March 19, 1935. J. WALZER 1,994,881

APPARATUS FOR INSPECTING IGNITION SYSTEMS

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Fig. 1.

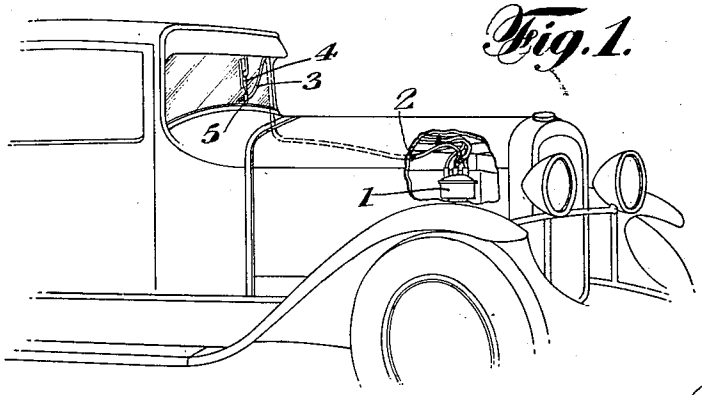


Fig. 8.

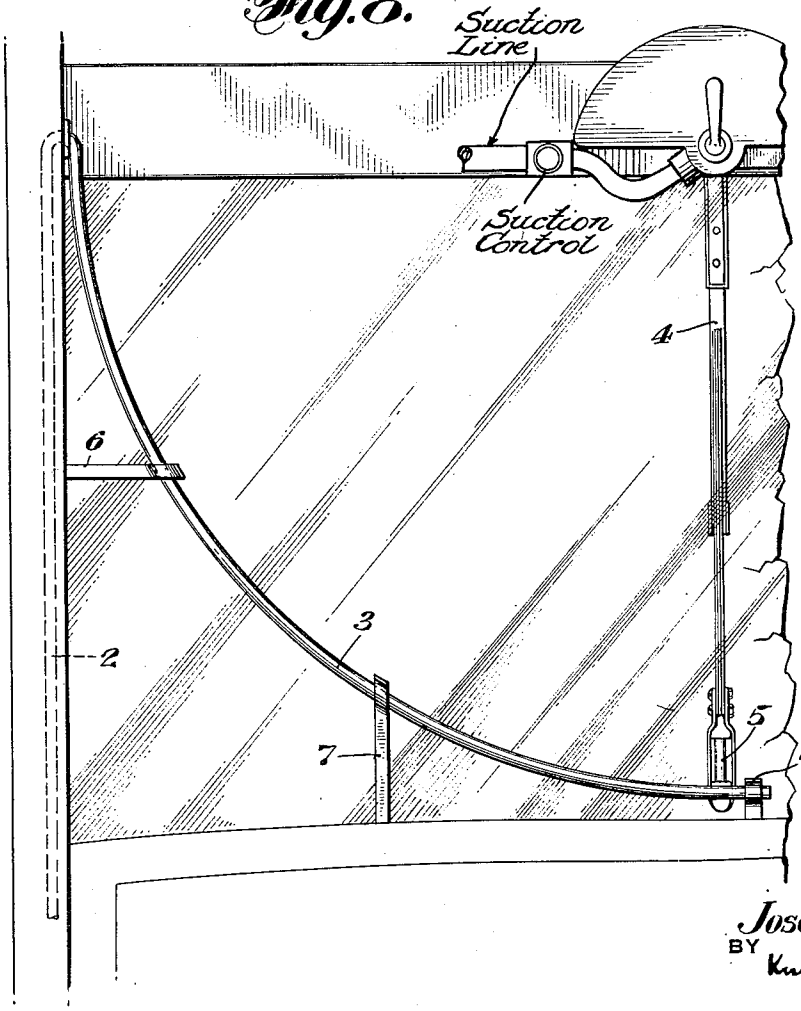
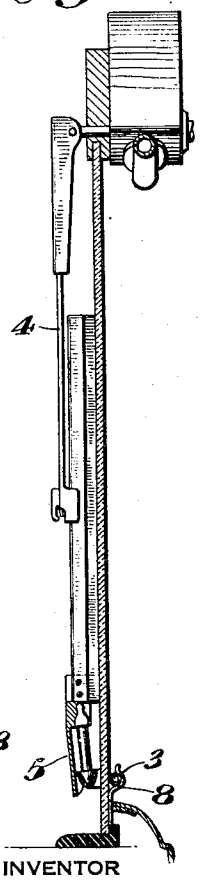


Fig. 9.



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Fig. 2.

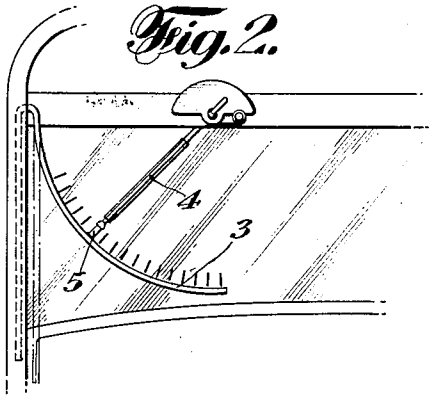


Fig. 3.

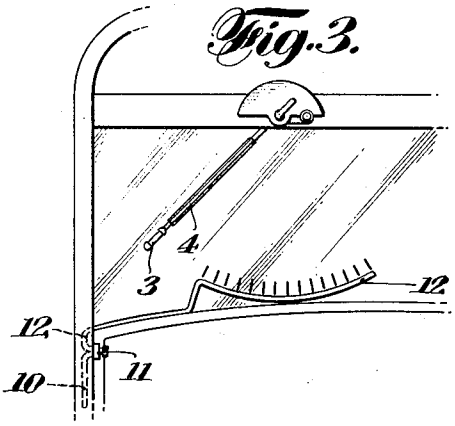


Fig. 4.

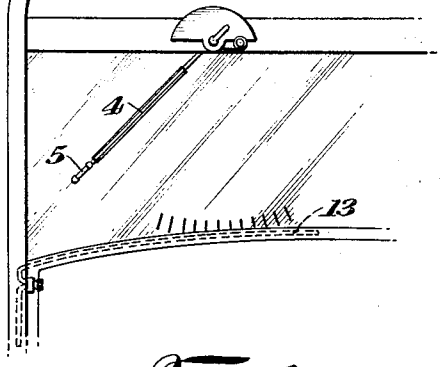


Fig. 5.

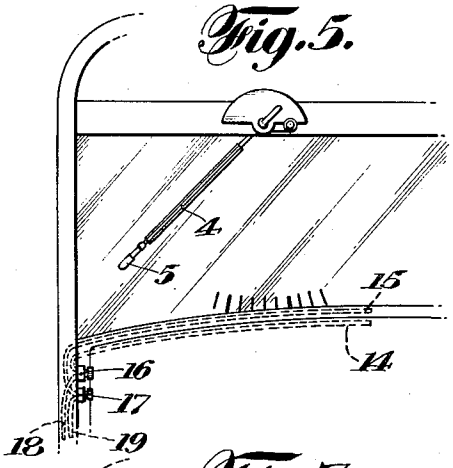


Fig. 6.

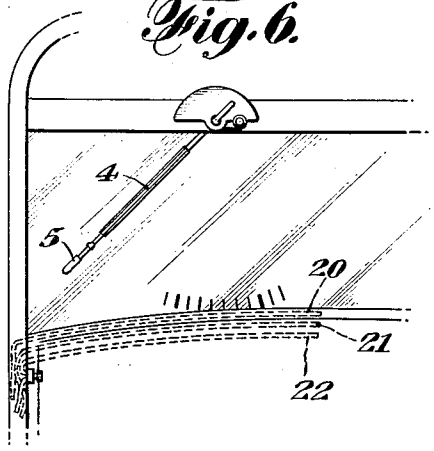
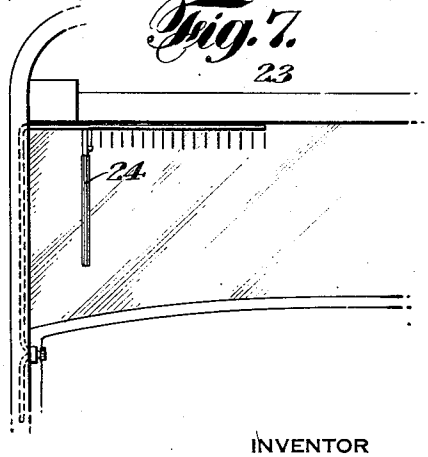


Fig. 7.



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Fig. 10.

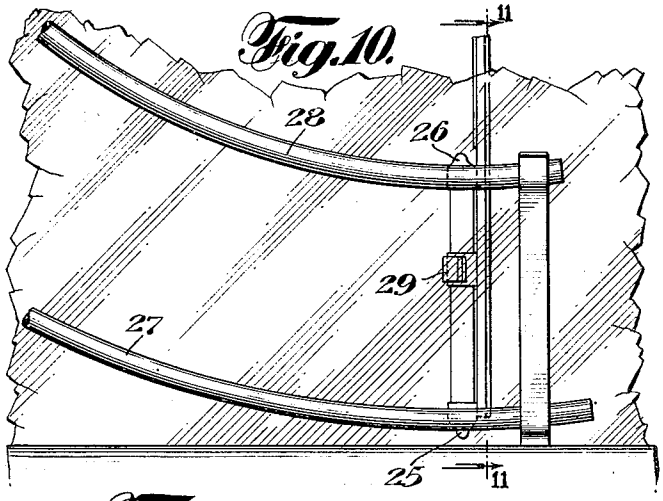


Fig. 11.

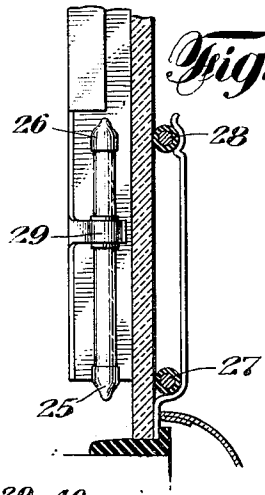


Fig. 13.

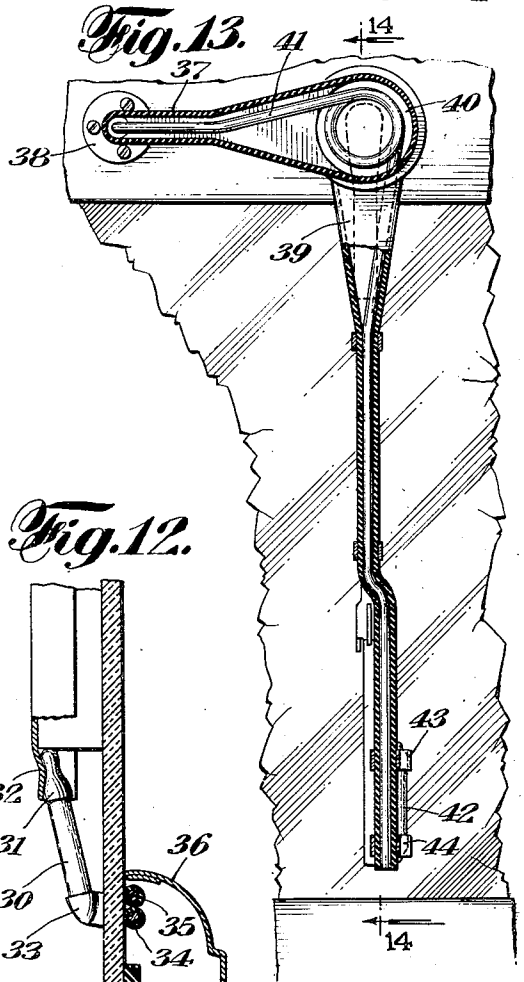


Fig. 14.

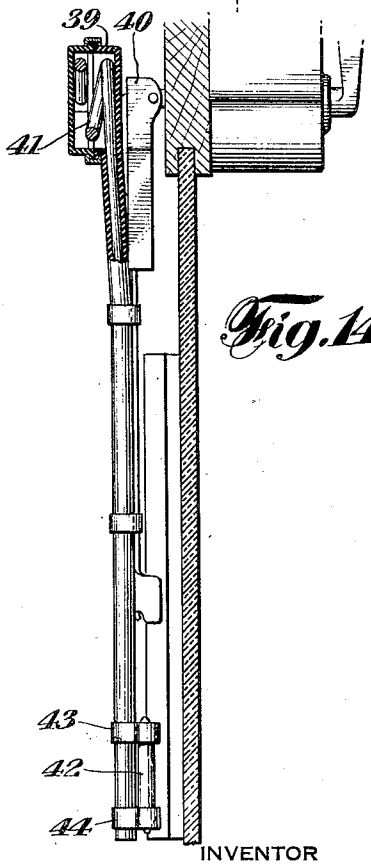


Fig. 12.

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APPARATUS FOR INSPECTING IGNITION SYSTEMS

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Fig. 15.

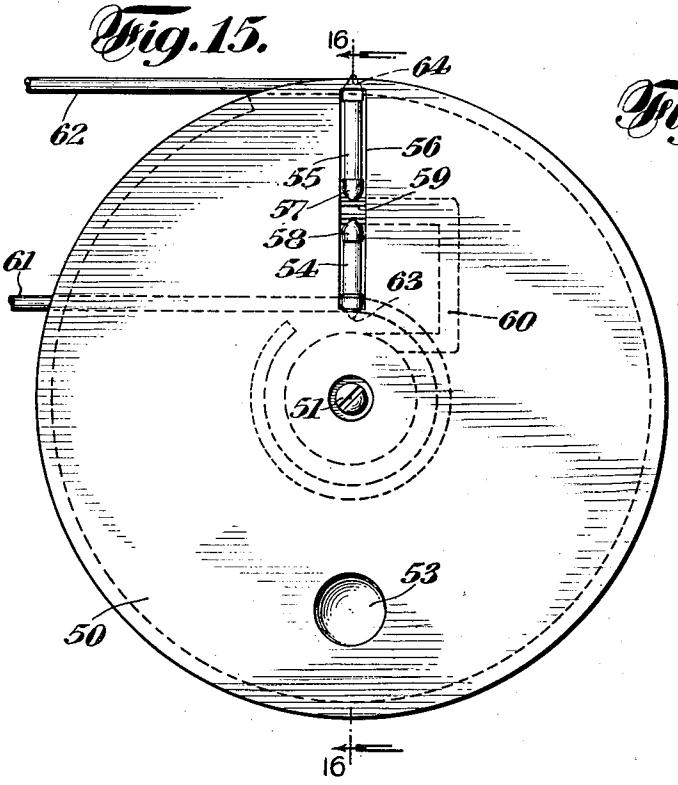


Fig. 16

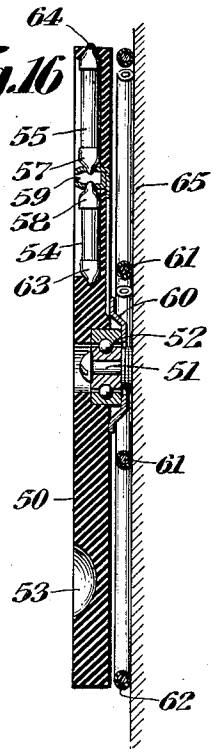


Fig. 18.

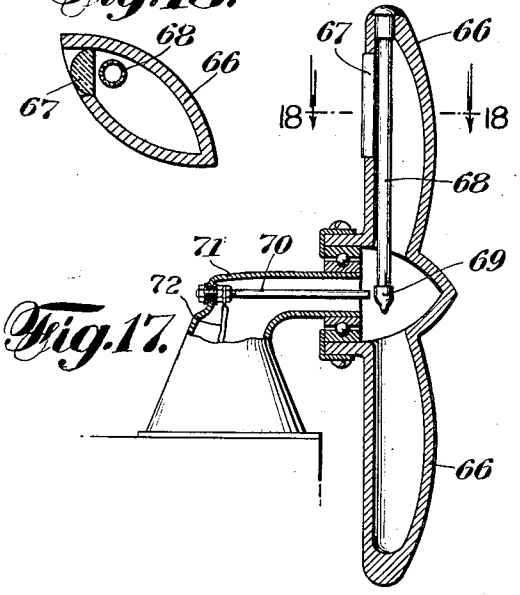


Fig. 17.

Fig. 19.

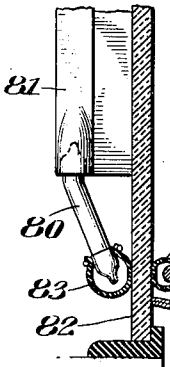
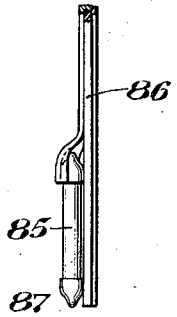


Fig. 20.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR INSPECTING IGNITION SYSTEMS

Joseph Walzer, Jamaica, N. Y.

Application March 5, 1932, Serial No. 596,914

9 Claims. (Cl. 175—183)

This invention relates in general to an apparatus for obtaining a visual indication of the operating conditions in an ignition system as employed for example in automobile engines.

Neon lamps and similar vacuum tubes have been employed in various ways to give a visual indication of the conditions existing at the spark terminals or in other electrical portions of the ignition system, by incorporating such tubes in various circuit relations associated with the high tension terminals or leads so as to obtain light flashes in the tubes simultaneously with the spark discharges which occur in the spark plugs.

An important object of the present invention is to provide a relatively simple construction or device by which the same neon lamp or the like is flashed successively as a result of the spark discharges occurring in the successive engine cylinders, and such flashes are rendered separately visible by movement of the tube across a field of view. A visual comparison of the successive flashes which are thus spaced apart thus enables a comparison of the sparking conditions in the different cylinders with respect to each other. Suitable exposure of the neon lamp or the like to the voltage impulses in the common high tension lead enables the successive sparks to be indicated by successive flashes in the same neon lamp or tube. The movement of the tube across the field of view, to space apart the successive light flashes, is obtained in accordance with one embodiment of the invention by mounting the tube on the windshield wiper of an automobile. By disposing a conductor along the arc or line of movement of the tube, and connecting such conductor with the high tension common lead of the ignition system, the light flashes are produced directly in the driver's view, and regulation of the relative speeds of the engine and the windshield wiper will enable the driver to obtain such spacing of the successive flashes as best suits his purpose.

Instead of moving the neon lamp or tube by operation of the windshield wiper, the invention also includes the mounting of the tube on a rotary disk which may, for example, be spun by hand, or the tube may be mounted for example on a wind-driven rotor attached on the front of the car, as for instance sometimes employed on radiator caps.

Several embodiments of the invention are shown by way of illustration in the accompanying drawings, in which

Figure 1 is a perspective view of the front portion of an automobile, with parts broken away, illustrating diagrammatically the connection of the device with the windshield wiper and high tension ignition lead.

Figures 2, 3 and 4 are diagrammatic views showing various locations of the conductor on the windshield, for energizing the tube from the ignition system.

Figure 5 is a similar view in which two conductors are mounted adjacent the path of movement of the tube, one to be connected with the common high tension lead and the other with the high tension lead of a particular cylinder, as will be further explained.

Figure 6 is a view similar to Figure 5 in which three conductors are disposed adjacent the path of movement of the tube, these three conductors to be connected in two ignition systems as used for example in eight and twelve cylinder cars.

Figure 7 is a diagrammatic view illustrating the location of a conductor along the path of movement of the tube when mounted on a straight line windshield wiper.

Figure 8 is an elevation showing additional details of the tube and conductor mounting, corresponding for example to the diagram illustrated in Figure 2.

Figure 9 is a vertical section thereof.

Figure 10 is a detailed elevation illustrating the mounting of two conductors and the use of a single tube with a ground connection at an intermediate point to secure a flash at one or both sides of the ground connection, depending on the energization of one or both of the conductors.

Figure 11 is a vertical section thereof on the line 11—11.

Figure 12 is a vertical section of a two-conductor system showing the mounting of the tube on the windshield wiper, and having one of its terminals, a wiper, in contact with the windshield.

Figure 13 is a front elevation, with parts broken away, illustrating the mounting of the conductor in a protective housing on the windshield wiper so as to move continuously with the tube.

Figure 14 is a side elevation thereof, with parts in section, on the line 14—14 of Figure 13.

Figure 15 is a face view of a hand actuated rotary disk for moving the indicating device.

Figure 16 is a central vertical section thereof on the line 16—16.

Figure 17 is a vertical section through a wind actuated rotary device for moving the indicator.

Figure 18 is a transverse section thereof on the line 18—18.

Figure 19 is a side elevation, with parts in section, illustrating a detail of mounting the tube and conductor, and

Figure 20 is a view showing a modified form of mounting the tube on the side of the windshield wiper.

It will be understood that the neon lamp or other vacuum tube is caused to flash for each high tension impulse that occurs in a conductor in close proximity to one of the tube electrodes; and that while it is possible to secure greater energy of flashing by grounding the opposite electrode, such grounding by direct electrical connection is not essential to the functioning of the tube in devices of the character herein described. In most of the embodiments of the invention illustrated in the accompanying drawings, reliance is placed upon the high tension field surrounding the conductor or conductors connected with the high tension side of the ignition system, and by moving one of the tube electrodes through a portion of this field of sufficient intensity, the excitation of the tube is accomplished. The conductor or conductors may advantageously be disposed behind or beneath the windshield of the car and thus protected from the weather, and are preferably suitably insulated for the purpose of safety to the driver or other car occupant. In a general way the principle of operation and use is apparent from Figure 1 of the drawings, in which is shown a distributor head 1, from the high tension intake wire of which a lead 2 extends to the dead end conductor 3 which is mounted inside the windshield in a position adjacent the path of the outer end of the windshield wiper 4 which carries the neon lamp or tube 5.

Referring for example to Figures 8 and 9, the dead end conductor 3, such as shown in Figure 1, is in the form of an insulated wire which depends or curves downward from the top of the windshield, and may be temporarily clamped in position by means of the non-conducting clips 6, 7 and 8 so as to conform approximately with the arc of movement through which the lower end of the neon tube 5 swings during the oscillation of the windshield wiper arm 4. When not in use, this dead end insulated conductor 3 may be withdrawn from the clips 6, 7 and 8 and hung downward along the side of the windshield. It will be observed in Figures 8 and 9 that the lower terminal of the neon tube 5 follows the line of the dead end conductor 3 when positioned in its clips, and as a result the tube 5 is flashed for each high tension impulse occurring in the conductor 3; and as these impulses occur, one for each spark discharge occurring in the engine ignition system, there will be a series of flashes which are spaced apart in the field of view when the windshield wiper is being operated. The normal speed of the ordinary windshield wiper is such that the successive sparks even in a twelve cylinder engine at high engine speed can readily be distinguished in the form of separate flashes along the path of movement of the windshield wiper. As shown conventionally in Figures 8 and 9, the ordinary suction-operated windshield wiper is regulatable as to speed, at any given engine speed, by the suction control inserted in the suction line.

The diagrammatic illustration in Figure 2 shows the general arrangement, already described with reference to Figures 1, 8 and 9, the position of the dead end conductor 3, when not in use, being indicated by the dot and dash lines at the side of the windshield frame. The short radial lines in this and other views are intended to represent typical positions of successive flashes during the operation of the device.

Figure 3 represents diagrammatically a somewhat different arrangement of the dead end conductor, wherein the high tension lead 10 connects through a single pole switch 11 below the lower corner of the windshield frame, with the dead end conductor 12 which follows the lower rail of the frame for a short distance and after bending slightly upward is continued in an arcuate curve concentric with the center of oscillation of the windshield wiper. The switch 11 is normally open, and the conductor 12 is thus disconnected from the high tension wiring but may be placed in service by turning the switch.

Figure 4 shows in general the same parts as Figure 3, but in this case the dead end conductor 13 is concealed within the trim or framework beneath the windshield and does not necessarily follow the arc of the windshield wiper, but may be more or less tangential thereto.

Figure 5 represents a system similar to Figure 4, with the exception that two dead end conductors 14 and 15 are provided. These are connected through switches 16 and 17 with the high tension leads 18 and 19, one of which is connected with the high tension wire leading into the distributor head, and the other of which is connected to the high tension wire leading from the distributor head to one particular spark plug of the engine. In this way the flash for each discharge of the particular spark plug thus directly connected is heavier than the others, and its relative position in the field of view with respect to the other flashes enables the ready identification of the flash corresponding with any other particular one of the spark plug discharges. The switches 16 and 17 in the leads 14 and 15 would both be closed when using the device in the particular manner just described. By closing switch 16, with switch 17 open, the uniformity of the timing can be readily observed as well as the relative intensity of the sparks in the different cylinders. The switch 17 need only be closed at the same time with switch 16 when it is desired to identify the location of the particular cylinder which shows irregularity with respect to the others. It is also perfectly feasible to operate with switch 17 closed and switch 16 open, in which event the successive flashes will all be from the particular cylinder to which the lead 19 is at the moment connected, and this lead of course can be connected to any spark plug desired. In this latter arrangement or use, each spark plug can be individually examined with regard to the regularity and intensity of its discharge.

Figure 6 represents an arrangement similar to Figures 4 and 5, with the exception that three dead end wires 20, 21 and 22 are here employed for use in eight or twelve cylinder engines, for example, where two separate ignition systems are employed. Wire 20, for example, may be connected to the lead from the distributor head to cylinder No. 1, and wires 21 and 22 connected to the intake wires of the distributor heads of systems Nos. 1 and 2 respectively.

Figure 7 represents the location of a dead end conductor 23 along the path of movement of the neon tube in the case of a straight line windshield wiper 24.

Figures 10 and 11 represent a two-wire system in which, instead of a heavy flash being produced for the spark discharge in a particular spark plug as described in connection with Figures 5 and 6, two flashes are produced in the same tube, by disposing the neon tube with its two end terminals 25, 26 opposite the two dead end conductors 27, 28, and providing an intermediate ground

connection 29 so that flashes corresponding with the energization of the distributor head common lead occur between one terminal and the intermediate ground, whereas flashes corresponding with the spark discharge in a particular cylinder occur between the other terminal and the intermediate ground. Thus the observer sees a succession of short flashes interspersed at regular intervals between longer flashes, and is enabled to identify the flashes corresponding with the respective cylinders by the location of the various short flashes with respect to the long flashes. The neon tube, when thus connected with an intermediate ground, is virtually a pair of tubes, and the principle described is obviously applicable to a one or two tube construction.

Figure 12 is a detailed constructional view showing a tube mounting on the windshield wiper applicable to systems such as shown, for example, in Figures 5 and 6, where a plurality of dead end wires connected as already described are employed to energize the tube from the same terminal. In this view the tube 30 is provided with an elongated upper electrode 31, which is clipped into a spring clip 32 formed on the wiper frame, the other tube terminal being covered with a rubber cap 33 provided with a flap to slide along the glass windshield opposite the dead end conductors 34, 35, which are concealed within a housing 36. In this construction the upper terminal 31 is virtually grounded by reason of its connection with the metallic framework of the windshield wiper. The simultaneous energization of both dead end conductors causes a stronger flash, whereas the energization of one dead end conductor alone produces a weaker flash, when these conductors are connected as described in connection with Figures 5 and 6. On account of the highly dielectric character of the windshield glass, a wiping contact, such as illustrated in this figure at the terminal 33, whether this contact be metallic or non-metallic, improves the functioning of the tube.

In some cases the dead end conductor may move with the neon tube, and one example of this is illustrated in Figures 13 and 14. The conductor is here mounted on the windshield wiper and, being exposed to the weather, should be provided with a suitable housing. For this purpose I provide for example a fiber housing member 37, which leads from a bushing or plate 38 where the dead end conductor enters, to a second housing 39 to which the first housing is rotatively connected upon a center coinciding with the center of oscillation of the windshield wiper 40. This second housing 39 extends along the windshield wiper arm to a point near its free or outer end. The conductor 41 enters the housing 37 through the bushing or plate 38, makes a turn or two about the oscillation axis of the wiper 40, and follows outwardly through the housing 39. The neon tube 42 is clipped on the outer end of the housing 39 by means of the clips 43, 44, so that one or both terminals 43 are permanently adjacent the dead end conductor 41; and this latter being connected for example to the high tension intake wire of the distributor head of the engine, a flash is obtained in the neon tube for each spark discharge.

In Figure 19 the tube 80 is shown as depending from a mounting in the windshield wiper 81 and directed toward the windshield 82. The lower terminal of the tube is enclosed in a cap 83 of soft rubber or the like, which yieldingly engages the glass windshield opposite the dead end conductor 84. This construction is effective in maintaining proper functioning of the tube, by reason of the wiping of the face of the glass. Where the windshield wiper extends too close to the edge of the glass frame to admit of the tube projecting beyond, a similar wiping action may be obtained by the construction shown in Figure 20, in which the tube 85 is mounted on the side of the wiper blade 86 so that the rubber thereof, extending past the lower tube terminal 87, serves to wipe the face of the glass windshield.

The examples described with reference to the mounting of the neon tube on the windshield wiper represent perhaps the simplest and cheapest ways of embodying the principles of the invention in connection with an automobile, since in most instances they do not require any extensive structural changes or additions. Furthermore, the windshield wiper offers a particularly advantageous element for readily gaining the desired steady motion of the tube at a speed which can be adjusted to suit the preference of the operator. In its broader aspects, however, the invention is susceptible to embodiment in other moving parts, whether driven automatically or by hand, and two examples of other forms of construction by which the movement of the tube may be secured are shown in Figures 15 to 18 inclusive.

Referring to Figures 15 and 16, the device here comprises a simple rotary disk or wheel 50 mounted on a post or stud 51 through ball bearings 52. This disk 50 is preferably of non-conducting material, such as fiber, wood, bakelite or the like. A finger socket 53 is provided in its outer face so that it may be spun by hand. A pair of neon tubes 54, 55 are mounted in a radial slot or groove 56, with their adjacent terminals 57, 58 seated in a common ground connection 59 from which a ground plate 60 leads to the outer race of the ball bearings 52. Dead end conductors 61, 62 are led in tangentially to respective circular positions behind the outer terminals 63, 64 of the neon tubes 54, 55, and are suitably secured on the stationary base plate or wall 65 on which the stud 51 is mounted. Obviously a single neon tube, as illustrated in Figure 11, may be employed in place of the separate tubes 54, 55, herein illustrated. There is, however, a particular feature in the use of two separate tubes in this or any of the other forms of construction, in that with two tubes different colors may be selected so that the flashes of one color indicate some of the cylinders, and the flashes of the other color indicate another cylinder. In the operation of the device, shown in Figures 15 and 16, it will be apparent that the wires 61, 62 are connected to the high tension leads, as already referred to in connection with Figure 5. With the engine running the sparks will be represented by flashes in the radial tubes 54, 55, and upon rotating the disk 50 these flashes will be circumferentially spaced apart to separately display them.

In Figures 17 and 18, I have shown the embodiment of the device in connection with the wind wheel on a radiator cap. In this construction, the wheel 66 is hollow and a cylindrical magnifying lens or window 67 is provided in its rear face. Behind this lens or window 67 is mounted a neon tube 68, whose inner terminal 69 is disposed in about the axis of rotation where it is constantly adjacent the stationary dead end conductor 70 mounted in the base 71 of the radiator

cap. A conductor 72 leads, for example, to the high tension intake of the engine distributor head, which latter is usually but a short distance from the radiator cap and thus the lead may be quite short. The dead end conductor 70 is, of course, insulated from the housing 71 so that high tension fields are produced about the tube terminal 69 as the spark discharges occur in the engine. Flashes of light are thus set up in the tube 68, which are visible through the window 67. During the running of the car the wheel revolves and the flashes will thus be visible over an arc slightly more than 180° within which the window remains visible from the driver's seat.

I claim:—

1. In an automobile ignition tester, the combination of an indicator excitable by high tension impulses, means for moving the same across a field of view at variable optional speeds with respect to the engine speed, and means for applying thereto high tension impulses from the engine ignition system to excite the same while in motion across said field of view.

2. In an automobile ignition tester, the combination of an indicator excitable by high tension impulses, means for securing same to a windshield wiper for movement therewith, and means for applying high tension impulses from the engine ignition system to said indicator to excite the latter.

3. In an automobile ignition tester, the combination of a conductor associated with the ignition system to receive high tension impulses therefrom, an indicator excitable by such impulses to produce light flashes corresponding therewith, means for moving said indicator across a field of view while exposed to high tension impulses in said conductor, and means for optionally varying the speed of movement of said indicator with respect to the engine speed, to adjust the spacing of the light flashes created in said indicator by such high tension impulses.

4. In an automobile ignition tester, the combination of an indicator excitable by high tension impulses, means for securing same to a windshield wiper for movement therewith, and a conductor connected with the high tension side of the engine ignition system and extending into proximity to said indicator for exciting the latter in accordance with the high tension impulses of the said ignition system.

5. In an automobile ignition tester, the combination of an indicator excitable by high tension impulses, means for securing same to a windshield wiper for movement therewith, a conductor connected with a high tension common lead of said ignition system and a second conductor connected with an individual high tension lead to a particular cylinder, both of said conductors extending into proximity to said indicator for applying high tension impulses thereto.

6. In an automobile ignition tester, the combination with a member movable across a field of view, of an indicator mounted on said member, said indicator excitable by high tension impulses, and means for applying to said indicator while in motion high tension impulses common to all cylinders of the automobile engine and additional high tension impulses peculiar to one of said cylinders.

7. In an automobile ignition tester, the combination with a member movable across a field of view, of a plurality of indicators mounted thereon, said indicators excitable by high tension impulses, means for applying to one of said indicators high tension impulses common to all cylinders of the automobile engine, and means for applying to the other of said indicators high tension impulses peculiar to one of said cylinders.

8. In an automobile ignition tester, the combination of an indicator tube excitable by high tension impulses, means for securing same to a windshield wiper for movement therewith, a conductor connected with the high tension side of the ignition system and extending along the inner face of the windshield in proximity to the path of movement of said indicator tube, and means for wiping the outer face of the windshield along the path of movement of said indicator tube.

9. In an automobile ignition tester, the combination of an indicator tube excitable by high tension impulses, means for energizing said tube by high tension impulses from an automobile spark plug, and means operable at variable speeds for any given engine speed for moving said indicator tube across a field of view during the successive excitations thereof.

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