April 12, 1932. H. SCHLAICH 1,854,072

INDICATING AND WARNING INSTRUMENT

Filed March 8, 1926

Fig. 1.

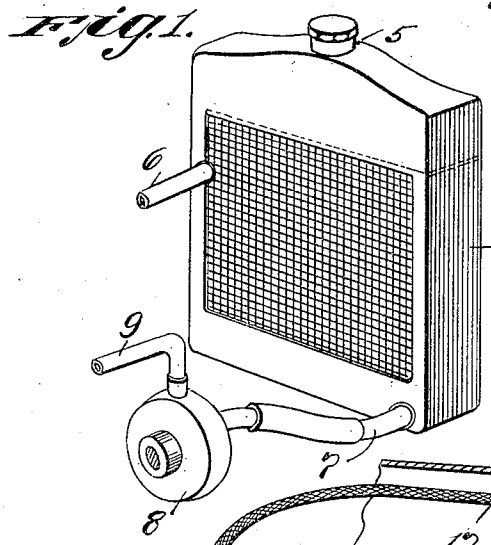



Fig. 5




Fig. 2.

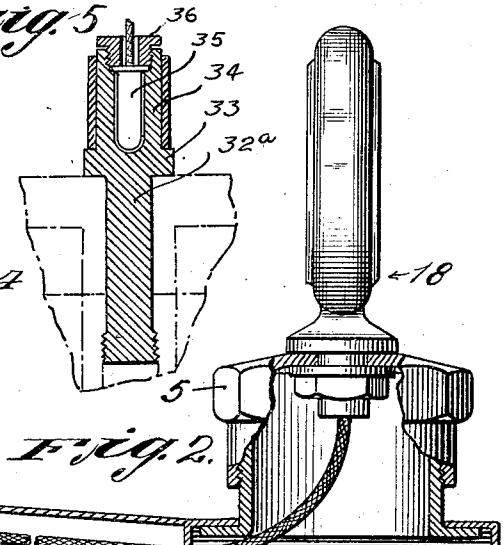



Fig. 3.

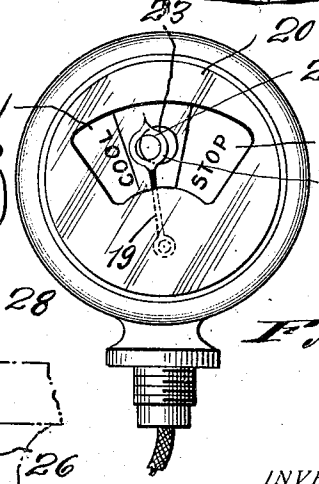
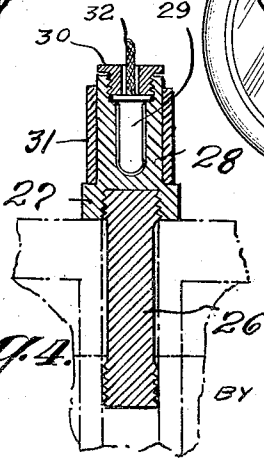



Fig. 4.

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# UNITED STATES PATENT OFFICE

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## INDICATING AND WARNING INSTRUMENT

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This invention relates to warning devices for motor vehicles of the kind provided for warning the operator when dangerous motor operating conditions occur.

There has been devised a cooling system which is capable of causing the motor to be operated either under the water cooled or under the constant temperature system as desired, the type of cooling depending upon the quantity of water put into the cooling system. Thus, with the radiator well filled, the motor operates under the water cooling system at a normal temperature somewhat below the boiling point, while with only enough water to fill the water jackets and the lower part of the radiator (condenser), the motor operates under the constant temperature system with the cooling medium normally at the boiling temperature. With this cooling system substantially no vapor reaches the top of the radiator.

Conditions in the cooling system are not necessarily dangerous when the boiling temperature is reached, even though the car is operating under the water cooling system, for a rise of temperature of the cooling medium to boiling does not necessarily show anything more than that sufficient water has been lost from the cooling system to cause the cooling system to function as a steam, or constant temperature system. This is not a dangerous condition at all because the motor can still be adequately controlled by the cooling medium.

It is an object of the present invention to provide warning means usable in connection with either a water cooling system, a steam cooling system or a combination cooling system of the type referred to above, which will in each case give a timely warning to the operator in case of dangerous operating conditions, but will not cause him undue alarm by warning of danger when conditions are not dangerous.

It is a further object of the invention to provide an instrument for use with a cooling system of this kind, when operated as a water cooled system, which will notify the operator when the water in the system has fallen too low for the system to function as a water cooling system and also to give a different indication when dangerous conditions occur.

It is a further object of the invention to provide warning means applicable to any one of these systems which will give the same indication for dangerous conditions when applied to any one of the systems.

To these ends it is a point that the temperature responsive element is located, to derive some of its heat directly from the motor cylinder metal independently of the cooling medium.

It is an object of the present invention to make provision for mounting the temperature responsive element under the joint control of the cylinder metal and the cooling medium with the minimum of inconvenience and without the necessity for requiring manufacturers to alter their cylinder block castings.

Other objects and advantages will hereinafter appear.

In the drawings:

Figure 1 is a perspective view showing the radiator or condenser of a combination cooling system of the type referred to and the connections thereto;

Figure 2 is a sectional, side elevation, partly broken away, showing the mounting of the temperature responsive element and its connections to an instrument on the radiator cap;

Figure 3 is a front elevation of the indicating instrument;

Figure 4 is a detail sectional view showing a modification of the element mounting; and

Figure 5 is a sectional view of a further modification.

The invention is shown as applied to a motor vehicle in which the motor is made up of a base block 1 and a cylinder head block 2 which are held together by cylinder head hold down bolts 3, these blocks forming the cylinder chambers 1' and the jacket around the cylinders for the circulation of the cooling medium. The cooling system employed on this vehicle is of the type referred to above which may be used either to operate the motor under the usual water cooling system or under the

steam cooling system, depending on the amount of water in the system.

The cooling system comprises a radiator (condenser) 4 having a cap 5 which is removable to permit water to be introduced into the system. The radiator differs from the radiator of the usual water cooled car, in that the pipe 6 for carrying the water and steam from the motor to the radiator is connected to lead into the radiator at one side and at a substantial distance below the top of the radiating portion thereof, the radiator tubes extend horizontally across the radiator, and the pipe 7 for conducting the water from the radiator to the motor is connected to the radiator of the lower end of the side opposite that at which the pipe 6 is connected. With this construction the water or water and steam is caused to circulate horizontally and downward across the radiator with the result that the full width of the radiator is used effectively. It has been found that this system is not only usable for steam cooling, but that it functions more effectively than the usual radiator when used for water cooling.

When operated as a steam cooling system, there is only enough water in the system to fill the water jackets and the lower part of the radiator (condenser) and the water is pumped from the radiator to maintain the jacket space surrounding the cylinders full of water, by a pump 8 which delivers the water through a pipe 9 to such jacket space.

When operated as a water cooled system, the parts and connections are exactly the same, but there is sufficient water in the system to keep the temperature of the cooling liquid below the boiling temperature in the normal operation of the vehicle.

In accordance with the present invention, provision is made for conveniently locating the temperature responsive element of the warning instrument in an environment like that of the cylinder walls themselves and this without the necessity of altering the cylinder castings or departing from standard practice in the construction of the motor in any way. In motors which are provided with a removable cylinder head block, the block 2 is held down fast to the base portion by cylinder head hold down bolts, some of which extend between the cylinders in contact with the cylinder metal.

In installing the temperature responsive element, one of these bolts is withdrawn and a similar bolt 11, having a central bore 12 therein for receiving a temperature responsive element is substituted in its place. The bore 12 may have a soft plug 10 in its lower end, if desired, which may be removed in part, or altogether to regulate the degree of exposure of the temperature responsive element to the cooling medium. The head of this bolt has an internally threaded opening 13, which is of somewhat larger diameter than the bore 12, so that a shoulder is provided at the junction of the threaded opening 13 and the bore 12. A temperature responsive element 14 having a flange 15 at its upper end is inserted to fit snugly within the bore 12. A nut 16 is threaded into the opening 13 to clamp the element flange down and fix the element securely in place.

With the construction described, the element is enabled to derive heat directly from the metal cylinder walls, but is insulated against variable outside influences by the cooling medium which circulates at both sides of the web in proximity to the element. The environment of the element 14 is therefore substantially the same as that of the cylinder metal so that the element may be made to accurately reflect the condition of the cylinder metal itself.

This is an extremely desirable condition whether a water or steam cooling system is used, because it may be utilized to give a warning which is more certainly indicative of danger than warning instruments that are under the sole influence of the cooling medium. Temporary overloading of the motor may result in boiling of the cooling liquid of the water cooled system, yet may not be indicative of danger at all. Yet, if the operator fails to heed the usual instrument of the prior art whenever it indicates boiling he is running the risk of serious accident on his own responsibility without the aid of any indicating means.

With the element mounted as described herein in the water cooled motor, this risk is avoided, for the indication of danger by the instrument is independent of the boiling of the water, being dependent upon the rise of temperature of the cylinder metal beyond a safe limit, i. e., to a point safely below that at which the pistons will seize.

The temperature responsive element is filled with a suitable heat-expansible liquid and is connected through a braid covered capillary tube 17 with an indicating instrument 18.

The instrument 18 is shown in the present embodiment as mounted on a radiator cap 5. This location is advantageous because it is conveniently near to the motor, is in direct view of the operator as he watches the road, and accords with the practice to which the public has become accustomed in indicating instruments of this general character. The indicating instrument 18 is of the well known distance type comprising Bourdon and compensating coils, and the necessary operating connections (not shown) for moving a pointer 19 in response to the variations of temperature at the element 14.

The instrument is provided with a dial plate 20 having a cool zone 21 thereon marked "Cool," a danger zone 22 thereon marked "Stop" and a safe zone between said cooling

and danger zones having a circular opening 23 therein through which light may pass from in front of the instrument to the eye of the operator. The pointer 19 has a circular enlargement 24 carrying a small colored celluloid disc 25 therein in position to be moved across the opening 23 in the dial. This indicator may be used either with the steam or water cooling system.

When the cooling system is used for water cooling the pointer will normally occupy a position just to the right of the right hand boundary of the cool zone. Should the cooling water be raised to boiling temperature, the pointer will move across so that the celluloid disc completely covers the opening 23 in the dial plate.

This shows that the cooling liquid is steaming, but does not indicate a dangerous condition because the cylinder metal is still at a safe temperature. It may be due to temporary straining of the motor, in which case the temperature will subside as soon as the straining is relieved. It may be due to the fact that enough water has been lost out of the cooling system to cause operation as a steam cooled system. Continued operation under these circumstances will result in no harm.

Since the cooling liquid is not lost from this kind of system by evaporation, however, such a condition is not likely to occur unless there is a leak in the cooling system. The operator may, therefore, continue to operate the car but is warned that the indication may signify depletion of the cooling liquid, and he will therefore examine the system at the first opportunity and replenish the supply of cooling liquid if necessary. If the operator fails to do this, however, there is absolutely no danger of damage being done until the cooling liquid falls so low that the cooling system cannot adequately control the temperature of the cylinder metal. Should this occur, the pointer will move over into the danger zone and thereby notify the operator that damage is certain to be done unless the operation of the vehicle is stopped at once.

Similarly, if the overheating is due to other dangerous conditions, as failure of lubrication, retarded spark, or stuck valves, the pointer will move over into the danger zone shortly before the temperature of the cylinder metal is reached which would be dangerous, and this even though the cooling system be completely filled with cooling liquid.

When the cooling system is filled only with enough liquid to operate as a steam cooling system, the pointer 19 will normally occupy a position such that the celluloid disc will cover the opening 23 in the dial, but the occurrence of a dangerous condition causing overheating of the cylinder metal will cause the pointer to move over into the danger zone.

It will thus be seen that the present invention provides for use in combination with either a water cooled or steam cooled motor, or with a motor having a cooling system operable under either system, an instrument which is applicable to either system and which will give a definite and positive indication of danger without needlessly or prematurely alarming the operator when boiling occurs unaccompanied by a condition which is truly indicative of danger.

Another important advantage of mounting the temperature responsive element in the location described is that a warning signal is quickly given on starting the motor, even if the cooling liquid has all leaked away during the period of disuse. Where the temperature of the cooling medium is relied on for giving a warning, a complete or substantial absence of cooling liquid will prevent the warning signal from functioning. With the mounting as described, however, the temperature of the element is quickly raised to the danger point to cause a wraning to be given, even though no cooling liquid is present.

In the form of the invention disclosed in Figure 4 the temperature responsive element is mounted outside the motor casting but in a position to derive heat directly from the cylinder metal and to be controlled in part by the cooling medium. This form of the invention is designed especially for application to a motor in which the cylinder head is held down by nuts screwed onto the upper end of the hold down bolts, and may be very easily applied by the car owner or a dealer, the element mounting being substituted for the hold down nut. A cylinder head hold down nut is removed from its bolt 26. A nut 27, having an upstanding stem 28 projecting therefrom, is threaded onto the upper end of the bolt 26 to bear upon the cylinder head block so that the combined bolt and nut serve the function of the usual hold down bolt and nut. The stem 28 is provided with a well in its upper end in which the temperature responsive element 29 is mounted. A nut 30 is threaded into the upper end of the stem 28 to hold the temperature responsive element in place, the element mounting being the same as that disclosed in Figure 2. A heat insulating sleeve 31 of hard rubber or other suitable material, surrounds the stem 28 to insulate the temperature responsive element from the influence of the atmospheric temperature.

The bolt 26 is in the same environment as the cylinder metal, being subjected to the heat of the motor and to the cooling influence of the cooling medium. The temperature of the element 29 is therefore dependent

upon both these factors, although its temperature will lag behind that of the bolt 26.

The element is connected through a capillary tube 32 to operate a warning instrument like that disclosed in Figure 3, the only difference being that the instrument is calibrated to take into account the fact that the element is at a lower temperature than the pin 26 so that the desired indications will be given under the proper conditions of motor operation.

In the form of the invention shown in Figure 5 the usual hold down bolt is replaced by a bolt 32a having a nut portion 33 for holding the cylinder head block down and an upstanding stem 34 provided with a well for the reception of a temperature responsive element 35. This element is held in place by a nut 36, as in the other forms of the invention described. A heat insulating sleeve 37 surrounds the stem 34.

The instrument installation described is of special value, also, when combined with a motor having a cooling system of the thermosyphon type. With this type of cooling the normal motor operating temperature is very little below the boiling point, so that the warning indicator under the influence of the cooling medium moves only a very short distance from its position in the normal operation of the motor to a position which it takes up when boiling occurs in the system. The movement of the indicator is so small, therefore, that it is apt to be overlooked by the operator. By mounting the temperature responsive element in the cylinder metal the movement of the indicator hand is not limited by a position corresponding to the boiling temperature, but moves through a very considerable distance to a position corresponding to the overheated temperature of the motor. It is thus capable of giving a significant and conspicuous warning when danger occurs.

It will be seen that the present instrument, whether applied to the steam cooled or water cooled system, is more keenly analytical of motor operating conditions than the instruments of the prior art which have depended solely on the temperature or other characteristics of the cooling medium for their control and that its indications are therefore more informative than the indications of such previous instruments.

It will be seen further that provision is made for mounting the temperature responsive element in the desired environment without any necessity for alteration in the motor on the part of the manufacturers, and that the parts employed in achieving this result are inexpensive and can be easily and quickly applied by anyone.

Variations may be resorted to within the scope of the invention and parts of the improvements may be used without others.

What I claim is:

1. In combination, motor cooling means operable either as a water or constant temperature cooling system, and a heat-responsive instrument constructed and arranged to warn of dangerous operating conditions under either cooling system, comprising an indictor and an indicator controlling element mounted to be subject to direct heating by the cylinder metal and to the indirect action of the cooling medium through the cylinder metal.

2. In combination, an internal combustion engine having a water cooling system, a heat-responsive means embedded within the metal of the cylinders adjacent to the cooling space, an indicator and means whereby the indicator is controlled by the heat-responsive means.

3. In a motor vehicle, a motor comprising a cylinder head block, means for holding down the cylinder head block comprising a bolt penetrating a cylinder wall and having a socket therein, a temperature responsive element mounted in the socket in said bolt to be controlled by the temperature of the cylinder metal and means operated by said element to give a warning indication.

4. In a motor vehicle, a motor casting, a member extending into the casting and imbedded in a cylinder wall to derive heat directly therefrom independently of the cooling medium and to have its temperature controlled in part from the cooling medium, a temperature responsive element mounted in thermally conductive relation with said member to derive heat from it, indicating means and means whereby the indicating means is operated from said element.

5. In a motor vehicle, a motor casting, a member extending into the casting and penetrating a cylinder wall to derive heat directly therefrom, and to have its temperature controlled in part from the cooling medium, said member having a socket therein, a temperature responsive element in the socket in said member, indicating means and means whereby the indicating means is operated from said element.

6. In combination, a member substitutable in a motor for a standard part that extends into the motor casting and penetrates a cylinder wall in proximity to the circulating space of the cooling medium and performing the function of such standard part, a temperature responsive element carried by said member to derive heat from it, indicating means and means whereby the indicating means is operated from said element.

7. In a motor vehicle, the combination with a motor comprising a member extending in proximity to a cylinder wall and in direct heat transferring relation therewith and also in proximity to the circulating space of the cooling medium, of a temperature responsive

element mounted on said member, indicating means and means whereby the indicating means is operated from said element, and heat insulating means guarding the temperature responsive element against external influences.

8. In combination, a motor, a bolt extending into the motor and penetrating a cylinder wall thereof, said bolt having a portion projecting beyond the motor and having a socket therein, and a warning instrument comprising a temperature responsive element mounted in the socket in the projecting portion of the bolt.

In testimony whereof I have affixed my signature to this specification.

HERMAN SCHLAICH.