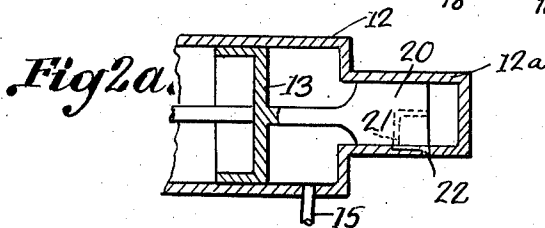
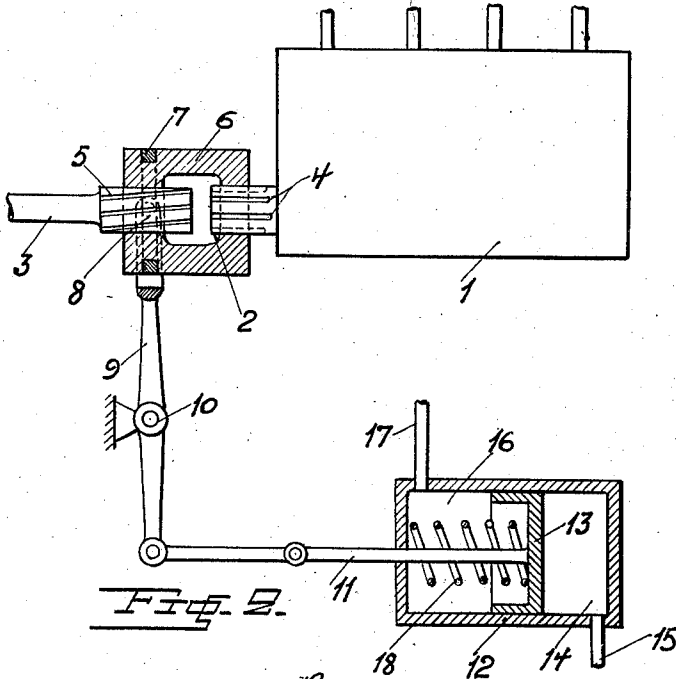
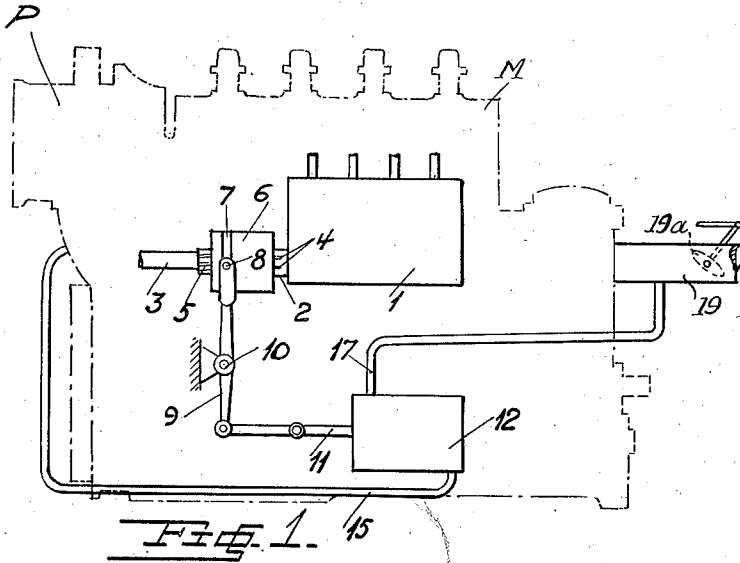


Jan. 20, 1942.

H. G. CAMNER
MEANS FOR AUTOMATICALLY CONTROLLING THE FUEL INJECTING
MECHANISM OF INTERNAL COMBUSTION ENGINES
Filed Nov. 7, 1939

2,270,410



INVENTOR
HILDING GUNNAR CAMNER
BY
Jannet Marklee
ATTORNEY

UNITED STATES PATENT OFFICE

2,270,410

MEANS FOR AUTOMATICALLY CONTROLLING THE FUEL INJECTING MECHANISM OF INTERNAL COMBUSTION ENGINES

Hilding Gunnar Camner, Ektorp, Sweden, assignor to Aktiebolaget Atlas Diesel, Stockholm, Sweden

Application November 7, 1939, Serial No. 303,222
In Sweden June 1, 1938

4 Claims. (Cl. 123—140)

In internal combustion engines it is desired to automatically time the fuel injection at changes of the number of revolutions of the engine. Thus, at a greater number of revolutions the fuel injection should take place earlier than at a lower number of revolutions.

This is often effected by using ordinary centrifugal governors, which, however, give an unsatisfactory result.

Another known manner of timing is to utilize the feed pressure in the suction chamber of the fuel pump, which varies at changes of the number of revolutions of the engine. This feed pressure acts on a servo-motor, which in turn controls a device for varying the timing of injection, and satisfactory action cannot be obtained by causing the servo-motor to act directly on the injecting mechanism, but separate motion transmitting means, based on the use of particularly shaped curved members, are used, which involves a complication. It also often occurs that it is desired to change the feed pressure of the fuel, which means that the above mentioned motion transmitting means has no longer the desired action, but must be replaced by another means suitable for the changed pressure.

Devices have also been suggested, which are based on the utilization of the pressure changes in the suction pipe of the engine occurring at changes of the number of revolutions. However, such devices, which necessitate throttling of the suction pipe, have the drawback that they must work at very low pressures, which entails an uncertain control.

The present invention has for its object to avoid the above mentioned drawbacks and consists essentially in that a servo-motor controlling the position of a member of the fuel injecting mechanism defining the time of injection is acted on by the scavenging air. The scavenging air is always at disposal and, since the pressure of same varies with the number of revolutions, the advantage is gained that the position of the injecting mechanism will be the desired one at any number of revolutions.

When running at a constant number of revolutions the scavenging pressure varies with the torque in such way that the said pressure increases at an increased torque and vice versa, substantially depending on the fact that the back-pressure in the exhaust conduit of the engine increases and decreases with the torque.

Thus, by making the time for the fuel injection dependent on the scavenging air the further advantage is gained that when running at a cer-

tain constant number of revolutions the said time will vary with the torque in such way that the injection occurs earlier at an increased torque, whereby a better combustion is obtained and also a greater torque can be taken out. At lower torques and when idling the injection occurs later and in this case no earlier ignition is required in order to effect a complete combustion. The said later ignition brings about a more uniform and smooth running of the engine, which is of a great importance particularly in idling.

The annexed drawing illustrates diagrammatically an embodiment of a device according to this invention. Fig. 1 is a side view showing the outlines of an ordinary internal combustion engine having the controlling device applied thereto. Fig. 2 is a side view on an enlarged scale of the controlling device.

Fig. 2a is a fragmentary section showing a part of the controlling device with damping means incorporated therein.

Referring to the drawing, M designates the engine proper and P an ordinary scavenging air pump thereof driven by the engine in any ordinary convenient manner. The fuel pump mechanism, which also is of known type and need not be particularly described, is denoted by 1 and its cam-shaft by 2, said shaft being driven by a drive shaft 3 driven by the engine in any ordinary manner. The cam-shaft 2 is provided with axially disposed slots 4 and the drive shaft 3 with obliquely directed slots 5 meshing with correspondingly arranged internal teeth in an axially displaceable coupling-sleeve 6. Freely mounted in an annular groove in said sleeve is a ring 7 provided with two diametrically opposed gudgeons 8, to which a double-armed forked lever 9 is applied, said lever being swingably mounted on a stationary pivot 10. The said pivot may, if desired, be replaced by an adjustable eccentric in order to change the relation of the arms of the forked lever 9. At its lower end the said lever is pivotally connected to the piston rod 11 of a servo-motor, comprising here a cylinder 12 and a piston 13 movable therein. The cylinder chamber 14 at the one side of the piston communicates through a pipe 15 with the scavenging air receiver of the engine or any part of the scavenging air conduit, whereas the chamber 16 at the opposite side of the piston through a pipe 17 may be in communication with the exhaust conduit 18 of the engine at a place between the engine and a throttling member 19a in said conduit. Besides, the piston 13 is acted on by a

spring 18 counter-acting the pressure in the cylinder chamber 14.

When changing the number of revolutions of the engine or the torque, the scavenging pressure alters correspondingly, and the servo-motor-piston 13 will be moved in the one direction or the other. By means of the lever 9 the coupling-sleeve 6 will thus be displaced in the one direction or the other and simultaneously brought to rotate relatively to the drive shaft 3 on account of the obliquely directed slots 5 and the corresponding intermeshing teeth. The said rotary motion is transmitted from the coupling-sleeve 6 to the cam-shaft 2 of the injection pump 1, whereby the time of the fuel injection will vary with the scavenging air pressure, i. e. with the number of revolutions or the torque of the engine as above described.

In engines, wherein a throttling of the exhaust gases is effected, the cylinder chamber 16 in the servo-motor can, as mentioned, be in communication with the exhaust conduit at a place between the engine and the throttling member, whereby the pressure of the exhaust gases will partake at the control. When throttling the exhaust gases, the difference between the scavenging air pressure and the exhaust gas pressure will practically be unaltered, and thus the throttling will not affect the control.

Evidently, the invention is not limited to any certain type of fuel injecting mechanism, and the motion transmitting means between the servo-motor and the control member of the fuel injecting mechanism can be of any desired kind. This is true also of the servo-motor, which, for instance, can be provided with a membrane, bellows or the like. If desired, the piston of the servo-motor or the axially displaceable coupling-sleeve may also be provided with suitable damping means in order to prevent oscillations, particularly when idling or running at low loads. One such form of damping means is illustrated in Fig. 2a by way of example, being of the general form disclosed in my co-pending application Ser. No. 303,221. In this arrangement the servo-motor piston 13 has a dash pot piston 20 secured thereto, the latter piston working in a dash pot extension 12a of cylinder 12. The dash pot piston 20 is provided with a vent passage 21 of small cross-sectional area communicating with a port 22 in the wall of the dash pot 12a. Obviously other forms of damping means may be employed.

What I claim is:

1. In an internal combustion engine, a scavenging air pump driven by the engine, a fuel injecting mechanism, means for driving said mechanism from said engine including a member shiftable to vary the timing of fuel injection with respect to the cycle of operation of the engine, and means for automatically timing the fuel injection

in accordance with changes of the number of revolutions of the engine or the torque, the last-mentioned means comprising a servo-motor having a movable part acted on by the scavenging air and in operative connection with said member, said connection being arranged to cause the timing to be advanced upon increase in said number of revolutions or torque, and vice-versa.

2. In an internal combustion engine, a scavenging air pump driven by the engine, a fuel injecting mechanism, means for driving said mechanism from said engine including a member shiftable to vary the timing of fuel injection with respect to the cycle of operation of the engine, and means for automatically timing the fuel injection in accordance with changes of the number of revolutions of the engine or the torque, the last-mentioned means comprising a servo-motor having a movable part acted on by the scavenging air and also in opposition thereto by the exhaust gas pressure and in operative connection with said member, said connection being arranged to cause the timing to be advanced upon increase in said number of revolutions or torque, and vice-versa.

3. In an internal combustion engine, a scavenging air pump driven by the engine, a fuel injecting mechanism, means for driving said mechanism from said engine including a member shiftable to vary the timing of fuel injection with respect to the cycle of operation of the engine, means for automatically timing the fuel injection in accordance with changes of the number of revolutions of the engine or the torque, the last-mentioned means comprising a servo-motor having a movable part acted on by the scavenging air and in operative connection with said member, and a damping device in connection with said movable part, said connection being arranged to cause the timing to be advanced upon increase in said number of revolutions or torque, and vice-versa.

4. In an internal combustion engine, a scavenging air pump driven by the engine, a fuel injecting mechanism, means for driving said mechanism from said engine including a member shiftable to vary the timing of fuel injection with respect to the cycle of operation of the engine, means for automatically timing the fuel injection in accordance with changes of the number of revolutions of the engine or the torque, the last-mentioned means comprising a servo-motor having a movable part acted on by the scavenging air and in operative connection with said member, said connection being arranged to cause the timing to be advanced upon increase in said number of revolutions or torque, and vice versa, and a damping device for timing movements of the shiftable member.

HILDING GUNNAR CAMNER.