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METHOD AND APPARATUS FOR EXAMINING THE COMPRESSION AND THE IGNITION OF INTERNAL COMBUSTION ENGINES BY MEANS OF A SMALL ILLUMINATING TUBE

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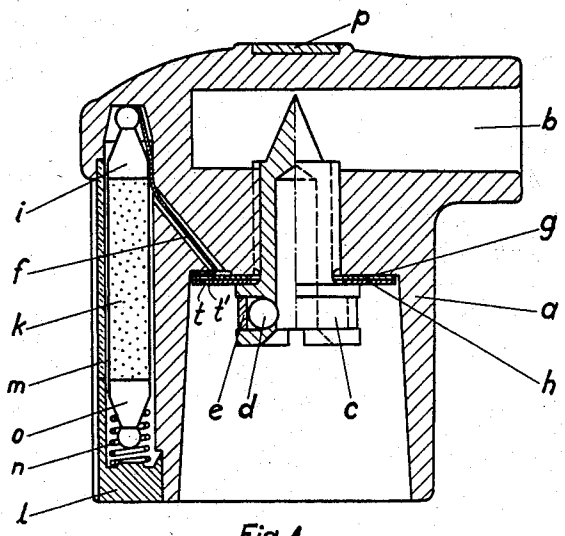



Fig. 1

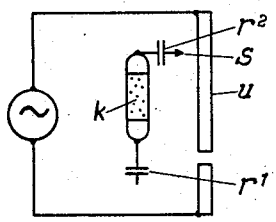



Fig. 2

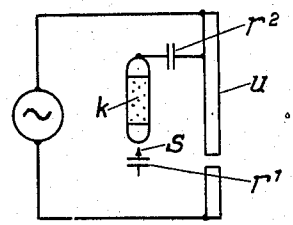



Fig. 3

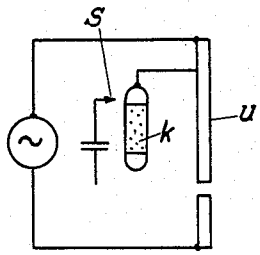



Fig. 4

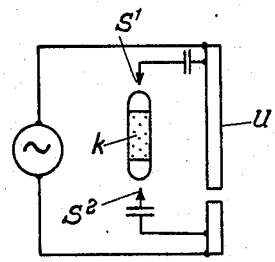



Fig. 5

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by [illegible]

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## METHOD AND APPARATUS FOR EXAMINING THE COMPRESSION AND THE IGNITION OF INTERNAL COMBUSTION ENGINES BY MEANS OF A SMALL ILLUMINATING TUBE

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4 Claims. (Cl. 175—183)

The invention relates to a method and apparatus for examining the compression and the ignition of internal combustion engines on sparking plugs, caps of such plugs, cable shoes, ignition cables or distributors by means of a small illuminating tube, and it is based on the novel observation that a small illuminating tube indicates by different degrees of brightness the compression and ignition of the corresponding cylinder.

According to the invention the method consists therein that the small illuminating tube is connected to the ignition circuit, for instance unipolarily, preferably through an auxiliary discharging gap, and that the energy transmitted from the igniting circuit to the small illuminating tube, by means of the auxiliary discharging gap or any other coupling element, is dimensioned so that, when the ignition and compression are normal, a lighting up of the illuminating tube of a certain average brightness occurs. If changes occur in the compression, and if disturbances happen in the ignition plant or on the sparking plug, the light becomes weaker or stronger, and if there is no compression and the ignition works perfectly the light is very feeble or does not exist at all.

As device for carrying out this new method a device may serve, in which the small illuminating tube is connected for instance by means of an insulated auxiliary electrode through the auxiliary discharging gap or the like to one of the two sparking plug electrodes preferably unipolarily and is arranged in or on a "protecting cap" adapted to be placed over the sparking plug.

An embodiment of the invention is illustrated, by way of example, in the accompanying drawing in which

Fig. 1 is a vertical longitudinal section through a device for fitting on a sparking plug.

Figs. 2 to 5 are diagrammatic views showing different circuit arrangements.

Fig. 1 shows in section the small illuminating tube connected unipolarily to the ignition circuit, i. e. to one of the sparking plug electrodes through the intermediary of an auxiliary discharging gap.

*a* designates a protecting cap adapted to be placed over the sparking plug and having a horizontal transverse channel *b* for the ignition cable. The ignition cable is pierced by the point of the vertical, electrically conducting carrier screw *c*, when this screw is screwed in; the central longitudinal bore of the carrier screw serves for accommodating the screw spindle of the sparking plug. A ball *d* and a band spring *e* serve as holding device and for establishing a good contact with the sparking plug electrode. An auxiliary electrode *f* is held by an insulating disc *g*, a metal disc *h* and the carrier screw *c*. The discs *g* and *h* have at the point below the lower bent off end of the auxiliary electrode *f* small apertures *t*, *t'* which represent the auxiliary discharging gap. The upper end of the auxiliary electrode *f* is in connection with the upper metallic coating *i* of the small illuminating tube *k*. The stopper *l*, also of insulating material, carries the observation tube *m* and presses a spiral spring *n* against the lower metallic coating *o*, so that the illuminating tube is lifted and securely held. A number plate *p* for the corresponding cylinder is mounted in the upper portion of the cap. The distance of the auxiliary electrode *f* from the metal disc *h* is determined by the thickness of the insulating disc *g* and is such that the illuminating tube lights up in the cylinder only with average brightness when the compression and ignition are normal; the illuminating tube thereby becomes very sensitive, so that, when disturbances occur in the compression and ignition numerous graduations of the brightness in downward and upward direction are obtained, said graduations being further indicated for the observer by broader and narrower light strips. If, for instance, the compression continually decreases owing to losses on pistons, packings and the like, the transition-resistance for the sparking plug in the cylinder decreases also continually, auxiliary discharging and lighting up becoming consequently continually feebler. The same is the case, if the sparking plug is sooted, or if the distance between the sparking plug electrodes is too small. If there is no compression the illuminating tube *k* lights up only very weakly notwithstanding full ignition tension, and, when disturbances in ignition occur, the lighting up of the illuminating tube may temporarily or completely cease. In this manner the service conditions of the motor and of every single cylinder is supervised.

The employment of the auxiliary discharging gap presents further the following advantage: Before the ignition tension has attained its maximum value, a quiet auxiliary discharging takes place between metal plate *h* and auxiliary electrode *f* through the apertures *t*, *t'* of the two discs mentioned above; owing to distributed inductivity and capacity and owing to the small dimensions

high frequency oscillations are produced which, acting upon the small illuminating tube $k$, superimpose the breakdown voltage, so that the ignition spark is now more easily produced owing to increase of voltage, and the device serves at the same time also as ignition exciter.

Figs. 2 to 5 illustrate several examples of connection with employment of different switching elements, for instance condensers, for otherwise coupling the illuminating tube with the ignition circuit $u$, in order to be able to adjust also at high and low compression motors the illuminating tube $k$ to average brightness at normal compression and ignition. As shown in Fig. 2 the illuminating tube $k$ has at the lower end a condenser $r^1$ as counterweight, and its upper end is series-connected with the condenser $r^2$ through the intermediary of an auxiliary discharging gap indicated by the arrow $s$. By this arrangement the control range of the illuminating tube can be enlarged from 0–20 atmospheres compression for instance for motors of sport cars. Also the arrangement illustrated in Fig. 3 is adapted for a large indicating range. The arrangement shown in Fig. 4 is adapted for low compressing motors, and that in Fig. 5 for the maximum efficiency from 20–18 atmospheres compression for a high compressing motor.

I claim:—

1. A device for testing the compression and ignition of internal combustion engines, comprising in combination with a sparking plug, a protecting cap of insulating material and adapted to be placed over and secured on said sparking plug having a hollow space in its wall, a carrier screw of conductive material in said protecting cap and having a bore for accommodating the screw spindle of the sparking plug, a metal plate and an insulating plate on said metal plate having each one an aperture forming the auxiliary discharging gap, an auxiliary electrode above said apertures in said metal plate and in said insulating plate, and an illuminating tube in said hollow space of said protecting cap, and means for connecting one pole of said illuminating tube to said auxiliary electrode.

2. A device as specified in claim 1, in which the protecting cap is numbered according to the sparking plug on which it is fitted and the auxiliary electrode and metal plate cooperate in producing high frequency oscillations acting on the breakdown voltage to incite ignition.

3. A method for testing the compression and ignition of internal combustion engines by means of an illuminating lamp, consisting in connecting the illuminating tube unipolarily in the ignition circuit over an auxiliary discharge gap, supplying a regulated amount of energy to said tube to induce illumination of medium intensity under normal engine ignition and compression conditions but fluctuations in intensity in the event of disturbances in either of said conditions.

4. A device for testing the compression and ignition of internal combustion engines, comprising in combination with a sparking plug, a protecting cap of insulating material adapted to be slipped on to said sparking plug and having a recess, an illuminating tube in said recess, elements in said cap forming an auxiliary discharging gap, an electrode leading from said gap to one end of said tube, and means pressing said tube against said electrode.

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