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MOTOR.

APPLICATION FILED NOV. 1, 1919.

1,380,795.

Patented June 7, 1921.

2 SHEETS—SHEET 1.

Fig. 1.

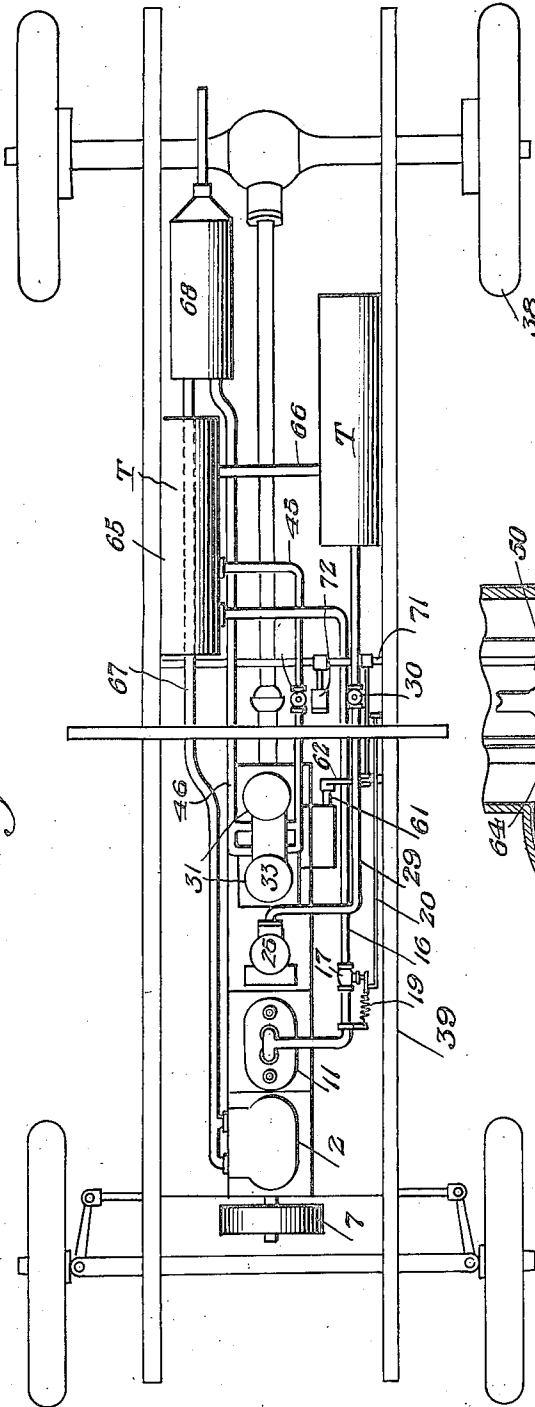
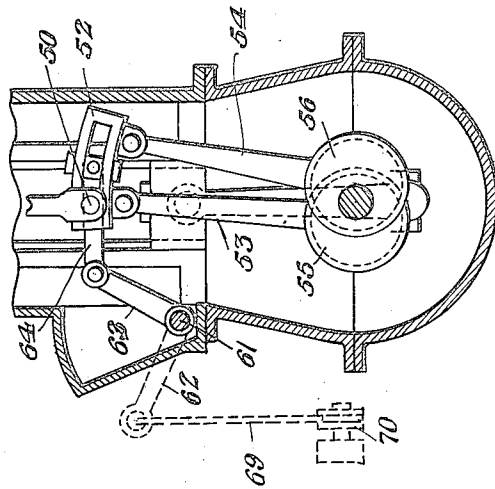


Fig. 3.



Witnesses
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2 SHEETS—SHEET 2.

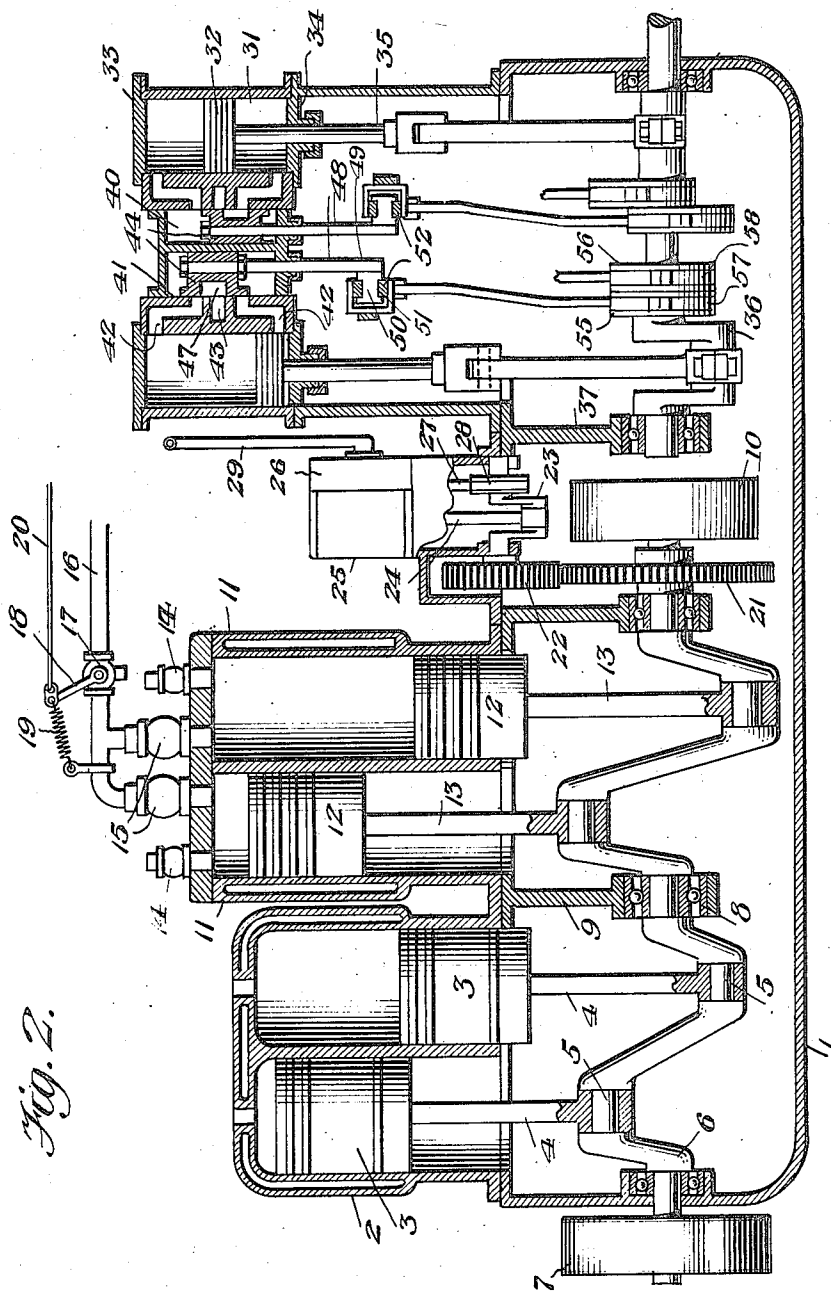


Fig. 2.

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UNITED STATES PATENT OFFICE.

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MOTOR.

1,380,795.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, JOSEPH GRAZIANO, son of Rosario, and JOSEPH GRAZIANO, son of Peter, citizens of Italy, residing at Newburgh, in the county of Orange and State of New York, have invented new and useful Improvements in Motors, of which the following is a specification.

Our present invention has reference to a fluid pressure engine.

The main object of the invention is the production of a power producing member primarily designed for use in connection with automobiles, which includes means for storing a fluid under pressure and for controlling the fluid as the same is fed to the pistons of an air engine which operates the propelling shaft of the automobile, and further which may be operated simultaneously with or independently of the operating means for the storing of the fluid.

It is a further object of the invention to construct a power producing member which shall be operated by air under pressure and which shall include means for compressing the said air, the latter being operated independently of the power producing means, whereby the air compressing means and the power producing means may be operated together or one of said means retained in operation while the other idles or stops, the construction dispensing with the employment of the usual clutch mechanism and the gears and levers for operating the same, while employing simple means for controlling the power producing means.

It is a still further object of the invention to produce an engine operated by air stored in a suitable tank and compressed therein by means operated by an internal combustion engine which operates independently of the air engine but which receives its initial start from mechanism connected with and actuated by the air from the compression tank.

It is a still further object of the invention to produce an air operated engine that includes a novel and efficient valve mechanism, whereby the admission of the fluid to and the exhaust of the same from the cylinders of the engine is properly controlled and timed to obtain the highest power and economic efficiency.

With the above and other objects in view, the invention consists in the construction,

combination and arrangement of devices herein described and claimed.

In the accompanying drawings:

Figure 1 is a plan view of the chassis of an automobile showing the application of our improved power producing means for driving the machine.

Fig. 2 is an approximately central vertical longitudinal sectional view through the improved engine.

Fig. 3 is a vertical transverse sectional view through the same taken through one of the valve chambers and showing the reversing link mechanism in elevation.

Our improved power producing mechanism includes a crank casing 1 which, at its outer end has secured thereon cylinders 2 of a multiple internal combustion engine. In the cylinders are the reciprocating pistons 3 provided with piston rods 4 that are connected to the cranks 5 of a crank shaft 6. One end of the crank shaft extends through a bearing in the outer or front end of the casing 1 and has secured thereon a fly wheel 7. The straight portions of the shaft 6 are journaled in suitable bearings 8 formed on the ends of webs or transverse flanges 9 in the casing 1, and the opposite straight end of the shaft 6 has secured thereon a second fly wheel 10. The fly wheels 7 and 10 serve as balancing elements for the shaft.

As the internal combustion engine is of the usual type and is operated in the usual manner by a compressed gas, a more detailed description thereof is not deemed necessary.

Inward of the internal combustion engine and also communicating with the crank shaft 1 are the cylinders 11 of an air compressor. In the cylinders 11 are reciprocating pistons 12 having piston rods 13 which are connected to the remaining cranked portions of the shaft 6. It will be apparent that when the pistons 3 of the internal combustion engine are reciprocated the pistons of the air compressor will be likewise reciprocated to compress air in the cylinders 11. Each of the cylinders 11 is provided with a valve intake 14 and with a valve outlet 15. The valves 15 are connected to a pipe 16 that leads to an air storage tank T. In the pipe 16 is a release valve 17 having the stem thereof provided with an offset handle

18 which is influenced by a spring 19 in one direction, so as to normally open the valve to the pipe 16 and close the outlet of the valve to the atmosphere. Also connected with the lever 18 is an operating element which may be in the nature of a rod or flexible member, designated by the numeral 20. A pull upon this element 20 will close communication between the pipe 16 and valves 15, and the tank, but will open the relief valve to the atmosphere, thus permitting air compressed by the pistons 12 to flow to the atmosphere.

On the end of the shaft 6 adjacent to the fly or balance wheel 10 is a gear wheel 21 that meshes with a smaller gear wheel or pinion 22, the latter being secured on one end of a crank shaft 23. This crank shaft operates a piston rod 24 connected with a suitable piston (not shown), arranged in a cylinder 25. The cylinder has at one side thereof a valve chamber 26 within which is a valve (not shown), operated by a piston or valve stem 27 that is actuated by a cam 28 on the said shaft 23. Air is delivered to the valve chest 26 from a pipe 29 that is connected with the air storage tank, the passage of the air through the pipe 29 being controlled by a suitable valve 30. The device just described constitutes a starter for the internal combustion engine. It will be apparent that when air is admitted to the cylinder 25 to act upon the piston therein the shaft 23 will be revolved, turning the pinion 23 which meshing with the pinion 21 will turn the shaft 26. In this operation the element 20 is actuated to open the relief valve 17, so that little resistance of the air is offered to the pistons 12 in the cylinders 11. When exploded gases in the cylinders 22 operate the pistons to revolve the shaft 6 the valve 30 is actuated to close the supply of air from the storage tank to the cylinder 25, and likewise the element 20 is released so that air compressed by the pistons 12 will be delivered through the pipe 16 to the storage tank and stored therein.

The foregoing mechanism provides the means for storing the air under pressure so that the same will operate my power imparting means which will now be described. The power imparting means is in the nature of an air operated engine of the multiple cylinder type. As the construction of each of the cylinders and the valve mechanism therefor is identical, a description of one will be sufficient to cover all. In each of the cylinders 31 is mounted a reciprocating piston 32. Each of the cylinders 31 has its ends provided with heads 33 and 34, and between the heads of the piston and the heads of the cylinder are the work chambers of the cylinder which are adapted to receive and exhaust air under pressure which operates the engine. Each piston 32 is coupled

by pivotally jointed connecting rods 35 to a crank shaft 36 that is arranged in the crank casing 1 and that has its inner straight end journaled in a bearing opening in the end of a transverse web or partition 37 in the casing and its outer straight end journaled in a bearing opening in the end of the casing 1. The straight portion of the shaft 36 is connected to the operating means for the rear or traction wheels 38 of an automobile 39.

Each cylinder 31 is formed with a laterally extending valve or air pressure chest 40 containing a machine valve seat 41 formed with inlet ports 42 and an exhaust port 43. Cooperating with the valve seat is a slide valve 44. The air under pressure from the storage tank T is admitted to the chest 40 through an inlet opening to which is connected a supply pipe 45 while the exhaust from the chest 40 passes out through an exhaust connection 46.

The inlet ports, of course, communicate with the cylinders 31. The valve 44 has a central recess or cavity 47 which is intersected by the exhaust port 43 of the valve seat 41. When the valve 44 moves downwardly to the limit of its stroke air under pressure is admitted through one of the ports 42 to act on one of the faces of the head of the piston 32, the air acted on by the opposite face of the said piston finding an outlet through the second port 52, the cavity 47 in the piston and the exhaust port 42, so that the piston will be driven, say downwardly. The valve 44 is thence shifted in the opposite direction closing the upper passage of the inlet port 52 and opening the lower passage of the said port, permitting the air under pressure to act upon the opposite face of the piston head and permitting air that has previously forced the piston downwardly to find an outlet through the upper passage of the port 52, the cavity 47 of the valve 44 and through the exhaust orifice or port 43. It is, of course, to be understood that the pistons in the separate chambers move simultaneously in different directions.

Each of the valves 44 has a downwardly projecting stem or rod 48, the lower end of which is provided with a fork 49 which straddles a block 50, the latter working in the arcuate slot 51 of an arcuate shiftable reversing link 52. The link 52 is operatively connected and is actuated at spaced apart points by a pair of arms 53 and 54 which embrace eccentrics 55 and 56 having eccentric straps 57 and 58 which engage eccentrics 59 and 60 on the crank shaft 36. The eccentrics are offset from each other, as illustrated in Figs. 2 and 3 of the drawings. The mechanism just described is duplicated for each cylinder, and each cylinder is therefore controlled by a separate and

independent slide valve which are, and as disclosed by the drawings, common to the connecting rods of all the pistons.

The several links 52 are all connected to 5 and operable by a rock shaft 61 to which a manually controlled lever 62 is secured. Extending from the shaft 61 is a plurality of crank arms 63 each of which is connected by a link 64 to the respective links 52. By 10 operating the single lever 62 all of the links 52 may be concurrently shifted from left to right in Fig. 2 for the purpose of reversing the position of the valves 44 and therefore reversing the direction of rotation of the 15 engine shaft.

We have previously stated that the pipe 16 connects with the tank T, but more properly speaking the said pipe connects with a heating tank or chamber 65, the latter being 20 in the nature of a cylinder which is closed at both of its ends and through this cylinder the exhaust pipe 67 from the internal combustion engine 2 passes, so as to superheat the air therein before the same is delivered 25 through a pipe 66 to the storage tank T. The exhaust pipe 67 communicates with a muffler 68, as does the exhaust air pipe from the air engine. The air mingling with the heated products of combustion delivered 30 through the exhaust pipe 67 tends to cool the same in the muffler 68 and consequently modify the noise which would otherwise be created in its passage through the muffler. The pipe 29 for the starter is also connected 35 with the heat or air expanding tank 65, as is the inlet pipe for the air engine. The reversing mechanism, above described, preferably has the control lever 62 therefor connected with a flexible element 69 trained 40 under suitable grooved guide wheels 70 connected to a crank on a transversely arranged shaft 71 journaled in bearings in the side members of the vehicle frame, and to this shaft is secured a foot pedal 72. The valves 45 for controlling the various pipes employed in the construction are arranged convenient for operation by the driver or operator of the device, and it is thought from the foregoing description, when taken in con-

nection with the drawings, the simplicity 50 of the construction and the advantages thereof will be readily apparent without further detailed description.

Having thus described the invention, what is claimed as new, is:— 55

In a driving device for automobiles or the like, an internal combustion engine having reciprocatory pistons therein and a crank shaft connected to said pistons an air compressor including cylinders having reciprocatory pistons therein which are operated 60 by the crank shaft of the internal combustion engine, valved air inlets for the cylinders, valved outlets for the cylinders, a pipe connected to said outlet valves, an air storage tank connected to said pipe, a spring influenced relief valve in the pipe, manually operated means for operating the valve to close the passage between the valve and tank and to open the passage to the atmosphere, 70 a starter for imparting initial motion to the pistons of the engine including a reciprocatory member having means operated thereby co-engaging with means on the crank shaft for turning the said crank shaft, 75 a valve pipe connection between the starter and the storage tank, an air engine having a crank shaft independent of the first mentioned crank shaft and connected to the drive means of the automobile, said air engine including cylinders having reciprocatory pistons therein connected with the crank shaft, valve chests to the sides of the cylinders, inlet and outlet ports between the cylinders and the valve seat, reciprocatory pistons in the valve and operated in timed relation by mechanism connected with the crank shaft, manually operated means for reversing the stroke of the valves and consequently reversing the stroke of the pistons, 80 means for feeding compressed air from the tank to the valve chests, controlling means for said feed means, and means for heating the fluid in the tank.

In testimony whereof we affix our signatures. 95

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