Nov. 16, 1948. R. DELZER 2,454,138

ENGINE DRIVEN PUMP

Filed Oct. 25, 1944 3 Sheets-Sheet 1

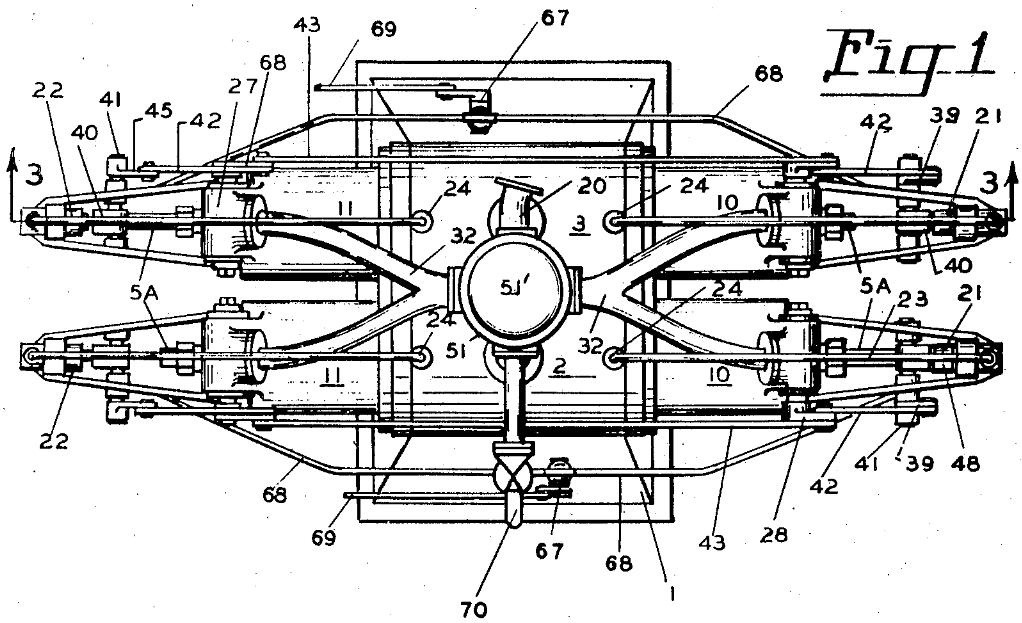

Fig 1

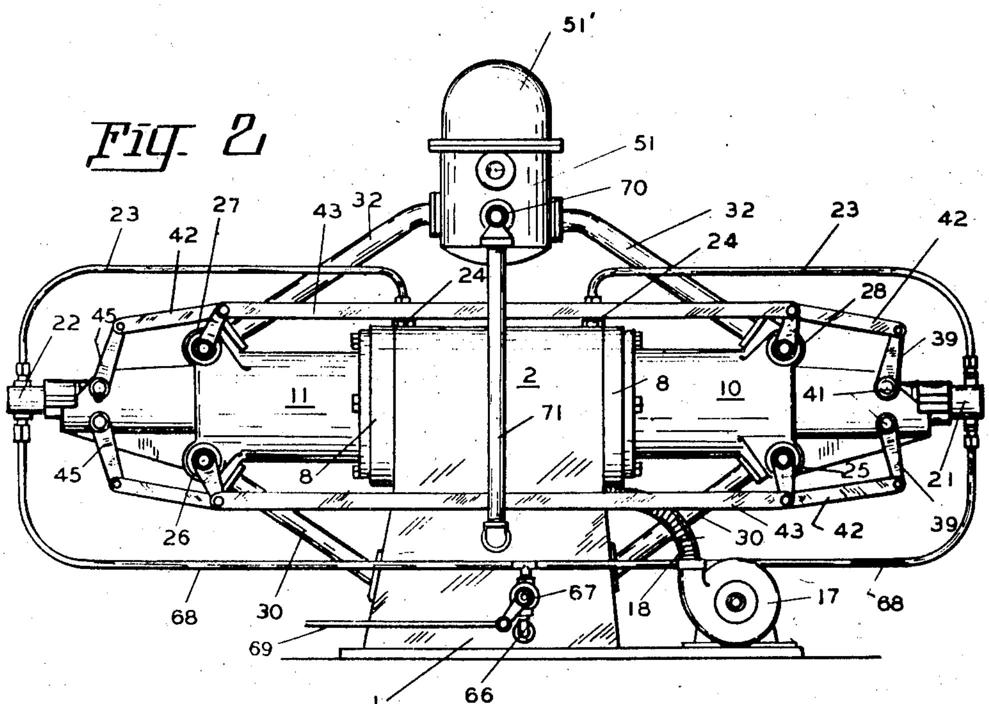

Fig. 2

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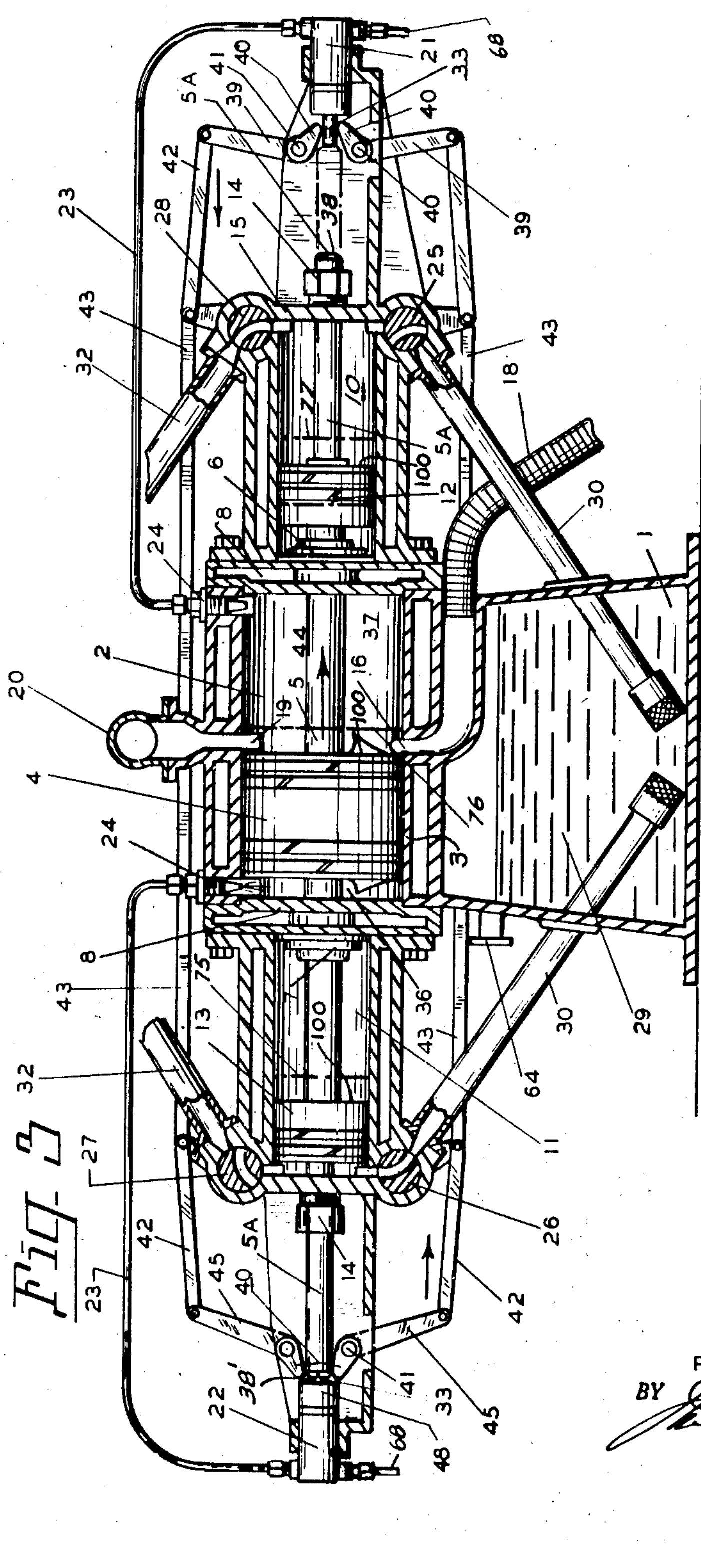

Fig. 3

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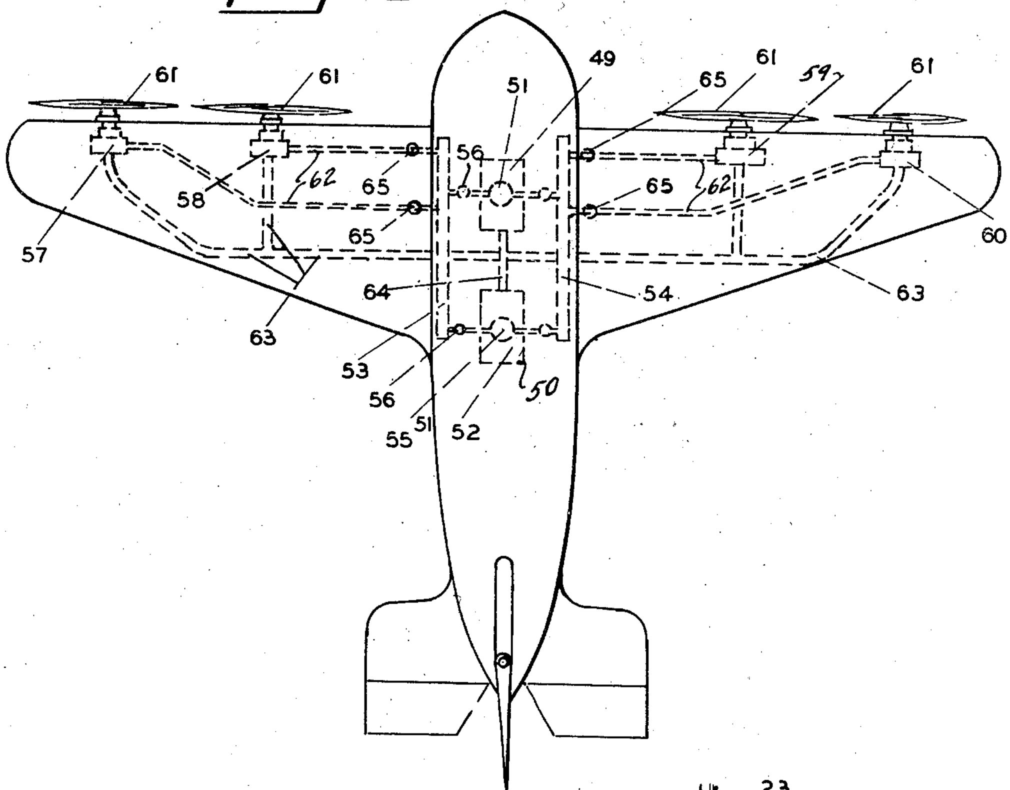
FIG. 5



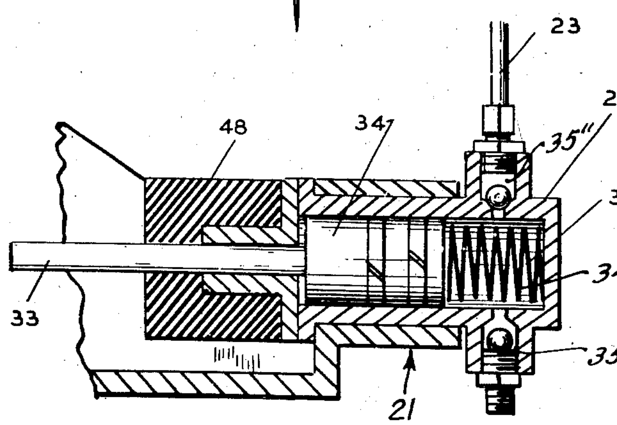


FIG. 4

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UNITED STATES PATENT OFFICE

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ENGINE DRIVEN PUMP

Reinhold Delzer, Portland, Oreg.

Application October 25, 1944, Serial No. 560,250

8 Claims. (Cl. 103—54)

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This invention relates to internal combustion engines and is particularly adapted to be used where the power unit is centrally located distributing its power to remote auxiliary fluid motors.

The primary object of the invention is to increase the efficiency of the internal combustion engine by eliminating crank shafts, thereby dead center losses.

With my new improved engine, the power developed by the fuel in combustion is directly applied to the work to be performed from the time the fuel is ignited until the end of the piston stroke of the motor.

With my new and improved motor, a steady and even power is transmitted from the fuel to the piston of the motor throughout the entire stroke of the piston.

A further object of my invention is to bring additional cylinders into effect as additional power is required, or vice versa, as for instance in the take-off of an airplane a greater amount of power is required than on level flight.

By the use of my new and improved internal combustion motor fuel is saved by operating the required amount of cylinders needed for varying loads and speeds.

These and other incidental objects will be apparent in the drawing, specification and claims to follow.

Referring to the drawings:

Figure 1 is a plan view of my new and improved internal combustion engine.

Figure 2 is a side view of Figure 1.

Figure 3 is a sectional side view, taken on line 3—3 of Figure 1, looking in the direction indicated.

Figure 4 is a fragmentary detailed sectional view of the fuel pump.

Figure 5 is a diagrammatical layout of my new and improved engine as applied to an airplane.

In the drawings:

My new and improved engine consists of a base 1, having cylinders 2 and 3 mounted thereon, and forming part thereof. The cylinders 2 and 3 are combustion cylinders and have reciprocating pistons 4 working therein. The pistons 4 are fixedly mounted to the piston rods 5, which are reciprocably mounted within stuffing boxes 6 and 7, forming part of the cylinder heads 8 and 9. The piston rods 5 extend into the hydraulic cylinders 10 and 11 and have pistons 12 and 13 fixedly mounted thereon. The piston rods 5 have extensions 5A working through the stuffing boxes 14 of the cylinder heads 15 of the hydraulic cylinders 10 and 11.

The combustion cylinders 2 and 3, together with the pistons 4 are of the two-cycle principle, receiving a supply of air through the port 16 from any suitable source of supply, as for instance the blower 17 and air pipe 18. An exhaust port 19 is located midway the length of the cylinder and communicates with the exhaust pipe 20. Fuel is supplied to the engine cylinders 2 and 3 from the fuel pumps 21 and 22 through the piping 23 and introduced into the cylinders by the nozzles 24. The fuel pumps 21 and 22, see Figure 4, consists of the cylinder 21' having a piston 34 working therein. The piston is forced to the left by the spring 34', pulling the fuel through the check valve 35 into the chamber 35' from the supply line 68. A throttle control valve 67 governs the amount of fuel entering the lines 68 from the supply line 66, which gets its supply from any suitable source, as the base tank 1. The throttle valve 67 is operated by the control lever 69. The fuel pumps are operated by the extended piston rods 5A contacting the piston rod 33 of the fuel pump, moving the piston against the spring 34' forcing the fuel out of the chamber 35' through the check valve 35'' into the line 23 to the nozzles 24 described later.

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In my new and improved internal combustion engine, the power developed by the pistons 4 within the cylinders 2 and 3 is transmitted by hydraulic means to motors, turbines or hydraulic cylinders located at remote points, the operation of which I will now describe. Located at the outer extremities of the cylinders 10 and 11 are suitable rotary valves 25, 26, 27 and 28. The valves 25 and 26 communicate with a hydraulic liquid supply 29 contained within the base 1 of the engine through the piping 30. The valves 27 and 28 are connected to the compensating tank 51 by the manifolds 32. The compensating tank 51 provides a pressure reservoir which may have an air cushion arrangement therein for cushioning the pulsations developed by the pistons 12 and 13.

Referring to Figure 3, the piston 13 is at the extreme left of the cylinder 11, also the power piston 4 is located at the extreme left of the cylinder 2, as is the case with the piston 12 relative to the cylinder 10. When the foregoing pistons are in the location shown, the extension 5A of the piston rod 5 has just forced the piston rod 33 of the fuel pump 22 towards the pump, causing the piston 34 to force the fuel out of the chamber 35 through the pipe 23 and nozzle 24 into the compression chamber 36 of the engine.

I have illustrated my engine of the high compression type requiring no ignition. When the fuel was injected through the nozzle 24 the combustion took place, causing the piston 4 to move in the direction of the arrow forcing the pistons 12 and 13 to the right within the cylinders 10 and 11. The cylinder 10 contains hydraulic liquid and as the piston 12 is forced to the right it will force this liquid through the valve 28 into the manifold 32, thence to the compensating tank 51 under pressure from where it will distributed to distant points for operating turbines and the like, which will be more fully described later. As the piston 13 was moved to the right, in the direction of the arrow, hydraulic liquid was pulled from the supply 29 through the piping 30, valve 26 and into the cylinder 11 ready to be forced into the compensating tank 51 when the piston 13 returns to the position shown.

Referring to Figure 3, when the power piston 4 is located as shown, the gases within the combustion chamber 37 were exhausted out of the exhaust port 19, at the same time this occurred fresh air was forced in through the port 16 into the chamber 37 through the air conduit 18. When the charge was exploded in the combustion space 36, forcing the piston in the direction of the arrow, the air received through the port 16 was compressed within the combustion chamber 37. When the piston assembly reaches the end of its stroke, the fuel pump 21 will inject fuel into the combustion chamber 37, firing and causing the piston 4 to travel in the opposite direction of the arrow, Figure 3. When the piston assembly reaches the position shown by the broken lines 75, 76 and 77 just before the exhaust port 19 opened the following valve action takes place. The end 38' of the piston rod 5A contacts the bell cranks 45 at 40 rocking them about their centers 41, forcing the connecting links 42 and 43 to the right, or in the direction of the arrow, which will manipulate the valves 25, 26, 27 and 28. The valve 26 will be opened while the valve 27 will be closed. This will relieve the pressure within the cylinder 11 into the supply tank 29. The valve 28 will be open and the valve 25 will be closed allowing a back feed from the compensating tank 51 through the valve 28 behind the piston 12, causing the piston assembly to continue to move in the opposite direction of the arrow to the end of its stroke. The back feed from the compensating tank against the piston 12 takes the place of a fly wheel, forcing the piston to the end of its stroke, while the exhaust port of the cylinder 2 is open and the air port 16 is admitting air into the space 37. When the piston assembly reaches the end of its stroke the piston rod extension 5A will operate the fuel pump 22 and valve assembly continually repeating the above cycle of operations.

In other words, when the power piston 4 is forced in either direction it has to travel beyond the exhaust port 19. Therefore when the piston 4 passes the port 19, the power is reduced to practically nothing due to the relief of exhaust and combustible material. To insure the full travel of the piston to complete the cycle, pressure is relieved from the compensating tank 51 against either of the pistons 12 or 13, and at the same time the valves 25 and 26 to the supply tank 29 are closed to prevent the escape of hydraulic fluid from the cylinders 10 and 11. The pressure from the tank 51 then forces the full travel of the piston rod and piston assembly.

Referring to Figure 3, the position of all of the parts are such that we are ready to combust the material within the cylinder at 36, which will force the pistons 4, 12 and 13 to the right until the end 38 of the piston rod 5A strikes the cams 40 of the bell cranks 39 opening the valve 27 admitting hydraulic pressure from the reservoir 51 forcing the piston 13 further to the right and carrying the power piston 4 over its dead center on the exhaust port.

At the same time the ejector pump 21 will eject fuel into the space 37 at which time it will be fired forcing the piston assembly to the left until the rear ends 100 of the pistons reach the dotted line positions 75, 76 and 77 where the valve 28 will be opened allowing pressure from the tank 51 to enter behind the piston 12 continuing the travel of the piston assembly to the position shown in the drawings.

It will be noted in Figure 3 that when the piston 13 is travelling to the right the valve 26 is open drawing in fresh hydraulic fluid from the tank 29 and when this piston reaches the point whereby hydraulics must be employed to cause it to continue its travel after the power stroke has been expended within the cylinder 2 the valve 26 will be closed and the valve 27 will be opened so that when hydraulic pressure fluid is delivered through the pipe and valve 27 it will not escape through the valve 26. By referring to valves 25 and 28 in the present position this position is quite well illustrated relative to the valves.

I have provided flexible bumpers 48 connected adjacent the fuel pumps 21 and 22 for arresting the travel of the piston assembly at the end of the stroke.

Referring to Figure 5, I have shown a diagrammatical illustration of my new and improved internal combustion engine and its associated power take-offs. I illustrate two engine assemblies 49 and 50 having their compensating tanks 51 and 52 connected to the manifolds 53 and 54 by suitable piping connections and control valves 56. Turbine motors 57, 58, 59 and 60 are located within the wings of the plane and have propellers 61 mounted thereon. The motor turbines receive their hydraulic liquid under pressure through the piping 62, and the exhaust from the turbines returns to the motor through the piping 63, which connects to the oil reserves 29 within the base 1 by way of the connection 64. The different turbines can be controlled by the valves 65, and any number of the turbines can be shut down when so desired, or one of the engines 49 or 50 can be completely closed down, thereby conserving on fuel, which is one of the primary objects of my invention.

With my new and improved assembly of internal combustion engines and hydraulic drive considerable reserve power is available when needed. It will be noted that I have eliminated the crank shafts, connecting rod and wrist pins that heretofore have been troublesome in the following manner. When the pistons were on top center and the combustion or explosion was of its most efficient nature, considerable resistance was offered to the movement of the piston due to the angular relation of the connecting rod, crank shaft and cylinder. In my new and improved motor when combustion takes place all of its energy can be expended into direct power against a hydraulic head, which in turn is delivered to motors and the like which receive hydraulic pressure from the beginning of the explosion and travel of the pistons to the end of their stroke.

I do not wish to be limited to the mechanical mechanism as herein illustrated, as other forms of mechanical embodiment may be employed still coming within the scope of my claims.

I claim:

1. A power plant including an internal combustion engine, a hydraulic pump having a movable pump member operated by the engine, a fuel injector for the engine and having a movable

injector member operated by the movement of the movable pump member, a pressure tank for storing and distributing the power from the hydraulic pump for further power use, and valved mechanism having an operating member operated by the movement of the movable pump member when it moves the movable fuel injector member for controlling the admission of the pressure medium to the hydraulic pump and the admission of such power medium from the hydraulic pump to the pressure tank.

2. A power plant including duplicate internal combustion engines, oppositely acting hydraulic compressors in alignment with and having pistons operated by each internal combustion engine, a pressure tank common to all hydraulic compressors for controlling and distributing the power developed by said compressor, means for admitting a power medium under pressure to each hydraulic compressor, means for admitting the power medium under pressure from each hydraulic compressor to the pressure tank, fuel injectors for the engine and having movable injector members operated by the movement of the pistons of the hydraulic compressors, and means operated by the movement of the hydraulic pistons when they operate the injector members of the fuel injectors to automatically control the admission of the power medium to each hydraulic compressor and to control the flow of such power medium under pressure from each compressor to the storage tank.

3. A power plant comprising duplicate internal combustion engines, each including a cylinder, a piston rod reciprocating in the cylinder and a piston on said rod, a hydraulic compressor at each end of and beyond the cylinder of each internal combustion engine, each of said hydraulic compressors including a piston mounted upon extensions of the piston rod of the internal combustion engine, a fuel injector arranged beyond each hydraulic compressor and operated by an extension of the piston rod of the internal combustion engine, means for admitting fuel under pressure from the fuel injectors to the opposite ends of the cylinder of each internal combustion engine, means for admitting air under pressure to each cylinder of the internal combustion engine, a pressure tank common to all hydraulic compressors for collecting and distributing the power developed by said compressors, and valved mechanism for controlling the admission of the pressure medium to each hydraulic compressor and the flow of the pressure medium under pressure to the pressure tank, said valved mechanism of each internal combustion engine being automatically operated by the piston rod extensions as they operate the respective fuel injectors of each internal combustion engine.

4. A power plant including duplicate internal combustion engine assemblies, each comprising an internal combustion engine cylinder, a piston rod operative therein, a piston on the piston rod, a hydraulic compressor in line with and beyond each end of the internal combustion cylinder, a fuel injector beyond and in line with each hydraulic compressor, the piston rod being extended in both directions beyond the cylinder of the internal combustion engine to operate the hydraulic compressors and the fuel injectors beyond the ends of the hydraulic compressors, a valve for admitting a hydraulic medium to each hydraulic compressor, a valve for admitting the hydraulic medium under pressure from the hydraulic compressors, a pressure tank common to both internal combustion engine assemblies and for collecting and distributing the power developed by said compressors, said pressure tank being served by said last named valves, means for simultaneously and reversely operating the admission valves of the hydraulic compressors of each internal combustion engine assembly, means for simultaneously and reversely operating the valves directing power medium under pressure from the hydraulic compressors of each internal combustion engine assembly, and means operated in the movement of the piston rod leading to the fuel injectors for simultaneously operating all said means.

5. A construction as defined in claim 4 wherein each cylinder of the internal combustion engine is mounted upon a hollow base to serve as a tank for the hydraulic medium and means leading from such hollow base to each hydraulic compressor admission valve.

6. A construction as defined in claim 4 wherein the means for operating the valves of the hydraulic compressors include rods connected to said valves and means on the piston rods leading to each fuel injector for actuating the rods.

7. A construction as defined in claim 4, wherein the internal combustion engines of each assembly are of the two-cycle type and wherein an exhaust outlet communicates with each cylinder intermediate the stroke of the piston.

8. An internal combustion engine, comprising a combustion chamber, having a reciprocating piston working therein, auxiliary cylinders arranged in line with the combustion cylinder and having reciprocating pistons mounted therein, means for charging the auxiliary cylinders with a hydraulic fluid and discharging the same therefrom under pressure of the pistons working therein, said hydraulic cylinder pistons being moved longitudinally of their cylinders by the piston working within the combustion cylinder, a valve assembly connected with the hydraulic cylinders for controlling the intake and discharge of the hydraulic fluid, said valve assembly being operated by the reciprocating movement of the hydraulic cylinder pistons, fuel oil pumps for injecting fuel into the combustion cylinder, said pumps being operated by the reciprocating movement of the hydraulic cylinder pistons.

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