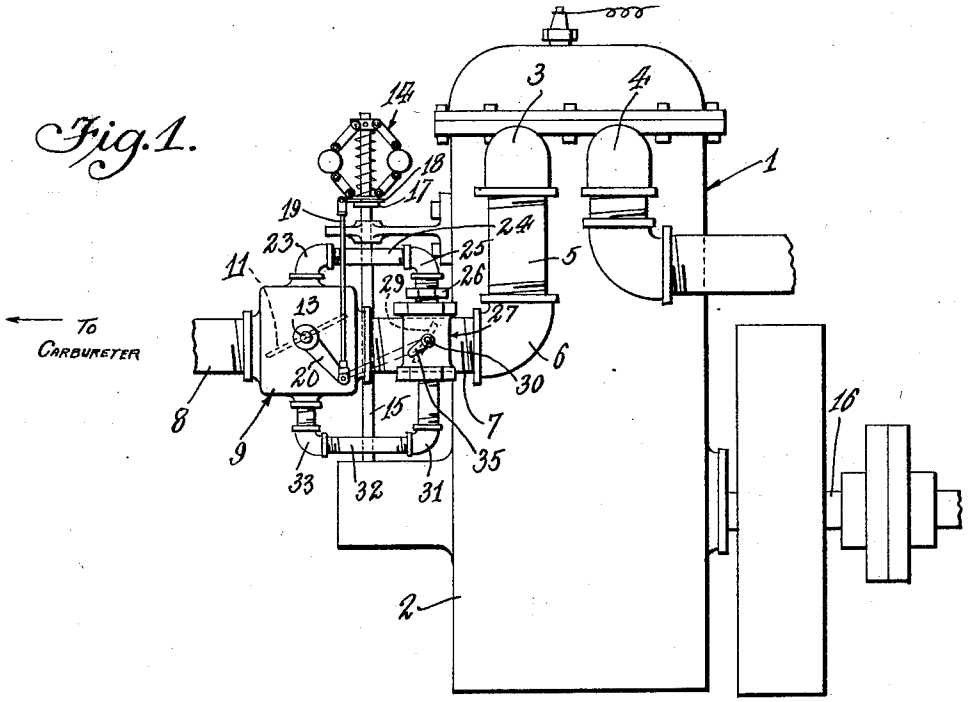
April 26, 1932. J. T. BRICE 1,855,594

CONTROL DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed July 21, 1930

Fig. 1.



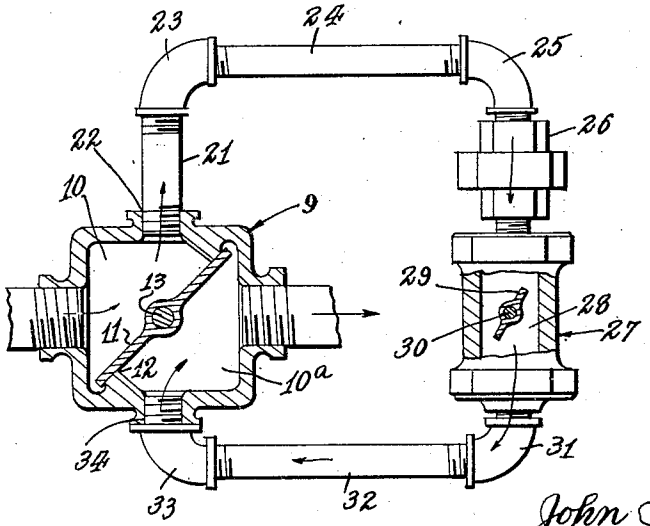


Fig. 2.

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Patented Apr. 26, 1932 1,855,594

UNITED STATES PATENT OFFICE

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CONTROL DEVICE FOR INTERNAL COMBUSTION ENGINES

Application filed July 21, 1930. Serial No. 469,299.

My invention relates to a control device for power producing machines, and has particular reference to a control device for an engine of the internal combustion type which is to be operated at a constant speed.

Industrial use of internal combustion engines as a source of power ordinarily requires that the engine shall maintain a constant speed independent of load. When such engines are to be utilized for producing power in which the load is applied more or less intermittently, great difficulty is encountered in maintaining the constant speed operation of the engine, since the amount of fuel which is required to maintain the speed under heavy load is far in excess of that required to maintain the same speed when the engine is idling, or is under a much smaller load duty.

While engines of this character are usually provided with governing devices which respond to the speed of the engine to control the fuel input into the engine automatically to thereby maintain the speed of the engine constant, such control is imposed upon the fuel inlet control valve. However, with such arrangement, the fuel required for the engine when idling is so minute in comparison with that required when the engine is under full load, that the control valve must be substantially closed during the idling periods.

It is obvious, therefore, that at the instant at which the load is taken off the engine, the speed of the engine will suddenly increase, thereby closing the control valve with considerable force, some times to the extent that the engine will become stalled. Then, when the speed is reduced, the valve opens again, and this process is repeated with the engine "hunting" for a considerable period of time, during which the control valve is being constantly opened and closed with considerable force.

It is also frequently necessary to operate different load devices at different speeds of operation. For example, it may be desirable to drive a heavy load at a relatively high speed while a different set of devices constituting a lighter load desired to be driven at a considerably lower speed to require the employment of two engines, one for the heavy load and high speed and another for the lighter load and lower speed, is extremely costly.

It is therefore an object of my invention to adapt a relatively heavy-duty engine to both heavy-duty loads at high speeds and lighter loads at lower speeds with economy of fuel required.

It is another object of this invention to provide a control for a heavy-duty engine in which the fuel input supplied to the engine may be governed by either of two valves, one for heavy-duty and the other for light-duty, in which the light-duty valve may be automatically governed to maintain the speed of the engine at a lower rate than the normal rate of the engine under heavy-duty.

Another object of my invention is to provide a control system for an engine employed under intermittent load conditions, in which the engine may be maintained at a substantially constant speed independent of the suddenness with which the load is applied or removed from the engine.

Another object of the invention is to provide an engine of the character described with a system of control which is responsive to the speed of the engine in which, upon removal of all or a substantial part of the load from the engine, it will cause the engine to idle at the desired speed without "hunting".

Another object of the invention is to provide a control system for an engine having a main control valve for controlling the fuel applied thereto during the loaded condition of the engine and with an auxiliary valve for supplying fuel in reduced quantities to the engine during the idling periods.

Another object of my invention is to provide a control system of the character described in the preceding paragraph in which the auxiliary valve constitutes a by-pass for fuel around the main control valve.

My invention will be described with reference to the accompanying drawings, wherein

Figure 1 is a side elevational view of an internal combustion engine provided with a

control device built in accordance with my invention; and

Figure 2 is a detail view, partly in section, of the control valves and by-pass arrangement constructed in accordance with my invention.

Referring to the drawings, I have illustrated an internal combustion engine 1 comprising a housing 2 in which is enclosed the cylinder, piston and other apparatus constituting the various parts of the engine (not shown).

Near the top of the housing 2, I have illustrated a fuel inlet opening 3, through which fuel may be supplied to the cylinder of the engine. Similarly, an exhaust outlet 4 is provided through which the exhaust gases from the engine may pass.

The fuel inlet 3 is connected as by means of a nipple 5 and elbow 6 and a second nipple 7 to a main control valve 9 which in turn is connected, as by means of a pipe 8, to a carbureter or other source from which mixed fuel may be supplied to the engine.

Referring particularly to Fig. 2, it will be observed that the main control valve 9 constitutes an inlet chamber 10 and an outlet chamber 10*a* separated by a butterfly valve 11 which seats upon a valve seat 12 to separate said chambers so that gas or other fuel may not pass through the valve 9.

By rotating the butterfly valve 11, as by rotating its shaft 13, the passage of gas or other fuel through the main valve 9 may be suitably controlled to adapt the quantity of fuel passed therethrough to the requirements of the engine 1 in driving the load which is placed thereon.

Referring again to Fig. 1, it will be observed that I have illustrated a governor 14 driven by means of a governor-shaft 15 geared in any well-known manner to the drive-shaft 16 of the engine. The governor 14 will, therefore, be rotated at a speed proportional to the speed of the drive-shaft 16 of the engine. By connecting the moving portion 17 of the governor 14 to the shaft 13 of the main valve 9, as by means of connecting ring 18, link 19 and crank-arm 20, it will be observed that the butterfly valve 11 in the main valve 9 will be opened or closed in accordance with the speed attained by the engine 1. The governor may be so arranged as to cause the proper amount of fuel to be supplied to the engine to make it operate at a predetermined speed when under full load conditions. Correspondingly, when the load is removed from the engine, the speed thereof will increase and the governor will automatically operate to close the butterfly valve 11 to thus reduce the amount of fuel supplied and reduce the speed of the engine.

Since the volume of fuel which is required to operate the engine at a desired speed under full load is relatively great, the passage through the valve 9 must therefore be relatively great and hence when no load is to be driven by the engine 1 and butterfly valve 11 in the main valve 9, it must be closed in order that the speed of the engine be greater than that for which the governor is set.

The relatively large variation between the quantity of fuel required when the engine is driving its full load and when it is driving a lighter load is such that a condition of hammering of the butterfly valve 11 upon its seat 12 will occur and will be repeated a great number of times before the engine will settle down to a constant desired speed under no load conditions.

To prevent this hammering of the butterfly valve 11, I have provided a by-pass around the main valve 9 which comprises a nipple 21 which enters a passage 22 formed in the housing of the main valve 9 at a point in advance of the butterfly valve 11. The nipple 21 is connected by suitable elbows and nipples 23, 24 and 25 and a union 26 to an auxiliary valve 27, which also may be of the butterfly type. The auxiliary valve 27 comprises a housing in which a gas passage 28 is formed and arranged to be completely obstructed by a butterfly member 29 which is fixed upon and rotates with a shaft 30.

The passage 28 through the auxiliary valve 27 communicates with an outlet opening to which is connected, by means of elbow 31, nipple 32 and elbow 33, an inlet opening 34 in the main valve 9 on the opposite side of the butterfly 11, to which the opening 22 is communicated. In other words, the opening 34 communicates with the main outlet of the main valve 9.

By suitably adjusting the positon of the butterfly 29 in the auxiliary valve 27, a predetermined gas passage is maintained around the butterfly 11 of the main valve 9. The predetermined passage may be suitably selected to produce the desired speed of the engine 1 when it is idling, so that under these conditions the butterfly 11 in the main valve 9 may be entirely closed by the governor 14 and yet a passage for fuel to the engine is provided which is of sufficient size to keep the engine running at the desired constant speed.

By the employment of an arrangement of the character described, repeated tight closing and subsequent opening of the main valve is avoided because upon its first tight closing under the influence of the governor, the auxiliary gas passage is sufficient to hold the engine at the desired speed, and it does not, therefore, fall below that speed to cause the reopening of the main valve 9.

Moreover, the same engine which is to be employed for heavy-duty operation at the desired speed may also be employed for driving a lighter load at any desired speed by connecting the governor 14 to the lever 35

which controls the position of the butterfly 29 in the auxiliary valve 27. This may be accomplished by connecting the rod 19 to the lever 35, as illustrated in dotted lines in Figure 1. The auxiliary valve 27 will then pass a sufficient quantity of fuel to maintain the engine at the required speed while operating continuously under the lighter load.

Also the speed of the engine may be reduced if it is desired to operate the lighter load at a lower speed by adjusting the position of the butterfly 29 with reference to its operating lever 35 so that for any given position of the governor 14 the butterfly 29 is in a more nearly closed position. Under these conditions the amount of fuel which is supplied by the auxiliary valve 27 will only be such as to cause operation of the engine at the desired lower speed.

It should be understood that upon disconnection of the governor 14 from the main valve 9 the butterfly 11 of that valve is moved to its completely closed position so that thereafter the entire control of the engine is imposed by the auxiliary valve 27.

Moreover, should it become necessary to speed up the engine while under the control of the governor actuated auxiliary valve 27, the main valve 9 may be manually opened to admit a larger volume of fuel to the engine and thereby causing the same to speed up to any desired speed.

It will be obvious that with the arrangement herein set forth, a considerable saving of fuel is effected since the reduction in speed of the engine upon the removal of load therefrom is supplied instantaneously, and there is no loss of fuel due to the engine slowing down, accelerating, again slowing down, and repeating this operation over extended periods of time before it finally settles down to a constant speed operation. Also, it is obvious that the wear on the main valve 9, occasioned by the repeated opening and closing thereof upon reducing the load on the engine, is avoided since this valve closes once, speed of the engine is reduced to the desired speed, and the valve 9 again reopens just to that value which is required to keep the engine at the desired speed.

An additional advantage achieved by my invention is that the governor control of the engine is rapid and accurate, thereby presenting no excuse to workmen to tamper with the same, as frequently happens with the types of governor controls which are now in use and, in addition, the lack of wear on the main valve 9 allows this valve to remain in efficient condition over long periods of time, requiring fewer shut-downs of the engine for repairs.

Moreover, since the speed of the engine may be accurately controlled, the running speed of the engine may be adjusted more closely to the desired speed value than is practicable with present governor control arrangements, in most of which, in order to prevent the engine from being stalled upon removal of load, are operated at a speed in excess of the necessary speed for varying the various operations for which power is produced by the engine.

While I have illustrated the preferred form of my invention, it is to be understood that the foregoing description is for illustrative purposes only, and I do not desire to be limited by any of the details shown, except as defined in the appended claim.

I claim:

In combination with an engine to be operated under varying load conditions, a main valve for controlling the supply of fuel to said engine, means driven by the engine and responsive to the speed of said engine for controlling said main valve to maintain the speed of said engine substantially constant and a fuel by-pass around said main valve for supplying sufficient fuel to said engine to keep the same running when said main valve is closed, an auxiliary valve in said by-pass, and means for connecting said auxiliary valve to said speed responsive means.

Signed at Bakersfield, California, this 10th day of July, 1930.

JOHN THOMAS BRICE.