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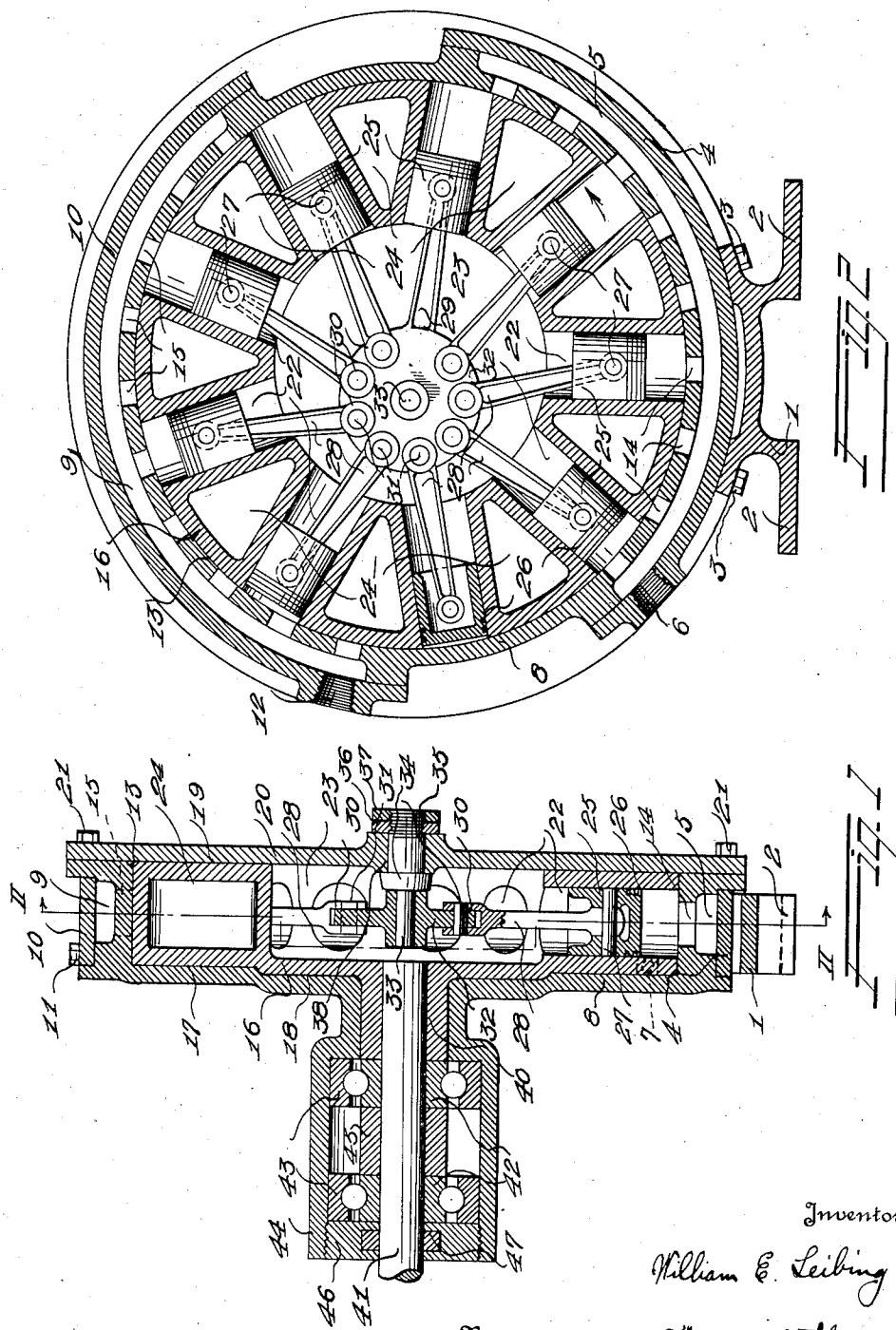
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MOTOR AND PUMP

Filed Sept. 17, 1928

2 Sheets-Sheet 1



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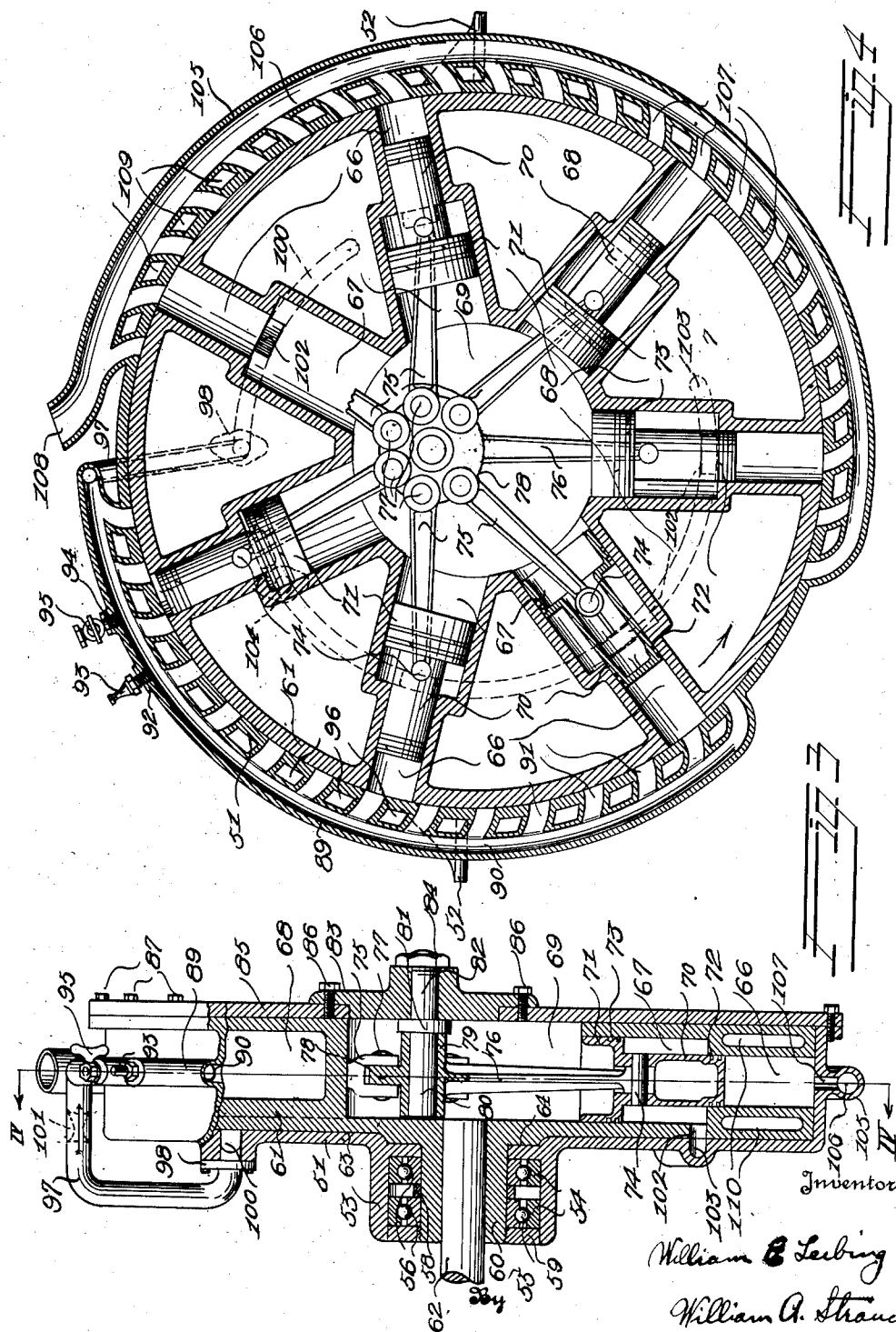
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UNITED STATES PATENT OFFICE

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MOTOR AND PUMP

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20 Claims. (Cl. 60—44)

The present invention relates to improved mechanisms adapted for use as motors or pumps, and more particularly the invention relates to improved mechanisms especially adapted for use as rotary motors, pumps, or compressors.

As is well known, in the usual types of multiple cylinder motor and pump mechanisms valving arrangements individual to each cylinder, must be provided necessitating the use of more or less restricted individual passages and ports which offer considerable resistance to fluid flow. Furthermore, the valve mechanisms require complicated and more or less delicate operating and timing mechanisms subject to ready derangement, and breakages in operation, and require careful adjustment and maintenance for reasonably efficient operation. Furthermore, in the existing types of multiple cylinder internal combustion engines it is the practice to provide each cylinder with an individual combustion chamber and individual ignition devices which must be operated in properly timed relation by more or less complicated mechanisms to ignite each explosive charge in each cylinder individually. Such ignition mechanisms, also are subject to ready derangement due to failure of the comparatively light mechanical parts, pitting of electrical contacts, and the like which result in inefficient, and frequently complete failure of operation.

In accordance with my present invention, the restricted porting, and complicated movable valve and ignition mechanisms may be eliminated in multiple cylinder pump and motor mechanisms by providing feed or inlet, and discharge or outlet chambers, common to and in direct communication with a plurality of cylinders at all times in the operation of the mechanisms. By reason of the fact that a plurality of cylinders are in communication with a common inlet chamber at all times in my improved mechanisms, by supplying a properly timed flow of combustible or explosive fuel mixture to the intake chamber of my improved device arranged to operate as a prime mover, after an initial ignition of the combustible mixture of fuel in the chamber, continuous combustion may be maintained due to the overlap of the operation of the cylinders, so that my improved mechanism lends itself readily to the provision of internal combustion engines in which the necessity for timed individual and successive ignition essential in the usual types of internal combustion engines is eliminated.

Accordingly a primary object of the invention is to provide novel and simplified and efficient

mechanisms adapted for use as motors, pumps, compressors, and the like.

Another object of the invention is the provision of improved rotary pump and motor mechanisms, permitting the use of simplified timing and valving arrangements.

Still another object of the present invention is to provide novel pump and motor mechanisms embodying multiple cylinder constructions in which complicated timing mechanisms, and restricted port openings are eliminated, and which are of simplified, rugged, reliable, and efficient construction that can be manufactured at relatively low cost.

A further object of my invention is the provision of a simplified internal combustion motor in which the usual complicated mechanically operated ignition and valve mechanisms and the timing means therefor, the primary source of troubles and cause of unreliability of internal combustion motors, are eliminated.

Further objects of the invention will appear from the following detailed description of the preferred embodiments thereof and are defined by the terms of the appended claims.

Referring to the drawings:

Figure 1 is a transverse vertical sectional view of a preferred embodiment of my invention for use as a gas or fluid motor, compressor or pump.

Figure 2 is a sectional view taken along line II—II of Figure 1.

Figure 3 is a transverse vertical sectional view partially in elevation of a preferred embodiment of my invention for use as an internal combustion engine.

Figure 4 is a sectional view taken along line IV—IV of Figure 3.

Referring to Figures 1 and 2 a supporting pedestal or base casting 1 provided with the supporting feet 2 supports, and is secured, by means of bolts 3 to casting 4 which forms the outer wall of chamber 5.

A suitable tapped pipe connection 6 formed in casting 4 is adapted to receive the end of a suitable fluid pipe or conduit. Secured to casting 4 by means of studs or bolts 7 and supported thereby, is housing casting 8, which at its lower outer part is suitably recessed to form the remaining walls of chamber 5. At its upper end housing 8 is recessed to define a chamber 9, the outer wall of which is formed by a curved cover plate 10 secured in position on housing 8 by means of the securing bolts 11. Formed in cover plate 10 is a suitably tapped pipe connection 12 adapted to receive the threaded end of a fluid

pipe or conduit connection. Formed in the housing 8 is an accurately machined cylindrical bore, or chamber 13 connected to chamber 5 by means of ports 14, and with chamber 9 by the 5 ports 15 formed in stationary housing 8. Rotatably supported in bore 13 with just sufficient clearance between the periphery thereof and the cylindrical surface of chamber 13 to provide space for lubrication and formation of a suitable oil 10 seal is a fly wheel member and cylinder block 16, the machined and finished side surfaces 17 and 18 of which bear rotatably against the complementary end wall surfaces of chamber 13, and the opposite surface 19 of which bears rotatably 15 against the inner face of housing end plate 20, rigidly secured in position on housing 8 by means of bolts or studs 21.

Formed in fly wheel member 16 is a plurality of cylindrical radial bores or cylinders 22, opening at the outer ends into the periphery of the fly wheel member 16, and the inner ends of which open into a crank case, or chamber 23. To lighten the weight of the fly wheel structure suitable cores or chambers 24 may be formed 25 between cylinders 22.

Mounted for relative reciprocation in each of the cylinders 22 is a piston 25 each provided with piston rings 26 of any well known construction, and pivotally connected by means of wrist pins 30 27 to the outer ends of the connecting rods 28, and to master connecting rod 29, respectively. The inner ends of the rods 28 are bifurcated at 30 and are connected by means of the crank pins 31 to crank disk 32 which is formed integrally 35 with the inner end of master connecting rod 29 and is journaled on an eccentric stationary crank pin 33. Crank pin 33 is provided with a shouldered section 34 and an extension 35 the outer end of which is threaded to receive the securing 40 and locking nuts or collars 36 and 37 respectively, and is rigidly secured in a suitable bore formed in boss 38 of housing end plate 20.

Formed integrally with fly wheel and cylinder block casting 16 is a tubular supporting extension 40 rigidly secured on and rotatable with the outer end of drive shaft 41, shaft 41 is supported for rotation on the inner races 42 of a bearing assembly, the outer races 43 of which are supported in tubular extension 44 of housing 50 section 8. Races 42 are spaced apart by the sleeve member 45 which surrounds drive shaft 41, and the entire bearing assembly is held in position in the bore of extension 44 by means of threaded adjusting collar 46 which is provided 55 with a suitable packing member 47 to retain lubricant in the bearing assembly in well known manner.

In operation of the mechanism so far described as a pump or compressor suitable lubricant is 60 supplied which provides an oil seal between the periphery of the fly wheel member 16 and the cylindrical wall of bore 13, and fly wheel 16 is driven by means of shaft 41 in the direction of the arrow in Figure 2. This rotation of the fly 65 wheel causes rotation of pistons 25 together with connecting rods 28 and 29, and crank disc 32 about eccentric crank pin 33, causing reciprocation of pistons 25 in cylinders 22. With the arrangement of ports 14 and 15 disclosed, just after 70 each piston passes the last port 15, inward radial movement thereof will commence and as the outer end of each cylinder in this position is sealed by the solid cylindrical wall of bore 13 and the oil seal as each piston moves inward a 75 vacuum will develop which is broken as soon as

the ends of the cylinders communicate with the first port 14. As each cylinder rotates past ports 14 the inward movement of its piston continues and a charge of gas or fluid is drawn into it from chamber 5. As each cylinder passes the last 80 port 14, it is again cut off from chamber 5 and its piston begins its outward radial movement compressing the gas or fluid contained in the cylinder until its outer end communicates with the ports 15 when discharge of the fluid from 85 each cylinder through ports 15 to chamber 9 occurs. This discharge continues during the outward movement of each piston until the end of the cylinder individual thereto has again passed the last port 15 completing its cycle of 90 operations. In this way, it will be seen that the gases or fluids are drawn into each cylinder as it passes chamber 5, and are discharged thereby under pressure through ports 15 into chamber 9.

It will be noted that inlet and outlet ports and 95 chambers are stationary, and my improved arrangement possesses the advantage that the porting may be arranged to establish any desired oil seal or glands between the ends of ports 14 and 15. It will also be understood that when non- 100 compressible liquids, such for example as water, are being pumped the ports 14 and 15 will be arranged to prevent hammer, and to avoid injury to the mechanism due to trapping of fluids in the cylinders on the outward stroke of the pistons, 105 in a manner apparent to those skilled in the art.

It will be noted that in operation of my improved device all movements are substantially rotary, and substantially no reciprocation of 110 parts occurs, relative reciprocation only between the pistons and their respective cylinder blocks and pistons rotate about different centers. It will be noted that due to this action the actual volumetric space in the central crank chamber 23 does 115 not vary, so that the entire central space may be entirely filled with a suitable lubricant without impeding the operation of the device. It will also be noted that if desired the ends of the cylinders may be opened entirely to the inlet and outlet 120 chambers 5 and 9, providing a minimum resistance to flow of fluid into and out of the cylinders.

To operate my improved mechanism so far described as a fluid motor, for example as water or oil motor, fluid may be supplied under pressure to 125 chamber 9, entering the cylinders 22 through the ports 15 and forcing pistons 25 inward to produce pressures and reactions that will cause rotation of the fly wheel assembly 16 and driving of shaft 41. As the ends of the cylinders pass ports 14, 130 the pistons on their outward stroke will discharge the fluid contained therein through the ports 14 into chamber 5 from which it is withdrawn through the connection 6.

Instead of utilizing two of my improved mechanisms on a common shaft as set forth to provide 135 an internal combustion engine, I prefer to combine the mechanisms for such internal combustion engines in a single unit and such a form of my invention is shown in Figures 3 and 4. 140

As shown in Figures 3 and 4 the preferred embodiment of my internal combustion engine comprises a stationary housing 51 provided with integrally formed supporting pads or extensions 52 145 by means of which the motor may be secured rigidly to the supporting frame members of a motor vehicle, aeroplane or the like, driven thereby. Formed integrally with the housing 51 is a tubular bearing supporting extension 53 in which the outer races 54 of an anti-friction bearing assem- 150

bly 55 are supported. The inner races 56 of the bearing assembly 55 are spaced by sleeve 58 and are held in position by an adjusting collar 59 threaded on the supporting hub 60 of cylindrical fly wheel and cylinder block casting 61. Casting 61 is rigidly secured to and in operation drives shaft 62, as will more fully hereinafter appear. Fly wheel casting 61 is rotatably mounted in a cylindrical chamber or bore formed in the housing 51. The plane side surfaces 63 and 64 of the fly wheel casting 61 are machined and finished and bear against complemental machined and finished bearing surfaces of housing 51, while the periphery of fly wheel 61 is finished to a running fit with the cylindrical walls of the fly wheel receiving chamber or bore of housing 51, the clearance of the fly wheel in the bore being such as to permit maintenance of an oil seal between them in operation as will more fully hereinafter appear.

Formed in the fly wheel 61 are the radial cylinder bores 66 and 67 separated by the cored chambers or pockets 68. Bores 66 communicate at their outer ends with the cylindrical periphery of fly wheel casting 61 and at the inner ends communicate with the outer ends of bores 67. Bores 67 at their inner ends open into a crank chamber 69.

Mounted for relative reciprocation in cylinders 66 and 67 are trunk pistons comprising the cylindrical sections 70 and 71 which are integrally formed. Piston sections 70 and 71 are provided with sealing piston rings 72 and 73 of any suitable construction and are pivotally connected by means of wrist pins 74 to the outer ends of the connecting rods 75. The inner ends of rods 75 are bifurcated and connected by means of crank pins 77 to a crank disc 78 which is formed integrally with master rod 76 and is provided with a hub section 79 journaled for rotation on crank pin 80. Crank pin 80 is provided with a shouldered section 81 and a securing stud section 82 which is threaded at its outer end and supported in crank case cover plate 83, being securely held in position by collars or nut 84 threaded on the end of crank pin section 82. Crank case cover plate 83 is provided with shouldered locating section which extends into a central opening in housing end plate 85 and is secured in position by studs 86. End plate 85 is secured to housing 51 by means of the securing bolts or studs 87.

Formed integrally with the outer cylindrical walls of housing 51 is an arcuate extension 89 in which combustion chamber 90 substantially circular in cross section is formed. Chamber 90 extends for a substantial distance around the periphery of the cylindrical wall of housing 51 and communicates with the cylinder block receiving bore of housing 51 through a plurality of ports 91. Threaded through a suitable boss 92 of extension 89 is an ignition device or spark plug 93 of any suitable and well known construction, and threaded into boss 94 of extension 89 is a priming cock 95 through which a suitable priming charge of fuel may be injected into chamber 90 for the purpose of initiating operation of the mechanism as will more fully hereinafter appear. Formed through extension 89 are a series of openings or passages 96 through which cooling air or other suitable cooling fluid may be circulated in operation of the device.

Formed integrally with extension 89 and provided with a passage that communicates at one end with chamber 90 is a conduit 97 which at its other end is connected by means of a suit-

able securing flange 98 to, and communicates with the upper end of arcuate chamber 100 formed in the end wall of the fly wheel receiving bore of housing 51. Located in the conduit 97, Figure 3, is a Venturi section 101 shaped to offer low resistance to the flow of fluids in the direction of the arrow, but to offer a high resistance to flow of fluid in the opposite direction under the influence of pressures developed in chamber 90 during operation, and operating to prevent ignition of fuel mixtures to the left of section 101 in Figure 3, in a manner that will be readily understood by those skilled in the art.

Annular chamber 100 opens into the fly wheel and cylinder block receiving bore of housing 51. Formed in cylinder block 61 are the annularly spaced, laterally extending ports 102 which terminate at their inner ends in cylinder chambers 67 and are adapted to communicate with chamber 100 in operation of the device. Formed in the end wall of housing 51 and adapted to register with ports 102 of cylinder sections 67 is an arc shaped chamber 103 which at its upper end terminates in a suitable pipe connection 104 to which a suitable carburetor and throttle (not shown) of any well known type such as used in supplying and controlling fuel mixtures for internal motors is connected by suitable securing bolts (not shown).

Formed integrally with the cylindrical outer wall of housing 51, opposite the combustion chamber 90, is an arc shaped extension 105 in which the exhaust chamber 106 is formed. Connecting the exhaust chamber 106 with the interior cylindrical wall of the fly wheel receiving bore of housing 51 are the ports 107 curved to direct exhaust gases discharged from the cylinders towards the exhaust outlet 108. Formed through extension 105 are the openings or passages 109 for the circulation of cooling air or other cooling fluids in operation of the device. To lighten the fly wheel and cylinder structure if desired suitable chambers 110 may be provided.

To start operation of my improved internal combustion motor a suitable supply or charge of combustible fuel such as gasoline is charged into chamber 90 through priming cock 95, and an igniting spark is passed between the points of plug 93. As a result combustion of the fuel mixture will occur in chamber 90, and the resultant expanding and burning gases will pass through ports or passages 91 into the cylinders 66 in communication therewith. The pressure developed will cause relative reciprocation between the pistons and cylinders causing rotation of cylinder block 61 and the parts connected thereto in a counter clockwise direction as indicated by the arrow in Figure 4. A suitable fuel mixture to maintain operation is supplied to chamber 103, and as cylinder sections 67 pass the chamber 103, the pistons move inward with relation to cylinders 66 and 67, and on this inward movement suitable mixtures of fuel will be drawn into the cylinders 67 by pistons 71 through ports 102 from chamber 103 and a suitable carburetor and fuel supply connected to flange 104. As each successive cylinder 66, passes the last port 91, a heated charge of expanding gases under pressure is sealed therein and will exert driving pressures causing rotation of the cylinder block and parts until it communicates with exhaust ports 107 when the gases contained therein will be released and discharged through the chamber 106. Shortly after each cylinder comes into communication with the ports 107 relative outward movement

of its trunk piston structure will commence and thereafter as its port 102 passes out of communication with the chamber 103 a charge of fuel mixture will be sealed in its chamber 67 by the end wall of housing 51. As the rotation continues the relative outward movement of the trunk piston structure will continue and each successive piston section 71 will compress the fuel charge sealed in cylinder section 67, and each piston section 70 will discharge the exhaust gases in cylinder section 66 through its port 107 into the exhaust passage 106. As each trunk piston approaches the outer end of its cylinder sections 66 and 67, port 102 will communicate with chamber 100 and the compressed charge of fuel in cylinder section 67 will be forced through chamber 100, conduit 97, and Venturi section 101 into the chamber 90 where it will be ignited by contact with the burning gases contained in the chamber and the other cylinders 66 at that time in communication with chamber 90 through the ports 91.

In operation the Venturi section 101 offers substantially no resistance to the flow of fuel into chamber 90, but in well known manner, exerts a large resistance to flow of gases in the opposite direction, and this action serves to prevent ignition of fuel in the conduit 97 and chamber 100. It will, however, be understood that if the Venturi section 101, is not utilized, and combustion extends back through conduit 97, and chamber 100 into the cylinders 67, the back pressures on the piston 71 would not materially affect the rotation of the fly wheel and cylinder block as the toggle effect of the crank disc 78 and rods 75 together with the inertia of the rotating parts will be ample to readily overcome such back pressures.

Rotation of the fly wheel or cylinder block 61, together with the pistons, connecting rods and crank disc about crank pin 80 will in this way continue, with a plurality of cylinders 66 at all times in communication with chamber 90 so that successive charges of fuel mixtures forced into the chamber 90 will become ignited by the hang-over from the preceding burning charge or charges. Continuous rotation of the parts and driving of shaft 62 will occur so long as a proper fuel supply is supplied to chamber 103 without the necessity of individual timed ignition and explosion of fuel charges in the individual cylinders as has heretofore been necessary in the operation of internal combustion engines.

Having described preferred embodiments of my invention only, it will be apparent to those skilled in the art that wide variations may be made in the details thereof as defined, in the appended claims.

Accordingly what is desired to be secured by Letters Patent and is claimed as new is:—

1. In combination, a stationary housing, a cylinder block rotatably mounted within said housing; a plurality of radially disposed cylinders in said cylinder block each having a reduced and an enlarged section; an eccentrically disposed crank pin supported by said housing; a crank disk rotatably mounted on said crank pin; reciprocating pistons having reduced and enlarged sections disposed in the reduced and enlarged sections of said cylinders respectively; means operatively connecting said pistons with said disk and for maintaining a fixed relative movement between said crank disk and said cylinder block; an arcuate fluid inlet chamber through which fluid is drawn into each cylinder by one section of its

piston, an arcuate combustion chamber in communication with a plurality of said cylinders in all positions of said cylinder block, exhaust passages in communication with a plurality of said cylinders; and means to provide communication between said combustion chamber and said enlarged sections.

2. In combination, a stationary housing; a plurality of cylinders arranged in axially aligned pairs of differing diameters rotatably mounted within said housing; pistons mounted for reciprocation in pairs of differing diameters in said cylinders; an eccentric crank structure rotatably supported from said housing; connections between said pistons and said crank structure comprising means for causing said crank structure to maintain a fixed path of movement with relation to said pistons; and fluid inlet and outlet chambers in said housing in communication with a plurality of pairs of said cylinders in all positions of said cylinders.

3. In combination, a stationary housing; a cylinder block rotatably mounted in said housing provided with a plurality of pairs of radially disposed cylinders, the centers of each pair being disposed in the same plane; a plurality of pairs of pistons in said pairs of cylinders, each pair of pistons being operable in unison; means rotatable eccentrically with relation to said cylinder block; and connecting rods operatively connecting said pistons with said means at least one of said connecting rods being rigidly connected to said means, arcuate inlet and outlet chambers for the inner set of cylinders; arcuate inlet and outlet chambers for the outer set of cylinders; and means to provide communication between said outlet chamber for said inner set of cylinders and said inlet chamber for said outer set of cylinders.

4. In combination, a stationary housing; a plurality of pairs of cylinders rotatably mounted within said housing, the centers of each pair being in a common plane, a pair of pistons mounted for reciprocation in unison in each pair of said cylinders constituting inner and outer sets of pistons; a crank structure rotatably supported from said housing in eccentric relationship to said cylinders; connections between said piston and said crank structure comprising means for causing said crank structure to maintain a fixed path of movement with relation to said pistons; an arcuate inlet chamber in communication with a plurality of inner cylinders in all positions, arcuate inlet and discharge chambers for the outer cylinders, and means for discharging fluid compressed by pistons of the inner cylinders into the inlet chamber of the outer cylinders.

5. An internal combustion engine comprising a plurality of rotatable motor cylinders; a plurality of rotatable pump cylinders driven by said motor cylinders; a common combustion chamber for said motor cylinders and with which a plurality of said motor cylinders continuously communicate in operation and in which combustion is continuous; a high pressure chamber for said pump cylinders; and a fluid connection between said high pressure chamber and said combustion chamber through which combustion supporting substance is injected into said combustion chamber and through which substantial pressures tending to drive said pump and motor cylinders in a reverse direction may be transmitted from said combustion chamber in operation of the mechanisms.

6. The combination as set forth in claim 5 in

which said motor and pump cylinders are equal in number and arranged in pairs, each pair being rotatable in phase and unison.

7. A rotary internal combustion engine comprising stationary combustion and exhaust chambers; a plurality of rotary motor cylinders adapted to communicate successively with said chambers; a plurality of said cylinders being in direct communication with each chamber in all positions; stationary low and high pressure chambers; a plurality of rotary compressor cylinders adapted to communicate with said low and high pressure chambers successively; and an open passage of substantial area between said high pressure chamber and said combustion chamber.

8. An internal combustion engine comprising a rotary cylinder block structure disposed in said housing; a plurality of motor cylinders in said block structure; a plurality of compressor cylinders in said block structure; a piston in each of said cylinders; a stationary eccentric crank pin; reacting connections between said crank pin and said pistons; a power shaft driven by said block structure; a stationary combustion chamber for said motor cylinders in which combustion is continuous; a stationary high pressure chamber adapted to communicate successively with said compressor cylinders; and an open passage of substantial area between said chambers.

9. An internal combustion engine comprising a rotary motor mechanism including a plurality of cylinders and pistons therein; rotary pumping mechanism driven by said motor mechanism; a combustion chamber constantly in communication with a plurality of motor cylinders and wherein combustion is continuous during operation; and a fluid connection between the high pressure side of said pumping mechanism and said combustion chamber through which combustion supporting substance is injected into said chamber under pressure and through which substantial pressures tending to drive said pumping mechanism in a reverse direction may be transmitted from said chamber in operation of the mechanisms; the working area of said pump mechanism exposed to said pressures normally being substantially less than the working area of said motor mechanism exposed to said combustion chamber pressures.

10. An internal combustion engine comprising a power shaft; a rotary motor mechanism driving said power shaft and including a plurality of cylinders with pistons therein; pumping mechanism driven by said motor mechanism independently of said power shaft; a single combustion chamber constantly in communication with a plurality of said motor cylinders and wherein combustion is continuous during operation; and a fluid connection between the high pressure side of said pumping mechanism and said combustion chamber through which combustion supporting substance is injected into said chamber under pressure and through which substantial pressures may be transmitted from said chamber in operation of the mechanisms; the effective area of said motor mechanism in communication with said combustion chamber normally being substantially greater than the effective area of said pump mechanism in communication with the high pressure side thereof.

11. An internal combustion engine comprising a plurality of rotatable motor cylinders; a plurality of rotatable pump cylinders driven by said motor cylinders; a common combustion chamber for said motor cylinders wherein combustion

is continuous during operation and with which a plurality of said motor cylinders continuously communicate in operation; a high pressure chamber for said pump cylinders; and a fluid connection between said high pressure chamber and said combustion chamber through which combustion supporting substance is injected into said combustion chamber and through which substantial pressures tending to drive said pump and motor cylinders in a reverse direction may be transmitted from said combustion chamber in operation of the mechanisms, the effective area of said pump cylinders in communication with said high pressure chamber normally being less than the effective area of said motor cylinders in communication with said combustion chamber.

12. The combination as set forth in claim 11 in which said motor and pump cylinders are equal in number and arranged in pairs, each pair being rotatable in phase and unison.

13. A rotary internal combustion engine comprising a stationary combustion chamber wherein combustion is continuous during operation; a stationary exhaust chamber; a plurality of rotary motor cylinders adapted to communicate successively with said chambers; stationary low and high pressure chambers; a plurality of rotary compressor cylinders adapted to communicate with said low and high pressure chambers successively; and an open passage of substantial area between said high pressure chamber and said combustion chamber, the effective area of said motor cylinders in communication with said combustion chamber normally being greater than the effective area of said pump cylinders in communication with said high pressure chamber.

14. An internal combustion engine comprising a stationary housing, a rotary cylinder block structure disposed in said housing; a plurality of motor cylinders in said block structure; a plurality of compressor cylinders in said block structure; a piston in each of said cylinders; a stationary eccentric crank pin; reacting connections between said crank pin and said pistons; a power shaft driven by said block structure; a stationary combustion chamber for said motor cylinders wherein combustion is continuous during operation; a stationary high pressure chamber adapted to communicate successively with said compressor cylinders; and an open passage of substantial area between said chambers, the effective area of said pump cylinders in communication with said high pressure chamber being less than the effective area of said motor cylinders in communication with said combustion chamber.

15. An internal combustion engine comprising a motor mechanism having movable power delivering parts; a pump mechanism directly connected to and driven by said motor mechanism; a combustion chamber for said motor mechanism wherein combustion is continuous during operation; a direct connection between the high-pressure side of said pump mechanism and said combustion chamber through which a combustion supporting substance under pressure is injected into said chamber; and a connection between said chamber and the power delivering parts of said motor mechanism to thereby drive said motor, said mechanisms and connections being so proportioned that total area of the power-delivering parts exposed to pressures from said combustion chamber is substantially greater than the total area of the movable part of said

pump mechanism so exposed, whereby reverse movement of said engine is prevented.

16. The invention as defined in claim 15 wherein said motor mechanism comprises a rotatable cylinder block having a plurality of radially disposed cylinders therein, with pistons in said cylinders forming the power-delivering parts thereof.

17. The invention as defined in claim 15 wherein said motor mechanism comprises a rotatable cylinder block having a plurality of radially disposed cylinders therein; pistons in said cylinders forming the power-delivering parts thereof; and said pump includes a plurality of cylinders with pistons therein; said connections with the combustion chamber being so arranged that normally a plurality of said motor pistons communicate with said chamber simultaneously with a lesser number of pump pistons.

18. An internal combustion engine comprising a motor mechanism having a plurality of power-delivery parts adapted to receive actuating pressures; a pump mechanism driven by said motor mechanism having a plurality of movable fluid delivery parts; a permanently closed combustion chamber in which during power delivering operation fuel is continuously in the process of combustion to create therein substantial pressures; means connecting the movable delivery parts of said pump to said chamber to maintain a combustion supporting mixture therein; and means connecting the power-delivery parts of said motor to said chamber to receive therefrom power impulses due to the substantial pressures continuously maintained therein, said connections being so arranged that the number of said power-delivery parts of said motor communicating with said chamber normally is greater than the number of movable delivery parts of said pump.

19. In combination, a stationary housing, a rotary cylinder block within said housing, a plurality of radially disposed cylinders in said block and in a common plane, an eccentrically disposed stationary crank pin, a crank disk mounted on said pin, reciprocating pistons in said cylinders, connecting rods connecting said pistons with said crank disk and preventing relative rotation between said disk and cylinder block, an arcuate fluid inlet chamber communicating with a plurality of cylinders in all positions of said cylinder block, and an arcuate fluid outlet chamber communicating with a plurality of cylinders in all positions of said cylinder block, whereby fluid under pressure in said inlet chamber may react directly against a plurality of said pistons at all times.

20. An internal combustion engine comprising a rotary motor mechanism; a rotary pump mechanism; said motor and pump mechanism comprising a rotary cylinder block having a plurality of radial cylinders therein, pistons in said cylinders, an eccentric crank pin, a crank disk on said pin, pistons in said cylinders, connecting rods between said crank disk and pistons, and means to prevent relative rotation between crank disk and said cylinder block; an arcuate combustion chamber for said motor mechanism wherein combustion is continuous during operation, said chamber being in communication with a plurality of motor cylinders in all positions; and a fluid connection between the high pressure side of said pump mechanism and said combustion chamber through which combustion supporting substance is injected into said chamber and ignited at once, the energy of movement of the parts being sufficient to overcome the tendency to drive the pump in reverse direction by back pressure through said fluid connection.

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