June 9, 1942. L. HARTRIDGE 2,285,711

PRESSURE SWITCH

Filed May 31, 1939

FIG. 1

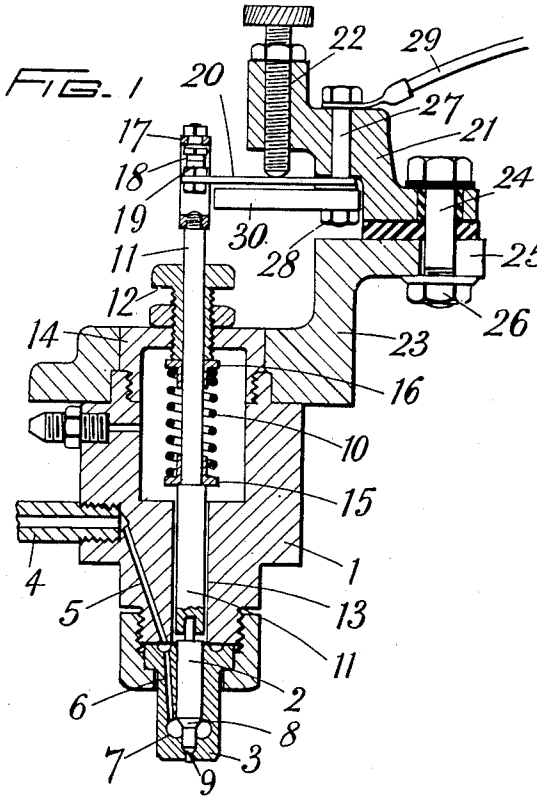


FIG. 2

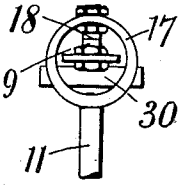


FIG. 3

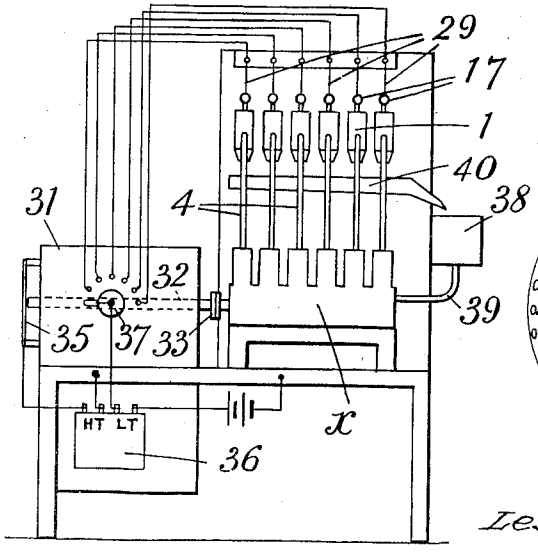
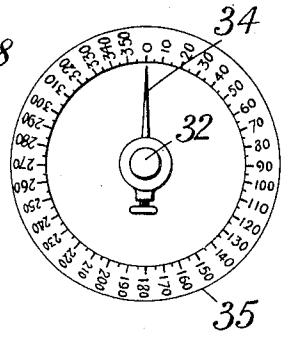


FIG. 4



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PRESSURE SWITCH

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3 Claims. (Cl. 200—81)

This invention relates to the means for testing and calibrating the fuel pumps of Diesel engines by reference to the phase angle between the pump units, namely, the relative points throughout a revolution of the pump shaft at which the pump units cause fuel to be injected into the engine cylinders.

The said means according to the present invention has a number of injector type valves adapted to be connected to the discharge side of the pump units (i. e., the pump cylinders) under test so as to be opened by fluid pressure from the units and are arranged when opened to break an electric circuit to cause a spark to be produced between a graduated electrode dial and a salient counterelectrode adapted to be rotated in synchronism with the pump shaft.

The valves are preferably of Diesel engine injector type each adapted when opened by fluid pressure from the pump units to separate two normally closed electrical contacts in the low tension circuit of an induction coil whereby a spark is produced between the salient electrode and the dial, both of which are in the high tension circuit of the said coil, at the moment of separation of the two contacts.

The preferred way of carrying out the invention will now be described with reference to the accompanying drawing wherein:

Fig. 1 is a sectional elevation of a Diesel engine injector type valve modified in accordance with the present invention;

Fig. 2 is a detail in connection with the operation and mounting of a pair of low tension contacts;

Fig. 3 is a diagrammatic view of means according to the invention for carrying out a test on the pump x; and

Fig. 4 is a face view of the electrode dial and a salient electrode in the form of a pointer, which dial is seen in side view on a smaller scale in Fig. 3.

The injector illustrated in Figs. 1 and 2 comprises a body part 1 to the lower end of which a valve having a stem 2 and a nozzle 3 is fitted. Pressure fluid is forced into the body by way of pipe 4 and passes through ducts 5 and 6 in the body 1 and nozzle 3, respectively, to a chamber 7. The fluid by pressure on the conical part 8 of the stem 2 lifts the small conical valve surface 9 off its seat with the result that the fuel issues from the nozzle 3. These elements are substantially known in connection with injectors of Diesel engine type.

The discharge of fuel from the nozzle is momentary as the surface 9 is pressed against its seat owing to the action of a powerful spring 10 the thrust of which is communicated to the stem 2 by means of a rigid rod 11. Hitherto the pressure of the spring as 10 has been communicated to the stem by means of one or more rods in the body 1. In the present injector the rod 11 is rigid from top to bottom and extends from the stem 2 to a point well above the top of the body 1, the top of the said rod being supported by a screw-threaded bush 12 whilst the bottom is a sliding fit in the usual bore 13. The spring 10 is housed in a chamber formed by a recess in the top of the body 1 and a cap 14 which screws into the said body: its lower end rests on a bush 15 pressing against a shoulder formed by reducing the rod 11. The upper end of the spring bears against a bush 16 which can be adjustably positioned on the rod 11, to adjust the degree of compression of the spring, by means of the bush 12.

A stirrup or ring 17 is fixed to the top of the stem and is provided interiorly at its top with a contact 18. A counter contact for the contact 18 is held within the ring by means of a blade spring 20 mounted on a bracket 21. Adjustment of a thumb-screw 22 borne by the bracket and bearing against the spring 20 enables the position of the contact 19 to be finely adjusted with respect to 18 in such a manner that the slightest upward movement of the rod 11 causes separation of the two contacts. The said bracket is fixed to a support 23, which support also carries the injector, by means of an insulated bolt 24. The lower end of the bolt lies within a fork 25 in the support 23 so that exact alignment of the axes of the contacts 18, 19 can be secured by appropriate manipulation of the bracket 21 before the nut 26 on the bolt 24 is tightened. The blade 20 is mounted on the bracket 21 by means of a bolt 27 and nut 28. The head end of the bolt anchors an electrical lead 29 to the bracket 21, thereby connecting contact 19 and the lead together by way of the blade spring, the bracket and the bolt and the nut and bolt support an insulating distance piece 30 in such relation to the stirrup 17 as to prevent the stirrup from rotating in a manner which would enable electrical contact to occur between the stirrup and the blade.

The preferred form of testing machine has a number of the above injectors as shown in Fig. 3. Each is connected to a pump unit or cylinder by the pipe 4 and the pump is driven by the output shaft of a variable speed gear of any suitable

known form in casing **31**. This gear has a through shaft **32** one end of which is coupled to the pump shaft at **33** whilst a pointer **34** is fixed to the other end of the said shaft. The pointer is coaxial with a dial ring **35**. The pointer is an electrode in the high tension circuit of an induction coil **36** and the ring **35** is the counter electrode, whilst by means of a selector switch **37** any pair of contacts **18**, **19** of an injector can be introduced into the low tension circuit of the said coil.

A pump to be tested is mounted on the machine, its shaft coupled to the shaft **32**, the discharge side of its cylinders connected to the injectors by means of the piping **4** whilst the intake side of the pump is connected to a small reservoir **38** by means of a pipe **39**. To make the test the variable speed gear is made to drive the pump and as the pump unit or cylinder operating the injector with the selected pair of contacts lifts the seating **9** the contacts **18**, **19**, are separated with the result that a spark is produced between **34** and **35**, the position of the spark as indicated by the dial indicating that point in the revolution of the pump shaft at which the unit opening the selected contacts operates to effect an injection. Thus, after each unit has been tested successively the phase angle of the pump is ascertained and any necessary adjustments can be made.

The injectors discharge into a drain **40** leading to the tank **38**.

The pointer **34** is adjustably mounted on the shaft **32** to enable its initial position to be preset to suit, if necessary, the order in which the pump units operate. For example, in practice it may be convenient to start the test with pump unit number **6** in which case the selector switch is moved to the appropriate position and the pointer is adjusted until the point of injection occurs when the pointer is opposite the reading "0."

What I claim is:

1. A switch mechanism for use in testing the phase angle of fuel pumps of Diesel engines of the type including an injector type valve, said mechanism including a housing in which the valve operates, a rigid rod bearing directly on the valve and extending through and above the housing, said rod being responsive to valve movement, a stirrup carried by the end of the rod above the housing, a contact carried by the stirrup, a spring plate secured to the housing laterally of the stirrup, a contact carried by the spring plate within the stirrup and underlying the contact carried by the stirrup, whereby the contact carried by the stirrup is lifted in the movement of the rod relative to the contact carried by the spring plate in breaking the connection, and means located beyond the stirrup, adjustable in the housing, and bearing on the spring plate to adjust said plate and the contact carried thereby relative to the contact carried by the stirrup.

2. A construction as defined in claim 1 wherein the stirrup is of ring-like form, and wherein the contact carried by the spring plate is arranged within the outline of said ring.

3. A construction as defined in claim 1 including an insulating member carried by the housing and terminating adjacent the stirrup to prevent turning movement of the stirrup in the operation of the rod.

LESLIE HARTRIDGE.