Oct. 5, 1943. F. ALWARD 2,331,156

FUEL INJECTOR TIMING DEVICE

Filed March 18, 1941

Fig. 1.

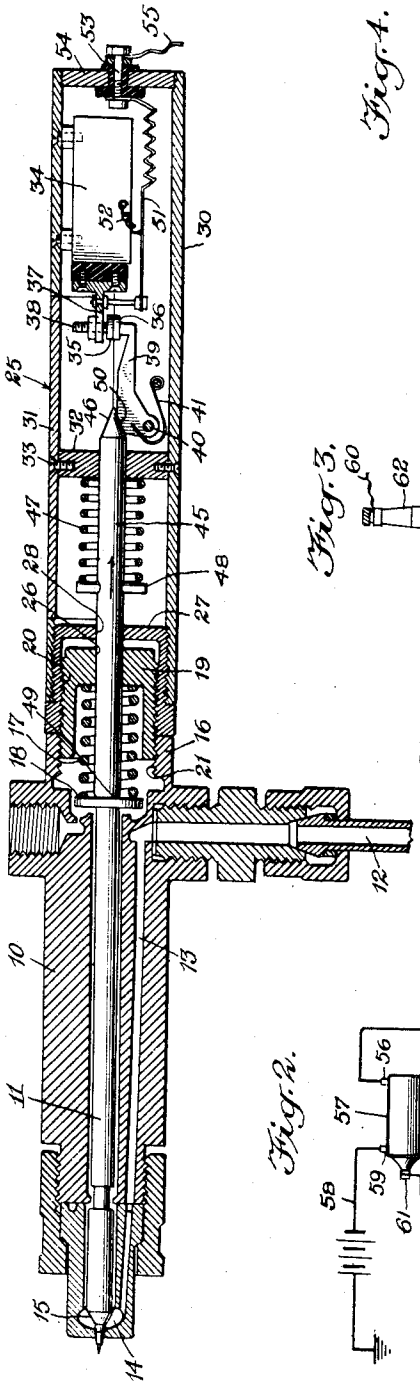


Fig. 4.

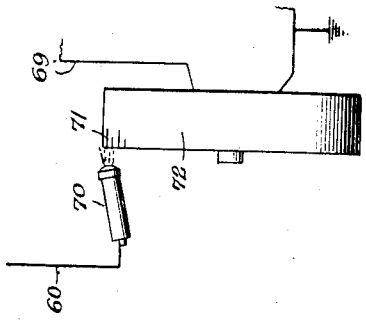


Fig. 3.

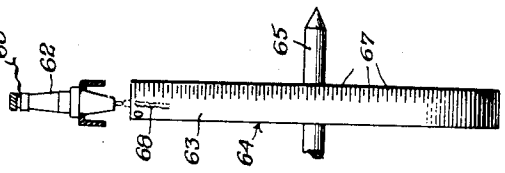
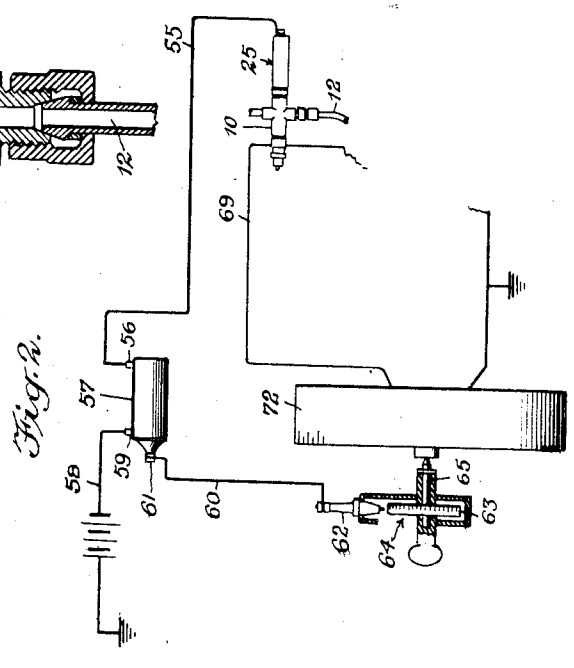


Fig. 2.



WITNESSES

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Patented Oct. 5, 1943

2,331,156

UNITED STATES PATENT OFFICE

2,331,156

FUEL INJECTOR TIMING DEVICE

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Application March 18, 1941, Serial No. 383,946

2 Claims. (Cl. 200—53)

This invention relates to timing devices, and more particularly to timing devices adapted to be used in fuel injector systems, such as those in compression ignition motors, commonly referred to as "Diesels."

An object of the invention is to provide a means whereby the actual injection of the fluid into each cylinder may be timed so that the injectors may be set to inject fuel at the proper moment to secure proper functioning and the greatest efficiency of operation.

A further object is to provide a device of the character described, which is readily adaptable to existing injectors of various types and which will be economical in construction and simple and sure in operation.

While in the accompanying drawing I have shown my invention adapted to the Bosch type of injector, it will be readily appreciated that with slight modifications my invention may be adapted to any of the standard types of fuel injectors.

In the accompanying drawing—

Fig. 1 is a sectional plan view of my invention adapted to a standard fuel injector;

Fig. 2 is a diagrammatic view of a circuit which may be used with my device;

Fig. 3 shows a form of device for recording the injections in the various cylinders; and

Fig. 4 shows an additional form of device for recording the injection into the various cylinders.

In the accompanying drawing, 10 represents the conventional fuel injector having an injector pintle 11 mounted therein. Oil is normally pumped under pressure through the pipe 12 and the channel 13 into the chamber 14 of the injector against the chamfered end 15 of the pintle 11.

Mounted in the rear end 16 of the injector 10 is a spring 17 which engages the end 18 of the pintle 11. The spring is positioned within the end 16 by means of the externally threaded head 19 provided with threads 20 which engage the threads 21 on the end 16.

In normal use the injector 10 is provided with a head having no opening therethrough and a cap member screws on to the head. When the fuel pumped through the tube 12 and the channel 13 builds up sufficient pressure in the chamber 14 against the chamfered end 15 of the pintle 11, the spring 17 will be forced back long enough to permit a small quantity of fuel to enter the combustion chamber of the engine. By tightening or loosening the head 19 the tension of the spring 17 can be increased or decreased.

Having generally described the operation of a type of injector, my invention consists in applying to such an injector a timing device 25. The outer cap and the head 19 of the injector are removed and a similar head 19 having an opening 26 is substituted therefor with an externally threaded cap 27 having an opening 28 in its top passing over the head 19.

A casing 30 is provided for my timing device having a plate 31 at the top thereof fastened to the post 32 by the screw 33. The plate 31 may be readily removed to adjust, repair or replace parts of my timing device. Mounted in the casing 30 is a condenser 34 and a pair of contact points 35 and 36. The contact point 35 is rigidly mounted in the standard 37 on the screw 38 so that its position may be delicately adjusted with relation to the standard 37. The contact point 36 is mounted on an arm 39 which is pivoted at 40 to the casing 30. A spring 41 tends to keep the contact points 35 and 36 in engagement.

Mounted in the casing 30 is a rod 45 having a cammed end 46. A light spring 47 engages the pin or collar 48 on the rod to normally hold it toward the injector, and the end 49 extends through the cap 27 and the head 19 of the injector to make contact with the end 18 of the pintle 11.

The arm 39 is provided with a cammed face 50 which is adapted to engage the cammed end of the rod 45. Running from the standard 37 is a wire 51 from which wire 52 runs to the condenser. The wire 51 engages the terminal 53 in the end 54 of the timing device. A wire 55 runs from the terminal 53 to the terminal 56 of the induction coil 57 and a wire 58 is run from the battery to the terminal 59 of the induction coil 57.

A wire 60 leading from the terminal 61 runs to any suitable recording device. This may be a spark plug 62 adapted to score paper or metal ribbon 63 mounted on a disk 64. The disk 64 is mounted for rotation on an axle 65 which may be attached to the crankshaft or any other convenient takeoff which will rotate it at motor speed. The tape may be lined with degree marks 67 to indicate its position.

When the oil builds up in the chamber 14 to the injection point and the pintle 11 is forced rearwardly, the end 46 of the rod 45 engaging the cam face 50 on the arm 39 will momentarily break the contact points 35 and 36. This will

allow the current produced in the coil **57** to flow to the plug **62** and to jump the gap to the disk **64** and burn or pit the paper ribbon **63**. These marks or pits, as indicated at **68**, will extend in length where the injection system is of the variable type so that after the disk **64** has been stopped a record of the timing range in degrees, before and after top dead center, will be indicated on the paper ribbon as well as the initial period of injection. If the injection system is not of the variable type, the marks or pits will be made in the same place on each revolution.

It will be seen that with the use of my device it is possible to accurately check and record the timing period if the ignition system is of the fixed type, and the timing range if the system is of the variable type, when the engine is running at any and all speeds from cranking to full throttle. It will be further appreciated that with my device the record will be made at the point of actual moment of fuel injection so that an extremely accurate timing check may be made.

It will be understood of course that the entire device is grounded due to the insertion of the injector into the motor block **69**. If desired, a timing light or stroboscope **70** may be used against timing marks **71** on the flywheel **72** or on a revolving disk attached to the shaft and revolved at engine speed.

It will be appreciated that while I have shown my device operating with a specific form of fuel injector, by a slight modification in the connecting means it may be adapted to any type of fuel injector which has an operating member such as the pintle **11**.

It will also be appreciated that other means may be used to make and break the contact and that the specific form and arrangement shown and described is clearly illustrative of my conceptive idea.

I claim:

1. In combination, a fuel injector switch device and a fuel injector of the type provided with a valve movable under fuel pressure to unseat the same, said injector being provided with a spindle, said switch device comprising a casing removably attached to the fuel injector and carrying a spring pressed member engaging said movable valve spindle, a switch in said casing having movable and fixed contacts normally urged into circuit closing position, and means operable by said member operating upon said movable contact to move said contact into circuit opening position upon unseating movement of the valve spindle.

2. The combination with a fuel injector nozzle of the fluid pressure type employing a reciprocatory valve mounted in the injector casing and unseating to discharge fuel pressure, said casing having a threaded extension on the end of the casing opposite the nozzle, of a switch device comprising a housing removably coupled with the threaded extension of the casing, said housing enclosing a switch mechanism and means to operate the switch comprising a rod, said rod extending into contact with the reciprocatory valve and means to cause the rod to follow the motion of the valve.

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