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2,766,441

MISFIRE INDICATOR FOR INTERNAL COMBUSTION ENGINES

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2 Sheets-Sheet 1

*Fig. 1.*

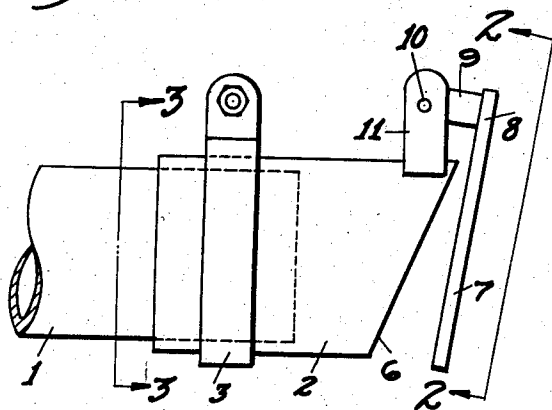
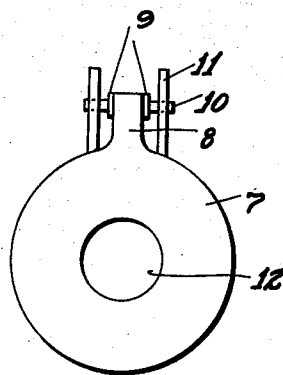


*Fig. 2.*

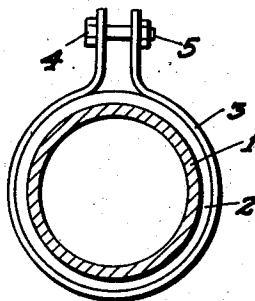


*Fig. 3.*

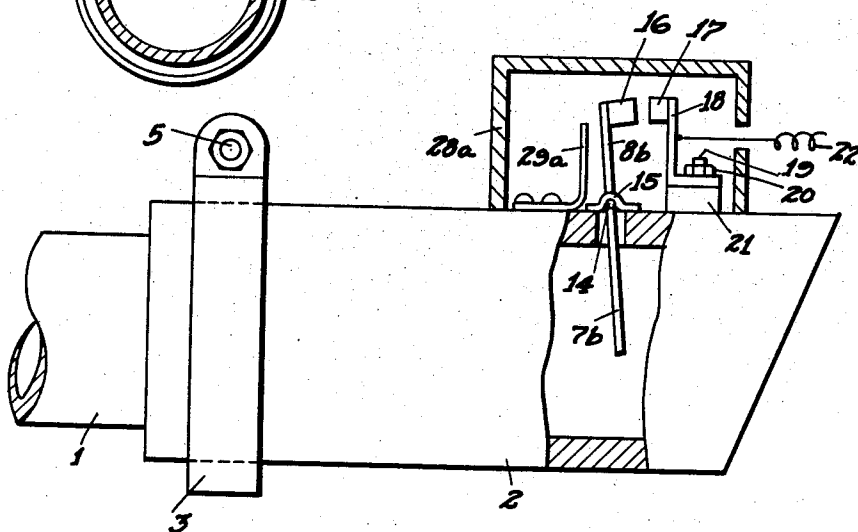


*Fig. 6.*

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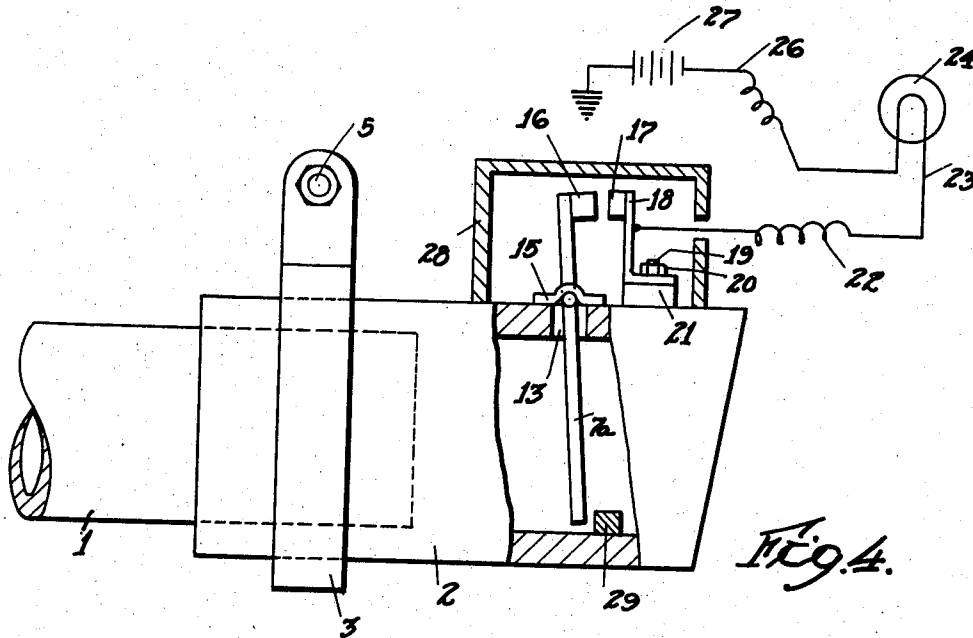
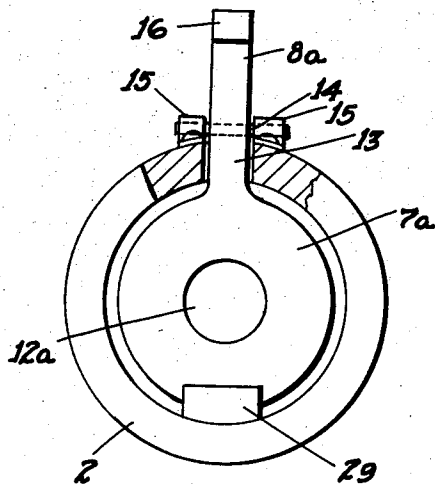
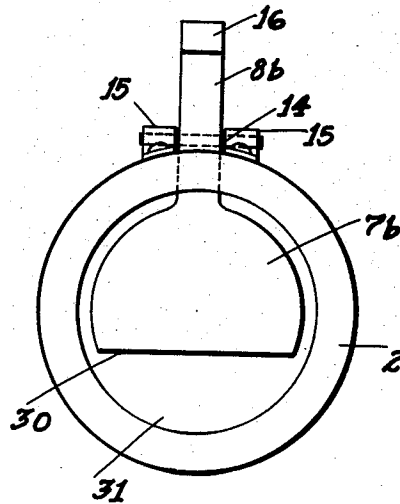
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2 Sheets-Sheet 2



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1

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## MISFIRE INDICATOR FOR INTERNAL COMBUSTION ENGINES

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Application August 26, 1954, Serial No. 452,282

10 Claims. (Cl. 340—239)

This application is a continuation-in-part of my co-pending application Serial No. 312,356, filed by me September 29, 1952 and entitled Internal Combustion Engines, now abandoned.

This invention relates to a device which can be readily attached to the exhaust pipe of an automobile so as to serve as a misfire detector for the engine of the automobile.

In the past many different types of explosion indicators have been proposed and designed for use in connection with internal combustion engines of the type used in automobiles. One such explosion indicator, for example, is described in United States Patent No. 1,171,192 issued to Haas February 8, 1916 and entitled Explosion Indicator for Internal Combustion Engines. One disadvantage of the Haas device, which is common to most devices of this type, is that certain changes are required in the structure of the basic mechanism itself in order to incorporate the device into it. Note that in the Haas system it is necessary to drill separate holes in the exhaust manifold adjacent each cylinder, or to provide "special fittings" in lieu thereof. Also, in the Haas system it is necessary to provide a separate indicator for each cylinder of the engine.

One of the important objects of my invention is to provide a device of the type described which may be readily attached to the exhaust pipe of an internal combustion engine without requiring any structural changes in the engine itself or in the pre-existing exhaust system.

Another important object of my invention is to provide a misfire device of the character described in which but one device is needed with each engine, regardless of the number of cylinders in the engine.

Other and further objects and advantageous features of my invention will hereinafter more fully appear in connection with a detailed description of the drawings in which

Fig. 1 is a view in side elevation of one modification of my invention, showing also the end of an exhaust pipe.

Fig. 2 is a sectional view taken along line 2—2 of Fig. 1, showing an end view of my novel flap.

Fig. 3 is a sectional view taken along line 3—3 of Fig. 1.

Fig. 4 is a view in side elevation of another modification of my invention.

Fig. 5 is a right-hand end view taken from Fig. 4.

Fig. 6 is a view in side elevation of still another modification of my invention.

Fig. 7 is a right-hand end view taken from Fig. 6.

Referring to the drawings in detail, in Fig. 1 the end of an exhaust pipe of a conventional automobile is designated by the numeral 1. My novel device consists of a hollow cylinder 2, which may be placed over the end of the tail pipe as indicated and held in place by means of a circular clamp 3. The clamp may be tightened by means of bolt 4 and nut 5. The right-hand end of cylinder 2 is inclined as at 6. At the upper right-hand end of the cylinder a freely swinging flap 7 is mounted. As shown in

2

Fig. 2, flap 7 is substantially circular in shape with an upper radial extension 8. A pair of flanges 9 are attached at right angles to extension 8. A horizontal pin 10 passes through flanges 9 and through the opposite sides of bracket 11 which is attached to the cylinder 2. A hole 12 is located in the center of flap 7.

Now, assuming the engine of the automobile to be running at a low rate of speed, as the gases pass out of the exhaust pipe 1, they will push flap 7 in a counterclockwise direction away from the cylinder end 6. As long as all of the cylinders are firing, the flap will oscillate about some fixed place at a given distance away from the end 6. If, however, any cylinder was not firing properly, there would be a short interruption in the flow of gases at each misfire. Such an interruption would cause the flap 7 to swing clockwise towards or against the end 6. This swinging would provide a visual indication of misfiring, or, if the flap were permitted to bang against the end 6, an audible indication would be provided as well. The inclination of end 6 and the size of hole 12 should be properly related to the normal idling speed of the motor in order to produce the desired indication.

Figs. 4 to 7 represent two modifications of my invention, each employing an electrical indicating circuit. For example, in Figs. 4 and 5, the flap 7a is mounted inside of the cylinder 2. Radial extension 8a projects through a hole 13 in the upper wall of the cylinder. Extension 8a is pivotally attached to the cylinder by means of a pin 14 passing through said extension and through a pair of brackets 15 disposed on opposite sides of the hole 13.

At the upper end of extension 8a I have provided a contactor 16 which is adapted, upon the misfiring of a cylinder, to swing against contactor 17 which is attached to bracket 18. Bracket 18 is secured to cylinder 2 by means of bolt 19 and nut 20 through a suitable insulating pad 21. An electrical conductor 22 is secured at one end to bracket 18 and at the other end to one terminal 23 of light bulb 24 which is located on the dashboard of the automobile. The other terminal 25 of the light bulb is connected to the ungrounded terminal 26 of the battery 27. Now, when the flap swings clockwise as the engine misfires, the meeting of contactors 16 and 17 will serve to ground terminal 23 of light bulb 24 thus causing the bulb to light up.

The contactors may be enclosed in a casing 28 which is attached to the upper portion of cylinder 2. Inside the cylinder 2 and on the lower surface thereof I have provided a stop 29 to prevent the flap 7a from swinging too far in a counterclockwise direction. Also, a hole 12a of suitable size is located in the center of the flap.

The modification shown in Figs. 6 and 7 is the same in most respects as that shown in Figs. 4 and 5. The stop 29a, however, is located within the housing 28a so as to limit the swing of radial extension 8b. Also, the form of the flap 7b is somewhat different. Instead of being circular and having a central hole, flap 7b is in the form of a circular segment having a lower edge 30. The space 31, between lower edge 30 and the inside of the cylinder 2, is the equivalent of the hole 12a in the flap 7a. The remaining elements in Figs. 6 and 7 are the same as those shown in Figs. 4 and 5 and are similarly numbered. The bulb 24 and battery 27 are not shown in Figs. 6 and 7, but it should be apparent that they are intended for use therewith.

Although my invention has been described in relation to an automobile engine, it should be obvious that this device could be used on any internal combustion engine to determine the misfiring thereof. My invention admits of other changes not shown or described which are within the scope of the invention.

I claim:

1. A misfire indicator for a multi-cylinder, internal

combustion engine comprising a hollow cylindrical member adapted to be attached at one end to the single common exhaust pipe of said engine so as to form a substantially horizontal extension of said exhaust pipe, and a disk pivotally mounted at the other end of said cylindrical member for free swinging movement about a horizontal axis, said disc being substantially transverse to the longitudinal axis of said cylindrical member, whereby, upon the discharge of gases through said cylindrical member due to the firing of the cylinders of said engine, said flap will swing in the direction of flow of said gases, and whereby, upon the misfire of any cylinder of said engine, said flap will swing in an opposite direction.

2. The invention according to claim 1 wherein said disk has a centrally located circular hole.

3. A misfire detector for a multi-cylinder, internal combustion engine, comprising a hollow cylindrical member one end of which is adapted to connect with the end of the single common exhaust pipe of said engine, a freely swingable flap pivotally mounted near the other end of said cylindrical member and covering a substantial portion of the free cross-sectional area of said cylindrical member, whereby upon the discharge of gases through said member said flap will swing in the direction of flow of said gases, and means disposed in the path of swing of said flap for energizing an electrical indicator, said energizing means being contacted by said flap only when said flap swings in a direction opposite to the flow of said gases due to a misfire of any cylinder of said engine.

4. A misfire detector for a multi-cylinder, internal combustion engine of the type having a single tubular exhaust pipe, comprising a hollow cylindrical member, means located near one end of said member for attaching said member to said exhaust pipe so as to form a substantially horizontal extension of said exhaust pipe, a disk swingably mounted near the other end of said cylindrical member, a radial projection on said disk extending outwardly through a hole in said cylindrical member, means mounted on the inner end of said radial extension for pivotally attaching said disk to said cylindrical member, said disk being adapted upon the discharge of gases through said cylinder to swing in the direction of flow of said gases, and means mounted near the outer end of said radial extension for energizing an electrical indicator, said energizing means being activated by said extension only when said disk swings in a direction opposite to the direction of flow of said gases due to a misfire of any cylinder of said engine.

5. The invention according to claim 4 wherein said disk has a centrally located hole.

6. The invention according to claim 4 wherein said disk has a portion cut off from its lower end.

7. A misfire indicator for a multi-cylinder internal combustion engine of the type having a single common exhaust pipe for all of said cylinders, comprising a hollow cylindrical member adapted to be attached at one end to said exhaust pipe so as to form a substantially horizontal extension thereof, and a flap pivotally mounted at the other end of said cylindrical member for free swinging movement about a horizontal axis, said flap being substantially transverse to the longitudinal axis of said cylindrical member, whereby, upon the discharge of gases through said cylindrical member due to the firing of the cylinders of said engine, said flap will swing away from the other end of said cylindrical member and in the direction of flow of said gases, and whereby, upon the misfire of any cylinder of said engine, said flap will swing in an opposite direction towards said other end of said cylindrical member.

8. The improvement as set forth in claim 7 wherein the slope of said other end of said cylindrical member is oriented relative to the swinging path of said flap such that, upon the misfire of any cylinder of said engine, said flap will strike against said other end of said cylinder to produce an audible signal.

9. The improvement as set forth in claim 7 including means disposed in the path of swing of said flap for energizing an electrical indicator only when said flap swings in said opposite direction due to said misfire.

10. A misfire detector for a multi-cylinder engine of the type having a single common exhaust pipe, comprising a hollow cylindrical member adapted to be connected with said exhaust pipe to form a continuous passageway for the discharge of gases from said engine, a freely swingable flap pivotally mounted within said cylindrical member and covering a substantial portion of the latter's free cross-sectional area, whereby upon the discharge of gases through said member said flap will swing in the direction of flow of said gases, and whereby upon the misfire of any cylinder of said engine said flap will swing in the reverse direction, and means disposed in the reverse path of swing of said flap for energizing an electrical indicator only when said flap swings in said reverse direction due to said misfire.

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