

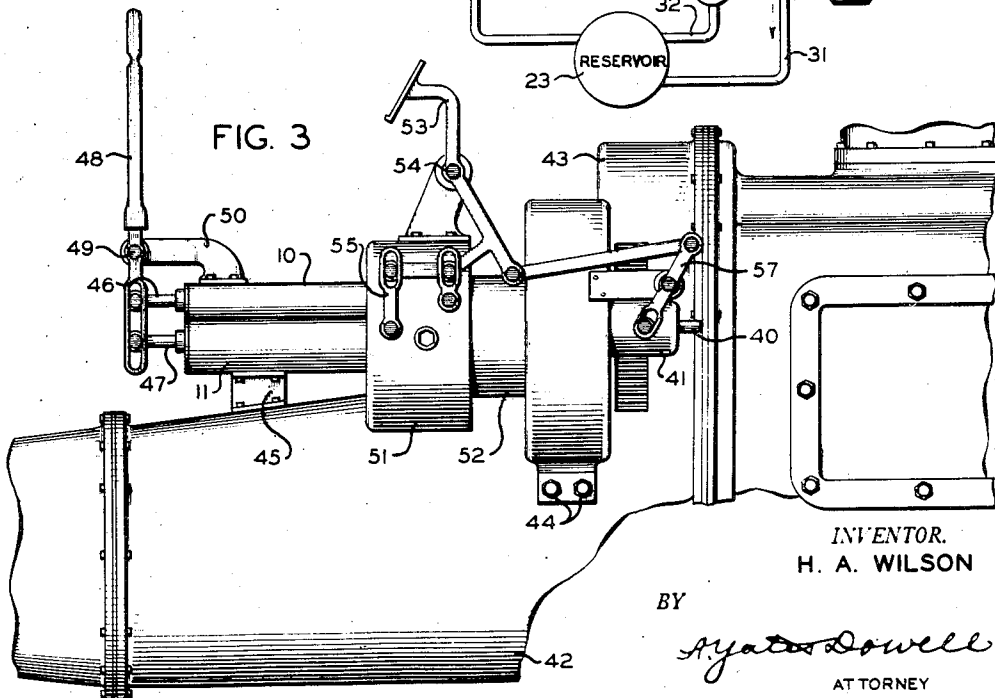
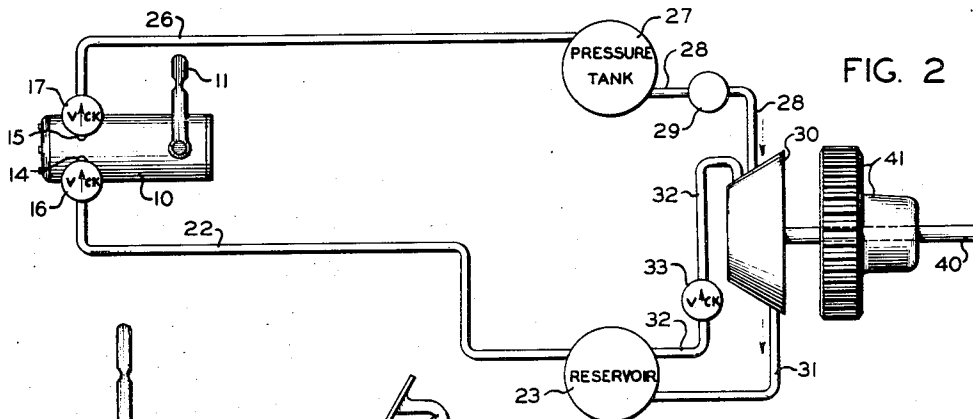
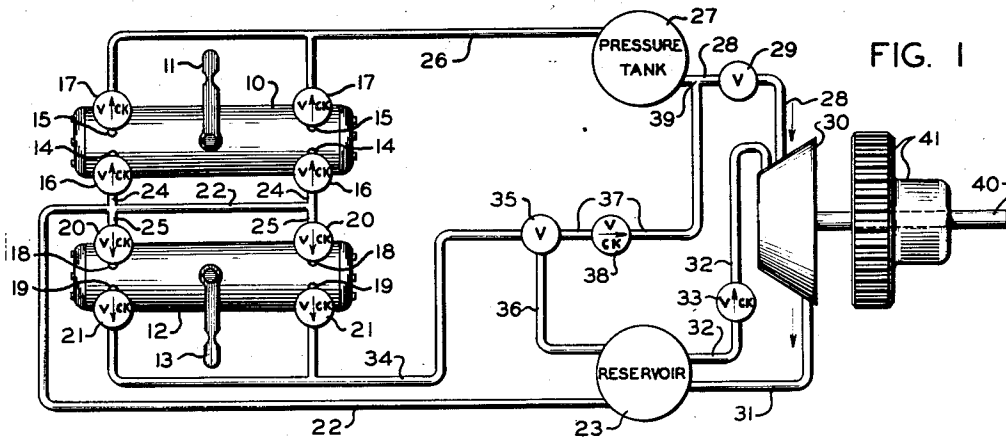
April 12, 1949.

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2,467,067

HYDRAULIC ENGINE STARTER

Filed Oct. 15, 1947



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2,467,067

HYDRAULIC ENGINE STARTER

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Application October 15, 1947, Serial No. 779,904

10 Claims. (Cl. 123—179)

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This invention relates to power devices and more particularly to a device for imparting initial motion to a power unit such as internal combustion engines.

The device of the present invention is intended to be employed alone as the starter of the engine, but is particularly adapted to be used as an auxiliary means for starting an engine when the regular starter fails.

In the conventional motor vehicle, a starter is employed for the internal combustion engine, power for which is provided from the customary six, twelve, or twenty four volt battery of the vehicle. In the event of failure of this source of power, which may occur under a number of circumstances, the starter will not function properly. It may also happen that mechanical failure in this customary starter itself will prevent its proper functioning when needed.

Various means for supplementing the starters of internal combustion engines have been provided among which are the conventional hand crank and various types of mechanically or hydraulically operated motors which are constructed to operate independently of the electrical system of the vehicle.

Some of the devices of the prior art have included a motor adapted to be hydraulically operated to drive the fly wheel of the engine by means of a fluid which is stored under pressure during operation of the vehicle. This system suffers from various defects, including those of greater complexity because of the necessity of providing means for storing the fluid under pressure as a result of the operation of the internal combustion engine, as well as the necessity for the fluid being kept under high pressure for long periods of time during which leakage may occur or the means for storing the fluid may become faulty.

Accordingly, it is an object of the present invention to provide a reliable auxiliary starter for an internal combustion engine which is simple and easy to install and operate, which has a minimum of working parts, and which does not require storing under pressure of operating fluids for substantial periods of time.

A further object of the invention is the provision of an auxiliary hydraulic starting motor for an internal combustion engine which is durable, relatively inexpensive to manufacture, and which provides maximum reliability.

Further objects and advantages of the invention will be apparent from the following descrip-

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tion taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a diagrammatic layout of a starter in accordance with the present invention employing two pressure pumps;

Fig. 2, a diagrammatic layout of an alternative form of starter employing only one pressure pump; and

Fig. 3, a side elevation of the device of Fig. 1 installed on the rear of a conventional internal combustion engine.

With continued reference to the drawings, the diagrammatic layout shown in Fig. 1 includes a high pressure low capacity double acting pump 10 having an operating lever 11, and a low pressure high capacity double acting pump 12 having an operating lever 13. Although separate operating levers 11 and 13 for the two pumps are illustrated it is contemplated that a single lever may be employed to actuate both pumps simultaneously.

Pump 10 has inlets 14 and outlets 15, the inlets being controlled by check valves 16 and the outlets by check valves 17. Pump 12 is likewise provided with inlets 18, outlets 19, inlet check valves 20, and outlet check valves 21. A hydraulic line 22 leading from a reservoir 23 has branch lines 24 and 25 leading to the inlet check valves of pumps 10 and 12 respectively.

The outlets 15 of pump 10 are connected to line 26 having its outlet at pressure tank 27, which may be of a conventional type. From pressure tank 27, a line 28, having a manually operated valve 29 therein, is connected to a hydraulic motor or the like 30. A return line 31 leads from the hydraulic motor to the reservoir 23. A by-pass 32 having a check valve 33 therein connects the reservoir 23 to the inlet of the hydraulic motor 30.

The outlets 19 of pump 12 are connected to line 34 leading to a manually operable three-way valve 35. In one position valve 35 permits flow from line 34 to reservoir 23 through a line 36. In its other position valve 35 permits flow from line 34 to a line 37 having a check valve 38 therein and which is connected to line 28 at junction 39.

The hydraulic motor 30 has attached thereto a shaft 40 adapted to turn a gear 41 splined to the shaft. It is contemplated that the hydraulic motor 30 may be disposed so that the gear 41 may be manually moved into and out of engagement with the ring gear on the fly wheel of an internal combustion engine to which the device is applied.

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In the normal operation of the device, it is contemplated that the high pressure low capacity pump 10 may be employed to establish pressure in the tank 27, the fluid therefor coming from the reservoir 23 through line 22 to branch lines 24, check valves 16, inlets 14 into the pump 10 and being forced by actuation of the handle 11 through the outlet 15, check valve 17, and line 26 into the pressure tank 27. If the operating handles 11 and 13 for pumps 10 and 12 are connected or if the pumps are actuated by only one handle so that operation of pump 12 occurs simultaneously with operation of pump 10, fluid from reservoir 23 will be pumped through line 22, through branch lines 25, check valves 20 and inlets 18 into pump 12 and through outlets 19 and check valves 21 to line 34 to valve 35, which may be positioned so that the flow passes to line 36 to return to the reservoir 23. By this means fluid pumped initially by the pump 12 will perform no useful work and the only additional force required for actuating pump 12 at this stage is that required to overcome the friction of the moving parts.

After the operator has pumped a suitable amount of fluid into the pressure tank 27 he may move a manually operated lever, to be described later, causing gear 41 on the splined shaft 40 to move into engagement with the fly wheel ring gear of the engine and at the same time to open valve 29 and change the position of valve 35 so that the flow from line 34 will be directed into line 37. When this occurs the fluid under pressure in tank 27 will flow through line 28 through the hydraulic motor 30 and return to the reservoir 23 by way of line 31. Simultaneously fluid from line 34 will flow through valve 35 into line 37 through a check valve 38 and past the connection 39 into line 28 to supplement the flow of fluid from the pressure tank.

The simultaneous operation of the pumps 10 and 12 may be continued until the engine starts, at which time the lever for moving the gear 41 into engagement with the fly wheel ring gear of the engine may be retracted, thus disengaging the gear and permitting the engine to operate under its own power. The movement of the lever will also close valve 29 and change the position of valve 35. In the event that the engine turning under its own power drives the hydraulic motor 30, before gear 41 and the fly wheel ring gear are disengaged at a speed faster than that for which fluid can be supplied from the pumps, the by-pass 32 is provided which will permit fluid to be drawn directly from the reservoir in order that the lines may be kept full of fluid at all times. The check valve 38 is located in the line 37 to prevent fluid under pressure from tank 27 from passing into line 36 or 34 at the instant the position of valve 35 is changed.

It is contemplated that in using the device the pump 10 may be employed to establish an initial pressure in the tank 27 following which its pumping action will be supplemented by that of the larger capacity pump 12 which may be utilized after the fluid motor 30 has begun its movement.

Fig. 2 discloses a diagrammatic layout of a starting motor and includes a pump 10 which may be either single or double acting with an operating handle 11. The pump has an outlet 15 having a check valve 17 therein and a line 26 leading to pressure tank 27. An inlet 14 is provided with a check valve 16 which is connected to line 22 and a reservoir 23. A line 28 from the outlet side of the pressure tank has a manually oper-

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ated valve 29 therein and leads to the hydraulic motor 30; a return line 31 from the outlet of the hydraulic motor leads to the reservoir 23. A by-pass 32 having a check valve 33 therein is also provided leading from the reservoir to the inlet of the hydraulic motor. The hydraulic motor 30 may have the shaft 40 and the gear 41 splined therein.

In the operation of the device, the pump 10 may be actuated to store fluid under pressure in the tank 27. After sufficient pressure has been attained in tank 27, the valve 29 may be opened permitting flow of the fluid under pressure to the hydraulic motor 30. The linkage for opening valve 29 may also move gear 41 into engagement with the fly wheel ring gear of the engine. During the movement of the linkage the operator may continue the pumping action to maintain fluid pressure during operation of the motor. After the engine has been cranked sufficiently for it to run under its own power, valve 29 may be closed and gear 41 retracted by the linkage later to be described, and in the event that the engine drives the hydraulic motor 30 for a substantial length of time fluid may be supplied to the motor through the by-pass 32 as described in connection with the operation of the device shown in Fig. 1.

Fig. 3 discloses a method of installation of the device of the present invention on a conventional internal combustion engine. It is understood that the invention is not limited to use with any particular type of engine but may be employed for starting any internal combustion engine.

In the drawing there is disclosed a housing 42 for the drive shaft of a conventional engine and a housing 43 for the fly wheel thereof. The starter may be mounted on the drive shaft housing 42 by suitable fasteners, such as the bolts 44 and the bracket 45, and comprises the high pressure pump 10 and low pressure pump 11 having rods 46 and 47 which may be operated by means of a pump arm 48 on pivot 49 and mounted on an arm or bracket 50 of the pumps. The housings 51 and 52 may include the system and valve disclosed in Figs. 1 and 2 of the diagrammatic layout. A lever 53 which may be either hand or foot operated is mounted on pivot 54 and is attached to valve operating mechanisms 55 and 56 which control the operation of the valves 29 and 35. The lever 53 is also attached to link 57 which is connected to shaft 40 for controlling the operations of the gear 41.

In the operation of the device as previously described, the pumps may be actuated by the handle 48 until sufficient pressure is stored in the pressure tank 27, after which the lever 53 may be actuated to open valve 29 and change the position of valve 35, at the same time moving gear 41 into engagement with the fly wheel ring gear of the engine. After the engine is operating under its own power, the lever 53 may be actuated oppositely from its previous motion to close valve 29 and restore the valve 35 to its previous position, at the same time moving gear 41 from engagement with the fly wheel ring gear of the engine.

Although the unit is shown as attached to the right side of an internal combustion engine, it is understood that it may be attached in another position if preferred.

The unit shown in Fig. 3 is a simple, easily constructed device and may be easily attached to a vehicle by conventional means.

It will be obvious to those skilled in the art that various changes may be made in the in-

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vention without departing from the spirit and scope thereof and therefore the invention is not limited by that which is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. A starting device for an internal combustion engine comprising in combination a high pressure low capacity pump and a low pressure high capacity pump, a fluid reservoir, a fluid conduit connecting said reservoir and said pumps, a pressure tank, a fluid conduit connecting said high pressure pump and said tank whereby upon actuation of said high pressure pump fluid will be pumped from said reservoir to said tank thus building up pressure therein, a fluid pressure operated motor having a shaft, a gear slidably mounted on said shaft for rotation therewith, said gear being constructed and arranged to engage a gear associated with said engine whereby upon rotation of said motor said engine will be rotated, a conduit connecting said tank and said motor, a manually actuated valve in said conduit for controlling fluid flow therethrough, a fluid return conduit connecting said motor and said reservoir, a conduit connecting said low pressure pump and a three-way valve, a first conduit connecting said three-way valve and said reservoir, a second conduit connecting said three-way valve and the conduit connecting said tank and said motor, a control linkage constructed and arranged to actuate said valves and shift said gear, manually operable means for simultaneously actuating said pumps, and a by-pass conduit from said reservoir to said motor whereby upon starting of said engine and prior to disengagement of said gear said motor may draw fluid directly from said reservoir to maintain sufficient fluid in said motor.

2. A starting device for an internal combustion engine comprising in combination a high pressure low capacity pump and a low pressure high capacity pump, fluid reservoir, a fluid conduit, connecting said reservoir and said pump, a pressure tank, a fluid conduit connecting said high pressure pump and said tank, whereby upon actuating of said high pressure pump fluid will be pumped from said reservoir to said tank thus building up pressure therein, a fluid pressure operated motor having a shaft, a gear slidably mounted on said shaft for rotation therewith, said gear being constructed and arranged to engage a gear associated with said engine whereby upon rotation of said motor said engine will be rotated, a conduit connecting said tank and said motor, a valve in said conduit for controlling the flow of fluid therethrough, a fluid return conduit connecting said motor and said reservoir, a conduit connecting said low pressure pump and a three-way valve, a first conduit connecting said three-way valve and said reservoir, a second conduit connecting said three-way valve and a conduit connecting said tank and said motor, means to actuate said valve and shift said gear, means for actuating said pump, and a by-pass conduit from said reservoir to said motor whereby upon starting of said engine and prior to disengagement of said gear said motor may draw up fluid directly from said reservoir to maintain sufficient fluid in said motor.

3. A starting device for an internal combustion engine comprising in combination a first pump and a second pump, means connecting said pumps to a reservoir of fluid, means connecting said first pump to a pressure tank where-

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by said pump may cause movement of fluid from said reservoir into said pressure tank, a fluid operated motor, a shaft associated with said fluid operated motor, a rear splined for sliding movement on said shaft, a conduit connecting said pressure tank to said fluid motor, a manually actuated valve in said conduit for preventing or permitting flow therethrough, means connecting said fluid motor to said reservoir whereby fluid from said pressure tank may actuate said fluid motor and return to said reservoir; conduit means connecting said second pump to a three-way valve, a first conduit means from said three-way valve connected to the reservoir, a second conduit means from said three-way valve connected to the conduit from the pressure tank to the fluid motor, and a by-pass conduit from said reservoir to said fluid motor whereby a demand for fluid greater than that supplied by means of the pumps may be met directly from the reservoir.

4. A starting device for an internal combustion engine comprising in combination a pump, a fluid reservoir, a fluid conduit connecting said reservoir and said pump, a pressure tank, a fluid conduit connecting said pump and said tank whereby upon actuation of said pump fluid will be pumped from said reservoir to said tank thus building up pressure therein, a fluid pressure operated motor having a shaft, a gear slidably mounted on said shaft for rotation therewith, said gear being constructed and arranged to engage a gear associated with said engine whereby upon rotation of said motor said engine will be rotated, a conduit connecting said tank and said motor, a valve in said conduit for controlling fluid flow therethrough, a fluid return conduit connecting said motor and said reservoir, a control linkage constructed and arranged to actuate said valve and to shift said gear, manually operable means for actuating said pump, and a by-pass conduit from said reservoir to said motor whereby upon starting of said engine and prior to disengagement of said gear said motor may draw fluid directly from said reservoir to maintain sufficient fluid in said motor.

5. A starting device for an internal combustion engine comprising in combination a pump, a fluid reservoir, a fluid conduit connecting said reservoir and said pump, a pressure tank, a fluid conduit connecting said pump and said tank whereby upon actuation of said pump fluid will be pumped from said reservoir to said tank thus building up pressure therein, a fluid pressure operated motor having a shaft, a gear slidably mounted on said shaft for rotation therewith, said gear being constructed and arranged to engage a gear associated with said engine whereby upon rotation of said motor said engine will be rotated, a conduit connecting said tank and said motor, a valve in said conduit for controlling fluid flow therethrough, a fluid return conduit connecting said motor and said reservoir, means to actuate said valve and shift said gear, means for actuating said pump, and a bypass conduit from said reservoir to said motor whereby upon starting of said engine and prior to disengagement of said gear said motor may draw fluid directly from said reservoir to maintain sufficient fluid in said motor.

6. A starting device for an internal combustion engine comprising a first and a second pump, a reservoir for supplying fluid to said pumps, a pressure tank connected to said first pump, a fluid motor, a shaft associated with said fluid motor, a gear splined on said shaft adapted to

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be engaged with the fly wheel ring gear of an internal combustion engine, manually operated valve means associated with said device whereby in one position fluid may be stored under pressure in said tank as a result of the operation of the first of said pumps and in another position fluid may be supplied to said fluid motor as a result of the operation of both of said pumps, control linkage for operating said valve means and shifting said gear, and a by pass conduit from said reservoir to said motor whereby upon starting of said engine and prior to disengagement of said gear said motor may draw fluid directly from said reservoir to maintain sufficient fluid in said motor.

7. A starting device for an internal combustion engine comprising in combination a first and a second pump, a reservoir for supplying fluid to said pumps, a pressure tank connected to said first pump, a fluid motor, a shaft associated with said fluid motor, a gear splined on said shaft adapted to be engaged with the fly wheel ring gear of an internal combustion engine, manually operated valve means associated with said device whereby in one position fluid may be stored under pressure in said tank as a result of the operation of the first of said pumps and in another position fluid may be supplied to said fluid motor as a result of the operation of both of said pumps, and control linkage for operating said valve means and shifting said gear.

8. A starting device for an internal combustion engine comprising in combination a pump, a reservoir for supplying fluid to said pump, a pressure tank connected to said pump, a fluid motor, a shaft associated with said fluid motor, a gear splined on said shaft adapted to be engaged with the fly wheel ring gear of an internal combustion engine, manually operated valve means associated with said device whereby in one position fluid may be stored under pressure in said tank as a result of the operation of said pump and in

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another position fluid may be supplied to said fluid motor, and control linkage for operating said valve means and shifting said gear.

9. A starting device for an internal combustion engine comprising in combination a pressure tank, a fluid reservoir, means for transferring fluid from said reservoir to said tank to build up pressure therein, a fluid pressure motor, means on said motor to engage a rotating part of said engine whereby upon rotation of said motor said engine will be rotated, means to supply a quantity of fluid at a low pressure to said motor, means to control the flow of fluid to said motor and the means engaging said engine, and means connecting said motor and said reservoir whereby upon starting of said engine said motor may draw fluid from said reservoir to maintain fluid in said motor.

10. A fluid pressure starting device for an internal combustion engine comprising in combination a fluid pressure motor, means on said motor to engage a rotating part of said engine whereby upon rotation of said motor said engine will be rotated, means to supply fluid pressure to said motor, means to control the supply of fluid pressure to said motor, and means whereby upon starting of said engine said motor may draw a quantity of fluid thereinto to maintain fluid therein.

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