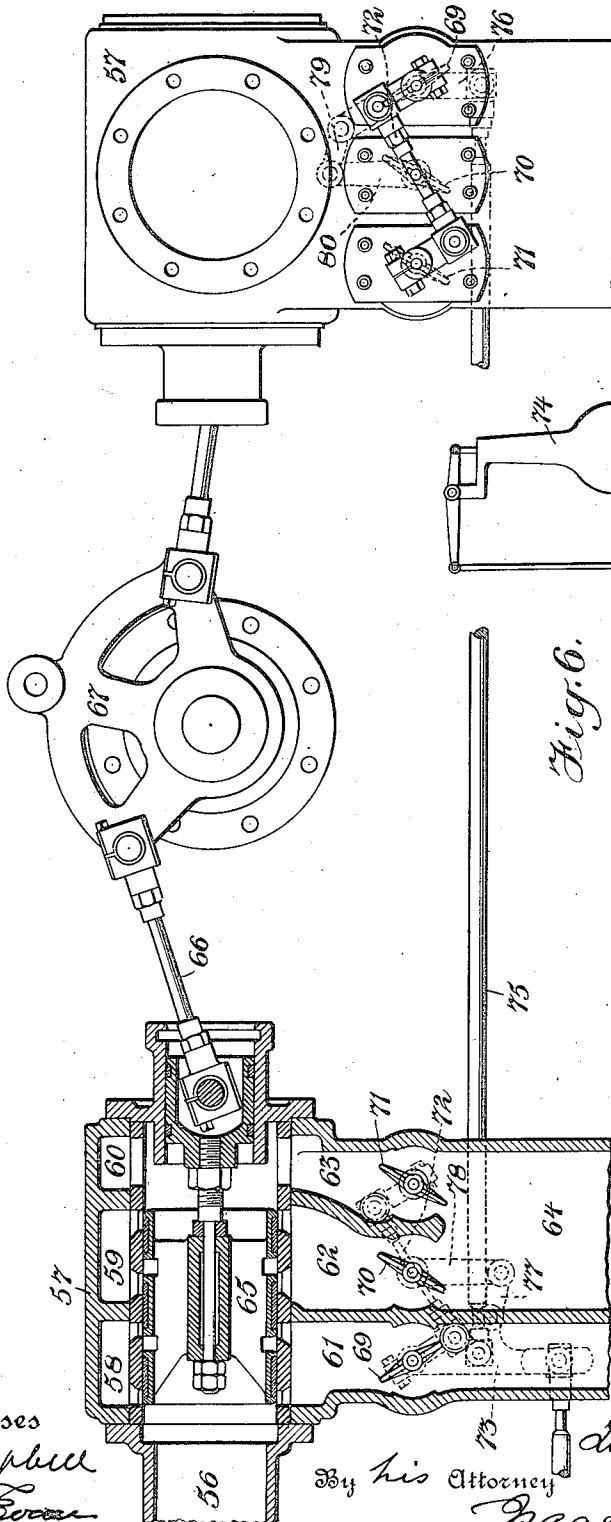
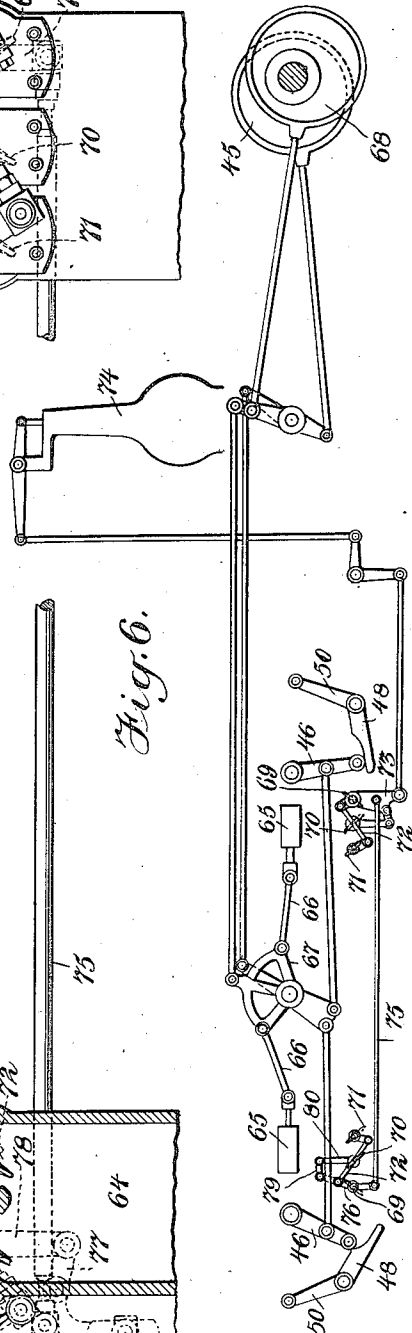


Fig. 6.



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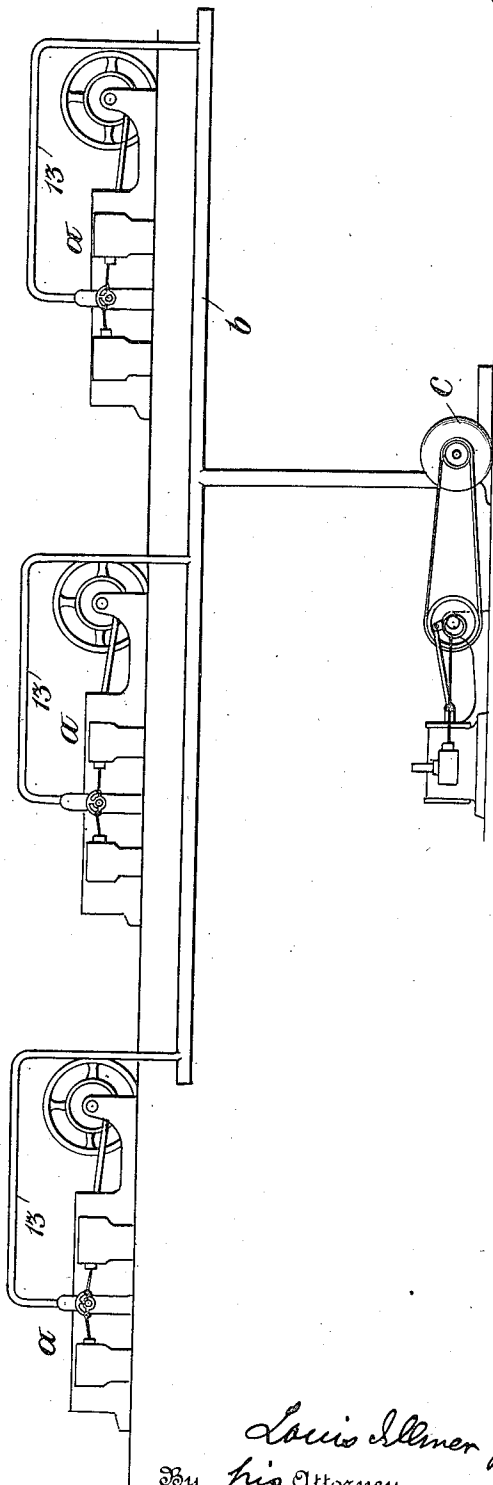
GAS ENGINE.

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5 SHEETS—SHEET 5.

Fig. 7.



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UNITED STATES PATENT OFFICE

LOUIS ILLMER, JR., OF BALTIMORE, MARYLAND, ASSIGNOR TO ILLMER GAS ENGINE COMPANY, A CORPORATION OF DELAWARE.

GAS-ENGINE.

1,069,785.

Specification of Letters Patent.

Patented Aug. 12, 1913.

Application filed July 26, 1906. Serial No. 327,967.

To all whom it may concern:

Be it known that I, LOUIS ILLMER, JR., of the city of Baltimore, State of Maryland, have invented certain new and useful Improvements in Gas-Engines, of which the following is a full, clear, and exact specification, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to certain improvements in internal combustion engines and power plants thereof, which improvements relate particularly to double acting two cycle engines using a gaseous fuel and scavenging air, although the invention involves various features which are applicable to engines of other types.

At the exhaust period of this engine the exhaust port is opened and pressure in the cylinder falls to atmosphere. Immediately thereafter this port is closed and communication is established between the mixing chamber and an exhauster or other form of pump, which exerts a sucking influence in the cylinder drawing out the gas of combustion remaining therein so that the inlet valve when opened will first admit the scavenging air and next the working charge. The movement of the air and gas is controlled by a mixing and measuring valve, which causes the air and gas to take the form of successive strata of air and mixture of air and gas. This it will be observed enables me by means of a single pump, to bring about the necessary movement of the air and gas. When the invention is adapted to a power plant composed of a plurality of engines, exhausting or pumping means are concentrated into a single exhauster or pump which serves equally all of the engines of the plant with respect both to the air and gas supplies thereof.

It is also an object of my invention to provide governor and manual control not only for the air and gas forming the fuel mixture but also for the scavenging air.

My invention involves various other features and all will be fully described hereinafter and particularly pointed out in the claims.

Reference is now had to the accompanying drawings which illustrate as an example one manner in which the essential prin-

ciples of my invention may be practically embodied and in which—

Figure 1 is a longitudinal section of the tail end portion of the engine showing the piston, exhaust ports and connections, the tail inlet valve and the adjacent parts; Fig. 2 is a rear elevation of the engine with parts broken away; Fig. 3 is a partial vertical section of the head, inlet valve and adjacent parts of the engine; Fig. 4 is a horizontal section of the same; Fig. 5 is a sectional elevation of the mixing and measuring valves and the air and gas supplies; Fig. 6 is a diagram showing the governing action and the transfer of motion for actuating the mixing and inlet valves, and Fig. 7 is a diagram showing a gas engine power plant organized according to my invention.

In general design the engine here illustrated involves a horizontal cylinder with an inlet port and valves at each end, and exhaust ports at the middle. The piston is double acting and its rod is joined by a cross head and connecting rod to the crank shaft. The scavenging air and fuel mixture are supplied to the inlet valves through mixing and measuring valves actuated from an eccentric on the crank shaft.

As shown best in Fig. 1, 10 indicates the cylinder which has at its center, suction exhaust ports 11 and at each side thereof pressure exhaust ports 12. The ports 11 communicate with a suction pipe or connection 13 while the ports 12 communicate with an annular exhaust chamber 14 from which the exhaust passes to the atmosphere. At each side of the chamber 14 the cylinder is inclosed by jacket sections 15 and 16 rigidly joined to the engine frame and in which the ends of the cylinder are movable to permit expansion and contraction independently of the jacket sections. The double acting piston 17 is connected to its rod 18 as shown and the heads of the piston have cavities 19 therein in the walls of which ports 20 are formed, the arrangement being such that the ports 20 first run into communication with the pressure exhaust ports 12 allowing the pressure in the cylinder to fall to atmosphere and said ports next run into communication with the suction ports 11 allowing the remaining gases to be drawn out and the scavenging air and mixing

charges to be taken into the engine all of which will be hereinafter set forth.

After the scavenging air is drawn through the cylinder the mixture charge enters and the piston then begins to return to compress the charge. On this return movement the ports 20 again register with the pressure exhaust ports 12 but the pressure in the cylinder at this time will not be sufficient to cause any material loss of the mixture. At each end of the cylinder an igniting means, such as a spark plug 21, is located and arranged to fire the charge through one of the ports 20 when the ports reach or approach the position shown at the left hand end of Fig. 1.

The valve housing 23 projects outward and carries a lateral pipe or conduit 28 communicating with the adjacent mixing and measuring valve as will hereinafter fully appear and serving to carry the scavenging air and fuel mixture into the housing 23 from whence it passes to the inlet valve 33 and into the cylinder.

The conduits 28 project out laterally from the valve housings as shown in Figs. 2 and 4 and as shown in Fig. 2, these conduits communicate with the outlets 56 from the mixing or stratifying valve housings 57. Fig. 5 illustrates the mixing and stratifying valves and their adjacent parts. The casings 57 contain ported compartments 58, 59 and 60 intended respectively for the gas, scavenging air and mixture air and supplied respectively by ducts 61, 62 and 63. Of these ducts the ducts 62 and 63 communicate with a common supply 64, which with the gas duct 61 passes upward from the source of supply. Within each housing 57 operates a ported piston valve 65 and these valves are joined by links 66 to a wrist plate 67 which in turn is actuated by a suitable linkage from an eccentric 68 on the crank shaft of the engine (see the diagram Fig. 6). This arrangement is such that the before described suction is exerted through the engine, the valves 65 operate to allow a quantity or stratum of air to pass from the chamber 59 into and through the cylinder to scavenge the same, which is followed by a stratum of combustible mixture the air and gas of which are drawn from the chambers 58 and 60. These valves, therefore, control and direct the sucking action in such a way as to cause it to bring about the movement of successive strata of air and combustible mixture, the air strata passing through the cylinder to scavenge the same and the mixture strata being compressed and ignited in the cylinder in the usual manner. The movement of the air and gas is due solely to the sucking action of the exhaust, no primary compression being necessary.

As shown in Fig. 5, the ducts 61, 62 and 63 have valves 69, 70 and 71 therein. These

may be of any desired form but are preferably of the damper type shown. Of these valves, the valve 69 commands the gas supply and the valve 71 the mixture air supply and these valves are linked together as indicated at 72 so that they will maintain a fixed relation to each other, opening and closing in unison to throttle the combustible mixture without varying the proportions of air and gas therein. The valve 69 at the head end of the engine (the left hand end in Fig. 5) has an arm 73 attached to the stem thereof and this arm is connected in any suitable manner with the governor 74 of the engine (see Fig. 6). In this manner the valves 69 and 71 at the head of the engine are automatically operated, while the corresponding valves at the tail end are actuated in unison with the first valves through the medium of a reach rod 75 articulated to the arm 73 and to a lever 76 which is fastened intermediate its ends to the stem of the tail valve 69. It will thus be seen that the valves 69 and 71 at both ends of the engine are operated synchronously under governor to vary the volume of the charge according to the load on the engine. The scavenging air valves 70 are normally open and are also under control of the governor in such a manner that when the engine is up to speed or momentarily exceeds the same, the movements of the valves 70 is very slight if not nil, while as the engine is running at slow speed as when starting or under overload the valves 70 close suddenly throttling or completely cutting off the scavenging air. As here shown the means for effecting this result consist, for the head valve, in a link 77 joined to the middle portion of arm 73 and to an arm 78 on the stem of the valve and, for the tail valve, in a link 79 joined to the upper end of the lever 76 and to an arm 80 fastened to the stem of the valve.

It will thus appear that all of the valves 69, 70 and 71 are under the governor control and that in this manner the automatic regulation of the engine is effected—the gas and mixture air valves 69 and 71 being arranged to open and close in fixed relation according to the load, and the scavenging air valves 70 being arranged to remain open or practically so at all times except when the engine may for any reason be running slow, at which times the scavenging air valves close quickly cutting off in whole or in part the scavenging air supply. Still further, by thus varying the scavenging air supply the engine may be regulated to suit different speeds of operation, increasing or diminishing the scavenging air supply, so as to insure that the volumes of the strata thereof will at all times bear the proper relation to the volumes of the mixture strata.

In the organization of a gas engine power plant according to my invention, the ar-

rangement is as shown in Fig. 7 in which *a*
 indicates three independent gas engines con-
 structed preferably according to my present
 invention; 13, the suction pipes passing
 5 from the exhaust ports of the engines as
 previously described, *b*, a suction main; and
c a pump, exhauster or other approved
 means for exerting a suction in the main *b*
 and pipes 13. In this manner a single pump
 10 is made to serve the purposes of several in-
 dependent engines. A further advantage is
 that by thus concentrating the pumping side
 of the plant, the various engines may be
 15 placed in different locations removed from
 each other and all operated in connection
 with the common pumping station. From
 this it follows that a plant of any number of
 engines may be operated with a single pump
 which causes the necessary flow of both the
 20 air and gas used in all the engines.

Having thus described the preferred em-
 bodiment of my invention, what I claim as
 new and desire to secure by Letters Patent
 of the United States is:

25 1. The combination of a plurality of in-
 dependent gas engines each having pressure
 and suction exhaust ports, an inlet port and
 valve, a gas and air supply, a mixing and
 stratifying valve at the gas and air supply,
 30 a duct connecting the two valves and means
 for successively opening and closing the
 pressure and suction exhaust ports at the
 exhaust period, and a sucking means com-
 mon to the suction ports of all the engines,
 35 whereby at the exhaust period, the high
 pressure exhaust is vented through the pres-
 sure exhaust port, and as the suction port is
 opened, the residue of the exhaust gases is
 drawn out, and suction is exerted in the air
 40 and gas supply causing the air and gas to
 be formed into alternate strata of scaveng-
 ing air and combustible mixture on their way
 to the inlet valve, a scavenging air stratum
 being drawn into and through the cylinder
 45 and the next following mixture stratum be-
 ing drawn into the cylinder as the working
 charge.

2. The combination of a plurality of in-
 dependent gas engines each having pres-
 50 sure and suction exhaust ports, an inlet port
 and valve, a gas and air supply, a mixing
 and stratifying valve at the gas and air
 supply, a duct connecting the two valves
 and means for successively opening and
 55 closing the pressure and suction exhaust
 ports at the exhaust period, and a sucking
 means common to the suction ports of all
 the engines, whereby at the exhaust period,
 the high pressure exhaust is vented through
 60 the pressure exhaust port, and as the suc-
 tion port is opened, the residue of the ex-
 haust gases is drawn out, and suction is
 exerted in the air and gas supply causing
 the air and gas to be formed into alternate
 65 strata of scavenging air and combustible mix-

ture on their way to the inlet valve, a scav-
 enging air stratum being drawn into and
 through the cylinder and the next follow-
 ing mixture stratum being drawn into the
 cylinder as the working charge, said means
 70 for successively opening and closing the
 pressure and suction ports consisting in the
 working pistons of the engines.

3. The combination of a plurality of in-
 dependent gas engines, each having an inlet
 75 port and valve, a duct leading thereto, a
 mixing and stratifying valve at the receiv-
 ing end of the duct and a gas and air supply
 leading to said valve, said valve serving to
 dispose the air and gas into alternate strata
 80 of scavenging air and mixture of air and
 gas and a sucking means communicating
 with and common to all of said engines and
 serving to draw said air strata into and
 through the engine and said mixture strata
 85 into the engine as the working charge.

4. A double acting gas engine having a
 suction exhaust port at its middle portion
 and a pressure exhaust port on each side
 thereof and a piston arranged to overrun
 90 and control said ports.

5. A double acting gas engine having a
 suction port at its middle portion and a
 pressure exhaust port on each side thereof
 and a piston arranged to overrun said ports
 95 and having in each end a port adapted suc-
 cessively to register with the corresponding
 pressure ports and the suction port.

6. A double acting gas engine having a
 suction port at its middle portion and a
 100 pressure exhaust port on each side thereof
 and a piston arranged to overrun said ports
 and having in each end a port adapted suc-
 cessively to register with the corresponding
 ports and the suction port and an igniting
 105 means at each end of the cylinder, such
 means being adapted to communicate igni-
 tion through the ports in the piston.

7. A gas engine having a gas and air sup-
 ply, a mixing valve to which said supplies
 110 lead, a duct leading from said valve to the
 inlet port of the engine, an inlet valve at
 said port and means for exerting a sucking
 action through the working cylinder, duct
 and mixing valve, said valve disposing the
 115 air and gas into alternate strata of scav-
 enging air and mixture of air and gas and
 the suction causing said strata to flow, the
 air strata into and through the cylinder and
 the mixture strata into the same as the work-
 120 ing charge.

8. A gas engine having a gas and air sup-
 ply, a mixing valve to which said supplies
 lead, a duct leading from said valve to the
 inlet port of the engine, an inlet valve at
 125 said port and means for exerting a sucking
 action through the working cylinder, duct
 and mixing valve, said valve disposing the
 air and gas into alternate strata of scaveng-
 ing air and mixture of air and gas and the
 130

suction causing said strata to flow, the air strata into and through the cylinder and the mixture strata into the same as the working charge and means for automatically varying the volumes of the mixture and air strata in inverse ratio.

9. A gas engine having a gas and air supply, means for disposing the gas and air into alternate strata of scavenging air and mixture of air and gas, and a suction means adapted to draw the scavenging air strata into and through the engine and the mixture strata into and through the engine and the mixture strata into the engine as the working charge and means for controlling the action of the suction means.

10. A gas engine having a gas and air supply, a mixing valve to which said supplies lead, a duct leading from said valve to the inlet port of the engine, an inlet valve at said port and means for exerting a sucking action through the working cylinder, duct and mixing valve, said valve disposing the air and gas into alternate strata of scavenging air and mixture of air and gas and the suction causing said strata to flow, the air strata into and through the cylinder and the mixture strata into the same as the working charge and a working piston serving to control the action of the suction means.

11. A gas engine having a gas supply, a mixture air supply, a scavenging air supply, means for throttling the gas and mixture air supplies as the load on the engine decreases and means for throttling the scavenging air supply as the load on the engine increases.

12. A gas engine having a gas supply, a mixture air supply, a scavenging air supply, means for throttling the gas and mixture air supplies as the load on the engine decreases and means for throttling the scavenging air supply as the load on the engine increases and means communicating with said supplies and with the engine and serving to dispose the air and gas in alternate strata of scavenging air and mixture of air and gas.

13. A gas engine having a gas supply, a mixture air supply, a scavenging air supply, a valve in each of said supplies, a connection between the gas and mixture supply valves to cause them to operate synchronously, a governor in connection with said valves to tend to close them upon increase in the speed of the engine, and a connection between the governor and the scavenging air valve to tend to open it upon increase in the speed of the engine.

14. A gas engine having a gas supply, a mixture air supply, a scavenging air supply, a valve in each of said supplies, a connection between the gas and mixture supply valves to cause them to operate synchronously, a governor in connection with said valves to tend to close them upon increase in the speed of the engine, a connection between the governor and the scavenging air valve to tend to open it upon increase in the speed of the engine, and means communicating with said supplies and with the engine and serving to dispose the air and gas in alternate strata of scavenging air and mixture of air and gas.

15. A gas engine having a gas supply, an air supply, divided into two ducts one for scavenging air and one for mixture air, valves commanding the mixture air duct and gas supply, a valve commanding the scavenging air supply, and means for automatically operating the valves, to throttle the gas and mixture air and open the scavenging air supply as the speed of the engine increases.

16. A gas engine having a gas supply, an air supply, divided into two ducts one for scavenging air and one for mixture air, valves commanding the mixture air duct and gas supply, a valve commanding the scavenging air supply and a governor for automatically operating the scavenging air supply.

17. A gas engine having a gas supply, an air supply, divided into two ducts one for scavenging air and one for mixture air, valves commanding the mixture air duct and gas supply, a valve commanding the scavenging air supply, means for automatically operating the valves to throttle the gas and mixture air and open the scavenging air supply as the speed of the engine increases and means communicating with said supplies and with the engine and serving to dispose the air and gas in alternate strata of scavenging air and mixture of air and gas.

18. A gas engine having a gas supply, an air supply, divided into two ducts one for scavenging air and one for mixture air, valves commanding the mixture air duct and gas supply, a valve commanding the scavenging air supply, a governor for automatically operating the scavenging air supply, and means communicating with said supplies and with the engine and serving to dispose the air and gas in alternate strata of scavenging air and mixture of air and gas.

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