

June 9, 1953

G. H. GRINDE ET AL
ELECTRICAL HEAD BOLT REPLACEMENT HEATER FOR
LIQUID COOLED INTERNAL-COMBUSTION ENGINES
Filed June 14, 1951

2,641,239

Fig. 2

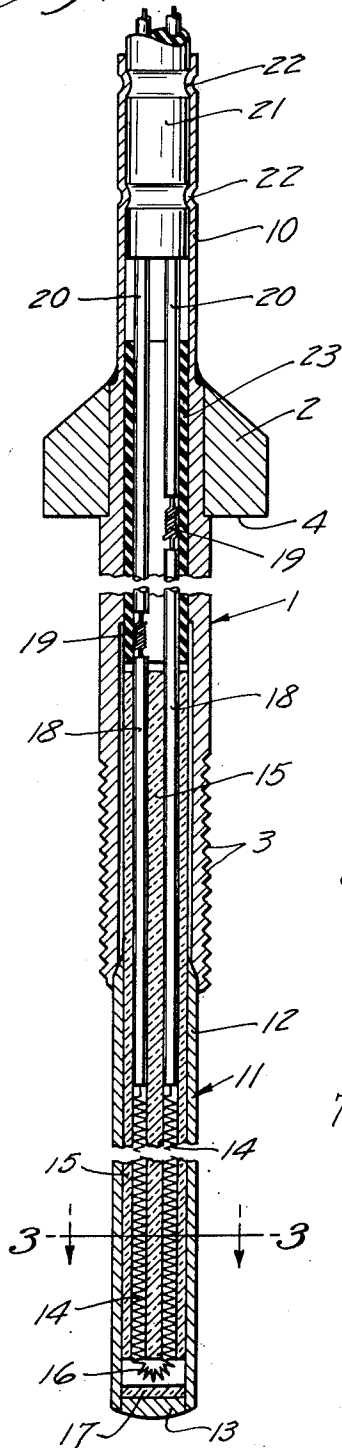


Fig. 1

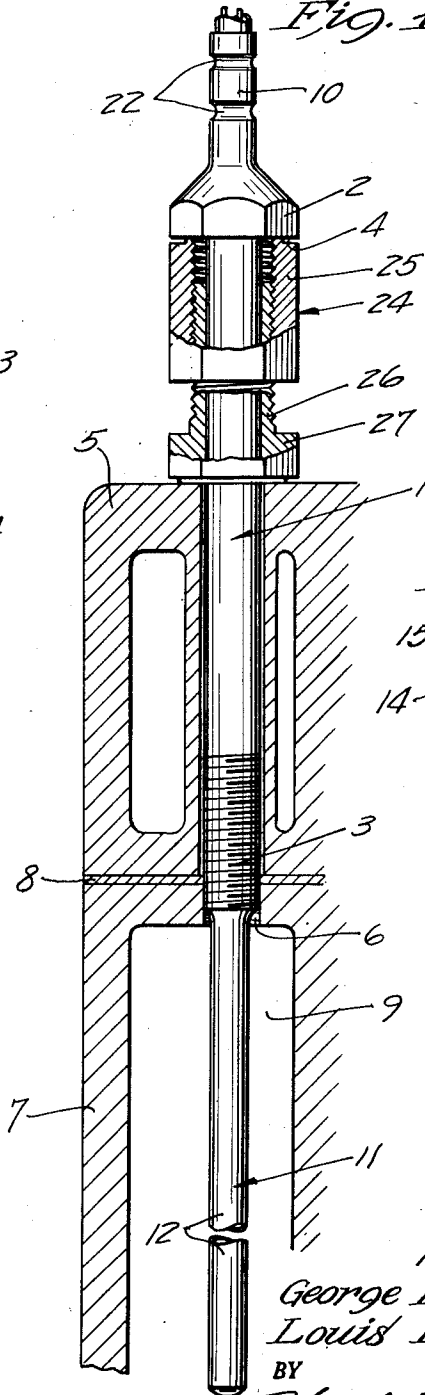
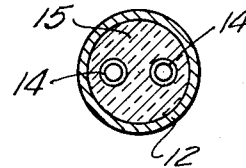


Fig. 3



INVENTORS
George H. Grinde
Louis L. Wolf

BY

Merchant & Merchant
ATTORNEYS

UNITED STATES PATENT OFFICE

2,641,239

ELECTRICAL HEAD BOLT REPLACEMENT
HEATER FOR LIQUID COOLED INTER-
NAL-COMBUSTION ENGINES

George H. Grinde and Louis L. Wolf, Minneapolis,
Minn., assignors to Phillips Manufacturing
Company, Inc., Minneapolis, Minn., a corpora-
tion of Minnesota

Application June 14, 1951, Serial No. 231,508

3 Claims. (Cl. 123—142.5)

1

Our invention relates to electrically-operated heaters for liquid cooled internal combustion engines, and more particularly to that type of heater which replaces one of the cylinder head bolts of a liquid cooled internal combustion engine and performs the function of the replaced cylinder head bolt, in addition to the heating function.

Our improved heater is adapted to be energized from any suitable source of electrical energy, such, for example, as a conventional domestic power line, and is adapted to be used in cold weather to keep the engine in relatively warm, favorable starting condition during idle periods, and to safeguard the engine by preventing congealing of the engine's lubricant and preventing freezing of the engine's cooling liquid.

The instant invention pertains particularly to improvements in head bolt replacement-type engine heaters of the kind comprising a cylinder head bolt which is externally similar to the conventional cylinder head bolt, which it replaces, but which is made tubular in contrast to the solid construction of the head bolt which it replaces. Of course when a cylinder head bolt of any given diameter is made tubular it is essentially materially weakened with respect to the conventional solid head bolt, which it replaces, and breaks off or snaps under much less stress or strain than is required to break or snap off a conventional solid head bolt. Obviously, the weakest part or parts of any cylinder head bolt is at the threaded portion or portions thereof and, of course, this weakness is particularly emphasized in tubular head bolts wherein the bolt threads cut deeply into the relatively thin walls of the tubular bolt.

In accordance with previous practice, the tubular head bolts of such engine heaters have been tightened down onto the cylinder head, either by turning the bolt bodily from the top to screw the same down into the cylinder block below the head, or by screwing down a nut threaded on the cylinder bolt above the cylinder head. In accordance with either such prior art practice, the tubular cylinder bolt of the heater is subjected to relatively high torque strain during the tightening down process, which is additive to the longitudinal strain imposed thereon. In practice, it has been found that breakage of such tubular head bolts is usually at a threaded portion thereof and usually occurs during the tightening process when the bolt is simultaneously subjected to combination of longitudinal stress or strain and torque stress or strain.

2

Hence, an important objective of the instant invention is a provision, in head bolt replacement engine heaters of the kind employing a tubular head bolt, of means whereby the tubular head bolt may be tightened down securely without subjecting the tubular head bolt to torque strain. In accordance with our invention, this important objective is achieved by provision of an expansible and contractible tubular spacer which is loosely applied on the tubular bolt and is longitudinally expanded between the cylinder head and a suitable stop shoulder portion on the tubular bolt above the cylinder head, to securely tighten the tubular cylinder bolt down onto the cylinder head, without subjecting the tubular bolt to torque strain. Preferably, and as illustrated herein, this expansible tubular spacer comprises cooperatively engaged externally and internally screw-threaded sleeves each provided with wrench-gripping surfaces. One of these cooperating sleeves engages the shoulder-acting portion on the tubular bolt and the other engages the top of the cylinder head. To tighten the tubular bolt down onto the cylinder head without subjecting the tubular bolt to torque strain, the upper sleeve of the expansible spacer, which normally engages the stop shoulder portion of the bolt, is held stationary with a wrench while the lower sleeve, which normally engages the cylinder head, is rotated in a direction to longitudinally expand the expansible spacer, which latter may be sometimes hereinafter referred to as a tubular jack.

Another important objective of the invention is a provision of a head bolt replacement type of heater for internal combustion engines which is adapted for use, without modification, on engines having different depths or thicknesses of cylinder heads, so that a standard heater unit can be conveniently utilized in connection with a number of different engines.

Another objective of the invention is a provision, in a heater of the character described, of a tubular bolt having a fixed bolt head which can be used to turn the threads of the bolt into the threads of the cylinder block of an engine and thereby eliminate any possibility of distorting or mutilating the tubular bolt, as often happens when applying threaded tubular bolts, which often require the use of a pipe wrench to the intermediate portion of the cylindrical body of the tubular bolt.

The above and other important objects and advantages of the invention will be further emphasized or made apparent from the following specification, claims and appended drawings.

In the accompanying drawings, like characters indicate like parts throughout the several views.

Referring to the drawings,

Fig. 1 is a view partly in section and partly in side elevation, with some parts broken away, showing our improved engine heater in operative position in an internal combustion engine;

Fig. 2 is an enlarged view in axial section, with some parts broken away, of our engine heater, with the expansible spacer thereof removed and before installation thereof to the engine; and

Fig. 3 is a detailed sectional view taken on the horizontal line 3—3 of Fig. 2.

The tubular head bolt of our improved heater is indicated as an entirety by 1. This tubular bolt 1 is provided adjacent its upper end portion with a fixed or rigid bolt head 2 and is provided below the head 2 with external screw threads 3. The under surface of the bolt head 2 provides a stop shoulder 4, which will be spaced above the top of an engine cylinder head 5 when the threads 3 of the bolt are screw threaded into mating internal threads in a bore 6 of the underlying cylinder block 7 of the internal combustion engine. The engine partially illustrated in Fig. 2 is shown as being provided between the cylinder head 5 and the cylinder block 7 with the usual cylinder head gasket 8. Referring to Fig. 2, it will be noted that the bolt hole 6 of the block 7 opens into the usual liquid coolant cavity 9 of the cylinder block of the engine, which, as previously indicated, is of the liquid cooled variety. While the bolt head 2 may be initially produced as an integral part of the tubular bolt 1, it is shown as having been separately formed and subsequently applied thereto in a manner to become a rigid integral part thereof by any well-known process, such as welding, brazing, silver soldering or the like. Silver soldering of the bolt head 2 to the tubular body of the bolt 1, to integrally unite these elements, has, as a matter of fact, proven highly satisfactory and may be assumed to be the expedient employed in the present illustration. In the present illustration, the upper end of the tubular bolt is extended upwardly or outwardly beyond the head 2, as indicated at 10. Preferably, however, the cylindrical wall of the upper extension 10 of the bolt is reduced in diameter and thickness, as compared to that portion of the bolt 1 underlying the head 2.

The bolt 1 is provided outwardly or downwardly beyond the threads 3 thereof with an axially extended electrically-operated liquid submersion type heating element, indicated as an entirety by 11. This submersion type heating element 11 comprises a casing-acting tubular shell 12 rigidly secured to the lower end portion of the main body of the bolt 1 by welding, brazing, silver soldering or the like, and forming an extension of the tubular bolt 1. This tubular shell 12 is tightly closed at its lower end by a plug 13 secured therein to provide a liquid-tight seal. If desired, the heater-containing shell portion 12 of the bolt may be initially formed integrally with the main body of the bolt 1, but because the main body of the bolt 1 will usually be made of steel, we find that it is preferable to make the shell portion 12 of material, such as brass or copper, having a higher rate of heat conductivity than steel. When the shell portion 12 is made of brass, it can most expediently be integrally united with the main body of the bolt 1 by brazing.

The heating element 11 comprises, in addition

to the tubular shell 12, a resistance heating unit 14 formed of a long coil of suitable resistance wire formed into a U-shape. Adjacent parallel portions of this U-shaped resistance heating unit 14 are contained within opposite laterally-spaced parallel passages of a long porcelain insulating rod 15. The connecting bottom portion 16 of the U-shaped resistance heating unit 14, which extends beyond the lower end of the porcelain rod 15, is insulated from the closed metallic lower end of the tubular shell 12 by a suitable insulating disc 17 of mica or the like. While the tube 15 has been described as being, and is preferably, of porcelain, it may be of any suitable material having good heat conductivity and high electrical insulation qualities.

The upper ends of the U-shaped resistance heating unit 14 are extended upwardly through the porcelain insulating rod 15 by insulated leads 18, which are connected at 19 to insulated extension leads 20 that extend through the upper portion 10 of the tubular bolt 1 and are adapted to be externally connected to a suitable source of power, such as a conventional domestic power line, not shown. Preferably, the upper portion of the extension leads 20 are contained within a common insulating cable 21, which is anchored in the bolt extension 10 by impressed beads 22. As shown, the extension leads 20 are spaced from the wall of the tubular bolt by an insulating sleeve 23 of rubber or the like.

The expansible and contractible spacer of our heater, which allows tightening of the tubular cylinder bolt 1 of the heater without subsection of the tubular bolt to torque strain, is shown in Fig. 1 where it is indicated as an entirety by 24. This expansible and contractible spacer is tubular and comprises cooperatively engaged internally screw-threaded and externally screw-threaded tubular sections 25 and 26. This two-part expansible and contractible tubular spacer 24 is loosely applied on the tubular bolt body 1 inwardly of or below the stop shoulder 4 formed by the bolt head 2. The tubular section or sleeve 25 has a polygonal wrench-receiving outer surface composed of flat surfaces and preferably of hexagon form, and the externally threaded tubular section or sleeve 26 is provided at its outer end portion with an enlarged head 27 having a corresponding or similarly-formed wrench-receiving outer surface.

To apply the heater of our invention to a conventional liquid-cooled internal combustion engine, one of the conventional or standard cylinder head bolts of the engine is removed and one of our heaters substituted therefor. The tubular bolt 1 of our heater is inserted through the bolt hole or holes in the cylinder head 5 and the screw threaded portion 3 thereof is screwed into the aligned internally threaded bolt hole 6 of the cylinder block 7. At the time the bolt is being screwed into the internally threaded bolt hole 6 of the block, the expansible and contractible sleeve 24 will be in a materially contracted condition wherein it is of less length than the distance between the stop shoulder 4 of head 2 and the top of the cylinder head 5, so that the bolt will not be subject to axial strain or tension at this time. Hence, the turning of the bolt threads 3 into the internally threaded bolt hole 6 of the block may be accomplished by a suitable wrench applied to the bolt head 2, since the torque strain required for this operation will not be accompanied by longitudinal stress or strain. After the tubular bolt 1 of the heater

5

has thus been threaded into the block 6, the bolt is effectively tightened down onto the cylinder head 5 by axially expanding the spacer 24. To accomplish this final tightening operation without subjecting the tubular bolt 1 to torque strain, the tubular sleeve 25 or 26 adjacent the stop shoulder 4 of the bolt head 2 will be held stationary with the wrench while the tubular sleeve 25 or 26 adjacent the cylinder head 5 is rotated with another wrench in a direction to expand the spacer 24. Preferably, the expansible and contractible spacer 24 is applied as illustrated in Fig. 1 with the sleeve 25 thereof adjacent the bolt head 2 and the sleeve 26 thereof adjacent the cylinder head 5. Obviously, by employing the technique described, the heater may also be removed from the engine without subjecting the tubular bolt 1 thereof to torque strain.

It should be seen that the expansible and contractible spacer allows a standard heater to be used in connection with engines having cylinder heads of quite widely varying depths or thicknesses.

Our invention has been thoroughly tested and found to be completely satisfactory for the accomplishment of the objectives set forth; and while we have shown a commercial embodiment of our improved device, it will be understood that the same is capable of modification without departure from the scope and spirit of the invention as defined in the claims.

What we claim is:

1. A cylinder head bolt replacement type of heater for internal combustion engines, said heater comprising a tubular head bolt having an externally threaded portion for engagement with the internal screw threads of an engine cylinder block below the cylinder head thereof and having a stop shoulder adjacent one end which will be spaced above the top of the engine cylinder head when the said externally screw-threaded portion of the tubular bolt is operatively engaged with the said internal threads of the cylinder block, an electrical liquid submersion heater extending longitudinally beyond the threaded portion of the bolt for extension in a liquid coolant cavity of the cylinder block when the said external threads of the tubular bolt are engaged with the internal threads of the cylinder block, internally contained power leads extending from the electrical heating element through the shoulder equipped end portion of the tubular bolt, and a longitudinally extensible and contractible tubular spacer loose on said tubular bolt adjacent said stop shoulder thereof and adapted to be longitudinally expanded between the said bolt stop shoulder and the top of the cylinder head to draw the cylinder head toward the cylinder block after the threads of the bolt have been engaged with the said threads of the block, said expansible and contractible tubular spacer comprising cooperating externally and internally threaded sleeves, one for engagement with the shoulder of the bolt and another for engagement with the cylinder head, said expansible tubular spacer allowing tightening of the tubular bolt without subjecting the same to torque strain, the outer of said sleeves having a polygonal wrench engaging peripheral surface composed of flat surfaces and the inner of said sleeves having a corresponding wrench-engaging peripheral surface adjacent its outer end.

6

spacer allowing tightening of the tubular bolt without subjecting the same to torque strain.

2. A cylinder head bolt replacement type of heater for internal combustion engines, said heater comprising a tubular head bolt having an externally threaded portion for engagement with the internal screw threads of an engine cylinder block below the cylinder head thereof and having a stop shoulder adjacent one end which will be spaced above the top of the engine cylinder head when the said externally screw-threaded portion of the tubular bolt is operatively engaged with the said internal threads of the cylinder block, an electrical liquid submersion heater extending longitudinally beyond the threaded portion of the bolt for extension in a liquid coolant cavity of the cylinder block when the said external threads of the tubular bolt are engaged with the internal threads of the cylinder block, internally contained power leads extending from the electrical heating element through the shoulder equipped end portion of the tubular bolt, and a longitudinally extensible and contractible tubular spacer loose on said tubular bolt adjacent said stop shoulder thereof and adapted to be longitudinally expanded between the said bolt stop shoulder and the top of the cylinder head to draw the cylinder head toward the cylinder block after the threads of the bolt have been engaged with the said threads of the block, said expansible and contractible tubular spacer comprising cooperating externally and internally threaded sleeves, one for engagement with the shoulder of the bolt and another for engagement with the cylinder head, said expansible tubular spacer allowing tightening of the tubular bolt without subjecting the same to torque strain, the outer of said sleeves having a polygonal wrench engaging peripheral surface composed of flat surfaces and the inner of said sleeves having a corresponding wrench-engaging peripheral surface adjacent its outer end.

3. The structure defined in claim 1 in which the tubular bolt has a rigid bolt head the under-surface of which defines the said stop shoulder.

GEORGE H. GRINDE.
LOUIS L. WOLF.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,205,571	Sharpnack et al.	Nov. 21, 1916
1,220,150	Williams	Mar. 20, 1917
1,360,510	Elliott	Nov. 30, 1920
1,466,686	Zwilling	Sept. 4, 1923
1,584,245	Robinson	May 11, 1926
1,746,853	Cheney	Feb. 11, 1930
1,854,072	Schlaich	Apr. 30, 1932
1,916,237	Sloan	July 4, 1933
2,130,365	Paulson	Sept. 20, 1938
2,176,601	Bates	Oct. 17, 1939
2,389,925	Morgan et al.	Nov. 27, 1945
2,487,326	Freeman	Nov. 8, 1949
2,611,066	Freeman	Sept. 16, 1952