

July 18, 1967

D. W. BYRON ETAL

3,331,200

INSTRUMENT FOR CHECKING ENGINE EFFICIENCY

Filed Oct. 18, 1965

2 Sheets-Sheet 1

FIG. 1.

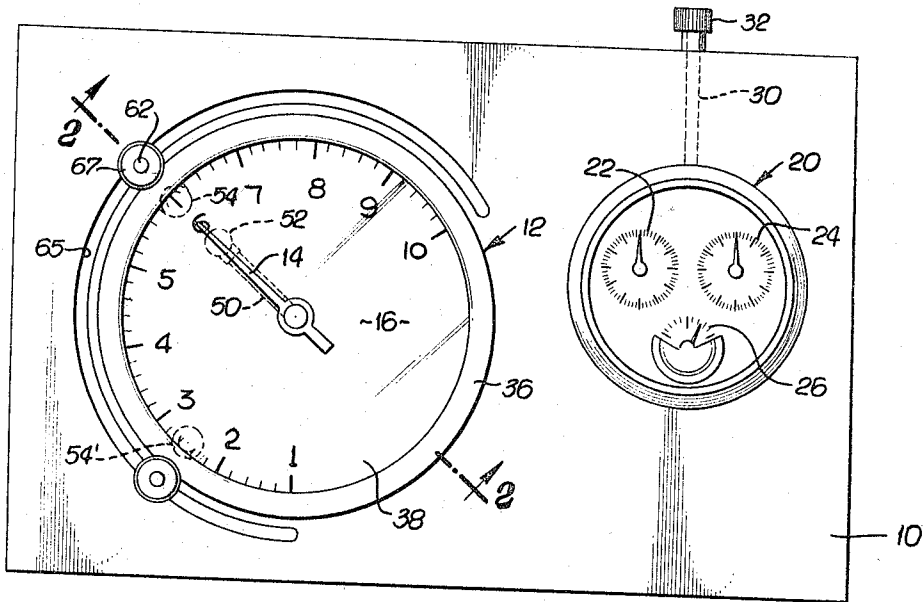


FIG. 2.

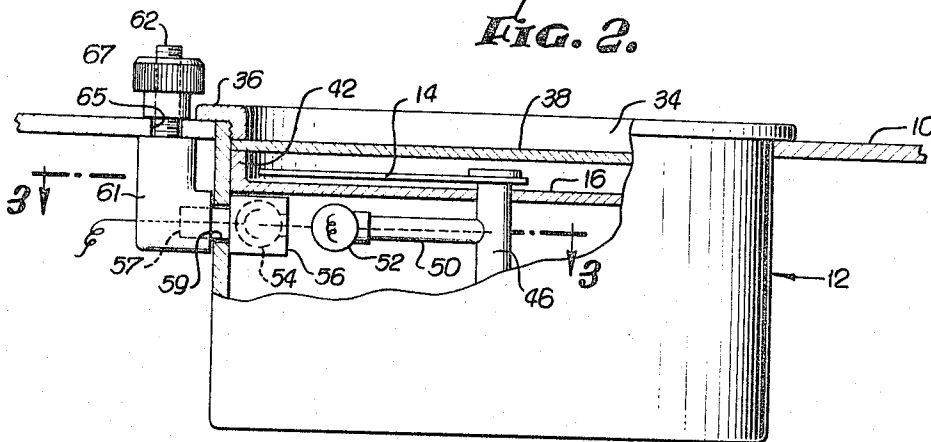
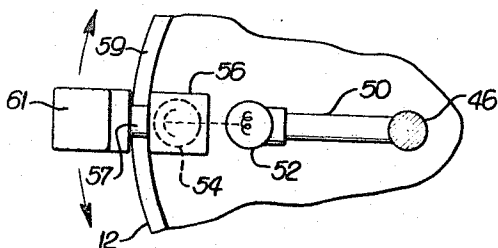


FIG. 3.



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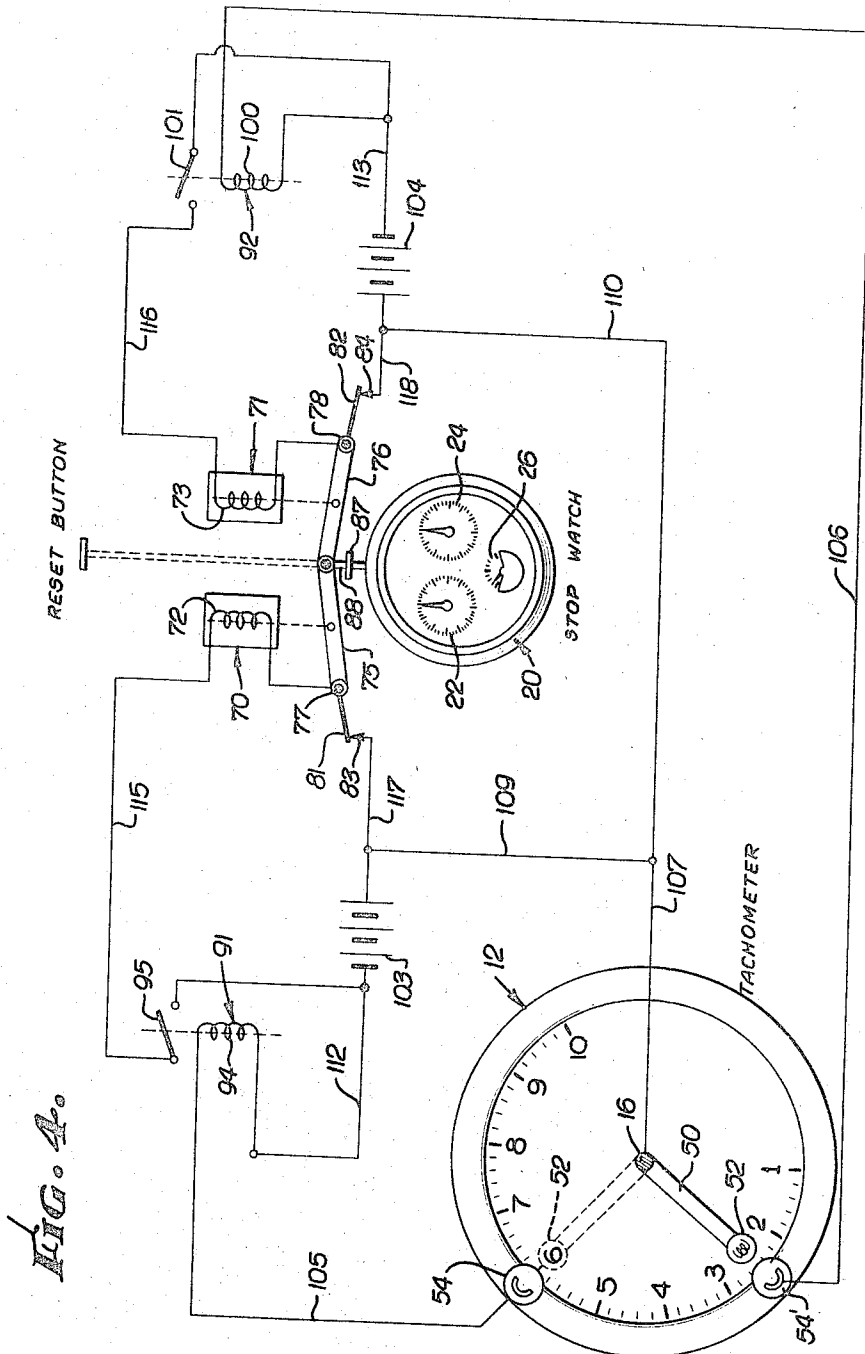


FIG. 4.

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INSTRUMENT FOR CHECKING ENGINE EFFICIENCY

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The invention relates to a novel and improved instrument or device for the purpose of testing or checking engine efficiency. The invention is particularly adapted for use with internal-combustion engines, but it also may be used with other types of engines.

It is known that the time during which an engine accelerates or decelerates between one speed and another is a good indication of the general condition of the engine, that is, of its performance. The elapsed time may be measured between any two selected speeds either when accelerating or decelerating to determine the performance of the engine. This method of checking engine performance is simple and reliable and not difficult to do. In a preferred form of the invention herein, it provides simple but dependable means for checking the performance of an engine by measuring the elapsed time while engine changes from one speed to another either while accelerating or decelerating. The performance of the engine may be checked either while the engine is loaded or at no load or both. The device of this invention is simple enough and easy enough to use that as many tests as desired may be made with great facility and in a short time.

The primary object of the invention is to provide simplified but adequate and reliable means for testing or checking the performance of an engine in the manner stated.

A further object of the invention is to provide engine performance testing means comprising a tachometer and a stop watch and control means between the tachometer and stop watch whereby the stop watch is started at one predetermined speed indicated by the tachometer and is stopped at another predetermined speed indicated by the tachometer. In the preferred form of the invention, a standard stop watch is used and the reset button at the top is actuated for starting and stopping the stop watch. In a preferred form of the invention, electrical control means connected between the tachometer and the stop watch are used for actuating the stop watch. In the preferred form of the invention, a standard tachometer may be adapted to the instrument of this invention in one or more different ways. Preferably and as disclosed in detail in this application, a source of light is carried by the tachometer shaft and photocells are arranged to be movable around the circumference of the tachometer to be actuated when the source of light is in proximity thereto. An ordinary commercial tachometer may be adapted in this way for providing a signal from the tachometer at particular predetermined speeds at which the photocell means are set. It is a further object of the invention to provide simplified but reliable means for testing engine performance wherein a commercial tachometer is adapted in this manner.

In a preferred form of the invention, electrical solenoid means are arranged for actuating the reset button of the stop watch.

Further objects and additional advantages of the invention will become apparent from the following detailed description and annexed drawings, wherein:

FIG. 1 is a front view of a preferred form of instrument or device of this invention;

FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2; and

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FIG. 4 is a wiring diagram of the invention.

Referring now more particularly to FIGS. 1, 2 and 3 of the drawings, numeral 10 designates a housing or casing containing the components of the instrument or device for checking engine performance or efficiency. Within the housing is mounted the tachometer 12 which may be of a standard commercial type having a pointer 14 and an indicating dial face 16. Numeral 20 designates a stop watch which may be a standard commercial make having a minute dial 22, a second dial 24, and a dial indicating $\frac{1}{10}$ second as designated at 26. Associated with each dial there is, of course, an indicating pointer.

Numeral 30 designates an extension on the stem of the reset button of the stop watch with a button 32 positioned outside of the housing 10.

The stop watch is automatically controlled by the tachometer. FIGS. 2 and 3 illustrate the control means forming part of the tachometer which control the starting and stopping of the stop watch. Numeral 34 designates the upper part of the tachometer housing which is in the form of a ring having a flange 36 which ring is threaded into the upper part of the housing 12 retaining a glass face plate 38 in position. Inside the housing, the dial face 16 has a peripheral flange 42 which fits inside the housing 12 and against the bottom edge of the glass face 38.

The tachometer has a center spindle 46 on which is carried the indicating pointer 14 adjacent to the dial face 16.

The spindle 46 has an extending radial stem 50 on which is mounted a miniature source of light, as designated at 52. The light 52 is adapted to cooperate with a photocell 54 mounted on a carrier 56 having a part 57 which extends out of the housing 12 through a slot 59 which extends a suitable distance around the circumference of the housing 12. Attached to the stem 59 is an angular bracket 61 having a threaded stem 62 which extends through an arcuate slot 65 in the outer face of the housing 10. An adjusting knob 67 is provided on the threaded stem 62. Thus, by loosening the nut or knob 67, the bracket 61 and photocell 54 can be adjusted around the circumference of the tachometer to be set opposite any particular speed. When the spindle 46 and pointer 14 are opposite this speed, the light source 52 will be in a position to activate the photocell 54.

Two photocells are provided having identical support and adjustment means, the second being identified by the numeral 54 in FIG. 4. Provision is thereby made for setting the photocells opposite each of two predetermined speeds.

FIG. 4 illustrates a preferred form of control means whereby the stop watch is controlled. A pair of solenoid mechanisms is provided as designated at 70 and 71. These mechanisms comprise windings 72 and 73 arranged to actuate pivoted arms 75 and 76 which are pivoted at 77 and 78, respectively. These switch arms carry contact blades 81 and 82 which cooperate with fixed contacts 83 and 84. The solenoids 72 and 73 are connected to the levers 75 and 76 so as to move the inner ends of these levers downwardly when the solenoids are energized. This will actuate the reset button 87 by way of the stem 88. This action will also open the switches formed by blade 81 and contact 83 and by blade 82 and contact 84. The stop watch may be reset to zero manually by the reset button 32 which is on the end of an extending stem.

The solenoid mechanisms 72 and 73 are controlled by a relay as designated at 91 and another relay as designated at 92. Relay 91 has a winding 94 which actuates a switch 95. Relay 92 has a winding 100 which actuates a switch 101. In the form of the invention shown two batteries are used as a source of power as designated at 103 and 104. The winding 94 is connected to the photo-

cell 54 by a wire 105, and the winding 100 is connected to the photocell 54 by a wire 106. The source of light 52 is connected through a wire 107 and wire 109 to the battery 103, and it is connected by way of wires 107 and 110 to the battery 104. Connections are provided from the winding 94 to the battery 103 by way of wire 112, and winding 100 is connected to battery 104 by wire 113. The switch 95 is connected to the winding 72 of solenoid 70 by wire 115, and switch 101 is connected to the winding 73 of solenoid 71 by wire 116. Battery 103 is connected by wire 117 to contact 83, and battery 104 is connected to contact 84 by wire 118.

The two photocells 54 and 54' may be adjusted around the circumference of the tachometer to be set opposite any two particular predetermined speeds. The tests may be made on an engine while it is accelerating from one particular speed to another. In testing in this way, the photocell 54' is set opposite the lower of the two speeds, and the photocell 54 is set opposite the higher of the two speeds, as illustrated in FIG. 4.

In operation, when the tachometer reaches a speed as shown in FIG. 3 at which the light source 52 is opposite the solenoid 54', a circuit is completed through the battery 104 and the winding 100 of relay 92. This closes switch 101 to energize the winding 73 of solenoid mechanism 71. This rotates the arm 76 clockwise about its pivot 78. The end of arm 76 actuates the stem 88 of the stop watch 20 to start the stop watch, the stop watch previously having been manually reset to zero by the reset button 32. The lever 76 also disengages switch blade 82 from contact 84 so as to open the circuit of solenoid 71. A time delay may be incorporated in the movement of arm 76 to assure that the reset button of the stop watch is actuated before solenoid 71 is deenergized. It becomes deenergized when blade 82 moves away from contact 84. Relay 92 is deenergized when the light source 52 moves away from photocell 54'.

The test being described is one wherein the engine being tested is accelerated from one speed to another. When the arm 50 and source of light 52 are brought opposite the photocell 54, relay 91 becomes energized closing switch 95. This energizes the solenoid mechanism 72 which moves the arm 75 in a clockwise direction to thereby actuate the button 87 of the stop watch to stop it. At the same time, switch blade 81 is moved away from contact 83 to deenergize the solenoid device 72. As mentioned previously, a time delay device may be incorporated in the actuation of the arm 75 to insure that the reset button 87 is actuated before the contact 83 is opened to deenergize the solenoid 70. When the light source 52 is moved away from proximity to the photocell 54, relay 91 will be deenergized.

In the manner described in the foregoing, the stop watch 20 which may be a standard commercial type is actuated to start at the beginning of an elapsed period of time and to stop at the end of the period the engine operating at one speed when the stop watch starts and operating at another speed when the stop watch stops. The test may be made either when accelerating or decelerating. A very quick but reliable check on the performance of an engine may be made in this manner.

From the foregoing, those skilled in the art will observe that the invention as described herein provides a simplified but reliable means of testing the performance of an engine. The instrument may be fabricated from standard commercial items having reference to the tachometer, stop watch and electrical actuators. The tachometer can be quite readily adapted in the manner shown to produce the electrical control impulses although this result may be achieved in other ways, if desired. The instrument is compact and inexpensive and does not require the use of skilled operators but, on the other hand, can be readily made use of by anyone. If desired, the instrument can be built into the dashboard of an automobile, or may be a separate portable instrument having means

to couple the tachometer to the drive cable of the automobile speedometer.

The foregoing disclosure is representative of a preferred form of the invention and is to be interpreted in an illustrative rather than a limiting sense, the invention to be accorded the full scope of the claims appended hereto.

We claim:

1. An engine performance indicator comprising a speed responsive device, a timing device having starting and stopping means, and control means whereby said speed responsive device is operative at a first predetermined speed to start the timing device and the speed responsive means is operative at a second predetermined speed to stop the said timing device whereby the timing device indicates the elapsed time for a predetermined change of speed to occur.

2. An engine performance indicating instrument comprising an assembly including a tachometer having an indicating dial and a timing device for indicating time, means actuatable by the tachometer to start the timing device in operation at a predetermined speed and means actuatable by the tachometer to stop the timing device at a second predetermined speed whereby to indicate the elapsed time for a predetermined change in speed to take place.

3. An engine speed indicator comprising a tachometer having an indicating pointer, a stop watch having a reset button for starting and stopping the stop watch, electrical solenoid means for actuating the reset button for starting and stopping the stop watch, said tachometer having electrical circuit controlling means for energizing electrical circuits at predetermined speeds whereby the stop watch is actuated to start and stop by the electrical control means at said predetermined speeds.

4. An engine performance indicator as set forth in claim 3, wherein the circuit controlling means comprises elements including a source of light and photocell means, one of said means being carried by the shaft of the tachometer and other of said means being positionable about the circumference of the tachometer to be set opposite a particular speed, the said light source being operative to actuate a photocell when in proximity thereto.

5. An engine performance indicator as in claim 2, wherein the means responsive to predetermined speeds comprises a control element carried by the shaft of the tachometer and a second control element positionable about the circumference of the tachometer.

6. An engine performance indicator comprising a tachometer having an indicating pointer, a stop watch having a reset button, said tachometer having control means comprising a light source and photocell means one of which is adjustable about the circumference of the face of the tachometer and the other is carried by the tachometer shaft, the said stop watch having a reset button for starting and stopping the stop watch, solenoid means including actuating members arranged to automatically actuate the reset button of the stop watch, and circuit control means for controlling said solenoid means in response to actuation of the said photocell means whereby to start and stop the said stop watch to indicate an elapsed period of time between a first predetermined speed and a second predetermined speed indicated by the tachometer.

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