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(71) Applicant: **Hayward, William Keith**
**27 Guildford Road**
**Farnborough Hants GU14 6PS(GB)**

(72) Inventor: **Hayward, William Keith**
**27 Guildford Road**
**Farnborough Hants GU14 6PS(GB)**

(74) Representative: **Holt, Michael**
**Potbridge House**
**Potbride Odiham Hants RG25 1JN(GB)**

## (54) Improvements to motor vehicle timing lights and tachometers.

(57) In an ignition timing light 10, a timing indication is provided by a stroboscopic lamp 11 whenever a pulse input is applied to lead 12 and trigger 14 is depressed. A value of engine rotation rate may be set by rotating a knob 15 having a pointer 16 relative to a scale 17. A circuit mounted within the timing light is arranged such that an indicator 18 indicates when the pulse input corresponds to the selected value of engine rotation speed determined by the setting of knob 15. Components of the same circuit can be used in the circuitry of the timing light advance feature.

The invention provides a combination timing light with advance feature and tachometer without recourse to the expensive meters and displays used in separate prior art tachometers.

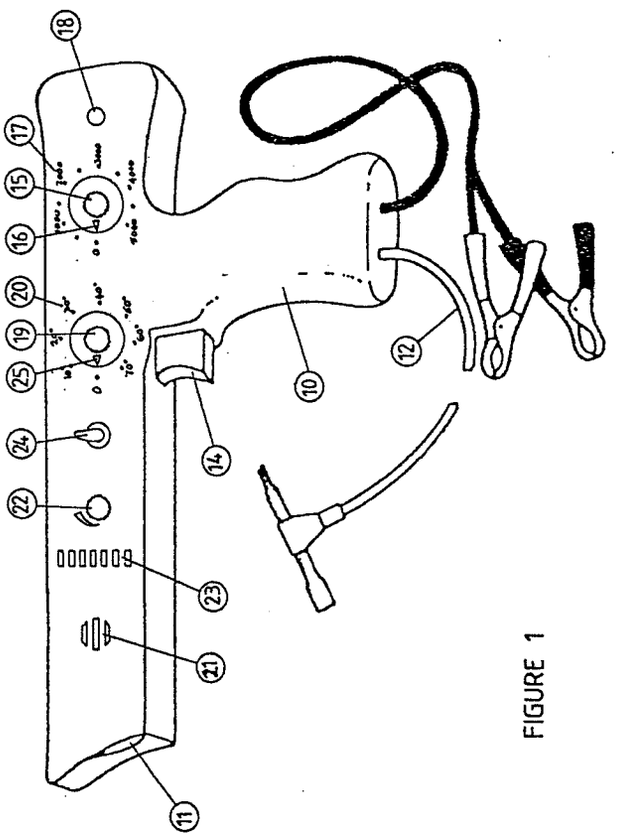


FIGURE 1

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# IMPROVEMENTS TO MOTOR VEHICLE TIMING LIGHTS AND TACHOMETERS

This invention relates to timing lights and tachometers.

Stroboscopic lamps known as "timing lights" are commonly used for measuring the timing of spark ignition in motor vehicle petrol engines. In this application, timing lights are used in conjunction with a pair of marks, one on a rotating part of the engine, usually the crankshaft pulley or crankshaft flywheel, and the other on a stationary part of the engine.

Timing lights can also have other uses, for instance for the timing of fuel injection in fuel injection petrol engines, and the timing of fuel injection in diesel engines.

Tachometers are often used in conjunction with timing lights, since engine timing is frequently specified as a function of engine speed. For example, the spark ignition timing of a petrol engine may be specified as 10 degrees before top dead centre at an engine speed of 1000 rpm, increasing to 30 degrees before top dead centre at an engine speed of 3000 rpm.

The above example also illustrates that the timing of an engine may not have a single value, but that several values of timing can be specified for various engine speeds. Similarly, the specified engine timing may vary with other factors, such as manifold vacuum. Engine timing may also vary with the type of petrol being used, particularly whether the petrol is "leaded" or "unleaded".

Unfortunately, motor manufacturers may only put one timing mark on the rotating member (or the corresponding stationary part), indicating a single timing advance, usually that corresponding to a low engine speed. Some manufacturers may instead or additionally provide a second mark indicating "Top dead Centre". It is unusual for manufacturers to provide more than two marks, or a scale of timing, even though such marks would be useful for a person who was using a timing light to measure timing. This is because the manufacturer's service agents would be expected to be equipped with equipment that would be connected directly with the car's diagnostic socket, and would therefore not need to use a timing light to measure ignition timing.

Some timing lights incorporate a method of measuring ignition advance whatever it may be from but a single moving mark and the corresponding stationary mark. It will be appreciated that this is a most useful feature. This is achieved by applying a small delay to the flash. The delay is adjusted by means of a control such as a knob, until the stationary mark and the moving mark are in apposition, and the degree of advance is then read from a scale which is typically attached to the knob. If the marks indicate Top Dead Centre; then the scale can measure advance directly. If the marks indicate some particular ignition advance, such as that appropriate to engine idle speed, then the actual advance would be obtained by adding the advance indicated by the marks to the advance indicated by the scale. For such an instrument to be accurate over the speed range of the engine, it will be appreciated that the instrument must take engine speed into account in determining the correct delay to apply to the flash.

According to the present invention an ignition timing light includes a circuit for indicating a selected value of an ignition variable and means for setting said value.

Preferably the ignition variable is engine rotation rate. A preferred embodiment of the present invention includes means for providing an offset timing indication.

An embodiment of the present invention will now be described by way of example only with reference to the accompanying diagrammatic drawing which shows an ignition timing light in accordance with the present invention.

In an ignition timing light 10, a timing indication is provided by a stroboscopic lamp 11 whenever a pulse input is applied to lead 12 and trigger 14 is depressed. A value of engine rotation rate may be set by rotating a knob 15 having a pointer 16 relative to a scale 17. A circuit mounted within the timing light is arranged such that an indicator 18 is illuminated when the pulse input corresponds to the selected value of engine rotation speed determined by the setting of knob 15.

Rotation of a second knob 19 provides an offset in the timing indication of stroboscopic lamp 11 in accordance with markings on a scale 20 being a scale of ignition advance in degrees in respect to top dead centre. Switch 24 can be used to reduce the offset to zero irrespective of the position of knob 19.

A knob 22 is provided to adjust sensitivity to the pulse train input whenever a level scale 23 of for example light emitting diodes indicating the time variance between pulses, indicative of spurious triggering, is excessive. The timing indication is re-inforced by a sounder 21.

In this embodiment the knob 15 is linked to a variable resistor (or an alternative inexpensive variable electronic device), and is set to a value corresponding to a particular engine speed. The variable resistor is used in conjunction with a suitable electronic circuit, to ensure that the LED is only illuminated at or near the speed indicated by the

pointer. With this instrument, the engine rpm can be measured simply by turning or moving the knob, and observing at what indicated rpm the LED is illuminated.

A feature of this invention is that engine rpm can be measured without for example recourse to using moving coil meters; moving iron meters, LED digital displays, and LCD digital displays, typically used in tachometers. These types of display are relatively expensive in comparison with many types of electronic component. In particular, they are much more expensive than a variable resistor, a pointer, a scale calibrated in rpm, and an indicator such as a single LED lamp, which are the principal components used in the present invention.

In a variation of this invention, the lamp is arranged to glow more brightly or less brightly, or indicate more strongly, or flash more frequently, or flash less frequently, the nearer the speed is to that set. In a further variation, a number of lamps, such as an array of 3, 5 or 7 LEDs, is used, the outer LEDs indicating that the engine speed is higher or lower than that set.

In an alternative embodiment of the present invention for a combination timing light and tachometer, the means of indicating that the speed was at or near that indicated by the pointer could be the stroboscope lamp itself, a simple electronic circuit ensuring that the stroboscope only operates when the engine speed is at or near that set.

Wear in the timing mechanism of an engine can result in a small variation in the spacing of the timing impulses received by the timing light or tachometer, and can be apparent as a blurring of the stroboscopic image. In the embodiment described, the LED bar display, 23 indicates the variability of the time interval and hence gives an indication of the state of wear of the engine.

This display may also be used to correctly adjust the sensitivity of a timing light or tachometer pick-up, since multiple impulses (i.e. impulses received from HT cables to which the pick-up is not connected), or missed impulses, commonly occur in spark ignition timing lights. In use, the sensitivity of the pick-up would be adjusted to give the minimum variability of the display. The same display, can be selected between a first use of sensitivity indication and a second use to indicate engine to indicate engine speed, and whether the speed is higher or lower than that set by which end of the display is illuminated as described above.

An indicator for use in setting the sensitivity of a pick-up can be a sound generator such as a miniature loudspeaker, bleeper, or sound transducer, since the human ear is more attuned to detecting extra bleeps or missed bleeps than the human eye is at detecting extra flashes or missed flashes, particularly at high rates of impulses.

A useful feature of a timing light is "advance control", in which the flash of the stroboscopic lamp is delayed by a short time interval to correspond with the required degrees of advance of the timing, for example, of spark ignition. Such timing lights offer the advantage that any degrees of ignition can be set from a single timing mark on the flywheel or fan belt pulley.

A further feature of this invention is that the electronics circuitry heretofore described in this application can utilise electronics components used in the circuitry for advance control, resulting in an overall saving in cost.

## Claims

1. An ignition timing light including a circuit for indicating a selected value of an ignition variable, and means for setting said selected value.

2. An ignition timing light as claimed in claim 1 and wherein said ignition variable is engine rotation rate.

3. An ignition timing light as claimed in Claim 1 or Claim 2 and including means for providing an offset timing indication.

4. An ignition timing light as claimed in any preceding claim and adapted to provide an indication of closeness to said selected values.

5. An ignition timing light as claimed in any preceding claim and adapted to provide an indication of the sense of error with respect to said selected value.

6. An ignition timing light as claimed in any preceding claim and wherein the circuit for indicating said selected value includes a light emitting diode, or other cheap visual indicator.

7. An ignition timing light as claimed in any preceding claim and wherein the circuit includes a sounder.

8. An ignition timing light as claimed in any preceding claim and wherein the circuit for indicating the said selected value includes the timing light stroboscopic lamp.

9. An ignition timing light substantially as hereindescribed with reference to the drawings.

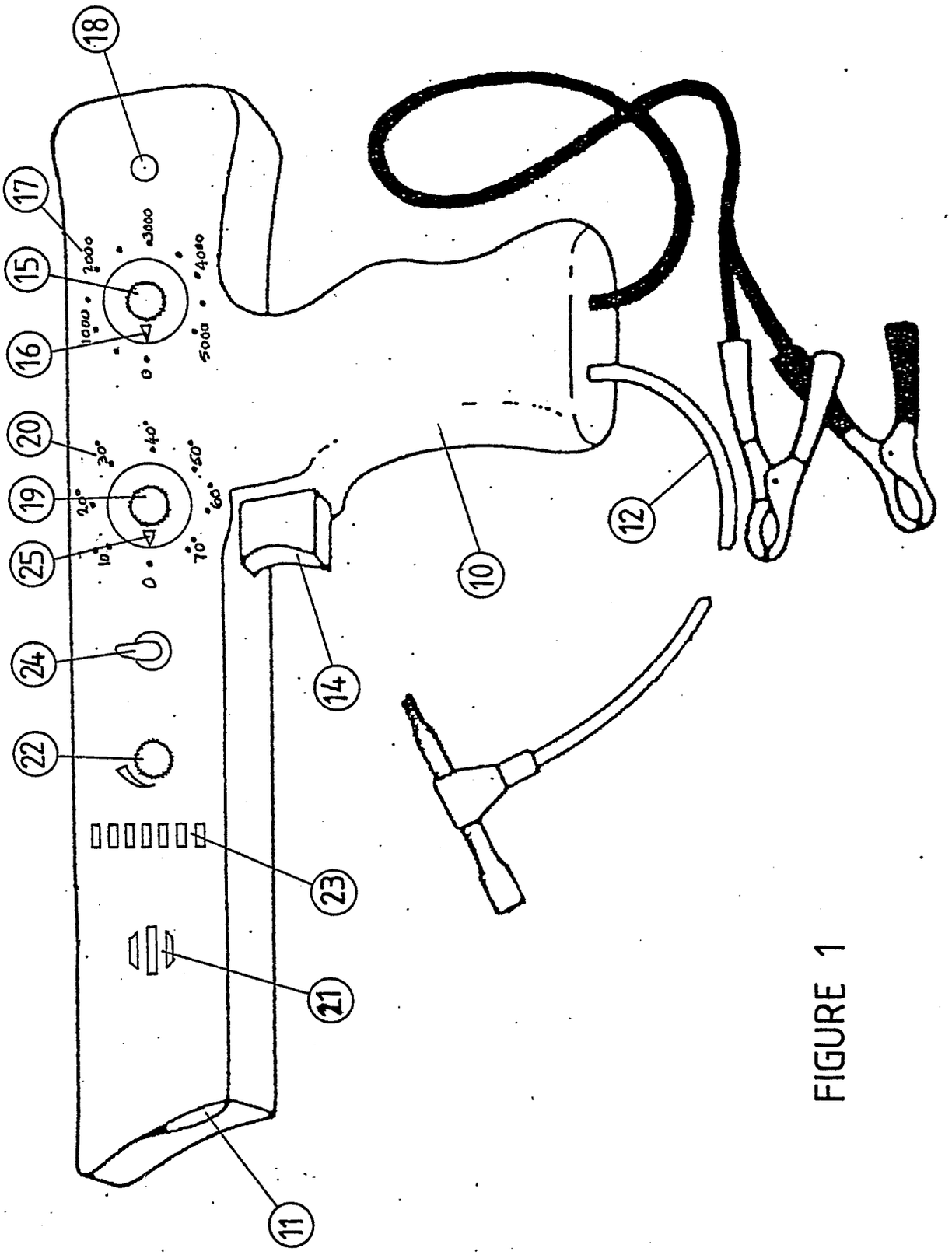
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FIGURE 1