(No Model.)

4 Sheets—Sheet 1.

D. D. HOBBS.

GAS ENGINE.

No. 506,817. Patented Oct. 17, 1893.

Fig 1

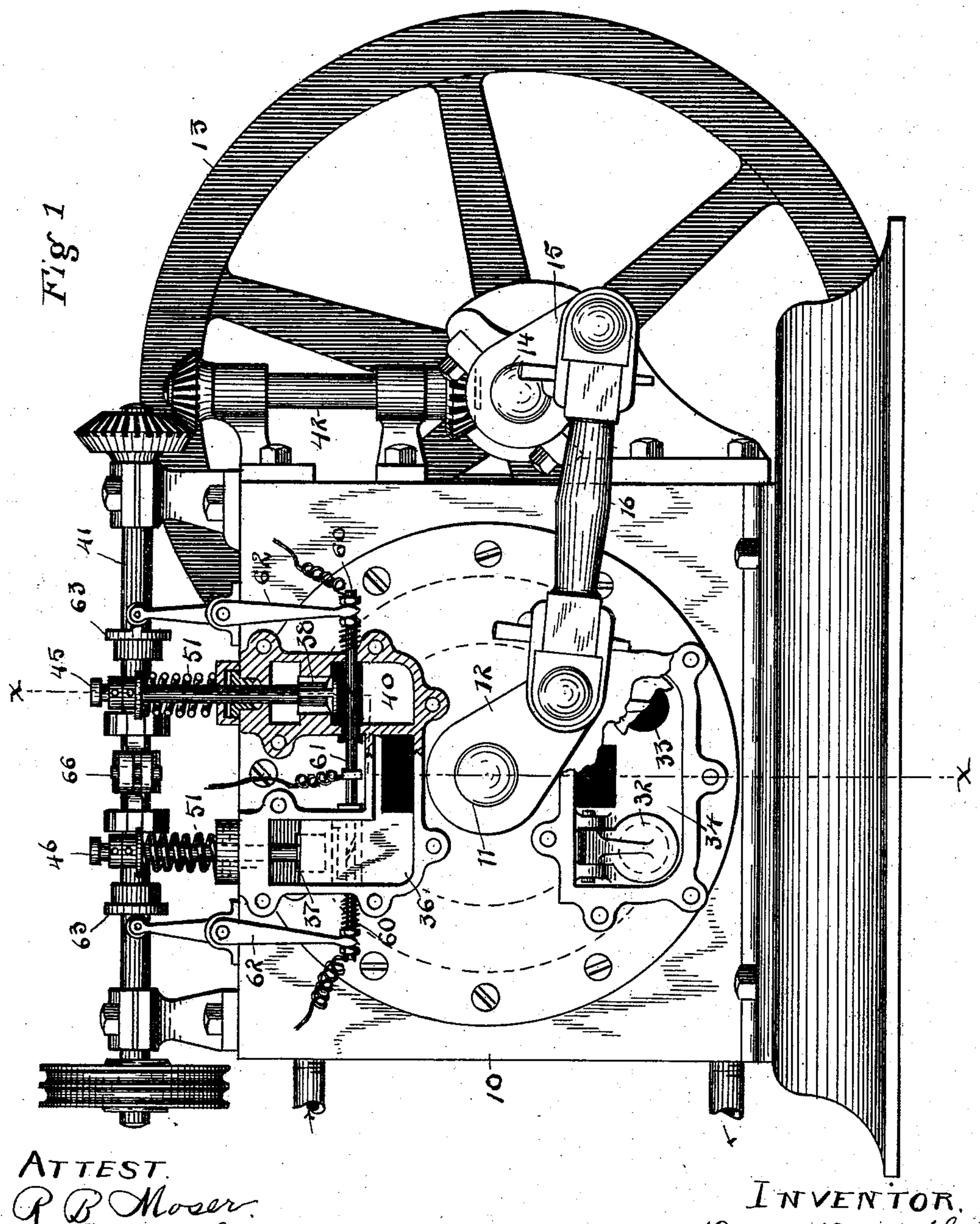

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Fig 2

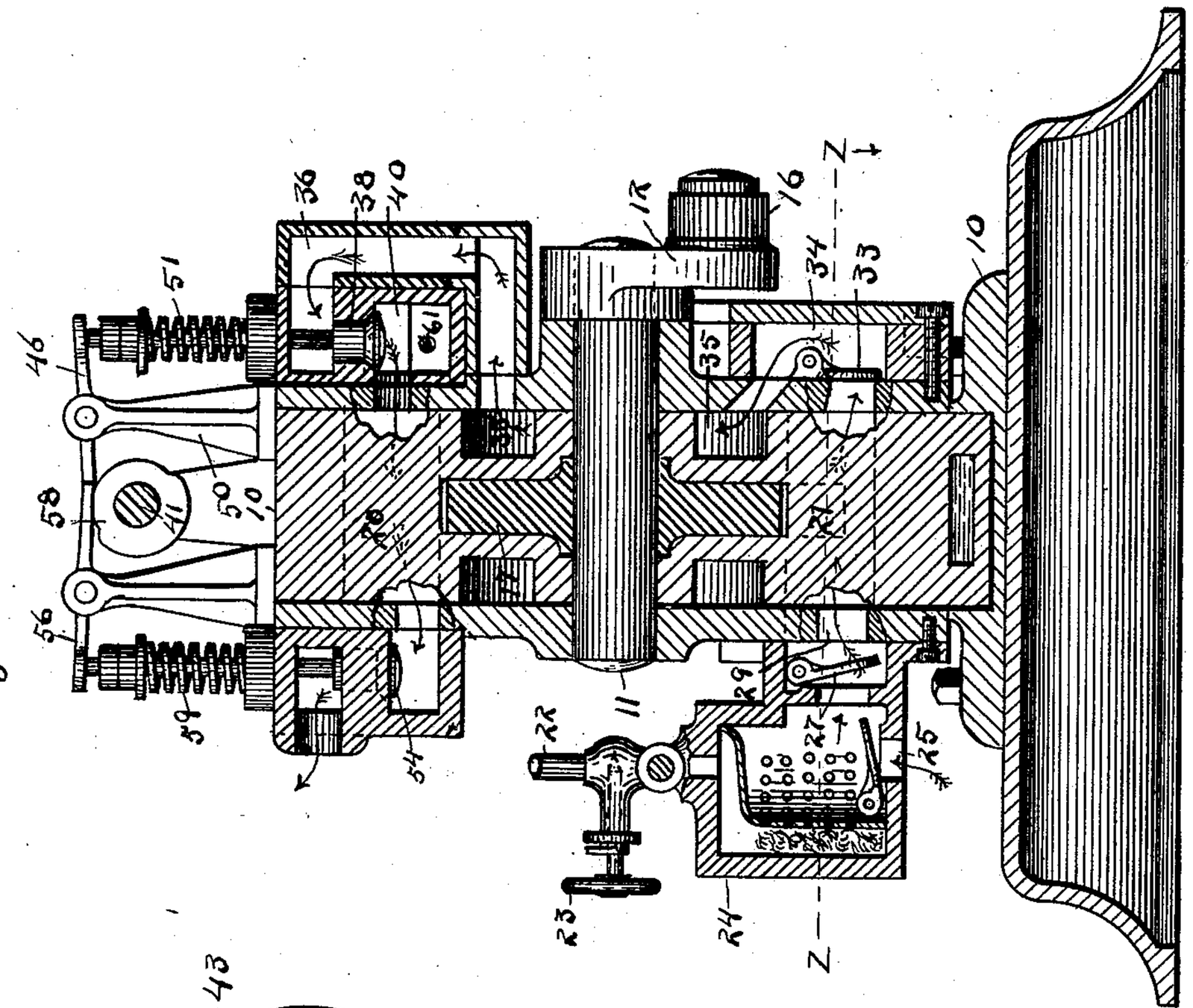


Fig 6

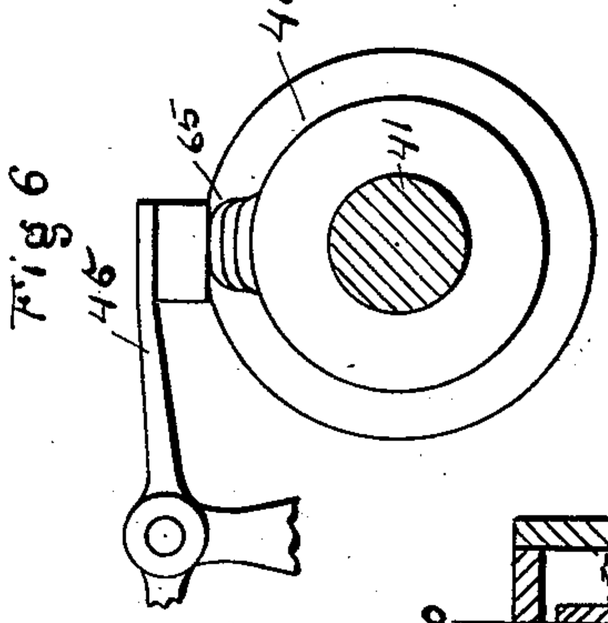


Fig 7

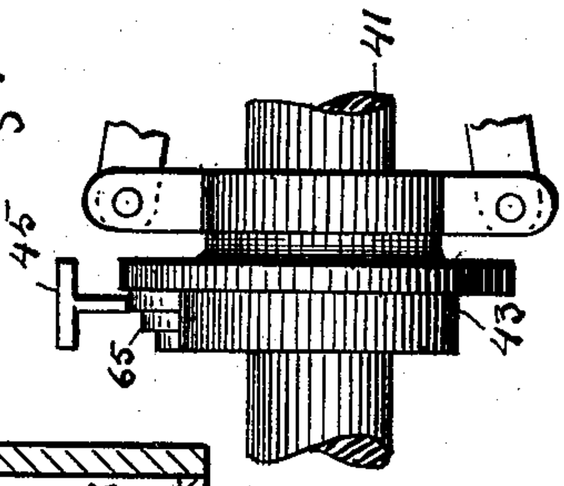
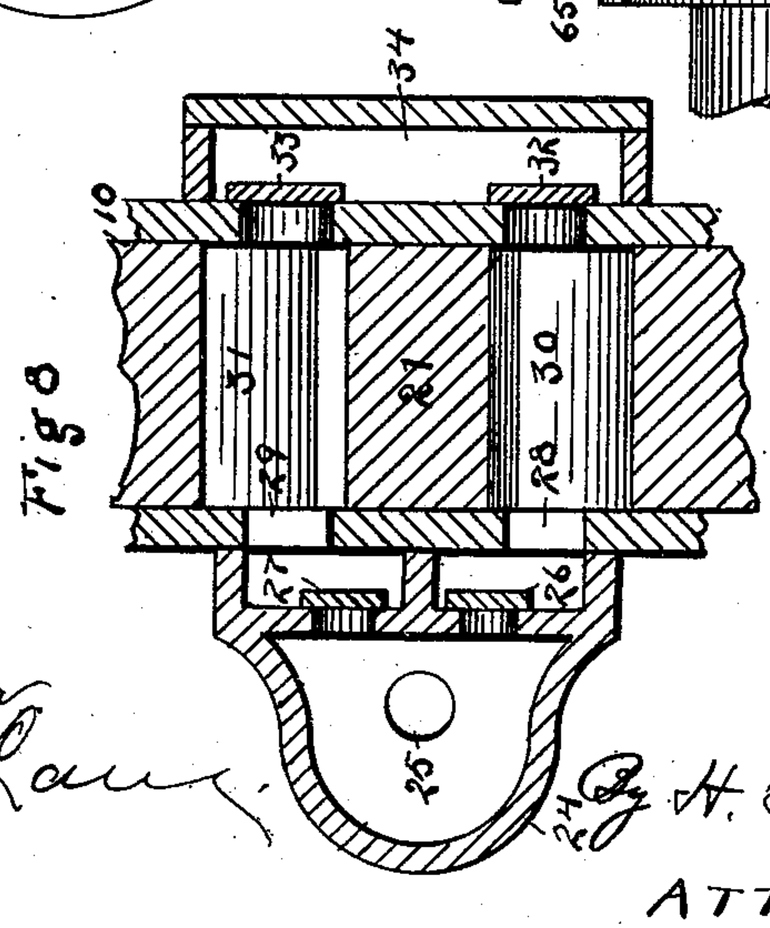


Fig 8



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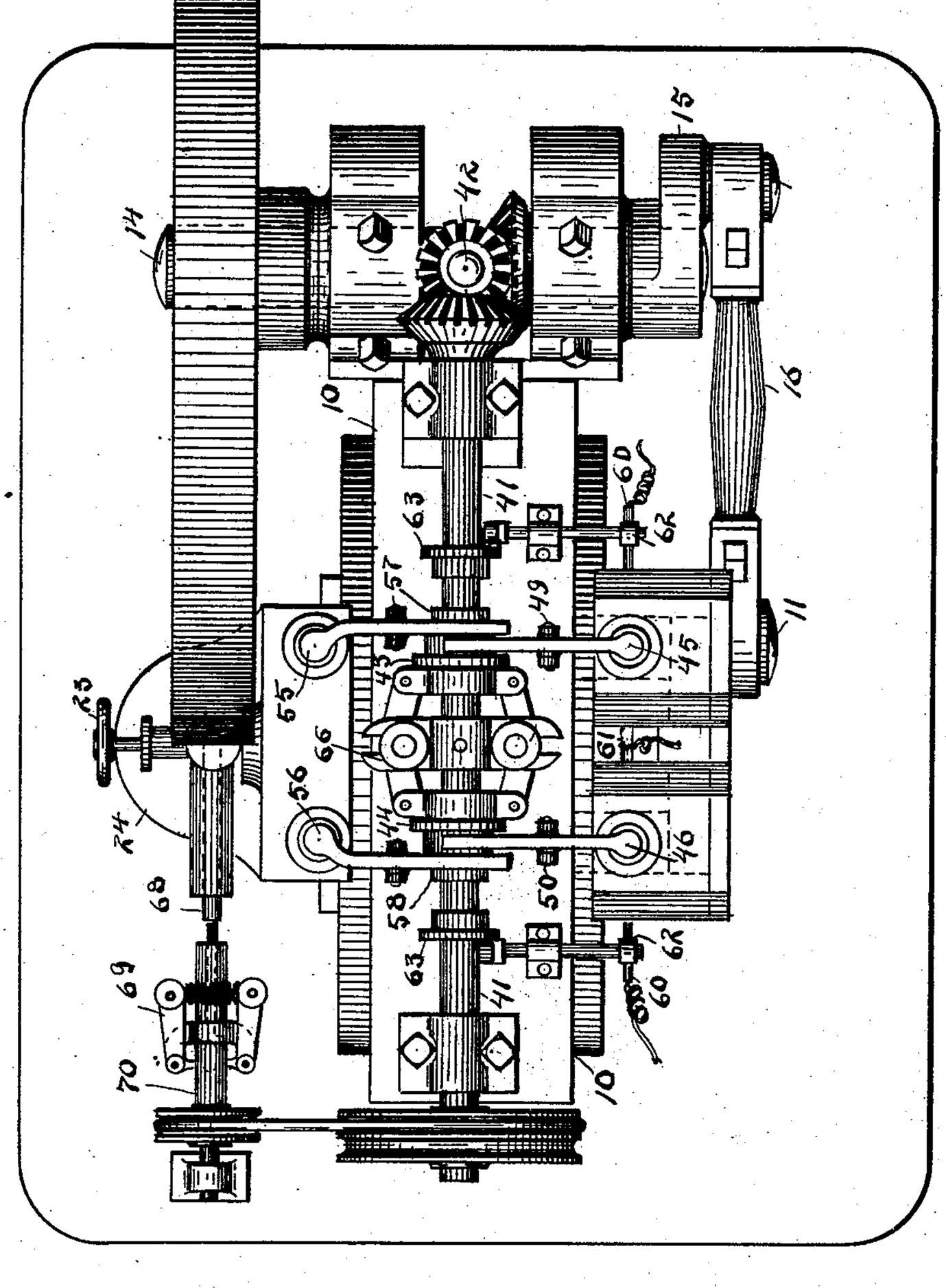
No. 506,817. Patented Oct. 17, 1893.

Fig 3



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GAS ENGINE.

No. 506,817. Patented Oct. 17, 1893.

Fig 4.

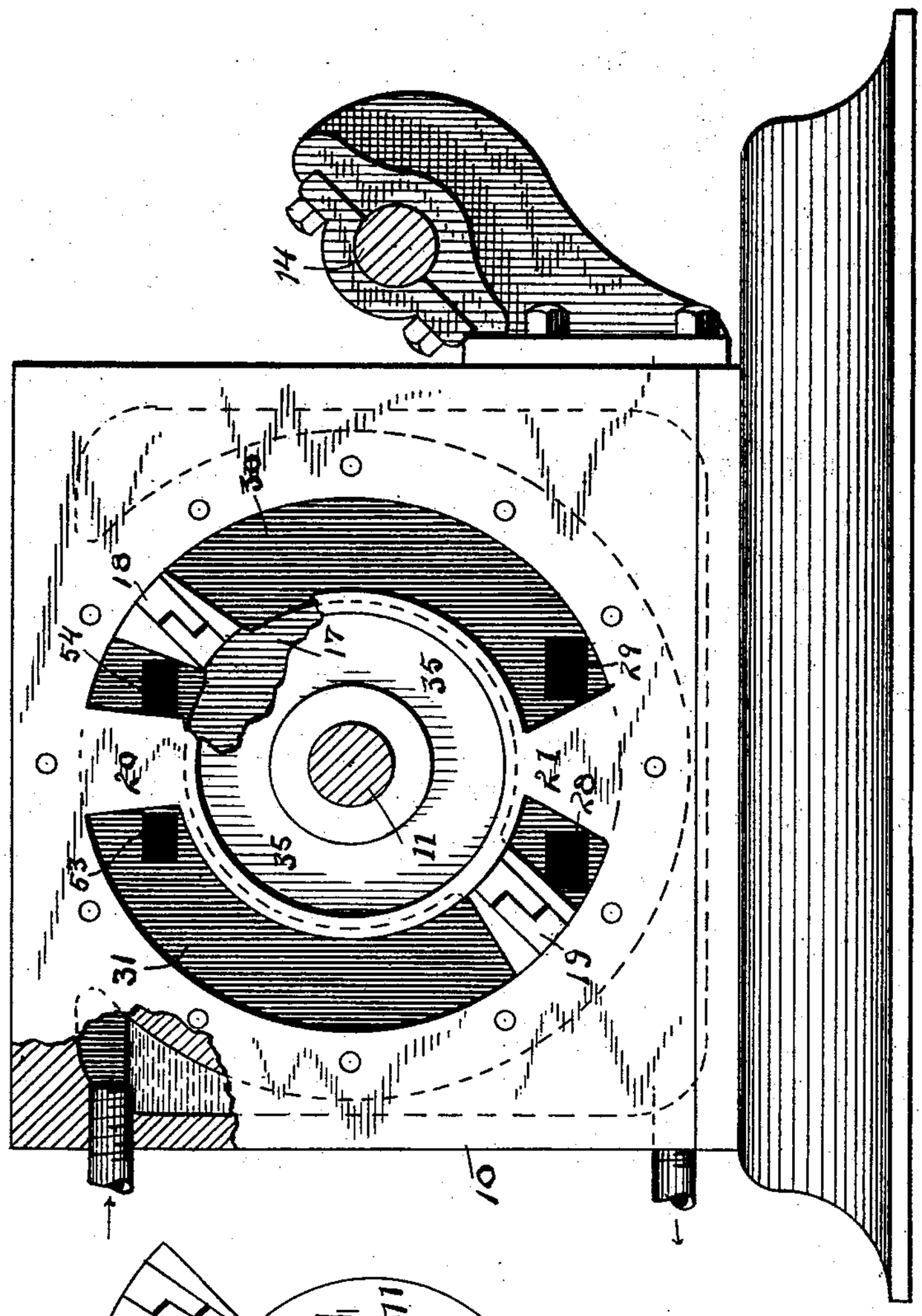
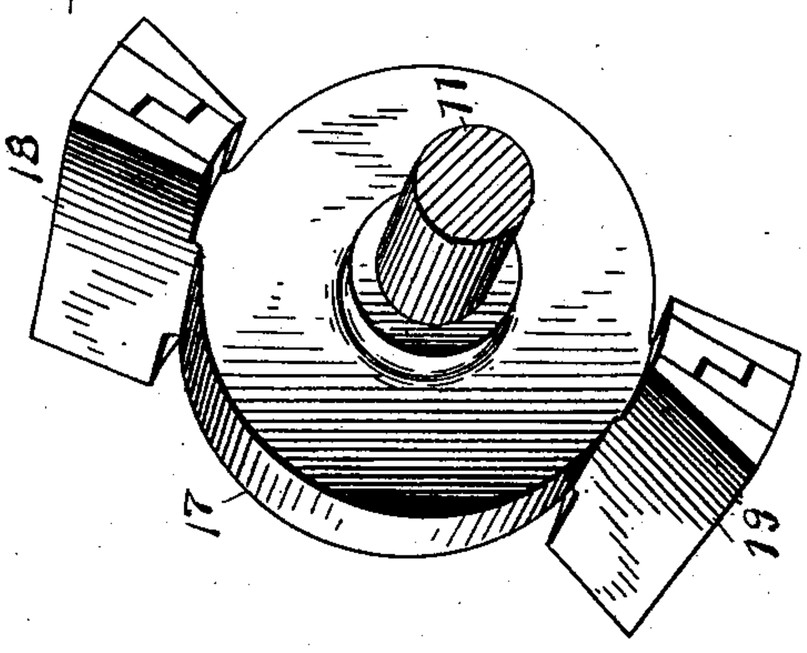


Fig 5



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UNITED STATES PATENT OFFICE.

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GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 506,817, dated October 17, 1893.

Application filed June 24, 1892. Serial No. 437,815. (No model.)

To all whom it may concern:

Be it known that I, DAVIS D. HOBBS, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Gas-Engines; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to gas engines, and the object of this invention is to provide a gas engine in which a semi-rotary, double-acting, reversible movement of the piston is obtained. To this end the piston is adapted to rotate or vibrate within certain limits, the limits being about half a complete circle, or thereabout, which however is sufficient to carry the crank of the fly wheel shaft over the center so as to give a complete and continuous rotation to said shaft. The said piston is double acting in that it is constructed to impart the power of two explosions with each and every complete rotation of the fly wheel, or one explosion to every half rotation of said wheel, and this occurs each time after the crank of the fly wheel shaft has passed the dead center to about the position, relatively shown in Fig. 1. The piston is reversible in that it swings from its center and is adapted to vibrate back and forth within fixed limits and does not make a complete rotation.

The invention therefore consists in a gas engine constructed and operating, substantially as described and particularly pointed out in the claims.

In the accompanying drawings Figure 1 is a side elevation of my improved engine, and showing some of the parts broken away or sectioned as hereinafter more fully described. Fig. 2 is a vertical transverse section on line *x*, *x*, Fig. 1. Fig. 3 is a plan view of my improved engine. Fig. 4 is a cross section corresponding to line *y*, *y*, Fig. 2, the side of the piston chamber or casing being removed so as to disclose the piston therein. In this view the passages below are the inlet passages from the mixing chamber, and those above are the exhaust passages. Fig. 5 is a perspective view of the piston alone, showing a section of the shaft on which it is supported and the opposite wings against which the explosions come. Figs. 6 and 7 are details showing the valve operating governor mechanism in different positions as hereinafter fully described. Fig. 8 is a horizontal section on line *z*, *z*, Fig. 2.

The casing containing the piston is denoted by 10, and the piston shaft by 11, having a fixed crank 12. A fly wheel, 13, is mounted on a power shaft 14, on which is a crank 15 connected by a pitman, 16, with the crank 12 of the piston shaft. The piston in itself is shown most clearly in Fig. 5, where it will be seen that the main portion or body 17 is fashioned substantially like a heavy disk, or hub and is rigidly affixed to the shaft 11 by a spline or wedge or otherwise, and at opposite points on its periphery are wings, 18 and 19, which extend laterally on both sides of the central portion 17, as clearly seen in Figs. 2 and 5, to give a wide surface for the action of the explosions. The main casing 10 is contracted so as to fit somewhat snugly about the sides of the body 17 of the piston, as shown in Fig. 2, and is expanded or enlarged immediately upon the outside of this body portion to adapt it to the operation of the wings 18 and 19. The two piston chambers in which the said piston wings operate are segmental in form, and lie respectively on opposite sides of the abutments 20 and 21, as seen in Fig. 4, and which abutments are at the limit of the strokes of the said piston wings respectively. That is to say, the limit of rotation or vibration of the piston upon its shaft, with its opposite wings, is within these two abutments, and the said wings act between these abutments respectively, and each of course in its own particular chamber. These abutments come at the points where the wings stop in their rotation, and these stopping points are determined by the position of the crank 15 on the fly wheel shaft. When said crank has passed the dead center at one side, the said wings are almost in touch with the abutments, but on opposite sides thereof, and when the said crank has passed the dead center at the opposite side, the said wings will hold an opposite position in respect to the said abutments. It is designed that the said wings shall ap-

proach very near to the abutments so that there will be little space between said parts when the dead center of the crank 15 has been reached, and then when the opposite dead center is reached the said wings approach to a like position on the opposite sides of said abutments. The crank 15 of course in the mean time continues to make its rotations while the wings are thus playing back and forth between the abutments 20 and 21, and thus the semi-rotary movement of the piston is converted into a continuous rotary movement of the fly wheel or power shaft, from which shaft the power is taken.

Now, in order that the engine may operate on the double-acting principle hereinbefore referred to, so that two explosions will be made available for each complete rotation of the power shaft, I provide a suitable inlet pipe, 22, for the gasoline or naphtha or other hydrocarbon fluid, from which the gas or vapor is derived. This pipe has a suitable controlling valve 23, and discharges into a mixing chamber, 24. In this chamber I have evaporating surfaces such as perforated plates, wire gauze, or the like, over which the fluid spreads and is vaporized, and an inlet air valve, 25, is provided for this chamber.

Both of the chambers in which the piston wings 18 and 19 operate, derive their supply of mixed air and gas from the same mixing chamber, and the line of travel of the gas, as this mixture may properly be termed,—is as follows: First, it passes through the inlet valves 26 or 27 according as one wing or the other creates suction reaching back to its corresponding inlet valve, and, having passed these valves, the gas flows through passages 28 and 29 into the piston chambers. That is, the valve 26 and its passages 28 open, say, into the chamber 30, and the valve 27 and its passage 29 open into chamber 31. These openings or passages 28 and 29, are into the chamber behind the pistons or wings 18 and 19, and hence out of reach of the explosions which occur on the other side of said wings. It follows also that when a wing leaves its inlet passages there is suction of gas into the chamber to fill the vacuum, and it follows also that on the return stroke of the piston or wing under the effect of the explosion on the other side, the gas thus drawn in behind said wing is forced out under pressure through its corresponding outlet valve 32 or 33, Fig. 1. Behind these valves is a chamber, 34, common to both and constructed to receive the compressed gas forced out of chambers 30 and 31 by the wings 18 and 19, as above described. From this chamber 34 the compressed gas flows through annular passage 35 to the inlet chamber 36, arranged at one side of the upper part of casing 10, and here are two inlet valves, 37 and 38, one for each piston chamber 30 and 31. Before or beneath each of these inlet valves is an ignition chamber, 40, one of these ignition chambers communicating with piston chamber 30, the other with chamber 31, and each ignition chamber provided with an electrical make and break contact lighting device, as hereinafter described.

The valves 37 and 38 are operated mechanically from the valve controlling shaft 41, Fig. 3, arranged across the top of the main casing and driven by upright shaft 42 and intervening gears from the power shaft 14.

Upon shaft 41 are two cam sleeves, 43 and 44, one for each of the valves 37 and 38, and levers 45 and 46 are connected with the top of the valve stems at one end. Said levers near their middle are pivoted on posts 49 and 50, and the valve stems work in guides and have springs, 51, by which the valves 37 and 38 are normally held up against their seats and kept closed. The cam sleeves 43 and 44 are for the purpose of opening said valves to admit gas to the ignition and thence to the piston chambers, and, are so arranged on the shaft 41 that each will act at exactly the right time and for the requisite period. The inlet ports from the igniting chambers 40 are directly opposite the exhaust ports shown in Fig. 4, and when the piston wing 18 is in the relation to said ports shown in said Fig. 4, and the cranks and operating mechanism are in position shown in Fig. 1, the inlet valve 38, or the one corresponding to piston 18 is supposed to have just been momentarily opened by the operation of its lever and cam, and a sufficient amount of gas admitted to produce the desired explosion. The instant this has occurred the valve is again automatically closed, and in the next moment a corresponding operation occurs with valve 37 and its actuating mechanism. These operations go on successively and regularly, and every part is so constructed and arranged that it does its work exactly at the right time and in the right way.

When one piston wing is under pressure from an explosion, at one side, it is driving gas before it at the opposite side, the burning gas being separated from the unexploded gas by the body of the piston itself, working gas tight in its casing. The gas is driven in this way to the inlet chamber, as has been explained. At the same time the other piston is drawing in gas behind it and moving to position to receive an explosion itself, and the two explosions occur during a single revolution of the power shaft and at certain predetermined points so as to make each explosion most effective. One side or face of each piston thus acts alternately as a pump to draw in gas from the mixing chamber and to expel it toward the ignition chamber, and the other sides or faces of both pistons are operated on alternately by the pressure of ignited gas.

On the opposite side of the casing from the inlet valves 37 and 38, are the exhaust valves 53 and 54. These valves are arranged in suitable chambers immediately on the outside of the main casing, and have pivoted levers 55 and 56, operated by cams 57 and 58 on the

valve shaft 41, like the valves 37 and 38. The cams 57 and 58 are constructed and arranged to open their corresponding valves as the respective piston wings are on the return stroke, so that the piston chambers are thus clearly exhausted after each explosion, and springs 59, close said valves when not acted upon by the said cams.

The igniting mechanism consists in this instance of two carbon or other suitable points, 60 and 61, extending into the igniting chambers, and each of the outer points provided with levers 62, actuated from a sleeve or collar 63 on the valve shaft, said collar having a projection at one side to engage the lever and press it momentarily outward. When this occurs the points 60 and 61 make contact and a spark is produced which ignites the gas and explosion occurs as designed. Both the movable points are spring pressed to keep them normally out of touch with the co-operating point, and both are actuated in like manner.

Referring again to the cam sleeves 43 and 44, Figs. 6 and 7, it will be seen that the cams 65 on the said sleeves are in series, stepped, or graduated in elevation, and the said sleeves are adapted to slide on the shaft 41 subject to the action of the governor 66 intermediate of the said sleeves and connected pivotally to both of them. As the speed of the engine rises and the said sleeves are drawn inward by the governor, the lower cam surfaces are brought beneath the valve controlling levers and the valves are moved less, and there is less inflow of gas than when the higher cam surface is in working position. The graduation may be varied in this way to meet any condition, and the feed or supply of gas kept wholly subject to the governor.

In Fig. 3 I show mechanism for automatically controlling the inflow of the liquid fuel through the pipe 22. Said supply pipe 22 is described as having a valve, 23, for governing the supply of gasoline and naphtha or other oil, and beneath this valve is a needle valve, 68, which is controlled by a governor 69 supported on a suitable small shaft 70 and operated by a pulley and cord on the valve shaft 41. If the speed of the engine should run very high the governor 69 would operate upon the valve 68 and diminish the inflow of liquid. If the speed were slow, a reverse action would occur and the valve 68 open so as to admit a liberal supply of liquid. In this way there is a double control effected upon the supply of gas to the engine, and it is therefore kept perfectly under control, and by means of its own mechanism and without the aid of the engineer or other operator to see that the speed is properly governed.

It is obvious that the details of the mechanism shown and described need not be followed closely in every particular to keep within the spirit and scope of the invention, but that said mechanism can be more or less varied and still be substantially the equivalent of what is shown and claimed. Nor do I wish to be considered as restricted to two gas explosion chambers in the main casing and two piston wings, because I could employ four or more on the same principle. I could also arrange two or more engines constructed on this principle to operate with a single power shaft, so that the accumulated power of all the engines would be applied to said shaft.

Any suitable gas may be used with this engine.

It will be noticed that when one piston wing has swung to the limit of its movement under the impulse of an explosion, the other wing is carried up in position to take an explosion, and thus the two wings alternate and the crank 12 is swung first in one direction under one impulse, and then in the other direction under the other impulse while crank 15 is making one complete revolution.

I show ordinary cranks 12 and 14 and connecting pitman 16, but eccentrics or their equivalent may be used, and when I employ the word "crank" herein, I mean to cover such equivalent constructions.

Suitable water jackets are provided about the piston chambers to keep the engine cool.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a gas engine a single chamber constituting the source of gas supply, a plurality of passages therefrom, each provided with a check valve, and each leading to a separate piston chamber, connected pistons each in its own chamber, and conduits leading away from the chambers at the same side of the piston as the inlets and leading to ignition chambers communicating with the piston chambers at opposite sides of the pistons, and means for igniting the gas in the ignition chambers, all combined substantially as described.

2. In a gas engine, a central hub or disk supported on a shaft, wings projecting radially and longitudinally from said hub into segmental chambers at each side thereof, said chambers being separated from each other and from forming a complete annulus by suitable abutments, gas ignition conduits communicating with each piston chamber at one side only of its piston, and driving means connecting the hub shaft to a rotary shaft, all combined substantially as described.

3. In a gas engine, the piston disk having pistons projecting from each side thereof, and extending lengthwise beyond the hub, a segmental chamber for each piston extending nearly to the other piston chamber but separated therefrom by an abutment, each piston chamber having an independent ignition chamber and gas supply therefor, and a crank connected to the piston disk and directly connected by a pitman with crank of nearly similar length on the rotary power shaft, whereby one reciprocation of the pistons in their cyl-

inders produces one rotation of the power shaft, all combined substantially as described.

4. In a gas engine, the piston hub and its projecting wings, the segmental piston chambers into which said wings project, the single supply chamber having valved openings to both piston chambers, the conduits from both piston chambers to the inlet chambers, and separate ignition chambers having valved communication with the inlet chamber and the piston chamber, all substantially as described.

5. In a gas engine, the casing having segmental piston chambers at each side of a central hub chamber, the hub in its chamber having wings projecting into the piston chambers, the supply pipe communicating to both the piston chambers by valved openings, the conduits in the casing leading from the same side of the pistons as the supply and thence to the inlet chambers, and valved ignition chambers communicating with said inlet chambers and with the piston chambers, all substantially as described.

6. In a gas engine, the combination with moving parts of the machine of a rotating governor and connections therefrom controlling the gas inlet supply valves, and a separate rotating governor having connections controlling the supply at a point some distance behind the inlet valves, substantially as described.

7. In a gas engine, the main casing having piston chambers and a mixing chamber common to said piston chambers, valved passages into and out of said chambers from the mixing chamber to the compressed gas chambers 34 and 36, and a passage from the chamber 34 to the chamber 36, in combination with a piston having wings working in each of said piston chambers, substantially as described.

Witness my hand to the foregoing specification this 15th day of June, 1892.

DAVIS D. HOBBS.

Witnesses:
H. T. FISHER,
NELLIE L. MCLANE.