United States Patent

[11] 3,587,548

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[54] **AUTOMOTIVE BLOCK HEATER**
8 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **123/142.5**
[51] **Int. Cl.** **F02n 17/02**
[50] **Field of Search** ..... 123/142.5 (E), 41.5, 198; 292/340, 353; 220/24; 215/90, 91, 94, 82, 54

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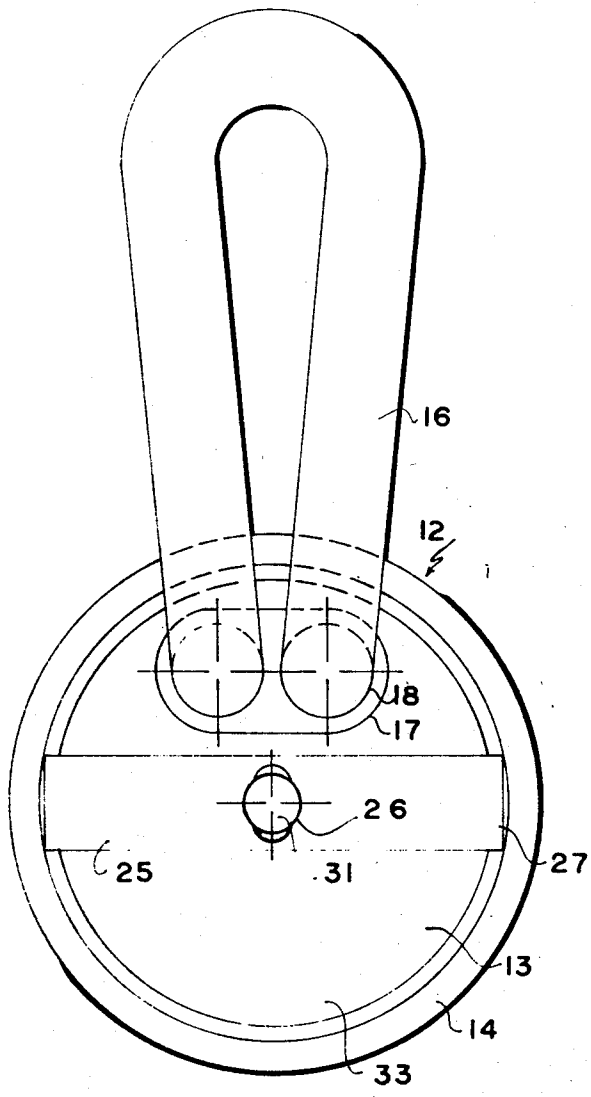
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ABSTRACT: An adapter carries the heating element and has a sealing ring around the perimeter. A bowed steel spring is forced into biting engagement with the wall of the frost plug aperture by tightening a cap screw passing through the center of the spring thus straightening it as the screw is tightened.



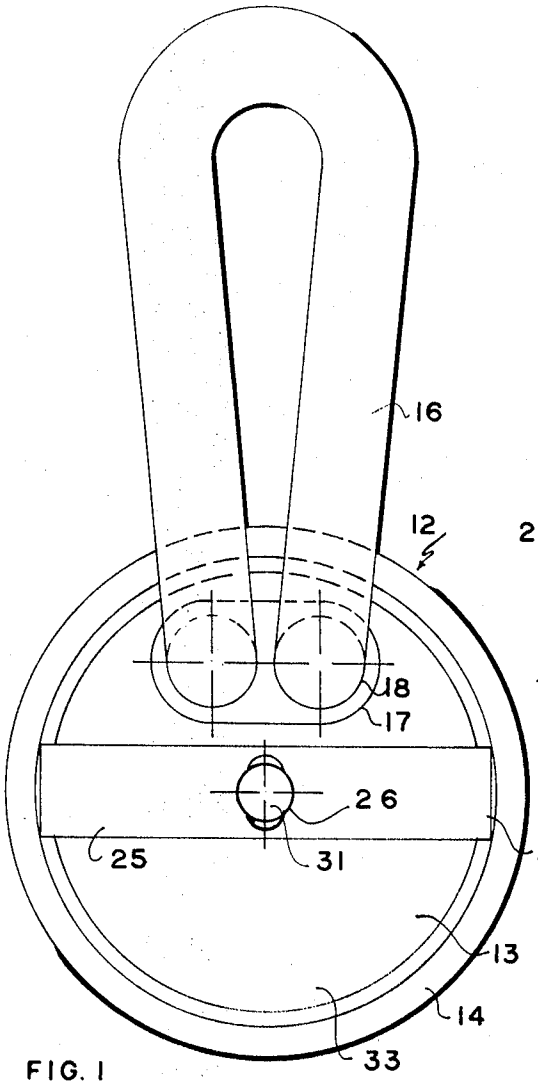


FIG. 1

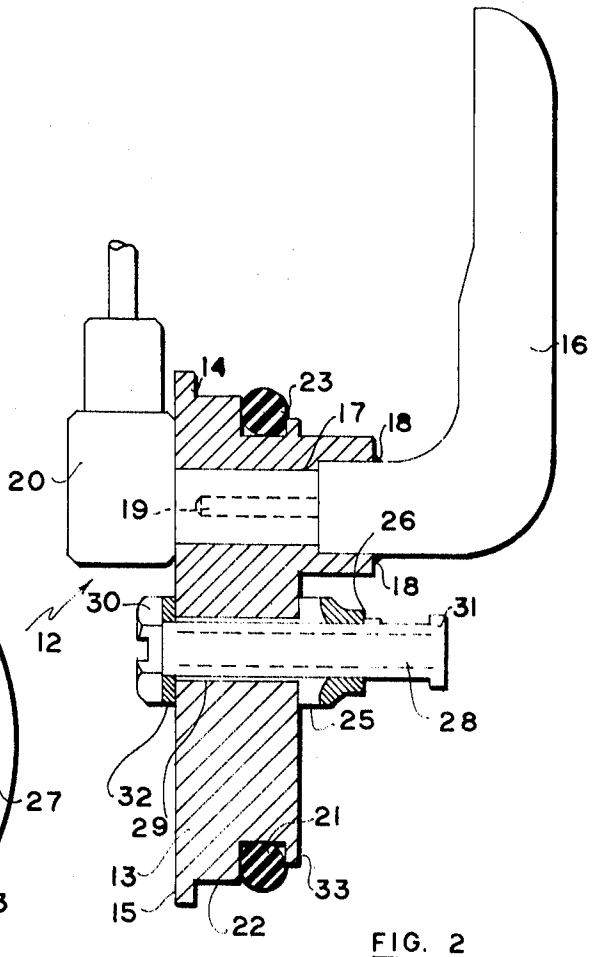


FIG. 2

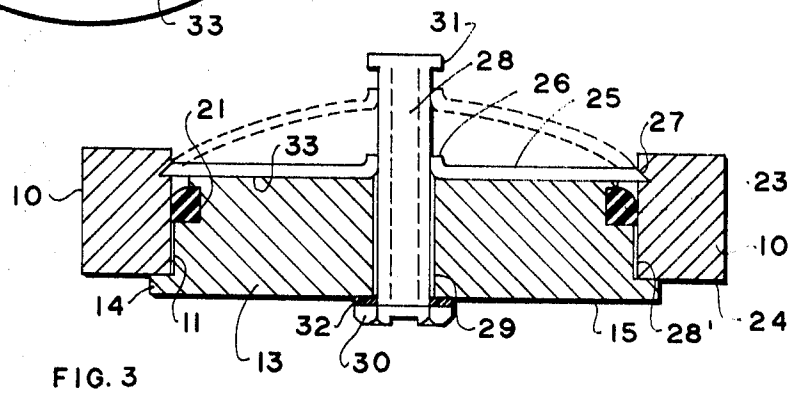


FIG. 3

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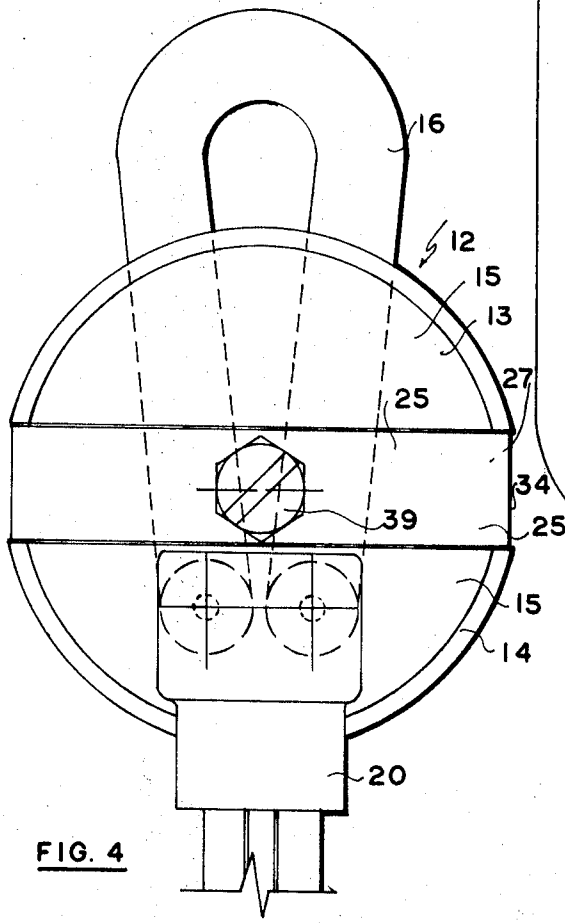


FIG. 4

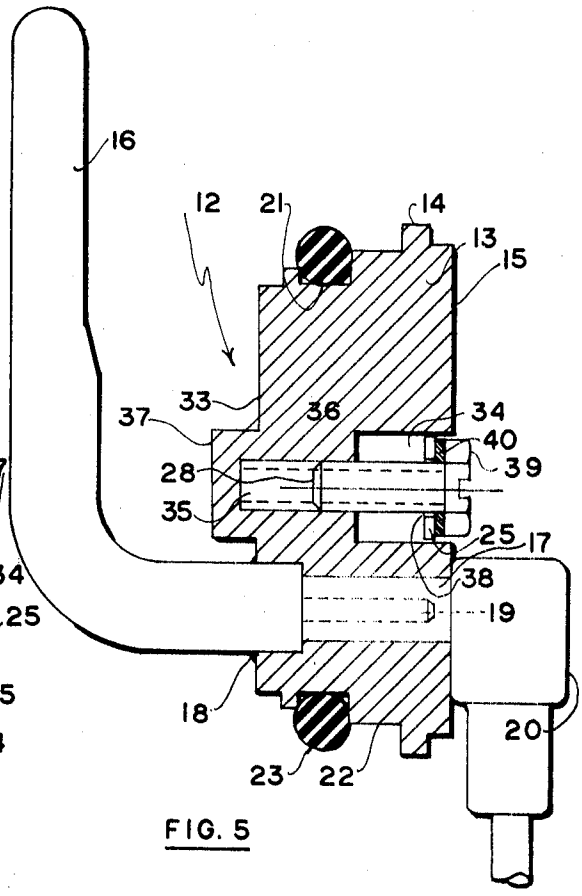


FIG. 5

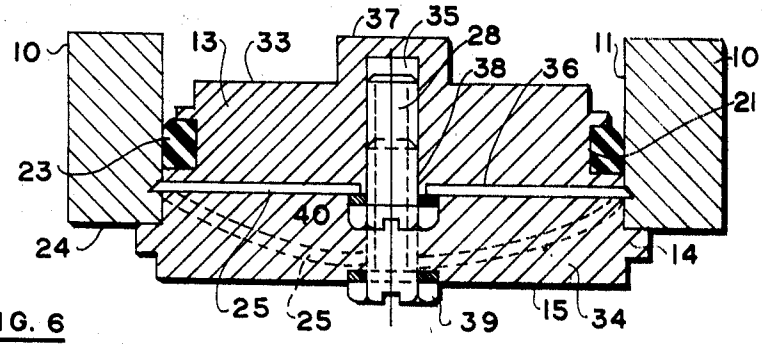


FIG. 6

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AUTOMOTIVE BLOCK HEATER

This invention relates to new and useful improvements in coolant heaters for automotive engines and the like.

Such coolant heaters normally include an electrical element extending from a plate, said electrical element being connectable to a source of electrical energy so that the element heats the coolant within the cylinder block thus maintaining same at a temperature above ambient temperature.

It is conventional that such block heaters be inserted within frost plug apertures normally formed in engine blocks and they are commonly known as frost plug heaters.

It is desirable to provide means to detachably secure said heater within the frost plug aperture so that not only is the heater sealed against fluid leakage but is also mechanically secured so that vibration will not cause the heater to disengage from the frost plug aperture with the subsequent loss of coolant.

It is also desirable to provide means whereby the heater can be removed and replaced if necessary but often the locking means becomes corroded and it is difficult to disengage from the walls of the aperture.

Some frost plug heaters require a torque wrench in order to ensure that the correct tension is placed upon the locking bolt and such a wrench is often difficult to engage due to the location of the frost plug apertures within the cylinder block, it being understood that auxiliary equipment and accessories often interfere with this engagement.

I have overcome all of the disadvantages attendant upon conventional frost plug heaters by providing an extremely simple mechanical fastening means which can be engaged and disengaged by a screw driver rather than a torque wrench and which furthermore presents a relatively shallow profile when installed so that it does not interfere with auxiliary equipment or accessories which may be attached to the engine block adjacent the position of the frost plug aperture.

In one embodiment of my invention, the locking means is remote from the coolant so that no corrosion can occur thus ensuring that disengagement is relatively easy when desired.

The principal object and essence of the invention is therefore to provide a frost plug aperture which can be mechanically locked into position with the frost plug heater and yet can easily be removed.

Another object of the invention is to provide a device of the character herewithin described which presents a relatively low profile when installed.

A yet further object of the invention is to provide a device of the character herewithin described which is designed to be locked and unlocked with a screw driver rather than a torque wrench.

In summary the invention consists of an adapter plate having a flexible sealing O-ring around the perimeter thereof, said adapter plate being a push fit into the frost plug aperture. A bowed spring strip spans the adapter plate and a screw threaded bolt cooperates between the strip and the plate to force the ends of the plate outwardly against the pressure of the bowed spring thus causing these ends to bite into the walls of the frost plug aperture thereby locking same mechanically into position.

With the foregoing in view, and such other or further purposes, advantages or novel features as may become apparent from consideration of this disclosure and specification, the present invention consists of, and is hereby claimed to reside in, the inventive concept which is comprised, embodied, embraced, or included in the method, process, construction, composition, arrangement or combination of parts, or new use of any of the foregoing, of which concept, one or more specific embodiments of same are herein exemplified as illustrative only of such concept, reference being had to the accompanying FIGS. in which:

FIG. 1 is a rear elevation of one embodiment of my device.

FIG. 2 is a vertical cross section of FIG. 1.

FIG. 3 is a cross-sectional view showing the method of securement to the walls of the frost plug aperture, the heating element being removed for clarity.

FIG. 4 is a front elevation of the preferred embodiment of my invention.

FIG. 5 is a vertical section of FIG. 4.

FIG. 6 is a view similar to FIG. 3 but showing the preferred embodiment of FIGS. 4 and 5.

In the drawings like characters of reference indicate corresponding parts in the different FIGS.

Proceeding therefore to describe the invention in detail, reference should first be made to FIGS. 1, 2 and 3.

Reference character 10 illustrates the cylinder block wall having a front plug aperture 11 formed therein, it being understood that this aperture is cylindrical and is normally closed by an expanding type frost plug which is removed for fitting of the frost plug heater collectively designated 12.

The heater consists of a substantially cylindrical adapter plate or plug 13 formed from die cast aluminum or the like and having a peripheral flange 14 adjacent the outer face 15.

A hairpin type heating element 16 which is conventional in construction, is secured within an aperture 17 extending through the adapter plate 13, by apoxy resin 18 or the like. This heater element terminates in conventional pins 19 so that a female cord plug 29 may be engaged within the aperture 17 and over the pins 19 thus connecting the element to a source of electrical energy in the usual manner.

An annular groove 21 extends around the perimetrical wall 22 of the adapter plate and receives a resilient O-ring 23 in the usual manner and the dimensions of the adapter plate and of the O-ring are such that the adapter plate together with the element may be pushed into the frost plug aperture 11, the inward movement being limited by the engagement of the shoulder or flange 14 with the outer surface 24 of the cylinder block wall 10 as clearly shown in FIG. 3.

Under these circumstances the O-ring is compressed and forms the necessary fluid seal thus preventing leakage of coolant past the adapter plate 13.

Means are provided to lock the adapter plate into position mechanically, said means taking the form of a spring steel strip 25 having a central aperture 26 formed therein. The ends 27 of this spring steel strip may be chamfered slightly as illustrated in FIG. 3 to assist in the engagement of these ends with the wall 28 of the frost plug aperture 11 as will hereinafter be described.

The material of the spring steel strip defining the aperture 26 is turned inwardly as shown in FIGS. 2 and 3 thus enabling a cap screw 28 to be screw threaded into this aperture. This cap screw passes through a central aperture 29 formed within the adapter plate 13 and is provided with a screw driver slot heat 30 on the outer end thereof and a peened inner end 31 so that the spring strip 25 cannot become disengaged therefrom.

A sealing washer 32 surrounds the cap screw adjacent the head 30 thereof and engages the head and the outer surface 15 of the adapter plate.

The spring steel strip is normally biassed to a bowed position shown in phantom in FIG. 3 and with the cap screw rotated so that the centrally apertured portion of the strip is adjacent the inner end 31 of the cap screw. In this position, the frost plug heater is engaged within the frost plug aperture as shown in FIG. 3.

The cap screw is then rotated in the direction necessary so that cooperation between the cap screw and the spring causes the central portion of the spring to move towards the inner face 33 of the adapter plate thus taking up the position shown in FIG. 3 in full line.

Due to the straightening of the spring by the rotation of the cap screw and the screw threaded engagement thereof with the spring strip, the ends 27 are forced outwardly into biting engagement with the wall 28 of the block defining the frost plug aperture 11, the chamfered formation assisting this mechanical engagement as clearly shown in FIG. 3.

In this position, the frost plug heater is firmly locked in position mechanically and is sealed against fluid leakage due to the O-ring 23.

However, if it is desired to remove the frost plug heater, the cap screw is rotated in the opposite direction thus allowing the

resiliency of the spring to bow same to the position shown in phantom in FIG. 3 thus withdrawing the ends 27 from the walls of the frost plug aperture and enabling the frost plug heater to be withdrawn.

FIGS. 4, 5 and 6 show the preferred embodiment in which the spring steel strip at no time is in contact with the coolant thus preventing any possibility of corrosion occurring.

Corresponding reference characters have been given the basic structure which is common to both embodiments.

In this particular embodiment, a transverse channel 34 is formed across the adapter plate 13 upon the outer face 15 thereof and the spring steel strip 25 rests within this channel.

A blind screw threaded aperture 35 extends from the base 36 of the channel towards the inner surface 33 of the adapter plate. This blind aperture is centrally located and a central boss 37 is formed upon the inner surface of the adapter plate as clearly shown in FIGS. 5 and 6.

The spring strip 25 is centrally apertured as at 38 similar to the spring strip of the previous embodiment with the exception that the cap screw 39 extends freely through the strip.

In operation, the cap screw is in the outer position shown in phantom in FIG. 6 whereupon the spring strip is in the fully bowed position also shown in FIG. 6 and in phantom.

When pushed into the frost plug aperture to the position shown in FIG. 6, the cap screw is rotated thus cooperating with the screw threaded blind aperture to pull the spring strip to the straightened or flat position thus forcing the ends outwardly into engagement with the walls of the frost plug aperture as in the previous embodiment.

However, it should be noted that the cap screw and the spring strip of this embodiment are on the outer side of the adapter plate and thus are not in contact with the coolant within the cylinder block.

Removal of this embodiment is similar to the previously described embodiment and once again a screw driver can be utilized.

In both embodiments, it should be observed when installed, the heater presents a relatively flat profile thus enabling same to be installed without interference with components or accessories normally found adjacent engine block frost plugs.

Finally it should be noted that a lock washer 40 is provided under the head 39 of the cap screw in the preferred embodiment, to prevent the cap screw from becoming loosened by vibration.

Various modifications can be made within the scope of the invention concept which is herein disclosed and/or claimed.

I claim:

1. An automotive engine block heater for mounting in a circular freeze plug aperture in the block, said heater comprising a cylindrical plug adapted to be inserted in a block aperture, a heating element carried by said plug, a bowed leaf spring extending diametrically of the plug, said leaf spring when relaxed having a diametric span no greater than the plug diameter, an actuating screw provided in said plug and operatively engaging the center portion of said leaf spring so that when the screw is tightened the bowed leaf spring may be flexed toward a straight position in which the diametric span thereof is increased beyond the plug diameter, said leaf spring having sharpened ends for biting into the block aperture wall whereby to positively retain the plug in position when said screw is tightened.

2. The heater as defined in claim 1 which is further characterized in that said plug has an outer face and an inner face in relation to its position in a block aperture, said leaf spring being disposed at the inner face of said plug, said actuating screw extending rotatably through the plug from the outer face to the inner face thereof, and the inner end of said screw being threaded in the center portion of said leaf spring.

3. The heater as defined in claim 1 which is further characterized in that said plug has an outer face and an inner face in relation to its position in a block aperture, said leaf spring being disposed at the outer face of said plug, said actuating screw being rotatable in the center portion of said leaf spring and being threaded into the plug from the outer face of the latter.

4. The heater as defined in claim 3 wherein the outer face of said plug is provided with a diametrically extending channel having said lead spring disposed therein to prevent rotation of the spring with said screw.

5. The combination of an automotive engine block having a wall provided with a circular aperture, and a block heater comprising a cylindrical plug inserted in said aperture, a heating element carried by said plug, a bowed lead spring extending diametrically of the plug, said leaf spring when relaxed having a diametric span no greater than the plug diameter, an actuating screw provided in said plug and operatively engaging the center portion of said leaf spring so that when the screw is tightened the bowed leaf spring may be flexed toward a straight position in which the diametric span thereof is increased beyond the plug diameter, said leaf spring having sharpened ends which bite into the wall of the block aperture whereby to positively retain the plug in said aperture when said screw is tightened.

6. The combination as defined in claim 5 which is further characterized in that said plug has an outer face and an inner face in relation to its position in said block aperture, said leaf spring being disposed at the inner face of said plug, said actuating screw extending rotatably through the plug from the outer face to the inner face thereof, and the inner end of said screw being threaded in the center portion of said leaf spring.

7. The combination as defined in claim 5 which is further characterized in that said plug has an outer face and an inner face in relation to its position in said block aperture, said leaf spring relation to its position in said block aperture, said leaf spring being disposed at the outer face of said plug, said actuating screw being rotatable in the center portion of said leaf spring and being threaded into the plug from the outer face of the latter.

8. The combination as defined in claim 7 wherein the outer face of said plug is provided with a diametrically extending channel having said leaf spring disposed therein to prevent rotation of the spring with said screw.