Nov. 20, 1928. 1,692,012

E. C. WELLS

INDICATING DEVICE

Filed Dec. 20, 1924

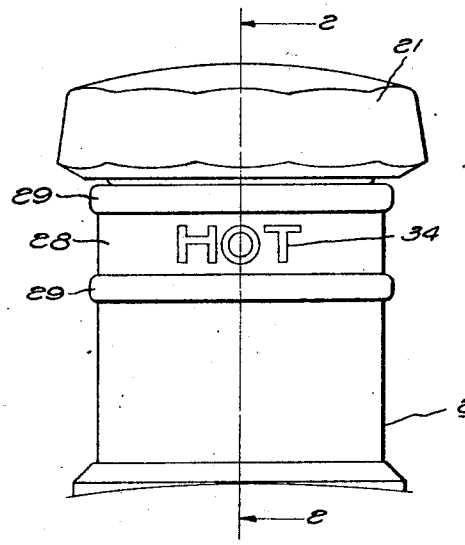


Fig. 1.

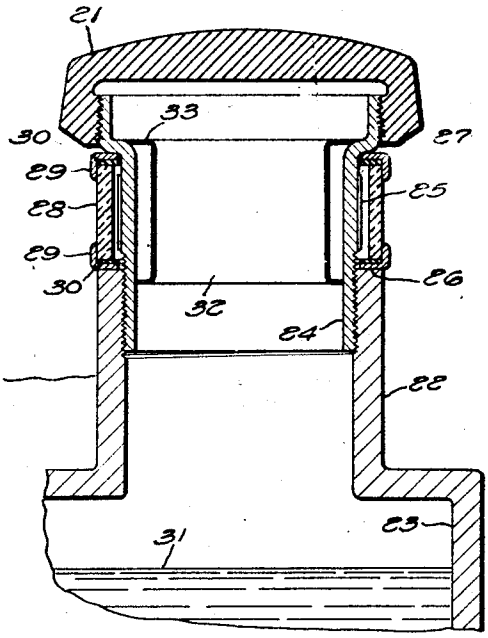


Fig. 2.

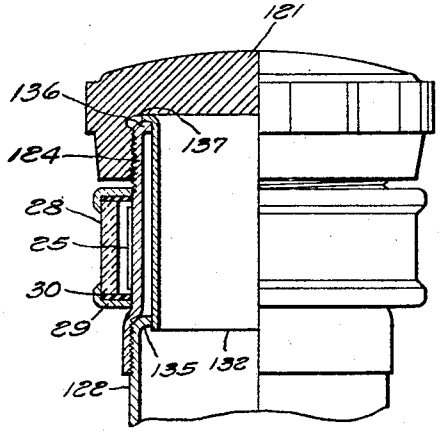


Fig. 3.

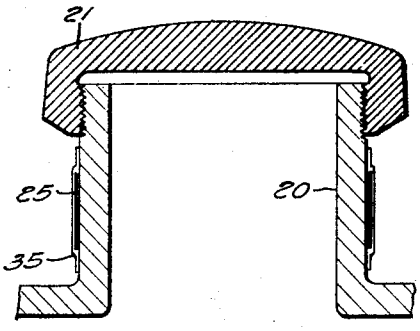


Fig. 4.

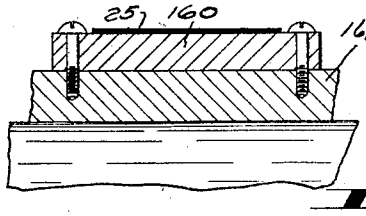


Fig. 6.

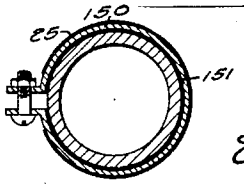


Fig. 5.

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# UNITED STATES PATENT OFFICE.

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## INDICATING DEVICE.

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The present invention relates to a temperature indicating device, and particularly to devices for indicating abnormal conditions in the operation of engines, machinery, and the like.

One of the main objects of the present invention is to provide a device adapted to be mounted in a suitable place for indicating abnormal temperatures, as for example, abnormal temperatures arising during operation of an internal combustion engine or the like, and of such character that it will give a sharp signal of sufficient emphasis to arrest or attract the attention whenever abnormal operating conditions raise the temperature of the indicating device sufficiently.

Another object of the invention is to provide an indicating device of this character particularly adapted to be associated with the cooling system of a water cooled engine and responsive to temperature conditions of the liquid in the cooling system.

Other objects of the invention will be apparent from the following description when taken in connection with the accompanying drawings in which:

Fig. 1 represents an elevation of the present invention applied to the spout of a radiator;

Fig. 2 is a central vertical section on the line 2—2 of Fig. 1;

Fig. 3 is an elevational view, partly in vertical section, of a modified form of the invention;

Fig. 4 is a central vertical section of a simplified form of the invention;

Fig. 5 is a plan view of a somewhat modified form of the invention; and

Fig. 6 is a fragmentary sectional view of the invention as applied to a bearing.

As showing a preferred embodiment of the invention it is herein illustrated and described as applied to the well known water cooled engine of conventional design.

It is generally understood that in such internal combustion engines designed for use in connection with automobiles and the like, wherein the engine cylinders are cooled by a liquid such as water delivered to it from a radiator or the like, the temperature of the cooling water in the radiator is normally somewhat below the boiling point of the water, and so long as the engine operates normally the temperature of the water remains normal. However, upon abnormal operation or condition of the engine such as a broken fan belt, an insufficient supply of water in the radiator, etc., the temperature of the water in the radiator rises abnormally to substantially the boiling point, so that, in general, the rise in temperature of the water in the radiator to its boiling point may be taken as a warning of such an abnormal operation or condition of the engine.

The present invention takes advantage of this rise in temperature to apply to the exterior of the radiator a temperature indicating material which changes color when the temperature within the radiator rises substantially to the boiling point to thereby give a warning of abnormal engine conditions or operation.

Referring now to Figs. 1 and 2 of the drawings, 20 indicates generally the filler opening or spout of a radiator the opening of which may be closed by means of a cap 21. As herein shown the spout consists of a lower spout tube 22 secured to the upper or tank portion of the radiator 23, and an upper spout portion or tube 24 in extension of the lower spout portion or tube and having screw threaded or other engagement with the inner surface of the latter. The upper end of the upper tube is flanged outwardly or enlarged to receive the radiator cap 21, it being provided with suitable screw threads or other fastening device for that purpose.

Surrounding the exposed portion of the upper tube, and preferably mounted directly upon the tube as by painting thereon, is a ring 25 of temperature indicating material, this material being of the type which is normally of one color but which changes its color when it is heated to a predetermined or critical temperature. One material which has been found satisfactory for the present purpose is the iodomercurate of copper the color of which is normally bright scarlet, but which becomes black when heated to its critical temperature which is about 150° F. On cooling below the temperature mentioned this material regains its original bright scarlet color. This temperature indicating material may be applied to the outer surface of the spout by simply painting it on. In the present instance the surface of the spout is prepared by first applying to it a layer of gum arabic, upon which is applied a second layer of gum arabic containing therein a suitable quantity of the iodomercurate of copper, and this is followed

by a third layer of gum arabic. The temperature indicating material is thus enclosed by the gum arabic which forms a protective coating to protect the temperature indicating material from injury or deterioration. The triple layer of gum arabic and iodomercurate of copper, herein referred to as a whole as temperature indicating material, is designated by reference character 25 in Fig. 2. While reference is made herein to a particular temperature indicating material, it will be understood that other temperature indicating materials may be employed having critical or color-changing temperatures either above or below that stated herein. It should also be understood that the method of applying the iodomercurate of copper and the materials employed, is susceptible of wide variation, including for example, the use of a relatively chemically inert varnish or other suitable material as a carrier for the iodomercurate of copper instead of the gum arabic, or the omission of part of the process described depending largely upon the particular materials employed.

Surrounding the temperature indicating material 25 and supported between the shoulder 26 formed by the upper end of the lower tube 22 and the shoulder 27 formed by the enlargement of the upper tube, is an inclosing structure for providing a dead air space about that portion of the spout carrying the temperature indicating material 25. This inclosing structure consists of a glass tube 28 surrounding the tube 24 and indicating material 25 and spaced therefrom, the glass tube being held in position by means of supporting rings 29 which with the tube 24 form grooves to receive the glass tube 28. The dead air space is sealed against the passage of air by means of rubber or other suitable packing rings 30 between the glass tube 28 and the supporting rings 29.

From the foregoing it will be seen that the temperature indicating material is in heat conducting connection through the parts 24, 22 and 23 of the radiator with the cooling water 31, and as a result the temperature of the indicating material 25 will rise or fall with a rise or fall in the temperature of the water. But since the critical temperature of the indicating material is about 150° F. whereas it is not desired to receive a temperature change indication until the water in the radiator reaches substantially its boiling temperature, it is of the essence of the invention that the indicating material 25 be of such thermal remoteness from the cooling water 31 that it will not reach its critical temperature, and hence give a temperature change indication, until the water reaches substantially its boiling temperature. This is accomplished in the present invention by securing the band of indicating material 25 to the radiator spout which spout is so exposed that the heat radiation losses therefrom result in such a temperature difference between the indicating material and the water that the indicating material reaches its critical or color-changing temperature at substantially the same time as the water reaches its boiling point. It will be understood that the temperature differential between the boiling water and the indicating material may be varied widely to meet the varying requirements of various temperature indicating materials, radiators and the like, by suitable changes in the size, proportion or location of the various parts, or the provision of heat insulation about certain of the parts, so as to establish a proper relation between the amount of heat being conducted from the water to the indicating material, and the amount of heat losses, whether by conduction, radiation or convection.

The inclosing structure formed by the glass tube 28 and associated parts provides a dead air space about the temperature indicating material 25 and thereby protects the indicating material 25 from the elements, prevents the condensation of water thereon under certain conditions, and assists in controlling the amount of heat radiation from the spout. It is apparent also, in this connection, that the inclosing structure may be of simpler construction than herein illustrated and in some cases may be omitted entirely.

Since there is generally more or less water vapor in the radiator and since this vapor may rise in the spout to heat the indicating material and give a premature temperature indication, it may be desirable, in some instances, to provide a deflector or wall 32 which, as shown in Fig. 2, may consist of an imperforate cylindrical tube spaced from the upper spout tube 24 and secured thereto by means of the outturned flanges 33.

The present invention is preferably provided with indicating symbols or indicia 34 such for example as the letters H O T, which symbols consist of material of fixed color superimposed on the indicating material, the indicating symbols having the same color as the indicating material when the latter is below its critical temperature, and being normally not distinguishable from the driver's seat. When the indicating material reaches its critical temperature and changes color it forms a background for the symbols 34, the outlines of which are then visible. The symbols thus give a signal of considerable emphasis to the operator of the engine and when the symbols are in the form of letters which spell a word such as Hot, then the indicator actually states in plain language the condition of the engine and cooling water so that it may be readily understood by one who may not be familiar with the significance of the change in color of the indicating material itself.

Referring now to Fig. 3, which shows a

modified form of the invention, the radiator spout consists of a lower tube 122 and an upper tube 124 which has screw threaded or other engagement with the external surface of the lower tube 122. The upper tube is screw threaded to receive the radiator cap 121. In this form of the invention, like that shown in Fig. 2, the temperature indicating material 25 is applied to the outer portion or tube 124 of the spout, and the indicating material is also surrounded by an inclosing structure for providing a dead air space around the indicating material 25. The inclosing structure is similar in construction to that above described and consists of a glass tube 28, supporting rings 29 and gaskets 30, the supporting rings being secured directly to the cylindrical wall of the tube 124. The upper ends of the tubes 122 and 124 are provided with inturned flanges 135 and 136 which constitute spacing and supporting means for the cylindrical vapor deflector or protecting wall 132, having an outturned flange 137 for engagement with the flange 136. This form of the apparatus may also, if desired, be provided with indicating symbols of the type herein described.

In the preferred form of the invention the temperature indicating material is preferably secured to the spout of the radiator where it may be readily seen from the driver's seat, but it should be understood that the indicating material may be applied to any other suitable or convenient part of the engine or motor vehicle which changes its temperature in accordance with the temperature of the water in the cooling system.

The apparatus may, in some cases, be simplified by the omission of the enclosure for providing a dead air space about the temperature indicating material. Such a simplified construction is illustrated in Fig. 4 in which 20 designates the filler opening or spout and 21 the cap, both of which may be of usual and well known construction. Upon the exterior surface of the spout is painted or otherwise applied a band 25 of temperature indicating material, which may be of the triple layer composition, above described, or simply a layer of the temperature indicating material secured to the spout in any suitable manner. The band of temperature indicating material may be protected by applying over the surface of the spout and the band 25 a coating of varnish or other transparent protective material 35.

In Fig. 5 is shown still another slightly modified form of construction. In this form of construction the indicating material 25 is applied to a clamping ring 150, of conventional mechanical construction, which may be clamped about the radiator spout, thus providing an indicating device of the character described above. The thickness of the clamping ring may be controlled as desired to give the desired temperature drop between the indicating material, which as stated above, will normally change color at approximately 150° F., and the material whose temperature is to be indicated, in the particular embodiment illustrated that material being the water within the radiator. In such a construction, it may be necessary to provide heat insulating material 151 in addition to the thickness of the clamping member in order to interpose sufficient resistance to the transfer of heat to that indicating material,—that is, to provide the necessary temperature drop between the body whose temperature is being indicated and the temperature indicating material.

It is not essential that this be done by means of the interposition of heat insulating material, as it may be just as well done by controlling the thickness of the layer of metal or other material interposed between the indicating material and the body whose temperature is being indicated. Furthermore this control may also be secured by properly varying the character of the material of which the clamp, or analogous part, is constituted; some metal such as copper for example being better conductors of heat than other metals, so that by properly controlling the nature of the material upon which the indicating means is mounted the proper temperature controls may be secured.

In Fig. 6 is shown still another slightly modified form of construction in which the indicating device is attached to a bearing for an engine to indicate abnormal temperature conditions at such bearing. As illustrated this is done by applying the indicating material 25 to the face of a disk or plate 160, which is in turn bolted or otherwise suitably secured to the bearing 161. Here again the necessary heat transferring resistance should be incorporated, and this may be done by varying the thickness of the plate 160, varying the material of which it is composed, interposing suitable heat insulating material, or in any other similar way.

Of course indicating characters may be used if desired in the clamping ring form of Fig. 5, or the plate form of Fig. 6.

To facilitate application of the temperature indicating material the latter may be prepared as a transfer by mounting it on a paper or other suitable backing from which it may be transferred to the object the temperature of which is to be indicated, in the manner of a decalcomania transfer. One method of preparing such a transfer is to coat one face of the paper with a water-soluble compound, apply thereon a coating of insoluble material such as collodion, then a layer of the iodomercurate of copper or other indicating material in the shape of the indicating symbol desired, then cover this with a layer of water insoluble material such as collodion, and, finally, apply a coating of water-soluble adhesive. The temperature indicating material is thus en-

cased in a protective coating of collodion, and the whole may be transferred from the paper backing to any desired object by soaking the transfer in water applying the adhesive surface to the object and then peeling off the backing, thus leaving the collodion-covered indicating material adhering to the object. While one method of preparing the transfer has been described it should be understood that this is merely illustrative and that any other suitable method may be employed. In the present instance the indicating symbol is in the form of a band or ribbon, but it will be obvious that it may take any desired form. While the indicating material is herein described as forming a complete ring about the spout, it should be understood that in either form of the device, the indicating material may be omitted from certain parts and retained only on that surface which is visible from the driver's seat.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made in either without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In a device for indicating abnormal temperature of the cooling liquid of an internal combustion engine, the combination with a radiator for the cooling liquid, said radiator having a filling spout thereon, of a band of temperature indicating material about said spout, and means for substantially enclosing said band, comprising a band of transparent material surrounding said spout and supporting rings carried by said spout and embracing the edges of said band of transparent material to support said band in position, said rings being constructed to permit exposure of said band of transparent material about the circumference thereof.

2. A temperature indicating device, comprising a tubular member, a layer of temperature indicating material about the exterior of said member, a tubular transparent covering over said indicating material, and means secured to said tubular member for supporting said transparent covering in position, said means comprising spaced-apart securing rings engaging respectively the ends of said tubular covering.

3. A device of the character described, comprising a detachable and replaceable integral tubular member having interior threads at one end and exterior threads at the other end and constructed to have one end thereof positioned upon a usual automobile radiator spout and the other end receive the usual radiator cap, and a layer of indicating material on the exterior of said tubular member intermediate the ends thereof, said indicating material being adapted to change color when heated to a predetermined temperature.

4. In a device of the character described and in combination with the spout of an automobile radiator, a layer of indicating material on the exterior of said spout normally of one color but adapted to change color when heated to a predetermined temperature, and means on the interior of said spout to prevent direct thermal contact of water vapor with the wall of said spout opposite the layer of indicating material.

5. In a temperature indicating device, a plurality of layers of gum arabic having therebetween a layer of gum arabic containing a color changing temperature indicating medium.

6. In a device for indicating abnormal temperature of the cooling liquid of an internal combustion engine, the combination with a radiator for the cooling liquid having a filling spout thereon, of a band of temperature indicating material about said spout, means surrounding said band comprising a strip of material through which said band is visible, supporting rings carried by said spout for holding the edges of said strip, and means on the interior of said spout to prevent direct thermal contact of thermal water vapor with the wall of said spout opposite a layer of indicating material.

In testimony whereof I hereto affix my signature.

EDWARD C. WELLS.