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ENGINE.

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969,221.

Patented Sept. 6, 1910.

4 SHEETS—SHEET 1.

Fig. 1.

Witnesses

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4 SHEETS—SHEET 2.

Fig. 2.

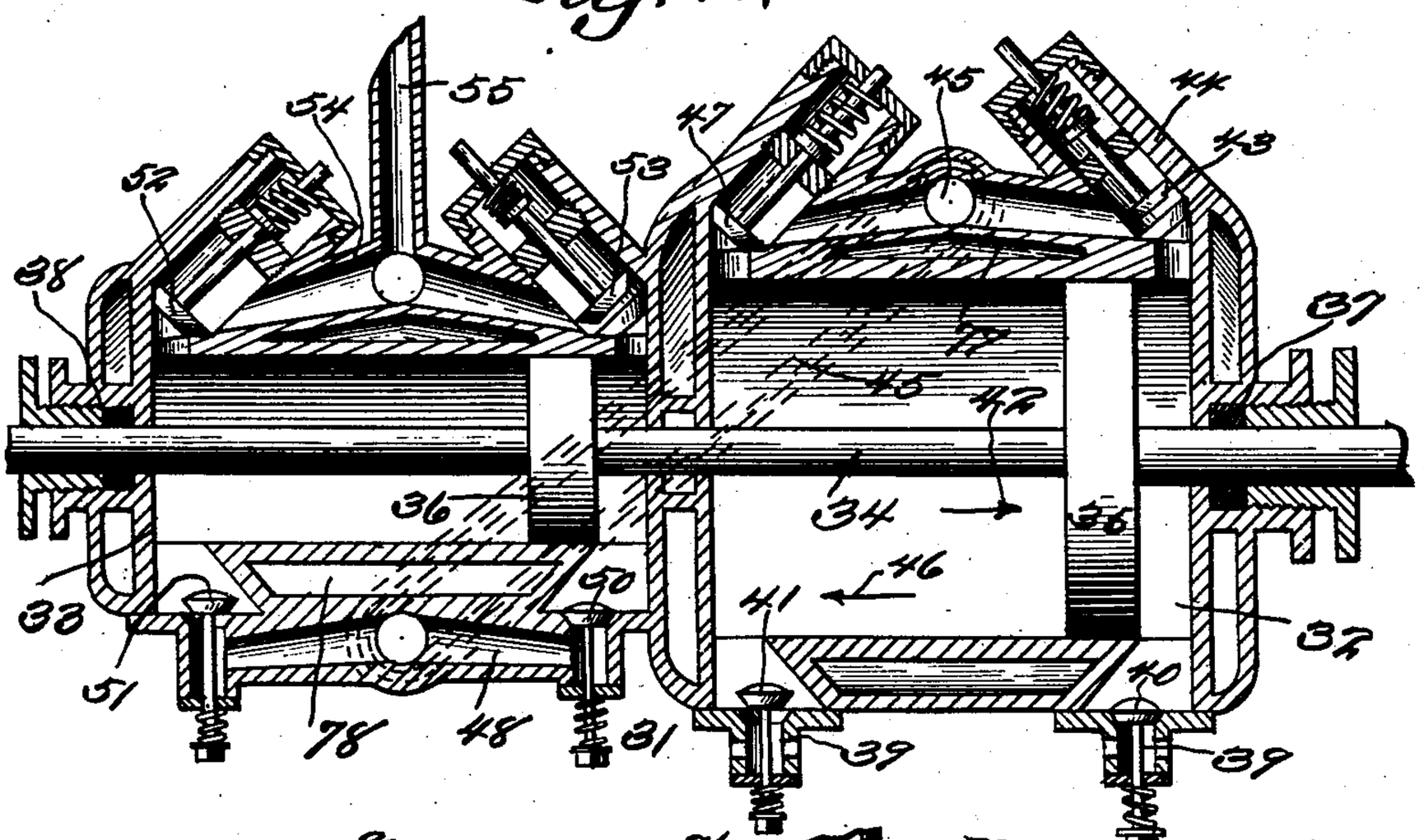
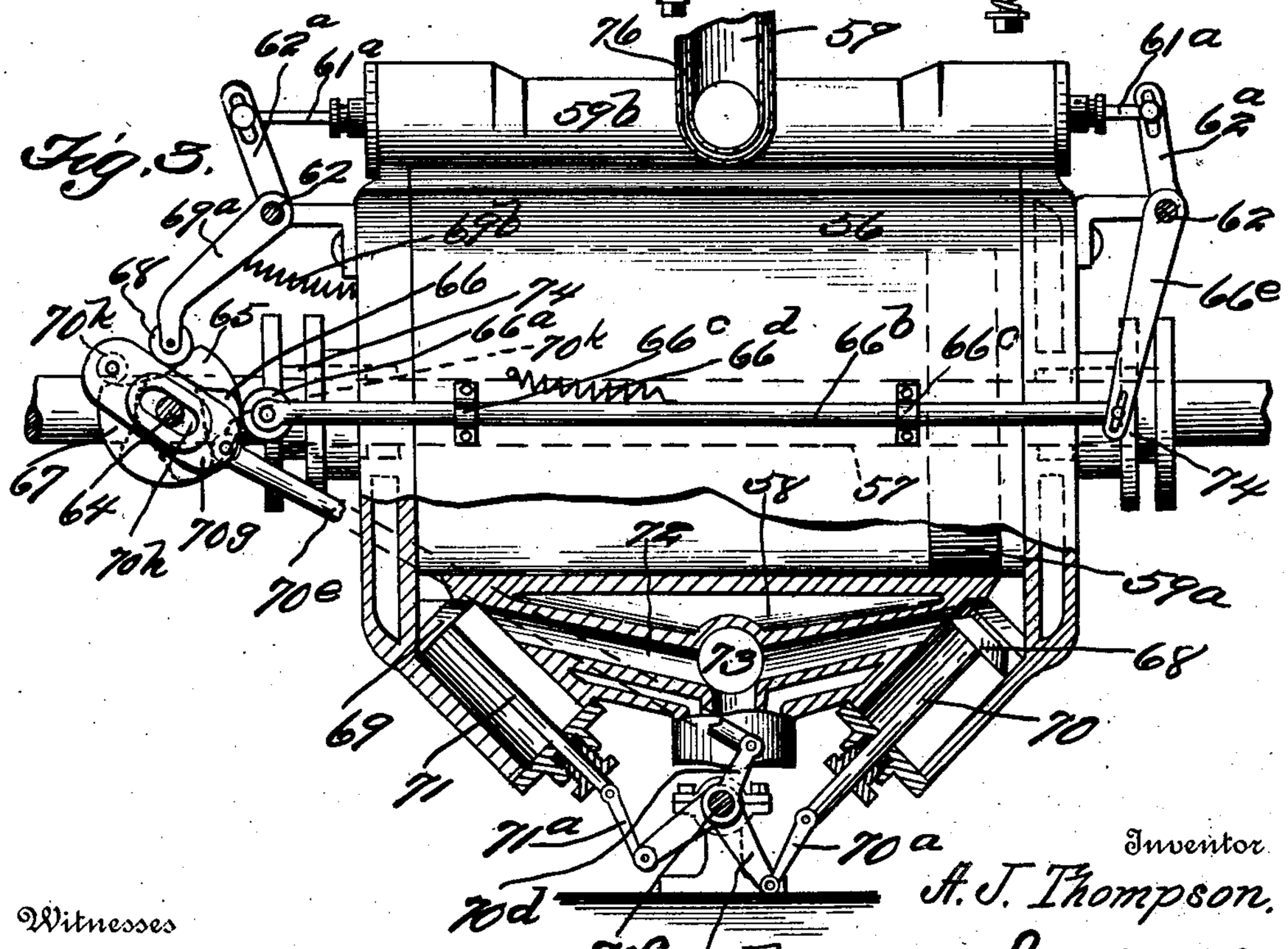


Fig. 3.



Witnesses

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4 SHEETS—SHEET 3.

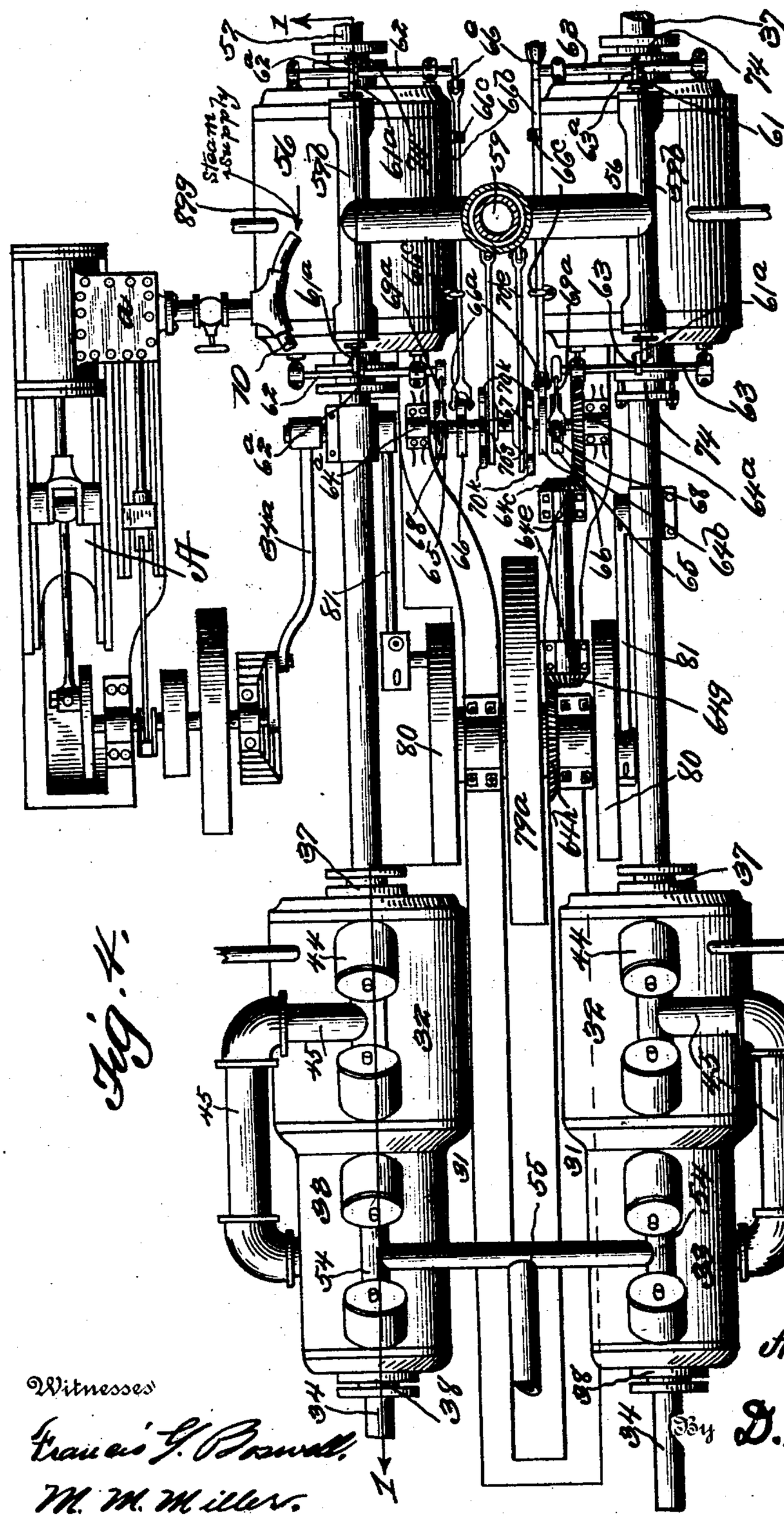

Fig. 4.

Witnesses

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4 SHEETS—SHEET 4.

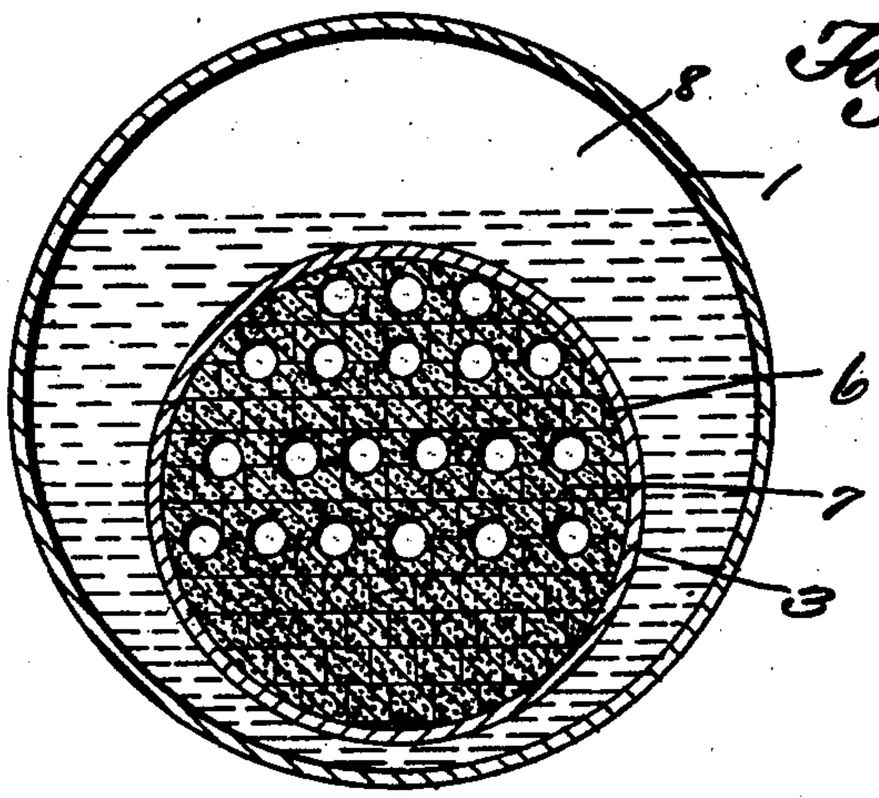
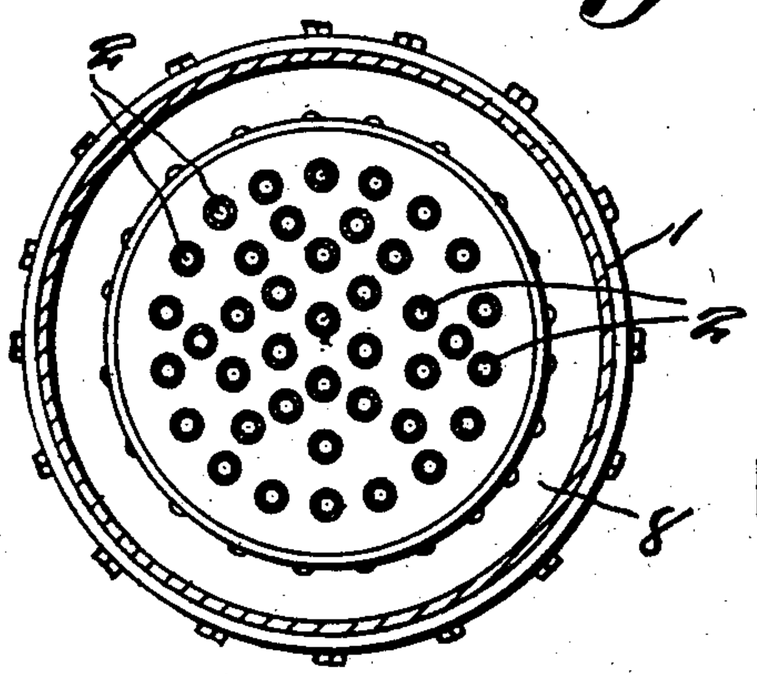


Fig. 5.

Fig. 6.



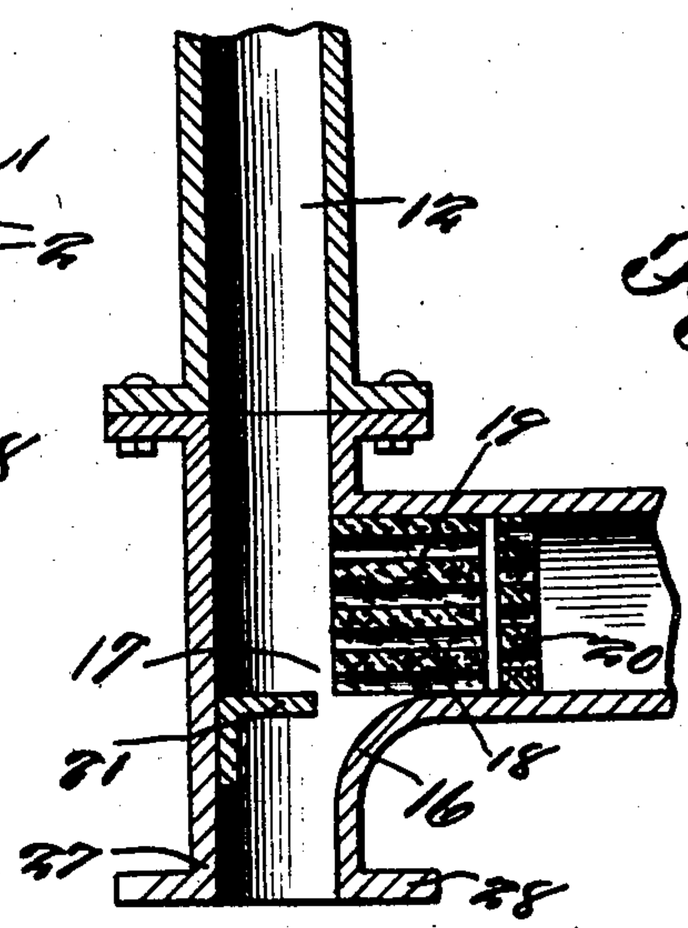


Fig. 7.

Witnesses

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UNITED STATES PATENT OFFICE.

ANDREW J. THOMPSON, OF ANETA, NORTH DAKOTA.

ENGINE.

969,221. Specification of Letters Patent. Patented Sept. 6, 1910.

Application filed February 16, 1910. Serial No. 544,274.

To all whom it may concern:

Be it known that I, ANDREW J. THOMPSON, a citizen of the United States, residing at Aneta, in the county of Nelson and State of North Dakota, have invented a new and useful Engine; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention belongs to the art of gas engines, and pertains especially to a type of engine in which a mixture of air or oxygen and the fumes from oil is employed as fuel, which is projected into a combustion chamber located within a steam boiler, in which combustion chamber the pressure therein is greater than atmospheric pressure, and by the explosion of the fuel, as it is projected into the combustion chamber, the water in the boiler and about the combustion chamber is heated to a great temperature, in order that the steam therefrom may be employed for running an engine, used in conjunction with the present invention, the detail structure of which will be hereinafter thoroughly described.

One of the objects of the invention is to provide an air compressor of a two cylinder type, whereby air may be drawn therein, compressed in a low pressure cylinder, and then ejected into a high pressure cylinder, where it is again compressed and forced or delivered into the air reservoir. From the air reservoir, a certain portion of the air ascends through a pipe or tube to an oil or fuel tank, above the level of the oil, so that the oil may be forced downward to that point where it may be vaporized by air or oxygen from the reservoir, and projected into the combustion chamber, in the form of combustible gases. The fuel used may be crude oil or petroleum, or any other suitable or similar fluid.

Another object of the invention is the provision of means or a power cylinder, into which the products of combustion from the combustion chamber, after passing through the flues of the boiler, are delivered, in order that the piston of the power cylinder may be operated, which, in turn, operates the air compressor, through the medium of the rod connection. As hereinbefore stated, an engine of the steam type is utilized in conjunction with the rod of the power cylinder and the air compressor, in order to assist in the thorough operation of those parts; said engine of the steam type, as shown, receives its supply of steam from the steam boiler of the gas engine, there being a suitable water supply for said steam boiler, and also an oil supply for the fuel tank.

In this specification and the annexed drawings, a particular design of device is adhered to, but the invention is not to be confined to this specific design.

The device in its actual reduction to practice may necessitate changes and variations, the right thereto belongs to the applicant, provided such changes and variations are comprehended by the appended claims.

To obtain a full and correct understanding of the details of construction, attention is directed to the accompanying drawings, the structure therein being described by this specification, and in which drawings—

Figure 1 is a vertical sectional view through the gas engine, showing the interior structure of the boiler, the combustion chamber, and the power cylinder and air compressor; in this figure an engine of the steam type is shown in connection with the gas engine. Fig. 2 is an enlarged sectional detail view through the air compressor. Fig. 3 is an enlarged sectional view through the power cylinder, which, in Fig. 1, is shown as coupled in conjunction with the air compressor, receiving the products of combustion from the combustion chamber. Fig. 4 is a top plan view of the gas engine, showing the various operating parts in elevation, and further illustrating the engine A coupled therewith. Fig. 5 is a sectional view upon line 5—5 of Fig. 1, showing the construction and location of the flues of the boiler. Fig. 6 is an enlarged detail view, showing the connections between the fuel tank, the air reservoir and the rear portion of the steam boiler. Fig. 7 is an enlarged detail view of the elbow connection 16, between the pipe 12, the pipe 15 and the flanged pipe 24, showing the deflector plate 21, and the perforated block or partition 18 (which consists of the two parts 19 and 20).

Referring more essentially to the detailed structure of the gas engine, 1 represents a steam boiler, which may be of any desired form, and is provided with a plurality of heating tubes 2. Located upon the interior of the boiler casing is an inner casing 3, consisting of two sections 4 and 5, between which sections the heating tubes are con-

nected. The section of the inner casing, for instance the greater part thereof, is utilized as a combustion chamber 6, in which is located a partition or section or body, which becomes incandescent under the heat of the flame or under the heat from the combustion of the gases. This partition, section or body 7 may be of various forms and materials, but in the drawings it is shown as being made or constructed of fire clay or brick or the like. As this partition, section or body becomes incandescent, after the gas engine is under way, the fuel or gases as they enter the combustion chamber are easily and readily united. Between the inner and outer casings of the boiler, a water space 8 is provided, which receives its supply from any suitable source, for instance as shown at 9. Leading from the outer casing of the boiler is a steam pipe 10, which communicates and connects with the steam chest *a* of the engine A, in order that the evaporation of the water in the boiler may be used for furnishing power to the engine A.

11 represents the oil fuel tank, from which a pipe 12 extends, and to the upper portion of which an air supply pipe 13 connects, in order that air may be supplied above the level of the oil or fuel, in order that the oil or fuel may be forced through the pipe 12. This air supply pipe 13 extends from and communicates with the air reservoir 14. Extending upwardly from the reservoir 14 is a short pipe 15, to which is coupled the elbow connection 16, which forms communication between the combustion chamber, the air reservoir, and the pipe 12. This elbow connection 16 is provided with a mixing chamber 17, in which is located a perforated block or partition 18, consisting of two parts 19 and 20, the purpose of which is to allow the combined fumes or gases from the oil and the air or oxygen to mix and pass therethrough, but the part 20 of said block or partition prevents the flames in the combustion chamber from reaching the mixing chamber in the elbow connection 16. Projecting laterally from one of the walls of the mixing chamber 17 is a deflector plate 21, against which the oil as it flows through the pipe 12 contacts, which action breaks or sprays the oil into small particles, in order that the incoming air under high pressure may easily spray and mix with the same in order to form the proper combustible gases, which extend or are projected into the combustion chamber. The end 22 of the elbow connection 16 is flanged at 23 and is connected to a flanged pipe 24, which is threaded into a plate 25 of the boiler. This plate 25 is located between the inner and outer casings of the boiler, and between it and the said casings is suitable packing 26, there being suitable bolts for holding the plate in position. The end 27 of the elbow connection 16 is also flanged, as at 28, and is bolted to a flanged portion 29 of the pipe 15, and at this junction, and preferably located in a portion of the pipe 15 is a check valve 30, which prevents back pressure of the gases or the combined fumes from the oil and air or oxygen from entering the air reservoir.

31 represents an air compressor, comprising a low pressure cylinder and a high pressure cylinder 32 and 33. Extending through the cylinders is a piston rod 34, at two locations thereon pistons 35 and 36 are arranged. The piston 35 operates in the low pressure cylinder, while the piston 36 operates in the high pressure cylinder. These low pressure and high pressure cylinders are provided with suitable packing glands 37 and 38, through which the piston rod 34 extends. The low pressure cylinder is provided with two air inlets 39, which are controlled by spring-tensioned valves 40 and 41, which valves alternately open and close. In other words, as the piston 35 moves in the direction of the arrow 42, the valve 41 is opened, in order to draw a supply of air, and the air in front of the piston 35, when the same is in the position shown in Fig. 1, closes the valve 40 and opens the spring-tensioned valve 43, (which is located in the casing 44), and by the opening of the valve 43, the air in front of the piston 35 is forced into said casing 44 and through the pipe 45. When the piston 35 is operating in the reverse direction, or in the direction of the arrow 46, a similar cycle of operations is accomplished, but with one exception, and that is, the valve 47 is opened, as well as the valve 40, and the valve 41 is closed. When the valve 47 is opened, the air passing thereby is also forced into the casing 44, and through the pipe 45.

The pipe 45 communicates with the casing 48, of the high pressure cylinder 33. The high pressure cylinder 33 is similar in construction to the cylinder 32, there being similarly operated valves, designated by the numerals 50, 51, 52 and 53, all of which are spring-tensioned, as well as the valves 40, 41, 43 and 47. The operations of the parts of the cylinder 33 are similar to those of the cylinder 32, but with the exception that the air as it reaches the casing 54, is delivered or forced through a pipe 55 and into the air reservoir 14, under extreme high pressure. The cylinder 33 is smaller in diameter than the cylinder 32, therefore, when the air reaches the cylinder 33, the same is considerably more compressed.

56 designates the means or power cylinder (the piston rod 57 of which is coupled with the piston rod 34 of the air compressor), and furnished power for the air compressor. This means or power cylinder 56 is provided with the usual water jacket 58, and connected with the power cylinder

is a pipe 59, which communicates with the inner casing, or rather the interior of the inner casing, of the steam boiler, forward of the heating tubes, so that as the products of combustion from the combustion chamber, emanate from the heating flues may reach the means or power cylinder 56, and in rear or in front of the piston 59[a] (which piston 59[a] is carried by the piston rod 57.) The products of combustion pass through the pipe 59 with sufficient force to reach the chamber 59[b] between the valves 60 and 61 (which alternately open or close by means of the rocking shafts 62 and 63.) These rocking shafts are provided with upwardly extending arms 62[a] and 63[a], which are connected with the valve rods 61[a]. To operate the rocking shafts or rods 62 and 63, a shaft 64 is provided. This shaft 64 is mounted in suitable bearings 64[a] of the base of the apparatus. To transmit power to the shaft 64[a], the same is provided with a beveled gearing 64[b], which is in mesh with the beveled pinion 64[c]. This pinion 64[c] is rotatable with the shaft 64[d] (which is mounted in bearings 64[e]). The shaft 64[d] is provided with a beveled pinion 64[g], which is in mesh with a beveled gear 64[h] (which is rotatable with the shaft 79.)

Mounted upon the shaft 79 is a suitable fly wheel 79[a] and two disks 80, which are connected by pitman rods 81, to the piston rods 34, clearly shown in Fig. 4 of the drawings. One of the piston rods 34 is connected by a pitman rod 34[a] to the engine A, in order to assist the piston rods 34 in their operations, and, therefore, assist the power cylinders in their operations. The shaft 64[b] is provided with a plurality of cams, there being six in number, three to operate the various valves of one power cylinder, while there are three more to operate the valves of the opposite power cylinder. These cams are designated by the characters 65, 66 and 67. The cams 65 are engaged by anti-frictional members 68, which are carried by the oscillating arms 69[a]. These arms 69[a] are mounted to move with the rods or shafts 62 and 63, which operate the valves 60. It will be noted that as the shaft 64 rotates, the cams 65 also revolve, which raise and lower the arms 69[a]. By this operation, the valves are opened and closed. The arms 96[a] are raised against the tension of the springs 69[b], and upon the reaction of the springs the arms are lowered. The cams 66 are engaged by the frictional members 66[a], which are carried by the rods 66[b]. These rods 66[b] are slidable in guides 66[c], and are spring-tensioned by means of the spring 66[d]. The ends of the rods 66[b], opposite the ends carrying the frictional members 66[a] are connected to the arms 66[e]. These arms are movable with the other two rocking shafts 62 and 63, as shown clearly in Figs. 3 and 4. It will be clearly noted that the various valves of the upper portion of the power cylinder are alternately operated by the above described mechanism.

To operate the exhaust valves 68 and 69, the rods 70 and 71 are connected by the links 70[a] and 71[a], which are connected to the arms 70[b] of the rocking shafts 70[c]. Movable with the rocking shaft 70[c] are arms 70[d], and connected to these arms are rods 70[e]. These rods 70[e] are provided with enlargements 70[g], having slots 70[h], through which the shaft 64 extends. These enlargements are disposed adjacent the cams 67, and mounted upon stud shafts of these enlargements are anti-frictional rollers 70[k], which ride about the periphery of the said cams, in order to impart a reciprocating motion to the rods 70[e], so as to rock the shaft 70[c]. These rods 70[e] alternate in their movements, for instance, as one of the rods is moving rearwardly and downwardly, the opposing rod is moving forwardly and upwardly. As the valves 68 and 69 are operated, an exhaust of the products of combustion is readily had through the casing 72 and pipe 73.

The portions of the power cylinder through which the piston rod 57 passes, are provided with packing glands 74 and 75, in order to prevent the escape of the product of combustion. The pipe 59 is provided with a water jacket 76, which water jacket 76 and the water jacket 58 are designed for the purpose of cooling the products of combustion as they reach the power cylinder. The high and low pressure cylinders of the air compressor are also provided with water jackets 77 and 78, which keep the air which is drawn therein at a cool temperature.

The water jackets of the power cylinder and the air compressor are provided with pipe connections 83 and 84 with the water supply tank 9, as shown clearly in Fig. 1, there being a suitable connection 83[a] between these pipe connections and the steam boiler. The connection or pipe 84 is provided with a check-valve 87, which closes automatically when the supply is cut off by the valve 89. The connection between the water supply and the steam boiler is provided with a valve 89[a], the purpose of which is to cut off the water supply from the steam boiler when it is so desired.

If at any time it is forgotten to shut off the valves 89 and 89[a], and the water flows continually until it backs against the check valve, the back pressure of the water will close the said check-valve. As air is taken in through the intakes below the pressure cylinders of the air compressor, the same is compressed and forced into the high compressor cylinder, where it is again considerably compressed. As the air is compressed in the high compress cylinder, it is forced into the reservoir. The piston rods and

pistons are operated through the medium of the power cylinder, and are also assisted in their operations by means of the engine A (which receives its generation of steam from any suitable source not shown, as indicated at 89ᵉ.) This engine A also receives its generation of steam from the steam boiler.

By forcing a high pressure of air into the reservoir, a certain portion thereof passes through the pipe 13, but the greater portion thereof passes through the check-valve in the pipe 15 into the mixing chamber 17, where it thoroughly mixes with and vaporizes the supply of oil from the pipe 12, at the point where the perforated block or partition 18 is arranged. The certain amount of air which goes through the pipe 13 enters the oil or fuel tank 11 above the level of the oil or fuel, and causes the oil or fuel to flow through the pipe 12, and when the supply of oil reaches a point adjacent the perforated block or partition 18, it strikes the deflector 21, where it is broken into particles of infinitesimal size. These small particles are easily and readily vaporized, and when the fumes are thoroughly mixed with the air, a high explosive mixture is produced, which is projected into the combustion chamber, and as this mixture reaches the partition, section or body 7 (which becomes incandescent from the heat of the flames), is ignited. After this explosive mixture is ignited, the products of combustion therefrom are conveyed through the heating flues of the steam boiler, and conducted through the pipe 59 and to the power cylinder 56, where it is utilized for operating the piston 59ᵃ, the piston rod of which, in turn, operates or assists in operating the compressor. From the combustion of this explosive mixture, an intense or extreme heat is produced, which, together with the products of combustion traveling through the heating flues, heats the water in the water space sufficiently to generate the proper amount of steam, whereby the engine A may be supplied with a supply of steam. The pressure, as hereinbefore stated, within the combustion chamber is considerably greater than atmospheric pressure, and by this great pressure, sufficient power is produced, in order to properly manipulate the piston 59ᵃ.

Having thus fully set forth the invention, what is claimed as new and useful is:—

1. In a gas engine of the type set forth, a steam boiler having an inner and an outer casing provided with heating flues, said inner casing having a combustion chamber provided with a partition of material designed to become incandescent, in combination with an air reservoir and an oil fuel tank, a mixing chamber for the air and the fumes from the oil having a deflector for breaking the oil into small particles, means for compressing and forcing air into the reservoir, and means for operating said last-named means.

2. In a gas engine of the type set forth, a steam boiler having an inner and an outer casing provided with heating flues, said inner casing having a combustion chamber provided with a partition of material designed to become incandescent, in combination with an air reservoir and an oil fuel tank, a mixing chamber for the air and the fumes from the oil having a deflector for breaking the oil into small particles, an air compressor for compressing and forcing air into the air reservoir, and means for operating the air compressor.

3. In a gas engine of the type set forth, a steam boiler having an inner and an outer casing provided with heating flues, said inner casing having a combustion chamber provided with a partition of material designed to become incandescent, in combination with an air reservoir and an oil fuel tank, a mixing chamber for the air and the fumes from the oil having a deflector for breaking the oil into small particles, an air compressor for compressing and forcing air into the air reservoir, a power cylinder for furnishing power to the air compressor, and means for assisting the power cylinder and the air compressor in their operations.

4. In a gas engine of the type set forth, a steam boiler having an inner and an outer casing provided with heating flues, said inner casing having a combustion chamber provided with a partition of material designed to become incandescent, in combination with an air reservoir and an oil fuel tank, a mixing chamber for the air and the fumes from the oil having a deflector for breaking the oil into small particles, an air compressor for compressing and forcing air into the air reservoir comprising a low compressor cylinder and a high compressor cylinder having an external pipe connection therebetween to convey the air compressed by the low compressor cylinder into the high compressor cylinder, and means for operating the air compressor.

5. In the gas engine of the type set forth, a steam boiler having an inner and an outer casing provided with heating flues, said inner casing having a combustion chamber provided with a partition of material designed to become incandescent, in combination with an air reservoir and an oil fuel tank, a mixing chamber for the air and the fumes from the oil having a deflector for breaking the oil into small particles, an air compressor for compressing and forcing air into the air reservoir comprising a low compressor cylinder and a high compressor cylinder having an external pipe connection therebetween to convey the air compressed by the low compressor cylinder into the high compressor cylinder, a power cylinder for

furnishing power to the air compressor, and means for assisting the power cylinder and the air compressor in their operations.

6. In a gas engine of the type set forth, an oil fuel tank, an air reservoir to receive air under high pressure, a mixing chamber intermediately arranged between the tank and the reservoir having a deflector plate positioned horizontally therein to break the oil in small particles and provided with a perforated block or partition consisting of two parts, one of which is to prevent the flames in the combustion chamber from reaching the mixing chamber, a steam boiler having a water space and provided with a combustion chamber to receive the combined fumes from the oil and the air, said combustion chamber having means becoming incandescent from the flames in the combustion chamber for igniting the explosive mixture, said steam boiler having heating flues forward of the combustion chamber, means for forcing and compressing air into the reservoir, a power cylinder for receiving the products of combustion through the flues whereby said compressing and forcing means may be operated, and means receiving steam power from the boiler for assisting said power cylinder and said compressing and forcing means in their operations.

7. In a gas engine of the type set forth, an oil fuel tank, an air reservoir to receive air under high pressure, a mixing chamber intermediately arranged between the tank and the reservoir having a deflector plate positioned horizontally therein to break the oil in small particles and provided with a perforated block or partition consisting of two parts, one of which is to prevent the flames in the combustion chamber from reaching the mixing chamber, a steam boiler having a water space and provided with a combustion chamber to receive the combined fumes from the oil and the air, said combustion chamber having means becoming incandescent from the flames in the combustion chamber for igniting the explosive mixture, said steam boiler having heating flues forward of the combustion chamber, an air compressor for compressing and forcing air into the reservoir comprising a low compressor cylinder and a high compressor cylinder having an external pipe connection therebetween to convey the air compressed by the lower compressor cylinder into the high compressor cylinder, a power cylinder for receiving the products of combustion through the flues whereby said compressing and forcing means may be operated, and means receiving steam power from the boiler for assisting said power cylinder and said compressing and forcing means in their operations.

8. In a gas engine of the type set forth, a steam boiler, comprising an inner and an outer casing and having a water space therebetween, said inner casing comprising two sections having located therebetween a plurality of heating flues, said inner casing having a combustion chamber in the rear of the heating flues having means becoming incandescent from the heat of the flames in the combustion chamber, means for mixing and projecting an explosive mixture into the combustion chamber.

9. In a gas engine of the type set forth, a steam boiler, comprising an inner and an outer casing and having a water space therebetween, said inner casing comprising two sections having located therebetween a plurality of heating flues, said inner casing having a combustion chamber in the rear of the heating flues having means becoming incandescent from the heat of the flames in the combustion chamber, in combination with an oil fuel tank and air reservoir having a mixing chamber arranged intermediately thereof, an air compressor for forcing and compressing air into the reservoir, a power cylinder to receive the products of combustion from the combustion chamber through the flues, and means for receiving the generation of steam from the boiler to assist the power cylinder and the air compressor in their operations.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ANDREW J. THOMPSON.

Witnesses:

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