D. H. BENNETT.

GAS ENGINE.

APPLICATION FILED DEC. 30, 1906.

948,950.

Patented Feb. 8, 1910.

4 SHEETS—SHEET 1.

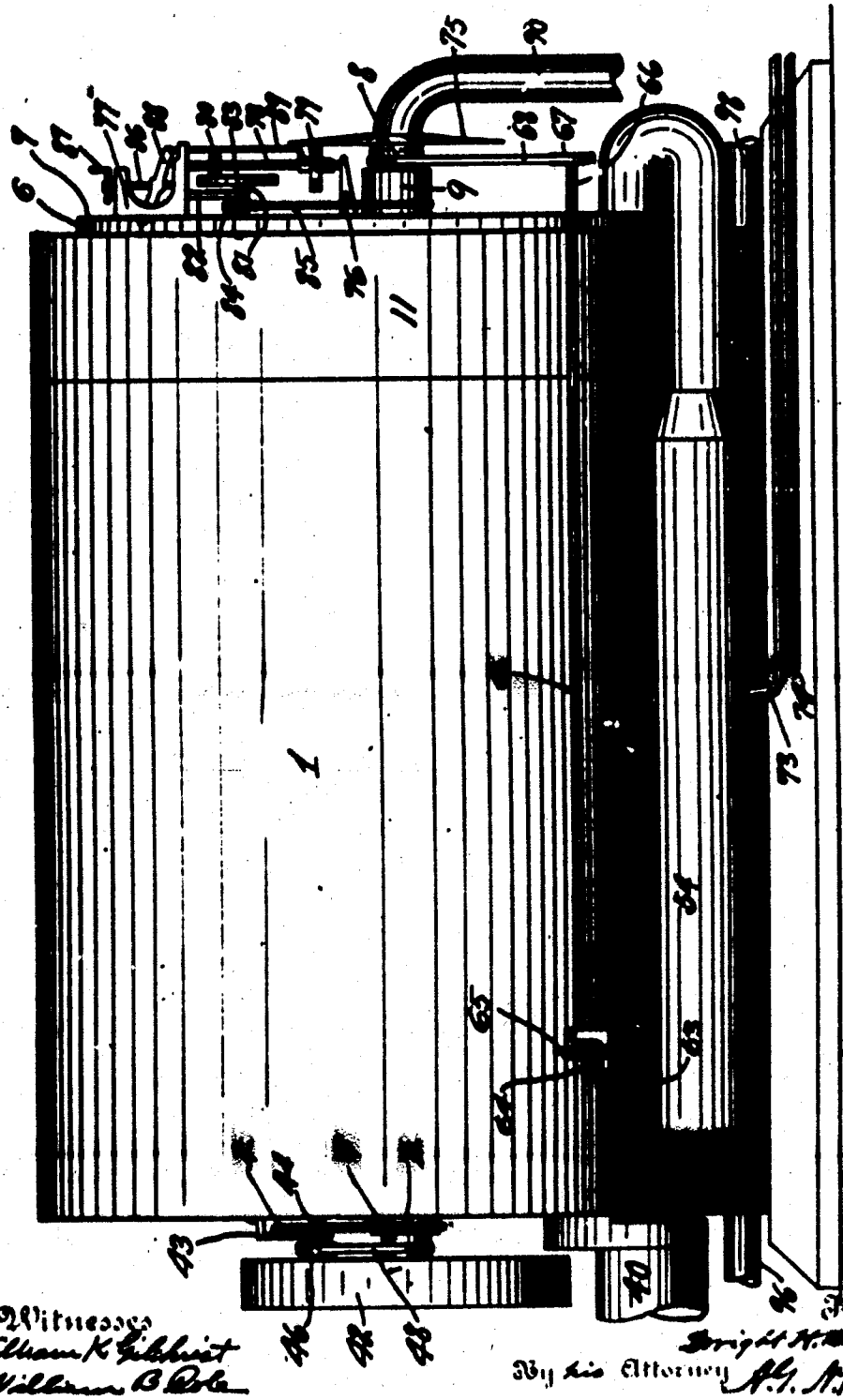

FIG. 1

Witnesses
William K. Gilbert
William B. Potter

Inventor
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By his Attorney A. G. Mumby

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4 SHEETS—SHEET 2.

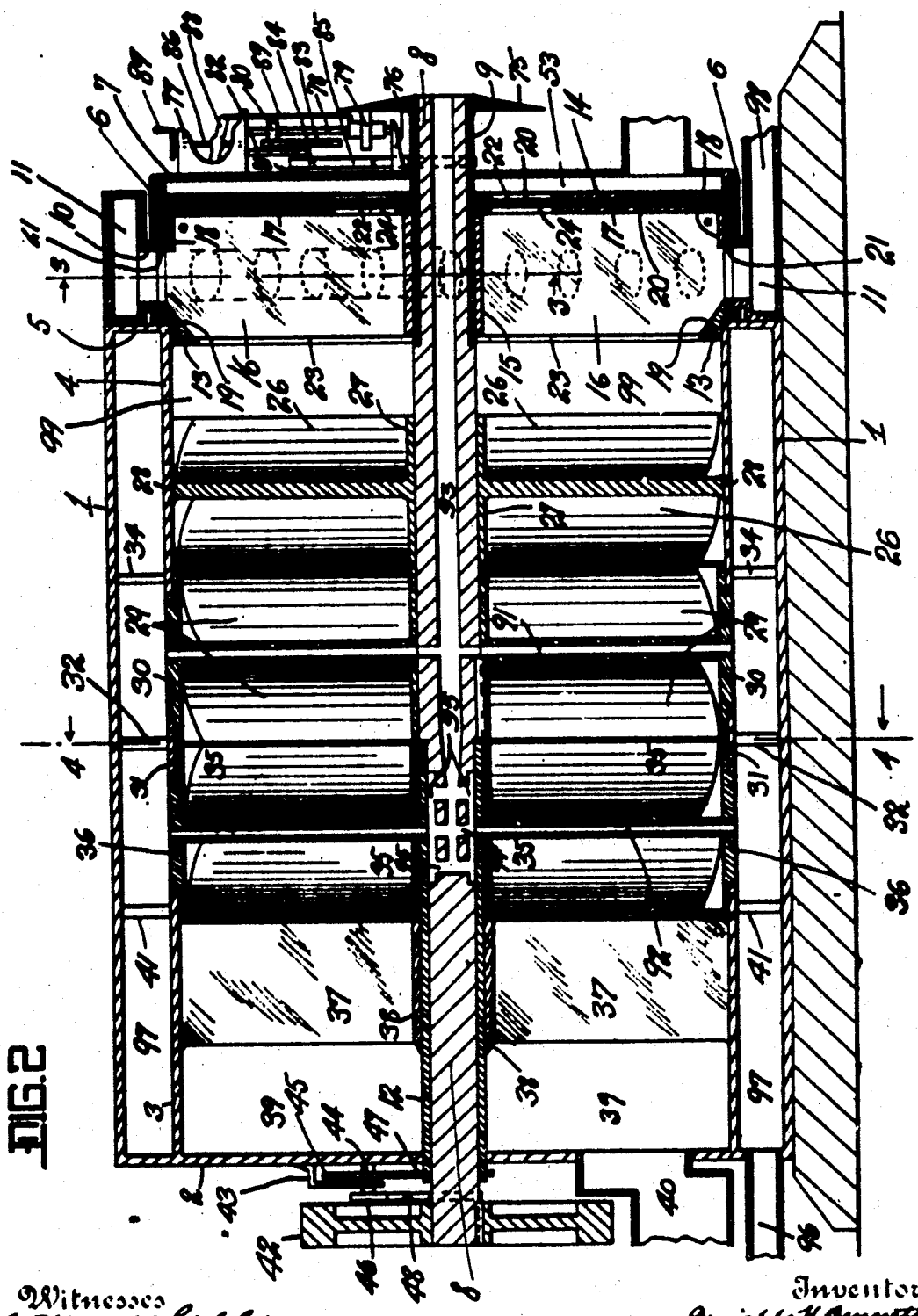

FIG. 2

Witnesses
William K. Gilchrist
William B. Cole

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D. H. BENNETT.

GAS ENGINE.

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4 SHEETS—SHEET 3.

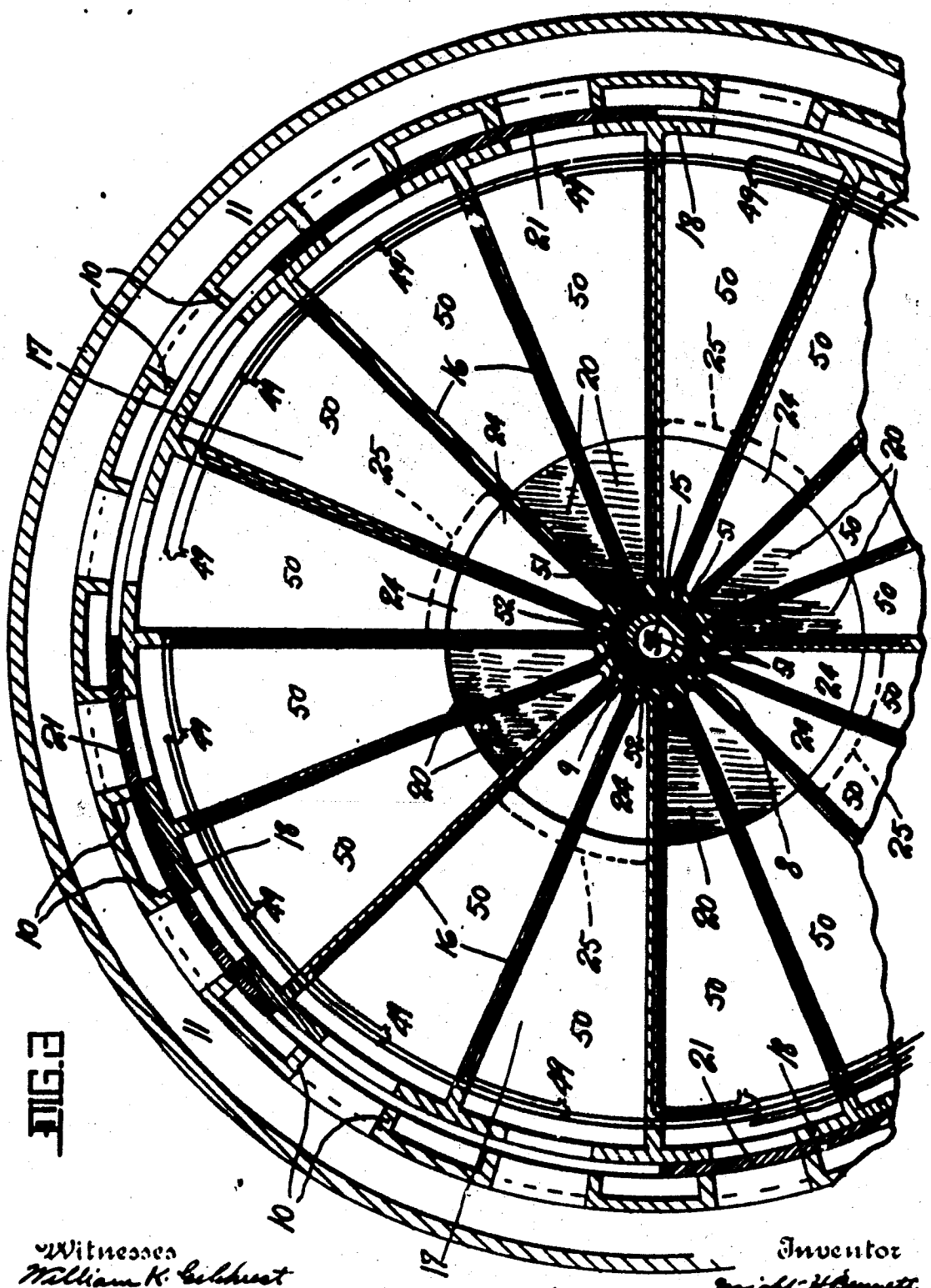

FIG. 3

Witnesses
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D. H. BENNETT.

GAS ENGINE.

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948,950.

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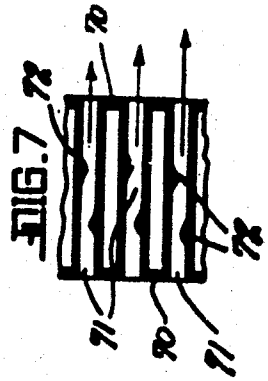
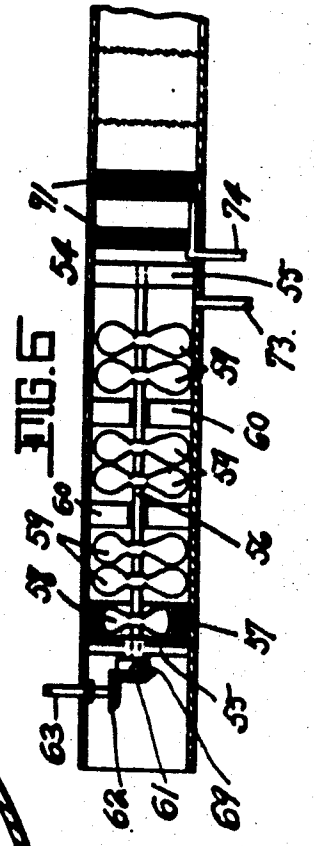
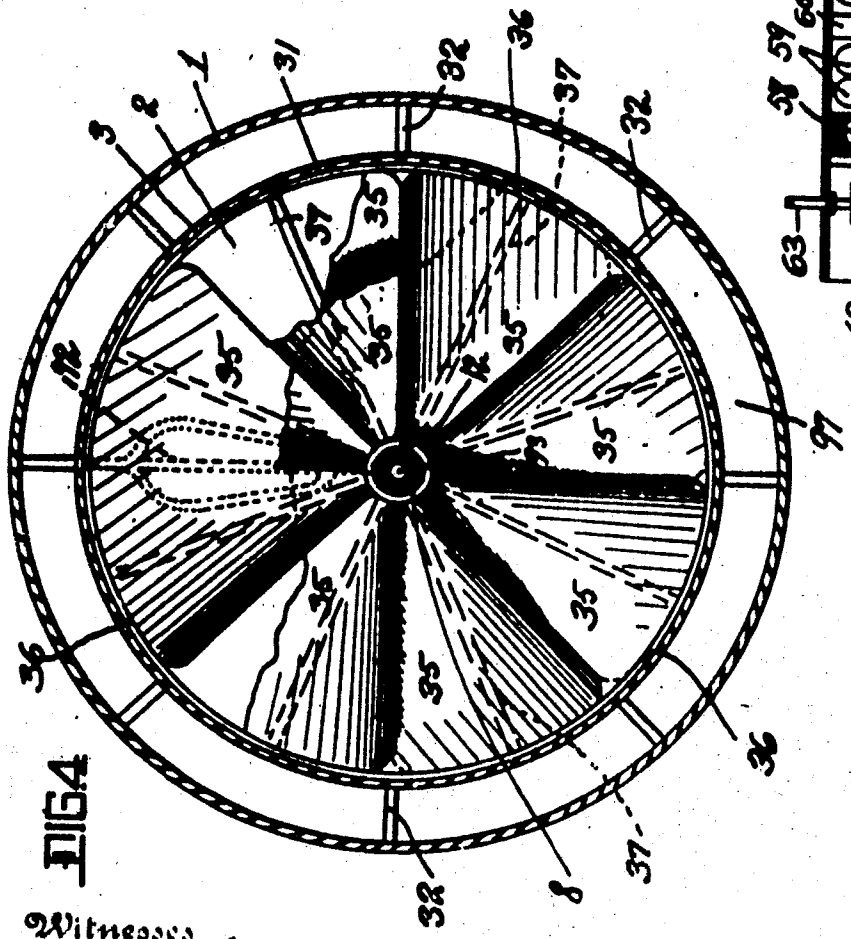
4 SHEETS—SHEET 4.







Witnesses
William K. Eckhardt
William B. Cole

Inventor
Dwight H. Bennett,
By his Attorney
A. H. Hemingway

UNITED STATES PATENT OFFICE.

DWIGHT H. BENNETT, OF BROOKLYN, NEW YORK.

GAS-ENGINE.

948,950. Specification of Letters Patent. Patented Feb. 8, 1910.

Application filed December 28, 1906. Serial No. 349,773.

To all whom it may concern:

Be it known that I, DWIGHT H. BENNETT, a citizen of the United States of America, residing at Brooklyn, Kings county, New York, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

My invention relates to gas engines of the class called turbines, and it consists in the devices and combinations of devices hereinafter described and claimed.

Figure 1 is a side elevation of such an engine, embodying my invention. Fig. 2 is a vertical longitudinal sectional view of the same. Fig. 3 is a vertical cross-sectional view on line 3 3 of Fig. 2. Fig. 4 is a similar view on line 4, 4, of Fig. 2. Fig. 5 is a cross sectional view of one of the vanes I employ. Fig. 6 is a vertical longitudinal sectional view of the air inlet and compression devices. Fig. 7 is a detail view of one of the perforated tubes of the carbureter. Fig. 8 is a detail view of the clutch mechanism interposed between the fan carrying shaft of the compressing mechanism and the gear wheel which is connected with the actuating power.

The outer casing or cylinder of the engine is indicated at 1. It has a head, 2. Concentric with the outer casing I construct an inner cylinder, 3, 4, one part —3— extending from head, 2, for a considerable distance inward, where it abuts against a rim of a set of blades, and the other part, 4, from the rim of a succeeding set of blades to a point in line with the farther end of casing, 1, where the space between them is closed by an annular head, 5. The space between 1 on the outside and 3 and 4 on the inside, is intended to constitute a water jacket for the engine. From the outer face of the annular head 5 another cylinder 6, extends longitudinally outward and is closed by a head, 7, having a central bore to accommodate the shaft, 8, and its sleeve, 9. This cylinder 6 is pierced at a number of places, here sixteen, and the walls of each such aperture are surrounded by flanges, 10, to the outer edges of which I secure an annular cylinder, 11, the interior face of which is apertured to register with the flanged apertures of cylinder 6.

In the heads 2 and 7, which are centrally bored for the purpose, I mount the main shaft, 8, one end carrying a sleeve 9 and the other a sleeve 12, entirely independent of sleeve 9. Bosses or other devices to constitute sufficient bearings for the sleeved shaft, are preferably formed on the heads 2 and 7, but if such bearings should be insufficient, I could readily extend the shaft and mount it in pillow blocks or other suitable supports. Sleeve 9 is fitted as closely to the shaft as possible without causing undue friction, and extends from a point some inches without the line of head 7 to a point slightly within the line of the head 5 of the main cylinder. At the inner end it carries a circular disk 13, rigidly secured to it and of a diameter to fit closely within the cylinder 4. Next in succession to disk 13, surrounding said sleeve 9, I place a wheel composed of a hub 15, radial partition arms 16, an apertured disk 17 covering its outer face and a partial rim in the form of a flange 18 extending inward from the edge of disk 17 over the edges of arms 16, to a line just within that of the circle of apertures in cylinder 6. The inner outer corners of the arms 16 are secured rigidly to a ring 19, triangular in cross section (as shown in Fig. 2) which is in turn secured to the cylinder 4 and head 5 and projects outward toward head 7 and in line with rim 18 to a line just beyond that of the inner side of the circle of apertures in cylinder 6 and inward toward shaft 8, to a line within the line of the circumference of disk 13. This ring 19 may be cast with and as part of arms 16 and bolted in place or as part of cylinder 4 or head 5. Its exact construction is not material in that regard, its main purpose being to attach the partitions 16, the hub, 15, the disk 17 and rim 18, firmly to the stationary cylinder and thus hold them also stationary, and, in conjunction with said hub, partitions and disk, to constitute a series of chambers to be more particularly described hereafter. Beyond disk 17, a partition 14 extends from the wall of cylinder 6, inward to a close fit with sleeve 9. It has a series of apertures 22 corresponding in number, size and relative location with the apertures 24 formed in disk 17. Between disk 17 and partition 14, I locate a third disk 20, rigidly secured to sleeve 9, so that its movement may be synchronous with that of disk 13, and so nearly filling the space between 17 and 14 as to just permit its turning without friction between it and them, and extending

outward to the inner face of cylinder 6 and there flanged or connected to a flange 21, which extends inwardly, parallel with the shaft, between flange 18 and the outer face of ring 19 on the one side and cylinder 6 on the other, to a line beyond the circle of apertures in cylinder 6, and substantially to head 5. Disk 14 is provided with a number (here 16) of radially cut apertures, 22, evenly spaced, cut from near the center outward for a distance usually (but not necessarily) about one-sixth of the diameter of said disk, the width being about equal to the space between the arms or partitions 16. Disk 17 is also provided with radially cut apertures 24, of a length and width corresponding to the length and width of apertures 22. Disk 20 has four radial apertures, 25, evenly spaced and in length equaling apertures 22 and 24, with which they register, but in width equal to the space between alternate arms 16, that is to the space occupied by two compartments 50, minus the width of the walls, and its flange, 21, is provided with four apertures evenly spaced which will at appropriate times register with the apertures in flange 18 and cylinder 11. Disk 13 has four radial apertures, 23, corresponding in width with the space between partitions 16 plus the thickness of the partitions and in length extending from quite near the sleeve 9 to a line just within that of ring 19. For a short distance within disk 13, the cylinder 4 is left vacant to form a reservoir of power, 99. Succeeding space 99, I place a circular series of vanes 26 secured to a sleeve or hub 27 surrounding shaft 8 and provided with a rim 28, which as here shown constitutes the cylinder itself. Closely following vanes 26 is a second series of vanes 29, but these are secured rigidly to shaft 8 and their pitch is the reverse of that of vanes 26. Their rim 30, is quite heavy and is chamfered or rabbeted to fit a corresponding chamfer or rabbet in the edge of cylinder 4, thereby substantially constituting rim 30, a continuation of said cylinder. On the side opposite to that joining cylinder 4, the rim 30 is also chamfered and there makes contact with a band 31 supported by braces, 32, which may be in the form of a ring extending to cylinder 1 and pierced with many apertures. Similar braces, 34 and 41, strengthen and support in place respectively the inner ends of parts 3 and 4 of the inner cylinder.

Sleeve 12 extends inward on shaft 8 to the line of the nearest edge of vanes 29 and on said sleeve adjacent to said vanes 29, I mount a third series of vanes, 35, having a rim 36 chamfered as described to fit on one side against the chamfered surface of band 31 and that of cylinder 3 on the other. The pitch of vanes 35 is, in general, similar to that of vanes 26. Succeeding vanes 35, are fixed partitions, 37, extending radially from a hub 38, surrounding sleeves 12, to and secured to the shell 3. The space 39 between the outer line of partitions 37 and head 2, is an open chamber and from it, an exhaust pipe 40 extends to a convenient point of discharge. A fly wheel 42 is mounted on shaft 8 and in a bracket 43 I mount a shaft 44 carrying a gear wheel 45 and a pulley wheel 46. Gear 45 meshes with a gear 47 mounted on sleeve 12 and pulley 45 carries a belt 48 running to shaft 8 and thereby any power developed by the movement of vanes 35 will be transmitted to shaft 8. Sparking plugs 49 are located in each explosion chamber 50, (formed by hub 15, partitions 16, cover 17, disks 13 and 20, flanges 18 and 21 and ring 19), and from them, wires, preferably buried in said partitions, run to contacts 51 at the inner face of the central aperture in disk 17 and four circuit closers 52 are bedded in the face of sleeve 9, evenly spaced, in such positions that they register with contacts 51 and, upon the movement of said sleeve 9, will sequentially close the respective circuits from a source of electrical power, not shown, to the respective spark plugs.

54 is the carbureter. It consists of a long tube open at one end and at the other end communicating with the equalizing chamber 53 lying within cylinder 6 between head 7 and disk 14. In standards 55 in said tube, I mount a shaft 56 and on that shaft a balance wheel 57 whose spokes 58 are vanes, and a series of fan blades 59 all pitched in the same direction. Radial partitions 60 of slight width but appreciable length, in a direction parallel with the shaft 55, are interposed in the series of fans to interrupt the too great rotary motion the air would otherwise acquire. Gear 61 on shaft 56 meshes with gear 62 on shaft 63, which in turn carries gear 64 meshing with gear 65 on shaft 66, which, through pulley 67 and belt 68 about 67 and shaft 8, would communicate power to move the fans, but gear 61 is not rigidly connected with shaft 56 but turns loosely thereon, and intermediate the two I arrange a clutch 69 secured to said gear 61. When gear 61 turns with a sufficient speed, the clutch will seize shaft 56 and revolve it and its burden, but if the speed of gear 61 should decrease, shaft 56 nevertheless, under its acquired momentum and that of its balance wheel 57 may for a moment continue at the higher speed independently of the gear 61 but cannot reverse unless 66 were reversed. In the carbureter, in advance of the fans, are one or more atomizers. They consist of two heads, 70 joined by a rim and by a series of tubes 71. These tubes are pierced by numerous fine holes 72.

Then a small tube 73 leads from the carbureter to the upper part of the tightly closed gasolene tank (not shown) and another tube 74, shorter than tube 73, leads from the lower part of said tank to the space between heads 70.

On that part of shaft 8 projecting out through head 7 and beyond the end of sleeve 9, I mount a friction disk 75. In two brackets, 76 and 77, projecting from head 7, I mount a shaft 78 and feathered on shaft 78 but free to move up and down thereon, I mount a friction wheel 79 so placed and arranged as to make frictional contact with disk 75. Near the upper end of shaft 78 I place a second friction wheel 80 and on a shaft 81, extending from a foot secured to head 7 and braced by an arm 82 extending down from bracket 77, I secure a second friction disk 83 placed and arranged to make contact with wheel 80. Shaft 82 also carries a pulley wheel 84 about which a belt 85 extends to and about the extended part of sleeve 9 outside of head 7. The bracket 77 is bifurcated or forked and through its tines I pass a threaded screw 86 provided with a crank 87. The thread of screw 86 carries an arm 88, from the end of which a rod cord or line 89 extends down to the hub of wheel 79, to which it is securely attached by means of a ring or collar thereon.

Shaft 8 is hollow for a considerable portion of its length and a tube 90 is connected to its open end by a suitable joint. From the space 93 within the hollow shaft, tubes or channels 91 extending through the thickest parts of vanes 29, lead to the open space between rim 30 and cylinder 1. Similar tubes or channels 92 lead through the thickest parts of vanes 35 and open into the same at their inner ends. These channels 92 extend through sleeve 12 and register with a series of ports 94 cut from space 93 to the surface of the shaft; but to insure that the passage shall not be cut off by the turning of the shaft 8 in sleeve 12, the face of the shaft is turned down for a distance on each side of ports 94, and other ports 95 lead from space 93 to the face of the turned part of the shaft. A discharge tube 96 extends through head 2 into the space 97, between cylinders 1 and 3, and another discharge tube 98 leads from the annular cylinder 11.

The operation of the engine is as follows: Motion must be communicated to shaft 56 to charge the chamber 53. Gasolene having been forced by any suitable means from the tank to the carbureter proper, the air forced in by the movement of the vanes 59 will, in passing through tubes 71 become charged with the gas making material issuing from holes 72 and will pass on and into equalizing chamber 53 as an explosive compound. Further motion of shaft 56 and its vanes 59 will compress the mixture in chamber 53. Now the shaft 8 is also started and through the connections already mentioned its motion will be communicated to sleeve 9 and its rigidly attached disks 20 and 13, their motion being of course always synchronous. The motion of disk 20 will speedily cause it to begin to uncover apertures 22 and 24 and thereby provide free passage for the explosive mixture from chamber 53 into four evenly spaced chambers 50. Not only so, but as disk 20 moves on, it will uncover the four chambers 50, respectively succeeding those first uncovered and thus throughout its motion. When four chambers 50 have thus been filled under pressure, the further movement of disk 20 will close the entrance ports and at the same instant the movement of disk 13 will begin to open ports 23 of said four chambers 50, the positions of disk 13 and disk 20 being so adjusted on sleeve 9 as to produce such effect: When apertures 23 are about one-third open (any other distance may be selected if desired) the circuit closers 52 reach and make contact between the contacts 51 of the four chambers 50 already named, sparks are created at the spark plugs 49 and the charges in those four chambers are fired. The gases produced by the explosions rush through ports 23 into chamber 99 and thence between the entire series of vanes 26, then 29 and then 35 and the pitch of each succeeding set of vanes being reversed, such passage will cause the vanes 29 to rotate in one direction, carrying the shaft 8 with them, and the vanes 35 to rotate in the opposite direction, carrying sleeve 12 with them, such power as is developed by such rotation of sleeve 12 being added to the shaft power through gears 47 and 45, pulley 46 and belt 48.

When the explosion has taken place and the gas passed out as described, disk 13 again closes ports 23 and in due course the movement of disk 20 brings the apertures in its flange 21 to register with the said four discharged chambers 50 and any remaining gas therein may escape through the flanged ports in cylinder 6 and into and through the annular chamber 11 and out of its exhaust 98, being hastened in that movement by the fresh incoming explosive mixture which will by that time be again entering those chambers 50 under pressure. The respectively succeeding four chambers 50 are likewise charged, closed, opened and their charges exploded and delivered into chamber 99 and thence to their work as described, and the cycle continues so long as material is furnished and movement permitted. The purpose of chamber 99 is to effect a more evenly continuous movement of the vanes and therefore the shaft than if the discharges were directly against the vanes. The gases fill

chamber 99 and in it become a species of buffer. From thence they flow against each set of vanes, and not merely the ones opposite the discharging chambers. Again the incoming gases add to the general pressure in chamber 99 which acts as a reservoir from which the power is continually proceeding with a less pulsatory character than would otherwise be the case. Meanwhile the shaft 8 has developed motion under the influences named and thenceforth will actuate all of its connected devices, including shaft 56. Its movement of course causes the air forced through pipe 73 to create a pressure on the gasolene tank and when the pressure in chamber 53 and tube 54 is momentarily lessened by the opening of ports 22 and 24, that pressure already in the gasolene tank acting through the shorter pipe 74 will cause the gasolene entering below heads 70 to issue in a jet like spray from holes 72 in tubes 71 and thereby continue to furnish the material needed for the explosive mixture. If shaft 8 should momentarily slow down the action of fans 59 would not necessarily be thereby retarded, for the balance wheel may for that moment proceed at its already acquired speed, clutch 69 being always ready to again seize and turn shaft 56, when the speed of shaft 8 again equals that of shaft 56. As they issue from between the blades 35, the gases will have acquired a rotary motion of considerable force and might therefore create an objectionable noise if nothing intervened between said blades and exhaust 40. I have therefore introduced the radial plates 37 at this place to guide those gases in the exit and in overcoming the rotary motion named, obviate the objection the noise might otherwise present. To cool the parts I introduce a stream of water through tube 90. It passes thence to and through space 93 and by centrifugal force will flow out through chamber 91 and ports 94 and 95 and channels 92 into chamber 97 and, thence to and out of discharge tube 96, this furnishing a very convenient means for effecting the desired end; and to enhance the cooling effect. I sometimes make supplementary channels in the thick parts of the vanes leading from and to channels 91 and 92 (as indicated in dotted lines in Fig. 4).

As will be manifest, there are times when it is advisable to change the rate of explosion, relative to the revolutions of the shaft and this may herein be readily accomplished by loosening the set screw holding wheel 80 in place on shaft 78 and shifting that wheel downward to increase and upward to decrease, the speed of the sleeve 9 (which governs the rate of discharge relative to the revolutions of shaft 8). If a momentary and rapid change of such relative speeds is desired, it may readily be accomplished (within the limits set by the location of wheel 80) by rotating screw 86 and thereby lifting or lowering arm 88 and its link 89, which will carry wheel 79 to a larger or smaller track upon the face of disk 79 and thus decrease or increase its speed as related.

I do not limit myself to the exact form, proportions or arrangement of parts herein shown and described. Many of them may be changed in various particulars and some may be omitted without departing from the spirit of my invention. I do not limit myself to the number of vanes employed nor to the number of different series of vanes nor to any other details other than as set forth in the claims or necessarily implied by the terms used.

What I claim as my invention and desire to secure by Letters Patent, is:

1. In a gas engine, a cylinder, a shaft extending through said cylinder and provided with a sleeve, a series of vanes surrounding said shaft and secured to said cylinder, a series of vanes surrounding said shaft and secured thereto, a series of vanes mounted on said sleeve, each series of vanes having its pitch arranged reversely to that of the preceding series, reversing gears intermediate said sleeve and said shaft and means for forcing gases between said vanes, all substantially as set forth.

2. In a gas engine, the combination of a cylinder, a shaft extending through said cylinder, a series of vanes surrounding said shaft and a series of radial partitions succeeding said vanes and interposed between them and the exhaust, all substantially as set forth.

3. In a gas engine, the combination of a cylinder, a shaft extending through said cylinder, a series of vanes surrounding said shaft, a series of explosion chambers, an intermediate chamber between the explosion chambers and the vanes, passages from each explosion chamber to the one intermediate chamber, approximating in size the proximate face of the contiguous explosion chamber, and valves for controlling said passages; the explosion chambers, the passages into the intermediate chamber and the intermediate chamber opening into the vane containing cylinder, being arranged in right lines, whereby the motive fluid created in the explosion chambers may pass in a right line to and impinge directly upon the vanes, all substantially as set forth.

4. In a gas engine, the combination of a cylinder, a shaft extending through said cylinder, a sleeve mounted on said shaft, perforated disks connected to said sleeve, a series of friction gears interposed between said shaft and said sleeve whereby motion will be communicated from one to the other, two of said gears being mounted upon one

shaft, one of them provided with a set screw whereby it may be adjusted on its shaft, and the other feathered thereto but movable up and down upon said shaft, together with means for moving it thereon, all substantially as set forth.

5. In a gas engine, the combination of a cylinder, a shaft extending through said cylinder, a series of radial explosion chambers secured to the cylinder arranged about said shaft and provided with a series of gas inlets and outlets, a rotary sleeve surrounding said shaft and carrying two disks, each provided with a series of apertures, those in one disk being arranged to successively register with the gas inlets, and those in the other to successively register with the gas outlets, and mechanism interposed between the said sleeve and the shaft, whereby one will partake of motion of the other, all substantially as set forth.

6. In a gas engine, the combination of a cylinder, a shaft extending through said cylinder, an explosion chamber, an equalizing chamber, a port in the explosion chamber, a port in the equalizing chamber, registering with that in the explosion chamber, and a movable apertured disk interposed between said ports, but so connected with the shaft as to move in unison therewith, whereby passage from one to the other of said ports will be alternately opened and closed, all substantially as set forth.

7. In a gas engine, the combination of an equalization chamber, a series of explosion chambers and a third chamber or space succeeding the explosion chambers and located intermediate the explosion chambers and the vanes, passages from the equalization chamber to the explosion chambers and from the explosion chambers to the succeeding third chamber, the latter series of passages respectively approximating in size the proximate face of the contiguous explosion chamber, valves interposed between the equalizing and the explosion chambers and between the explosion chambers and the said third chamber, substantially as set forth, whereby the gas may pass from the equalizing to the respective explosion chambers in succession and the motive fluid may pass from the respective explosion chambers to the said third chamber, for the purposes set forth.

8. In a gas engine, the combination of a cylinder, a shaft extending through said cylinder, a series of radial explosion chambers secured to the cylinder arranged about said shaft and provided with a series of gas inlets, a double series of outlets, one series at the side and one at the ends of said chambers, a rotary sleeve surrounding said shaft and carrying two disks, one beyond the explosion chambers, provided with a series of apertures arranged to successively register with the gas outlets on the sides of the explosion chambers, the other on the opposite side of the explosion chambers being provided with a flange extending over the end outlets of the explosion chambers, both face and flange being provided with a series of apertures arranged to successively register, those in the flange with the end outlets and those in the face with the inlets, together with mechanism interposed between the shaft and the sleeve whereby one will partake of the motion of the other, all substantially as set forth.

9. In a gas engine, the combination of a cylinder, a shaft extending through said cylinder, a series of radial explosion chambers secured to the cylinder arranged about said shaft and provided with a series of gas inlets, a double series of outlets, one series at the side and one at the ends of said chambers, an annular chamber surrounding the explosion chambers and provided with an outlet and a series of apertures, registering respectively with but at a distance from the outlets in the ends of the explosion chambers, a rotary sleeve surrounding said shaft and carrying two disks, one beyond the explosion chambers provided with a series of apertures arranged to successively register with the gas outlets on the sides of the explosion chambers, the other on the opposite side of the explosion chambers being provided with a flange extending over the end outlets of the explosion chambers, and between them and the apertures in the annular chamber, both face and flange being provided with a series of apertures arranged to successively register, those in the flange with the end outlets and those in the face with the inlets, together with mechanism interposed between the shaft and the sleeve whereby one will partake of the motion of the other, all substantially as set forth.

10. In a gas engine the combination of a cylinder, a shaft extending through said cylinder, a series of radial explosion chambers secured to the cylinder, arranged about the shaft and provided with a series of gas inlets and outlets, an equalizing chamber adjacent to the explosion chambers, means for forcing an explosive mixture into said equalizing chamber, outlets therefrom registering with the inlets of the explosion chambers, a rotary sleeve surrounding said shaft and carrying two disks, each provided with a series of apertures, those in one disk being arranged to successively register with the gas inlets of the explosion chamber, and those in the other to successively register with the gas outlets from said chamber, means for communicating motion from said shaft to said sleeve, an intermediate chamber, in the cylinder, immediately succeeding the explosion chamber and adapted to receive gases

issuing therefrom, a series of vanes surrounding the shaft and secured to the cylinder a second series of vanes secured to the shaft but having their pitch the reverse of those secured to the cylinder, and an exhaust outlet, all substantially as set forth.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses, this 19th day of June 1906.

DWIGHT H. BENNETT.

Witnesses:

CHARLES B. DAVIS,

A. G. N. VERMILYA.