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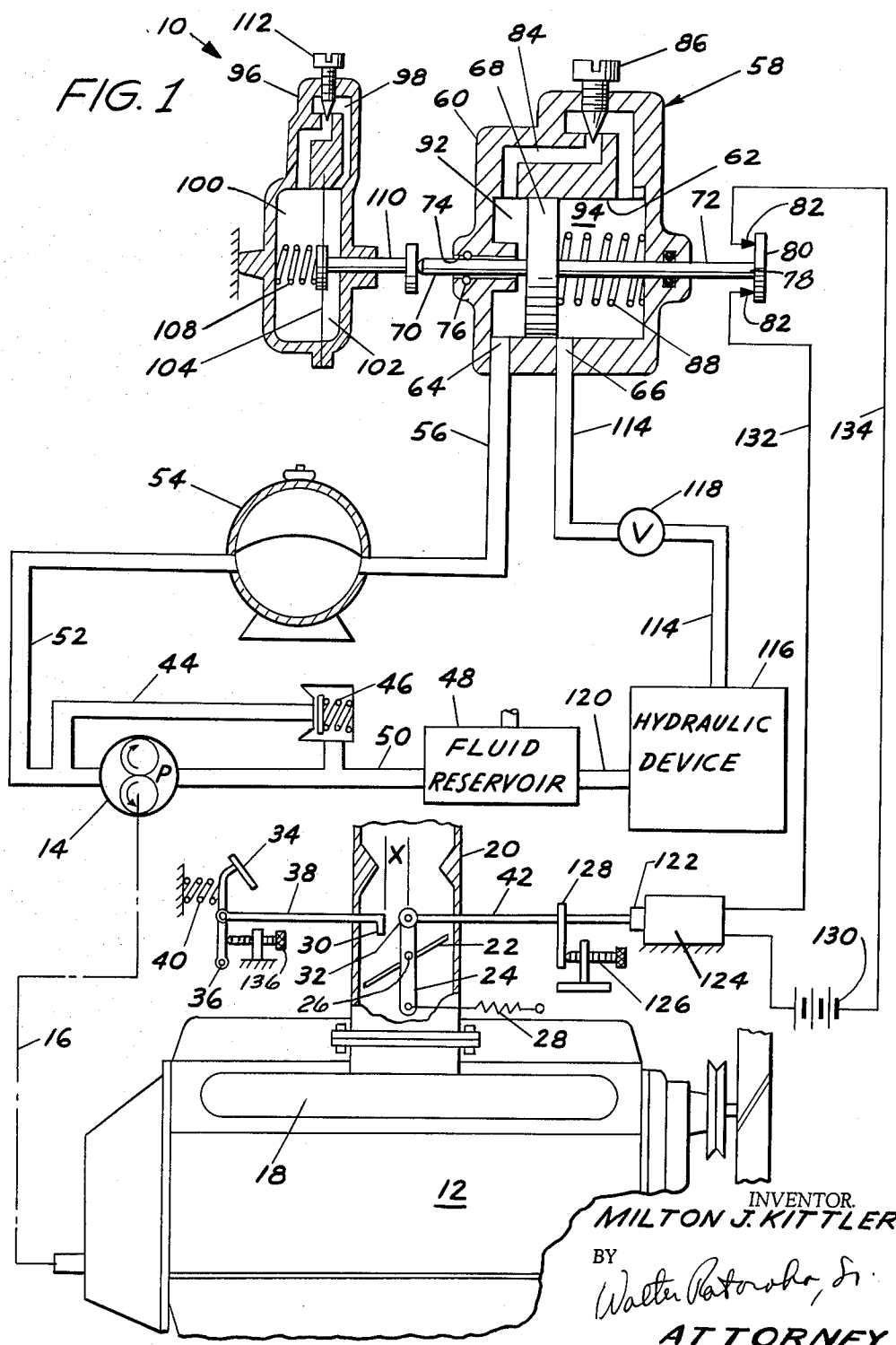
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MEANS FOR SUPPLYING POWER ON DEMAND

Filed Dec. 31, 1964

2 Sheets-Sheet 1



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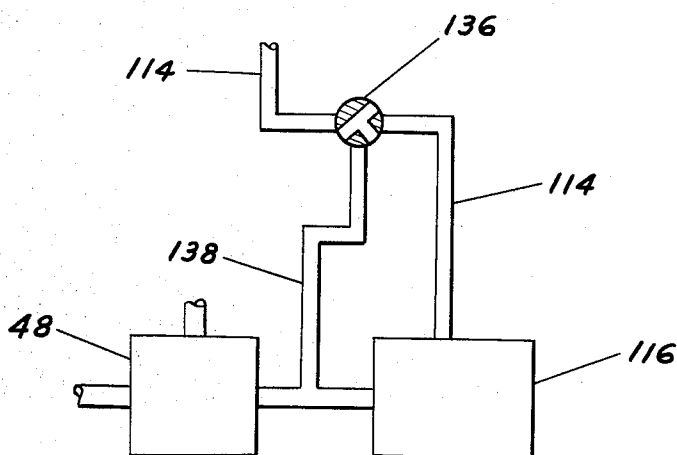
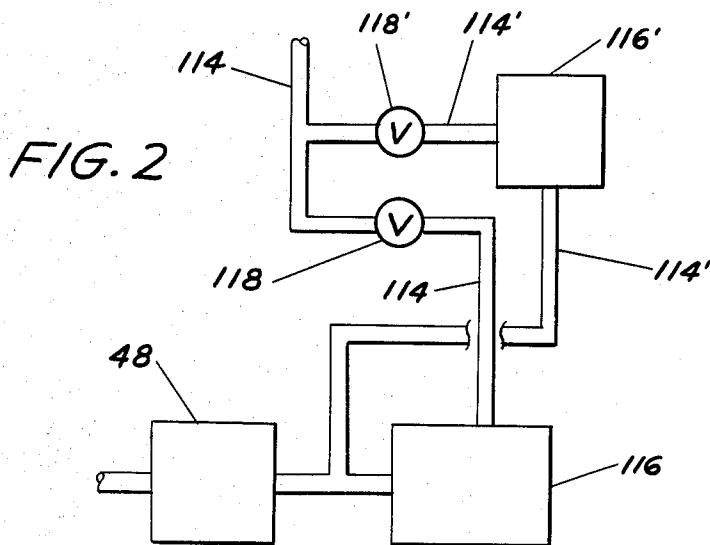
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2 Sheets-Sheet 2



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MEANS FOR SUPPLYING POWER ON DEMAND
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This invention relates generally to systems for supplying increased power output upon demand, and more particularly to a system for regulating the speed of an internal combustion engine driving a hydraulic pump so as to increase engine speed only when increased pump output is required.

There are many special types of trucks or other service vehicles where the engine that drives the vehicle also drives a pump that supplies hydraulic fluid under pressure to an auxiliary device such as a movable platform, as disclosed in Troche et al. 2,949,741, the output of the pump being proportional to its speed.

It is desirable and the usual practice, to locate the controls by which the operator may move the platform to various positions on the platform. This, of course, requires that the engine driving the pump be operated continuously so as to have hydraulic pressure available at any time that the operator may want to move the platform.

The engine must, of course, be operated at some speed higher than idling speed when pump power output sufficient to operate the hydraulic mechanism is demanded by the operator. However, since the platform is stationary most of the time, increased hydraulic output is demanded during only a small fraction of the time that the platform is in use. Consequently, in order to save wear and tear on the pump and the engine, it is desirable to maintain the engine at idle speed at all times, except when it is desired to operate the hydraulic equipment.

Accordingly, an object of the invention is to provide a system including an engine-driven pump and adapted to supply increased hydraulic output upon demand by automatically regulating the speed of the engine between predetermined lower and higher speeds.

Another object of the invention is to provide such a system wherein the engine will operate at the lower speed at all times, except when the higher speed is required to supply the increased hydraulic output.

Still another object of the invention is to provide such a system wherein control of the engine is automatically provided by operation of the controls for the hydraulic equipment.

Another object of the invention is to provide such a system wherein control of said engine is responsive to flow of hydraulic fluid, whether the hydraulic equipment be of the rotary hydraulic motor or the hydraulic piston type.

These and other objects and advantages of the invention will become more apparent upon reference to the following specification and accompanying drawings, wherein:

FIGURE 1 is a schematic illustration of an engine-driven hydraulic system embodying the invention.

FIGURES 2 and 3 are fragmentary portions of FIGURE 1 illustrating modifications of the invention.

Referring now to FIGURE 1, the system 10 includes an internal combustion engine 12 connected to drive a hydraulic pump 14 through the transmission line 16. The engine 12 may be a separate engine mounted on the bed of a service type vehicle so as to drive the pump directly, or it may be the same engine that drives the vehicle, in which case it would be provided with the usual power take off unit for driving the pump 14.

The engine 12 includes an intake manifold 18 fitted with a carburetor 20. While the carburetor forms no

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part of the invention, the throttle control mechanism therefor must be of a particular design adapted to permit the type of automatic control contemplated by the invention. In FIGURE 1, the carburetor is fitted with the usual pivotally-mounted throttle plate 22 having a lever 24 fixed to the throttle shaft 26. One end of the lever is urged in a throttle opening direction by any suitable spring 28 or other resilient means. The extent to which the spring 28 can open the throttle 22 is dependent upon the position of the abutment 30 adapted to engage the other end 32 of the throttle lever, the position of the abutment 30 being controlled by means such as the operator's foot pedal 34. The foot pedal 34 is pivotally mounted at one end 36, and the linkage 38 from the abutment is connected thereto, the pedal 34 being urged by a spring 40 in a direction to maintain the throttle 22 closed. The end 32 of the throttle lever 24 has pivotally connected thereto a linkage 42 actuated by the system 10.

This manner in which the system actuates the linkage 42 will be described, it being sufficient at this time to point out that the abutment 30 may be set to provide some maximum throttle opening, and therefore a maximum engine speed; however, the system 10 may reduce the engine speed, regardless of the position of the abutment 30, through the linkage 42 in opposition to the force of the throttle opening spring 28.

The remainder of the system 10 includes the previously mentioned hydraulic pump 14, which may include the usual bypass passage and valve arrangement 44 having a spring 46 for limiting the maximum pressure in the system 10. The pump 14 delivers hydraulic fluid from the fluid reservoir 48 through the line 50 and discharges it through the line 52 to an accumulator 54 which may be employed if it is desired to limit pressure fluctuations in the system 10. From the accumulator 54 the fluid passes through a line 56 to what may be referred to as a demand sensitive switch assembly 58.

The switch assembly 58 comprises a housing 60 formed in any desired manner to provide a hydraulic cylinder 62 having an inlet 64 and an outlet 66. A piston 68 is slidably mounted in the cylinder 62, the piston having shafts 70 and 72 extending axially from both ends thereof. The shaft 70 extending from the left hand side of the piston 68 passes to the outside of the housing 60 through the opening 74 including any suitable dynamic type seal 76 to prevent leakage. The shaft 72 extending from the right hand side of the cylinder is similarly constructed, except that the external free end 78 of the shaft is fitted with a movable type switch contact 80 cooperating with a pair of stationary switch contacts 82.

The housing 60 may also be formed with a bypass passage 84 between chambers 92 and 94 on the left and right hand sides of the piston 68, the area of the bypass passage being adjustable by means of a screw 86. A compression spring 88 positioned in chamber 94 between the piston 68 and the right hand cylinder end wall urges the piston 68 to the left in opposition to any hydraulic pressure urging the piston to the right.

To smooth out the operation of the piston 68, a dashpot mechanism 96 may be provided against which the shaft must operate. While the particular construction of the dashpot 96 is not important, in the construction shown, the dashpot effect is obtained by the transfer of fluid through the adjustable bypass passage 98 between the right and left hand chambers 100 and 102 provided by mounting a diaphragm or other movable member 104 in the housing 106, the spring normally urging the dashpot stem 110 to the right. Adjustment of the bypass is provided by the screw 112.

The outlet 66 from the switch assembly 58 communicates through conduit 114 with a hydraulic power device 116, such as a hydraulic rotary motor, employed to drive

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some accessory equipment such as the mobile tower shown in the above referenced Troche patent. The line 120 returns the fluid from the hydraulic device back to the fluid reservoir 48. A control valve 118 is included in the line, the purpose of the control valve being to either supply or cut off hydraulic fluid to the hydraulic device 116.

The previously mentioned linkage 42 pivotally connected to the end 32 of the throttle lever 24 is secured to the armature 122 of a solenoid 124. An adjustable screw stop 126 limits the travel of the linkage 42 in the throttle closing direction when the solenoid is energized by reason of its engagement with an abutment 128 fixed to the linkage 42. The solenoid electric circuit includes a battery 130, the leads 132 and 134 and the switch contacts 80 and 82.

OPERATION

In operation of a service type vehicle for which the invention is primarily intended, the vehicle would be parked with the vehicle engine or the auxiliary engine that drives the pump 14 running. In case of an aerial platform type vehicle, the control valve 118 would preferably be located on the platform itself.

Prior to boarding the platform, the operator would set the abutment 30 in any desired manner, such as by the stop screw 136, to that engine speed required for the pump 34 to produce the power output necessary to operate the hydraulic device 116 and actuate the platform. Then he would board the platform and manually operate the control valve 118 to a position demanding increased hydraulic output, thereby opening the line 114. This will immediately drop the pressure in the chamber 94 to the right of the piston, and the higher pump output pressure in chamber 92 to the left of the piston 68 will force the piston to the right against the force of the spring 88 until the piston moves past the outlet 66 so as to supply pump output pressure to the device 116. Movement of the piston to the right will also break the switch contacts 80 and 82, thereby deenergizing the solenoid, thereby permitting the spring 28 to move the throttle lever 24 in the throttle opening direction until the end 32 thereof engages the previously set abutment 30. This causes the engine 12 to speed up so as to increase the pump 14 speed to provide the required increased hydraulic output.

When the platform has reached its desired position, the operator closes the control valve 118, blocking the line 114 and stopping flow to device 116. The pressures on opposite sides of the piston 68 then become equalized by reason of the bypass passage 84, at which time the spring 88 returns the piston 68 to its left most position, against the dashpot 96 if one is provided, so as to close the switch contacts 80 and 82. Closing of the contacts again energizes the solenoid so as to move the linkage 42 to the right until the abutment 128 engages the stop screw 126. Thus, the engine will again return to the predetermined idle operation.

The pump driving engine 12 must of course be kept running so that the platform may be moved any time it is desired. However, as stated above, the length of time during which the platform is being moved is a very small percentage of the total time that it is in operation. Therefore, it is obvious that considerable wear and tear on the engine 12 and on the pump 14 is saved by maintaining the engine at an idle speed at all times except when higher speed is desired.

It will be noted that with the use of the system described, the engine speed control is obtained automatically merely by operating the control valve 118 for the hydraulic device 116; no separate engine speed control levers or other mechanisms are required.

FIGURE 2 is a fragmentary portion of FIGURE 1 illustrating a parallel connection of two identical hydraulic devices 116 and 116' and their associated control valves

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118 and 118' between the demand sensitive switch assembly 58 and the fluid reservoir 48. Such a parallel arrangement could be employed, for example, where the aerial platform has mechanisms for both raising and lowering it and for rotating it about a vertical axis. Other additional parallel-connected hydraulic devices and control valves could be added if additional movements of the platform or additional hydraulic power were required for some reason or other.

With such a parallel-connected system, movement of one or more of the control valves, either independently or simultaneously, would result in the same speed up and subsequent return to idle of the engine 12 and the pump 14.

FIGURE 3 is a fragmentary view similar to FIGURE 2 except that it illustrates a three-way control valve 136 to accommodate the return or dump line 138, the three-way valve 136 and the line 138 being employed where the hydraulic device 116 is a hydraulic piston requiring return of hydraulic fluid back to the fluid reservoir 48, rather than a continuous flow rotary motor. The three-way valve is also required to lock the piston in any desired position. Any number of piston type hydraulic devices and their associated three-way valves may be connected in parallel, similar to the arrangement in FIGURE 2.

It should be apparent from the above description of its construction and operation that applicant's invention provides a relatively simple, fast-response and foolproof remotely located means for controlling an engine driving a hydraulic pump that supplies a fluid output necessary to operate hydraulic equipment. Engine and pump wear are minimized because the engine remains at an idle speed at all times except when a temporary higher speed is required. As soon as the demand for increased hydraulic output is satisfied, the engine automatically returns to the idle speed. The bypass passage 84 is adjusted by means of the screw 86, so that ordinary minimal or leakage flow through the system will not actuate the mechanism; that is, the mechanism will operate only when the operator demands increased output.

While a preferred embodiment and two modifications of the invention have been disclosed, other modifications are possible. For example, it is apparent that any gate type demand valve may be employed in place of the piston 68, and that the invention is equally adapted to control the speed of a diesel or other engine for the purpose stated. Also, while parallel arrangements are shown, the scope of the invention includes any possible series arrangements of the hydraulic devices and their associated control valves. Thus, no limitations are intended other than those recited in the appended claims.

What I claim as my invention is:

1. The combination of an internal combustion engine, a carburetor supplying motive fluid to said engine and a hydraulic system requiring intermittent periods of high engine speed, said carburetor having a throttle valve urged in the opening direction by resilient means, means for limiting the opening movement of said throttle valve to the said high engine speed position, and means working against said resilient means urging said throttle valve open for setting said throttle to some predetermined lower engine speed.

2. The combination of an internal combustion engine; a carburetor supplying motive fluid to said engine; and a hydraulic system requiring intermittent periods of high engine speed; said carburetor having a throttle valve urged in the opening direction by resilient means, means for limiting the opening movement of said throttle valve to the said high engine speed position and means opposing said resilient means for urging said throttle valve open for setting said throttle to some predetermined lower engine speed; said system including a hydraulically-operated device, a fluid reservoir, a hydraulic pump driven by said engine, a control valve for supplying and cutting

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off fluid pressure from said pump to said hydraulic device, suitable hydraulic conditions connecting the above elements of said system, and a fluid flow responsive piston assembly connected in one of said conduits, said assembly including means adapted during periods when hydraulic fluid is not flowing in said system for actuating said opposing means for reducing engine speed to said lower speed.

3. The combination of an internal combustion engine; a carburetor supplying motive fluid to said engine; and a hydraulic system requiring intermittent periods of high engine speed; said carburetor having a throttle valve urged in the opening direction by resilient means, means for limiting the opening movement of said throttle valve to the said high engine speed position and means opposing said resilient means for urging said throttle valve open for setting said throttle to some predetermined lower engine speed; said system including a hydraulically-operated device, a fluid reservoir, a hydraulic pump driven by said engine, a control valve for supplying and cutting off fluid pressure from said pump to said hydraulic device, suitable hydraulic conduits connecting the above elements of said system, and a fluid flow responsive piston assembly connected in one of said conduits, said assembly including means adapted during periods when hydraulic fluid is flowing in said system for allowing said resilient means to open said throttle to said high speed.

4. The combination recited in claim 2, wherein said latter means comprises an electrical circuit including a switch actuated by said piston assembly and a solenoid for moving said throttle to said lower speed when said switch is closed.

5. The structure recited in claim 2, wherein said hydraulic device is of the piston type and said control valve is a three-way valve so that said piston may be actuated, locked in any position and returned.

6. In an internal combustion engine having a fuel control system including a throttle valve, a hydraulically operated device, means for operating said device and means for regulating the position of said throttle valve, said last mentioned means comprising a circuit including a stationary contact, a solenoid, a movable contact operated by said first mentioned means, and linkage means between said solenoid and said throttle valve.

7. In an internal combustion engine having a fuel control system including a throttle valve, a hydraulically operated device and means for operating said device and for regulating the position of said throttle valve, said means including a hydraulic pump driven by said engine, a

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hydraulically operated piston, a first conduit communicating between said pump and one side of said piston, a second conduit communicating between the other side of said piston and said hydraulically operated device, a control valve in said second conduit for opening said second conduit and thereby decreasing the pressure adjacent said other side of said piston and causing said piston to move so as to permit direct communication between said first and said second conduits, and means actuated by movement of said piston for regulating the position of said throttle valve.

8. The device described in claim 7, wherein said last mentioned means comprises a circuit including a stationary contact, a movable contact operated by said piston and a solenoid, and linkage means between said solenoid and said throttle valve.

9. The combination of an internal combustion engine supplied with motive fluid by a fuel control system including modulating means for varying the amount of said fluid, a hydraulic pump driven by said engine, a hydraulically operated device, a conduit system communicating between said pump and said device, a control valve in said conduit system, a piston in said conduit system, said piston being movable in response to opening of said control valve for permitting said fluid to flow to said device and cause it to operate, a solenoid, linkage means connected between said solenoid and said modulating means, and an electrical switch operatively connected to said solenoid and to said piston, said switch being actuated by movement of said piston for causing said solenoid to reposition said modulating means through said linkage means.

10. The combination of claim 9, wherein additional means are provided to limit the open position of said modulating means.

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