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AUTOMATIC THROTTLE CONTROL

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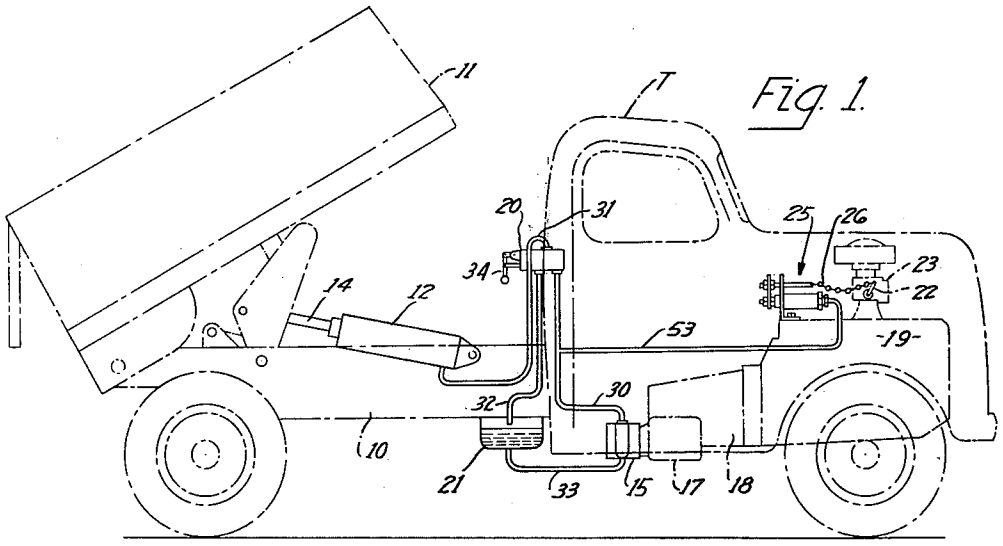


Fig. 1.

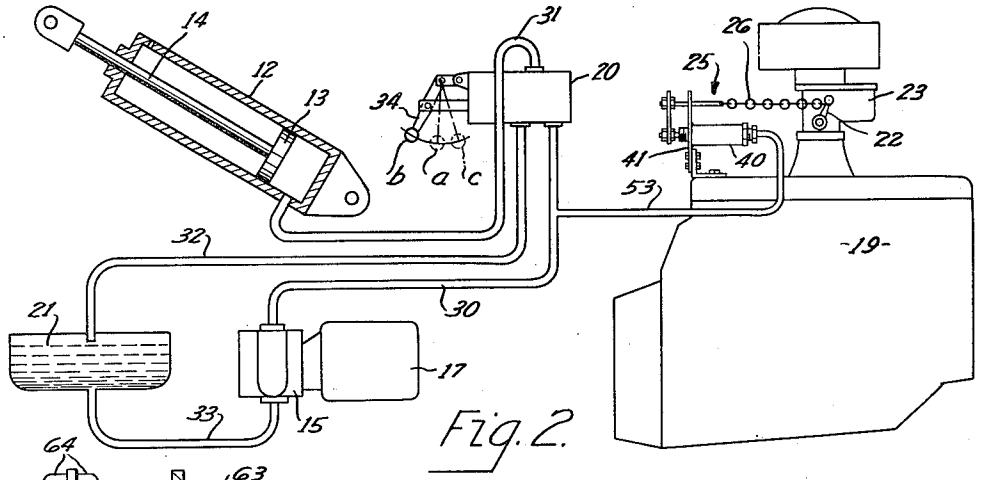


Fig. 2.

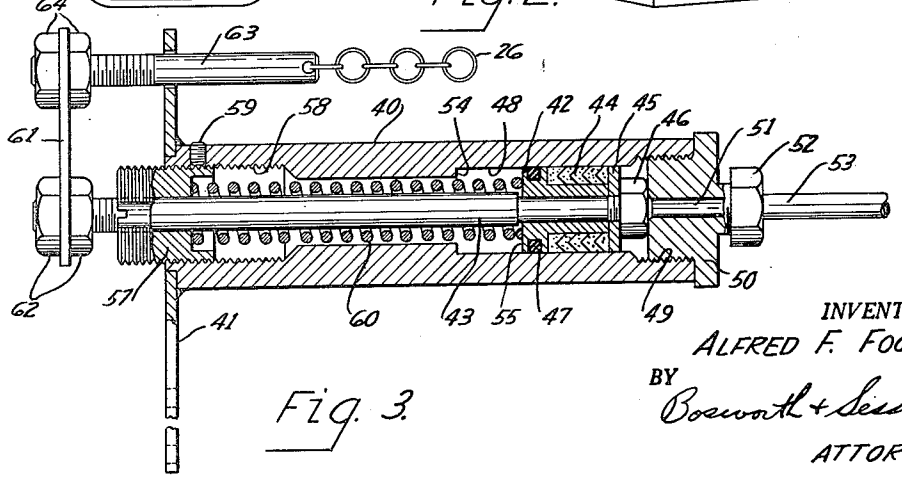


Fig. 3.

INVENTOR.
ALFRED F. FOOTE
BY
Bosworth & Sessions
ATTORNEYS.

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AUTOMATIC THROTTLE CONTROL

Alfred F. Foote, Elyria, Ohio, assignor to Stratton Equipment Company, Cleveland, Ohio, a corporation of Ohio

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1 Claim. (Cl. 103—16)

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This invention relates to an automatic speed control for internal combustion engines and more particularly to an automatic throttle control for the engines of motor trucks embodying hydraulically operated devices such as dump bodies, lift platforms and the like in which the hydraulic pressure for operation of the device is furnished by a pump driven by a power take off from the truck engine.

Large numbers of trucks having hydraulic devices operated by power take off means driven by the engine are in use at the present time. Such trucks customarily embody a hydraulic motor, usually in the form of a cylinder, arranged to actuate a dump body, lift platform and the like or to perform some other desired function; a valve for controlling the flow of fluid to the hydraulic cylinder, the valve ordinarily being disposed outside of the cab of the truck at a point where the operator can observe the motion of the body, platform or the like; a pump; hydraulic fluid which is supplied under pressure to the cylinder; appropriate fluid connections for the devices; and a power take off usually embodying auxiliary gearing so that the main truck engine can be employed to drive the pump.

The ordinary idling speed of the engine is not sufficient to furnish sufficient fluid under pressure to operate the hydraulic cylinder at a reasonably rapid rate of speed. Accordingly, operators of such trucks frequently pull out the hand throttle in the cab of the truck sufficiently to race the engine under no load at the speed which the operator thinks is proper. Then the operator leaves the cab, goes to his station adjacent the hydraulic control valve and by suitable manipulation of the valve, controls the operation of the cylinder. The result is that the truck engine is raced at excessive speeds for considerable periods of time, fuel consumption of the engine is excessive and the engine is subject to injury and rapid wear because of racing under no load. Another mode of operation employed by some drivers is to move the control valve to operating position with the engine idling, then to go back to the cab and manipulate the throttle while leaning out of the door of the cab in an effort to observe the position of the body, platform or the like. This mode of operation is dangerous because it requires the operator to be away from his proper position at the control valve during the dumping or lifting operation.

According to the present invention these difficulties are eliminated by means of a hydraulic actuator for the carburetor throttle of the truck

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engine that permits the engine to operate at idling speed whenever there is no lifting load on the pump; i. e., whenever the back pressure of the pump is at a comparatively low value, and opens the throttle to a predetermined amount to give the desired speed of engine operation whenever the hydraulic cylinder is operated to lift the body, platform or the like, i. e., whenever the back pressure on the outlet side of the pump exceeds a predetermined amount.

A general object of the present invention is the provision of a simple, substantially foolproof device for controlling the speed of operation of truck engines so as to automatically increase the speed of the engine whenever it is desired to lift a load by the hydraulic cylinder and automatically to reduce the engine speed to the idling rate when the load is removed. Another object is the provision of a sturdy device of this character which can be readily installed on an existing truck engine and in connection with conventional hydraulic systems. A further object is the provision of such a device which can be adjusted to suit the requirements of various installations and operating conditions. Further objects and advantages of the invention will become apparent from the following description of a preferred form thereof, reference being made to the accompanying drawings. The essential characteristics are summarized in the claim.

Referring to the drawings, Figure 1 shows the control apparatus of the present invention as it may be applied to a truck having a hydraulically actuated dump body; Figure 2 is a diagram showing the hydraulic circuits of the apparatus of Figure 1; and Figure 3 is a longitudinal sectional view on an enlarged scale illustrating a preferred form of hydraulic device consisting of a cylinder and piston mechanism for operating the engine throttle.

As shown in Figure 1 of the drawing, the control device may be adapted to a conventional motor truck indicated in broken lines at T. Truck T has a chassis 10, a dump body 11 and a hydraulic lifting cylinder 12 embodying a piston 13 and piston rod 14. The cylinder and piston act between the chassis and the dump body 11 and operate so as to raise and lower the body to and from the dumping position as shown in the drawing when fluid under pressure is admitted to and withdrawn from cylinder 12.

Fluid under pressure is supplied to the cylinder 12 by the pump 15 which is driven from the conventional power take off unit 17 associated with the truck transmission 18. Thus, power

for pump 15 may be furnished by the truck engine 19. The flow of hydraulic fluid to and from the cylinder 12 is controlled by the control valve 20 which preferably is mounted outside of the truck cab at a point where the operator can observe the motion and position of the dump body 11. Fluid returning from the cylinder 12 is discharged into a sump or tank 21 which is connected to the intake side of the pump 15 to complete the hydraulic circuit. The speed of the engine 19 is controlled by a conventional throttle or butterfly valve operated through lever 22 disposed adjacent the carburetor 23. All of these elements may be of conventional construction. The opening of the throttle is automatically controlled by a pressure responsive mechanism preferably comprising a hydraulic cylinder and piston assembly indicated in general at 25 in Figures 1 and 2 and which will be described in detail below, this mechanism preferably being connected to the lever 22 through a flexible tension element such as the non-kinking chain 26; the chain acts as a slip connection so that there is no interference with ordinary control of the engine throttle in driving the truck.

Referring now to Figures 2 and 3 of the drawings, the hydraulic circuits include a pump outlet conduit 30 extending from the outlet side of pump 15 to valve 20, a cylinder conduit 31 extending from the valve 20 to the lower end of the cylinder 12, a return conduit 32 extending from the valve 20 to the tank or sump 21, and a pump intake conduit 33 extending from tank or sump 21 to the intake side of pump 15. The valve 20 may be of conventional construction, is operated by handle 34 and is arranged so that when the valve is in the central position shown in broken lines and indicated at *a* the control is in neutral and the liquid is simply circulated by the pump through the conduit 30 to the valve 20 then through conduit 32 to the sump 21 and through conduit 33 back to the pump. With the valve in this position the only back pressure on the pump is created by pressure drop in the fluid lines and in a properly designed system this pressure drop is low as compared to operating pressures.

When the handle 34 is moved to the full line position shown at *b* the fluid supplied to the valve through the conduit 30 is pumped through conduit 31 to cylinder 12. Thus, a load is placed upon the pump 15 and the pressure in conduit 30 promptly increases substantially above the normal idling or neutral pressure on the pump. The valve is arranged so that pressure can be retained within the cylinder 12 merely by moving the handle 34 back to position *a* at which time the fluid within the cylinder is locked therein while the fluid displaced by the pump is simply re-circulated as described above. The piston 13 may be returned to its lower position by moving the valve handle 34 to the position shown in broken lines at *c* in Figure 2 which permits the fluid displaced from the cylinder 12 to flow into the sump 21. With handle in this position, fluid discharged by the pump 15 is simply recirculated as when the handle is in the neutral position *a* and again the back pressure on the pump is reduced.

According to the present invention the difference between the back pressure on pump 15 under the no load conditions of valve handle positions *a* and *c* and the back pressure on the pump under the load condition of position *b* is utilized to control the engine throttle so that the engine is idled whenever the valve is in neutral position or in position to lower the load and is operated at a predetermined increased speed whenever the valve is moved to the position to raise the load. This is accomplished by the apparatus indicated in general at 25 in Figures 1 and 2 and shown in enlarged section in Figure 3. Referring particularly to Figure 3 the control apparatus 25 comprises a cylinder 40 supported by a bracket 41 which in turn may be mounted at any convenient location within the engine compartment, for example, on the cylinder head of engine 19. Within the cylinder 40 is a piston 42 mounted on piston rod 43 and embodying any suitable fluid-tight packing such as the chevron packing 44 held in place by washer 45 and nut 46 and the O-ring packing 47 disposed in an appropriate groove in the periphery of the piston.

Piston 42 operates in bore 48 of the cylinder 40 which is enlarged as at 49 to receive the end cap 50 which constitutes the head of cylinder 40 and which is provided with a central bore 51 and a fluid coupling 52 for connecting the cylinder to conduit 53. Conduit 53 is connected to conduit 30 at any convenient point and thus the discharge pressure of pump 15 is reflected within the interior of cylinder 40.

At the end remote from cylinder head 50, chamber 48 terminates in an inwardly extending shoulder 54 which acts as a stop to limit the movement of piston 42 to the left as viewed in Figure 3. Thus, in the embodiment shown, the piston can move under the influence of pressure within the cylinder from the position shown in the drawings where the nut 46 is in engagement with the end of the cap 50 to a position where the end 55 of the piston is in engagement with the shoulder 54. Piston rod 43 which extends to the exterior of the opposite end of the cylinder 40 moves with piston 42 and is guided in such movement by a central bore in adjusting nut 57 through which it passes. Nut 57 is threaded into an enlarged end portion 58 of the bore of cylinder 40 and is locked therein by any suitable means such as set screw 59.

In order to return the piston 42 to the position shown in Figure 3 consequent upon a reduction of pressure within the cylinder 40, a spring 60 is disposed concentrically of piston rod 43 between the piston 42 and the adjusting nut 57. It will be evident, therefore, that with this arrangement the tension on the spring 58 can be adjusted so that under no load conditions with the valve control handle 34 in either of positions *a* or *c*, the spring will retain piston 42 in the position shown in Figure 3 against the end cap 50 and against the comparatively low back pressure upon the pump 15 existing in the lines 53 and 30. However, when the valve handle 34 is moved to position *a* and the pump 15 placed under load, the increased back pressure upon the pump will move the piston to the left of the cylinder 40 against the action of the spring, and if the pressure becomes sufficiently great the piston will be moved against the shoulder 54. However, as soon as the pressure is reduced the spring will move the piston back to its original position.

These movements are utilized to control the throttle and hence the speed of the engine 19. This is accomplished by connecting the piston rod 43 to the throttle by suitable means such as the rigid link 61, which is secured to piston rod 43 by nuts 62, and the plunger 63 which is se-

cured to link 61 by nuts 64. Plunger 63 is guided in an opening in bracket 41 and is connected to the throttle lever 22 by the flexible chain 26. It will be noted that the threads on piston rod 43 and plunger 63 are of sufficient lengths to afford a considerable range of adjustment of the position of plunger 63 so that by selecting a chain of proper length the chain will be slightly slack as shown when the piston 42 is in the position shown in Figure 3 under no-load conditions and, the conventional spring in the engine throttle mechanism operates to move the throttle to idling position. However, when the pressure within the cylinder 40 builds up by reason of a load on the pump 15, the piston moves to the left (Figure 3) and the plunger 63 applies tension to the chain 26, thereby opening the throttle slightly and speeding up the engine and further building up the pressure within the system. Thus, the speed of the engine is increased until further opening of the throttle is prevented either by spring 53 or by engagement of the end 55 of piston 42 with shoulder 54 of cylinder 40. By adjustment of the longitudinal position of plunger 63 with respect to cylinder 40, the speed to which the engine is accelerated under load may be set to the desired value; this value should be selected to avoid operation of the pump at speeds in excess of those recommended by the manufacturer.

Inasmuch as the back pressure on the pump 15 under no-load conditions varies in different installations and sometimes under different temperature conditions, the tension on the return spring 58 is made adjustable by the nut 57. Preferably, this tension is adjusted so that the spring 58 will exert sufficient force against the piston 42 to return it to idling position whenever the load is removed from the pump 15. The tension exerted by the return spring, however, should not be made much greater than is necessary in order to obtain prompt opening of the engine throttle as soon as the fluid pressure begins to build up in lines 53 and 30 when the pump is placed under load.

In operation and with the device properly adjusted the truck driver merely engages the power take off unit 17 to start operation of the pump. Thereafter, he leaves the truck cab with the throttle in idling position, goes to the proper station by the control valve 20 and operates the control valve handle 34 to raise and lower the truck body and load as desired. Whenever the pump is under load, the truck engine automatically accelerates to the desired speed to give ample power for lifting the load. Whenever the load on the pump 15 is removed, the engine immediately decelerates to idling speed, thus saving fuel and wear and tear on the engine. The device is simple and foolproof and can be adapted readily to various makes of trucks and adjusted to meet different operating conditions. The device does not interfere with ordinary manual control of the throttle in driving the truck.

Those skilled in the art will appreciate that various changes and modifications can be made in the preferred form of apparatus described herein without departing from the spirit and scope of the invention.

I claim:

An automatic control device for controlling the throttle of an engine operating a pump, said automatic control device comprising a cylinder, means for supporting said cylinder adjacent said engine, a piston in said cylinder, a conduit connected to said cylinder on one side of said piston and communicating with the outlet side of said pump, whereby pressure on the outlet side of said pump tends to move said piston in one direction, a piston rod secured to said piston and extending to the exterior of said cylinder on the side opposite the side on which said conduit is connected, a spring engaging said piston and surrounding said piston rod for moving the piston in the opposite direction, an internal shoulder within said cylinder engageable with said piston for limiting the movement of said piston in response to pressure in said cylinder, a nut adjustably threaded into the end of said cylinder opposite said conduit and engaging the end of said spring opposite said piston for adjusting the force exerted on said piston by said spring, a link connected to said piston rod, a plunger adjustably secured to said link and extending parallel to but offset from said piston rod, and a flexible chain for operatively connecting said plunger to the throttle of the engine to open the throttle upon movemnet of said piston in response to an increase in fluid pressure in said cylinder, and to permit the throttle to close upon movement of said piston in the opposite direction under the influence of said spring when the fluid pressure in the cylinder is reduced.

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