United States Patent

Lasswell et al.

[15] **3,635,369**

[45] **Jan. 18, 1972**

[54] PRECOATED PLUG

[72] Inventors: **Tull C. Lasswell,** 230 Pawnee Path, Lake Orion, Mich. 48035; **John L. Monier,** 1968 Harwood Drive, Oxford, Mich. 48051

[22] Filed: **Aug. 19, 1969**

[21] Appl. No.: **851,261**

[52] **U.S. Cl.** .....**220/42 B,** 220/24 A

[51] **Int. Cl.** **B65d 41/00**

[58] **Field of Search** .....220/24, 24 A, 24.5, 42 B, 46

[56] **References Cited**

UNITED STATES PATENTS

3,476,287 11/1969 Kinnavy 220/42

FOREIGN PATENTS OR APPLICATIONS

204,385 9/1923 Great Britain 220/24

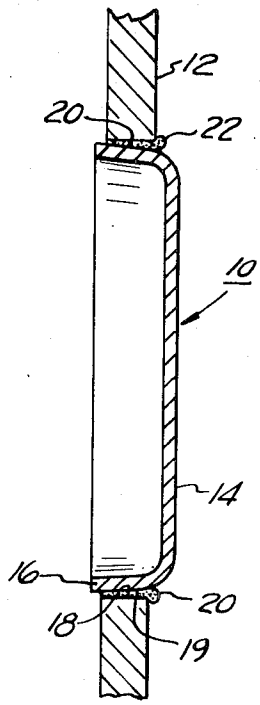
Primary Examiner—George T. Hall

Attorney—Hauke, Gifford and Patalidis

[57] **ABSTRACT**

A plug adapted to close off core openings in an internal combustion engine is precoated with a plastic which forms a fluid-tight seal between the peripheral surface of the plug and the core opening upon insertion of the plug therein. The plug is preferably coated with a solution of a polyvinylidene chloride in cyclohexanone which is cured by heating for 20 minutes at 160° F. The thickness of the plastic coating may be doubled by heating the coated plug for 10 minutes at 350° F.

7 Claims, 4 Drawing Figures



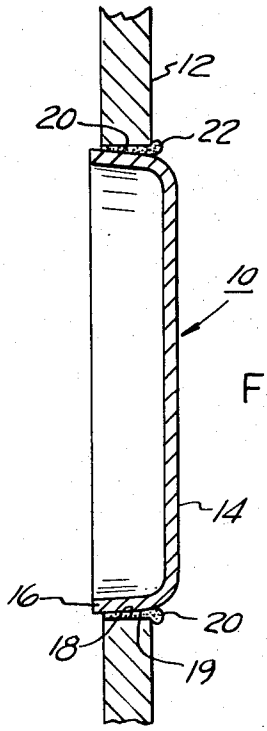


FIG. 1

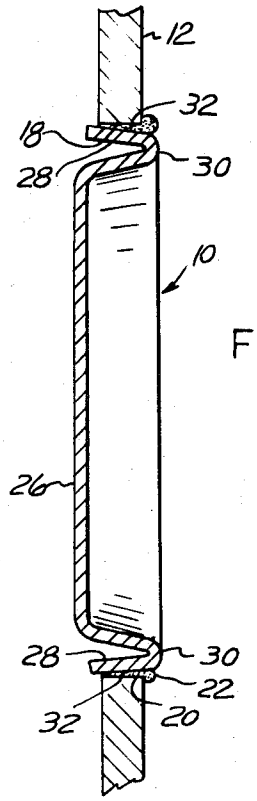
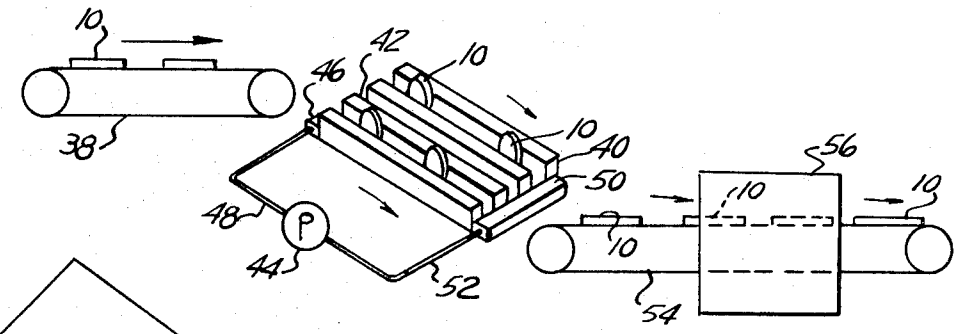


FIG. 2

FIG. 3



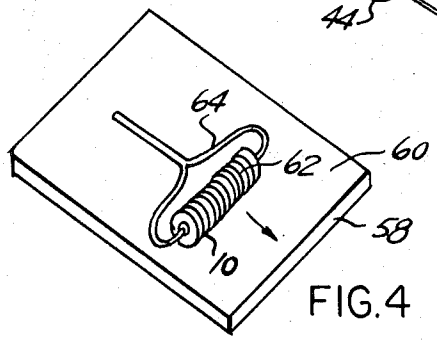


FIG. 4

INVENTORS
TULL C. LASSWELL
JOHN L. MONIER
BY Hauke, Gifford & Patalidis
ATTORNEYS

PRECOATED PLUG

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to plug members adapted to provide a seal closure in an apertured workpiece, and more particularly, to a precoated plug for sealing an opening for the core holes in water jackets of internal combustion engines and other similar manufacturing holes, and to a method for applying a plastic coat to the peripheral surface os such plug members.

DESCRIPTION OF THE PRIOR ART

the cylinder block of an internal combustion engine is usually provided with a water jacket which in many cases is cast integral with the cylinder. This jacket generally has a plurality of holes passing therethrough to the outside which have been provided for removing the sand cores after the block has been cast. They are ordinarily provided with a sealing plug secured therein by friction so as to provide an enclosed cavity.

It may also be necessary to drill access holes or passages in a casting in order to permit internal machining or to provide for cross-connecting internal fluid carrying passages and the like. It is usually necessary to close off these access holes or passages in order to preclude introduction of foreign matter internally of the part and to prevent fluid leakage therefrom. On of the current methods of closing off such access holes in passages has been the forcing of a short metal rod into the end of the passage. Although this method is satisfactory in certain applications, it is quite unsatisfactory under circumstances where fluid under pressure is subsequently introduced into the passage inasmuch as the rod may be forced out of the hole or the passage by the pressurized fluid.

A variety of methods have been employed to provide a satisfactory sealing plug which is reliable and inexpensive. Such prior methods have included the use of a plug having a diameter larger than the opening it is to close, at least to the extent that there will be a relatively large compressive engagement between the plug and the opening. In order to insert the rod into the opening without cracking the workpiece it is sometimes necessary to heat the area of the workpiece about the opening or to cool the rod to cryogenic temperature prior to insertion. This type of sealing means results in a relatively expensive operation and is difficult to use on high-volume production. Other methods have consisted in tapping the access hole and threading a bolt or threaded plug therein. Such methods are relatively time consuming and therefore expensive from a production standpoint, and it is also possible that fluid pressure behind the plug may result in leadage past the threads to the outside of the casting.

Specifically in the automotive industry, core openings are generally sealed by means of plugs which are press fitted within the openings. Prior to the press fitting of the plugs within the openings, the openings are coated with an adhesive material by an operator. Although such a method is satisfactory, it does require two steps, that is, the manual coating of the opening and the insertion of the plug generally by means of an automatic plug-inserting machine. Since the coating is applied manually this sometimes leads to an improper coating on the part by the operator, and thus a proper seal between the plug and the opening is not achieved. Furthermore, existing adhesive coatings utilized in the automotive industry tend to become brittle and chip off in a relatively short period, thus losing the desired seal. Such existing adhesive coatings are subjected to oil, oil additives, water, antifreeze and high temperature, all of which lead to a short sealing life.

It would therefore be very desirable to provide a plug for sealing an access hole in a metallic casting and the like in which the plug has been precoated with a plasticlike material so as to provide and insure a fluidtight seal upon insertion of the plug within the opening.

SUMMARY OF THE INVENTION

The present invention which will be described in greater detail hereinafter comprises a metallic plug adapted to be inserted within an aperture or opening formed within a metallic casting and the like. The peripheral surface of the metallic plug which engages the walls of the opening is precoated with a plastic material prior to insertion. The plastic coating is of such thickness that when the metallic plug is press fitted into the aperture of the metallic workpiece, the plastic coating fills any cracks within the wall of the aperture while at the same time interference between the plug and the walls of the opening tends to peel back a portion of the plastic coating such that the coating acts as a gasket between the two parts, thus forming a fluidtight seal to prevent introduction of foreign matter internally of the part and to preclude the passage of fluid leakage therefrom.

The plugs are precoated by applying a solution of a polyvinylidene chloride powder in a solvent, preferably cyclohexanone, to the engaging surface of the plug. The plug is then heated at a predetermined temperature for a predetermined period of time. For example, to obtain a 1-mil thickness on the peripheral surface of the plug, a mixture of 1 part by weight of the aforementioned powder to 2 parts of the solvent is applied to the plug surface and heated for 20 minutes at 160° F. However if the same composition by weight of powder to solvent is heated at 350° F. for 10 minutes the thickness of the resultant plastic coating will be double that of the plastic coating obtained when heated at 160° F. for 20 minutes. Plugs coated in the manner described herein are resistant to oil, oil additives, water, antifreeze and are capable of withstanding substantially higher temperature than the hereinbefore mentioned prior art devices, thus a long sealing life is insured.

It is therefore an object of this invention to provide a simple, efficient and inexpensive precoated plug having a long life, for use in closing an apertured workpiece.

It is also an object of this invention to provide a method for precoating such a plug.

DESCRIPTION OF THE DRAWING

The several objects, advantages and applications of the present application will become apparent to those skilled in the art when the accompanying description of some examples of the best modes contemplated for practicing the invention is read in conjunction with the accompanying drawing wherein like reference numerals refer to like parts and in which:

FIG. 1 is a fragmentary sectional view of a water jacket wall of an internal combustion engine illustrating an example of a sealing plug constructed in accordance with the present invention;

FIG. 2 is a similar fragmentary sectional view of a water jacket wall showing another example of a sealing plug constructed in accordance with the present invention; and

FIG. 3 is a diagrammatic illustration of an example of one method employed in practicing the present invention.

FIG. 4 is a diagrammatic illustration of another example of a method employed in practicing the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 there is shown one example of a precoated plug **10** inserted in the water jacket wall **12** of an internal combustion engine. The plug **10** is cup-shaped having a bottom portion **14** and a cylindrical side flange portion **16**. The plug **10** is adapted to be mounted in a circular opening **18** formed in the water jacket wall **12**. The side flange portion **16** is so designed as to be slightly tapered outwardly from the bottom portion **14**, this taper of he flange being illustrated in an exaggerated form in FIG. 1. The outside of the peripheral surface **19** of the side flange **16** is precoated with a plastic material **20** which will be described in greater detail hereinafter. The outside diameter of the side flange **16** is so sized relative to the inner diameter of the opening **18**, and the thickness of the

plastic coating **20** is such as to permit the precoated plug **10** to be inserted forcefully within the opening **18** such that a portion of the plastic coating **20** is peeled back and acts as a gasket as is illustrated at **22**. The combination of the press fit of the side flange **16** against the inner diameter of the opening **18** and the plastic coating **20** results in providing a fluidtight seal between the outer periphery of the side flange **16** and the opening **18** so as to prevent introduction of foreign matter internally of the water jacket and to preclude fluid leakage therefrom. The plug **10** is preferably of a metallic material such as steel and has a predetermined amount of resiliency in the tapered side flange **16** such that when it is inserted within the hole **18** the side flange **16** tends to exert an outward force against the opening **18**, to further maintain the fluidtight seal. As viewed in FIG. **1** the precoated plug is inserted leftwardly into the opening **18** such that the bottom portion **14** is external of the water jacket.

Referring to FIG. **2** for a description of another example of a precoated plug constructed in accordance with the present invention there is shown a plug member **10** including a cup-shaped portion **26** having its side flange **28** reversely bent at **30** to provide an outer peripheral wall **32** which extends outwardly and tapers slightly outwardly from the bend **30**, as illustrated in FIG. **2** in an exaggerated form. The tapered outer peripheral wall **32** is precoated with the plastic coating **20** which will be described in greater detail hereinafter.

The plug member **10** of FIG. **2** is adapted for use in the same manner as hereinbefore described with respect to the plug **10** of FIG. **1** namely it is adapted for mounting in the circular opening **18** formed in the water jacket **12**. The outer diameter of the outer peripheral wall **32** and the thickness of the plastic coating **20** are so dimensioned that when the plug **10** is forcefully press fitted into the opening **18**, a portion of the plastic material is peeled back to form a gasket which is illustrated at **22**, thus creating a fluidtight seal between the wall **12** of the opening **18** and the peripheral wall **32** of the plug **10**. In a similar manner as the plug **10** of FIG. **1** the plug member **10** of FIG. **2** is made of a metallic material, such as steel and has a slight resiliency in the peripheral wall **32** thereof which causes it to exert an outwardly force against the surface of the opening **18**, thus to further insure a fluidtight seal between the wall **12** and the plug **10**. As viewed in FIG. **2**, the precoated plug is inserted leftwardly into the opening **18** such that the bottom portion **26** is internal of the water jacket.

The plastic coating **20** applied to the peripheral surface of the plug member **10** is initially in a liquid form. Referring to FIG. **3**, for a schematic illustration of one example of the application of the plastic material **20** to the plugs, there is shown a conveyor belt **38** which carries the uncoated plugs **10** to an inclined trough **40**. The uncoated plugs are transferred from the conveyor belt to the trough **40** by any suitable means (not shown) such as manually or by gravity.

The trough **40** is comprised of a plurality of narrow channels **42** which are adapted to guide the plugs **10** as they roll along their outer surfaces. The trough is partially filled with the liquid plastic material and as the plugs roll down the inclined trough **40** under the influence of gravity their peripheral surface is coated with the liquid plastic material. The liquid plastic material is recirculated in the trough passageways **42** by means of a pump, illustrated schematically at **44**. The pump **44** supplies the liquid plastic material to a distributing element **46** via a conduit **48**. The liquid plastic liquid material flows through the trough passageways **42** wherein the peripheral surfaces of the plugs are coated. The liquid is received by a liquid-collecting element **50** and returned to the pump **44** via a conduit **52** for reuse within the trough **40**.

The plugs leave the trough **40** and are transferred by any suitable means (not shown) such as manually or by gravity, to a conveyor belt **54** which in turn carries the coated plugs **10** to a heated drying area indicated schematically at **56** wherein the coated plugs are heated at a predetermined temperature for a predetermined period as described in the several examples hereinafter. The conveyor belt **54** carries the plugs past the heated drying area **56** where they are unloaded and packaged in the customary manner.

Referring to FIG. **4**, for a schematic illustration of another example of the application of the plastic material **20** to the plug, there is shown a coating pad **58**, the surface **60** of which consists of a fabric impregnated with liquid plastic material **20**. The surface **60** may be initially impregnated with the liquid plastic material **20** by any suitable means (not shown) such as by painting, rolling or spraying the plastic material thereon. After subsequent use of the pad **58**, the surface **60** is replenished in the same manner.

The plugs are stacked together on top of each other as illustrated in FIG. **4** to form a cylindrically shaped roller unit **62** which is maintained as a unit by means of a clamping device **64**. The clamping device **64** is attached to the opposite ends of the roller unit **62** in such a manner as to provide sufficient clamping force against the stacked plugs to prevent their separation, while permitting the roller unit **62** to rotate about its longitudinal axis. The roller unit **62** is moved back and forth across the impregnated surface **60** by means of the clamping device **64** until the tapered peripheral surfaces of the plugs have been sufficiently coated.

The clamping device **64** may be manually moved across the surface **60** or actuated by suitable machinery (not shown).

After the plugs have been suitably coated with the liquid plastic material **20**, they are placed on the conveyor **54** of FIG. **3** and dried in the heated area **56** in the same manner as hereinbefore described.

The plastic material is comprised preferably of a polyvinylidene chloride powder and the solvent cyclohexanone. However other solvents such as methol-ethyl-ketone and the like may be used with the polyvinylidene chlorine powder.

EXAMPLE I

A plug similar to the types described hereinbefore was coated with a solution of 1 part by weight of polyvinylidene chloride powder and 2 parts by a weight of cyclohexanone. The coated plug was heated at 160° F. for 20 minutes and resulted in a 1 mil, thickness of the plastic coating on the outer peripheral surface of the plug.

EXAMPLE II

A plug was coated with a solution composed of 1 part by weight of the polyvinylidene chloride powder and 1½ parts by weight of cyclohexanone solvent. The coated plug was heated at 160° F. for 20 minutes and resulted in a coated plug having a plastic coating of a thickness of 1½ mils on the peripheral edge surface of the plug.

EXAMPLE III

A plug was rolled through a solution of 1 part by weight of the polyvinylidene chloride powder and 1 part by weight of a cyclohexanone solvent. The coated plug was heated at 160° for 20 minutes, and resulted in a plastic coating of 2-mil thickness on the peripheral surface edge of the plug.

EXAMPLE IV

Each of the prior examples I, II, III was repeated except the coated plug was heated at 350° F. for 10 minutes. In each case the thickness of the resultant plastic coating on the plug was doubled, that is, when the plugs were heated at 350° F. for 10 minutes in example I and 2-mil thickness resulted, in example II a 3-mil thickness resulted and in example III a 4-mil thickness resulted.

EXAMPLE V

A group of plugs coated as described in each of the examples I–IV were heated in an oven at 400° F. for 3 minutes without any deterioration. A temperature of 400° F. is substantially higher than the actual temperatures which such plugs are subjected to in automotive applications.

The resultant plastic which is precoated on the plugs is one that will adhere thereto, is nonsticky and pliable. A range from 1 to 6 mils, with 3 mils being typical, is representative of a sufficient thickness for the plugs so as to achieve the desired amount of sealing in the particular applications in which such plugs may be employed such as hereinbefore described.

Having thus described the invention, what is claimed is as follows:

1. A plug for closing an opening formed in a workpiece comprising a body member having a periphery of a shape which is complementary to that of said opening, and a plastic coating disposed on said periphery for creating a seal between said plug and said opening when said plug is positioned therein, said plastic coating being comprised of a polyvinylidene chloride and a solvent selected from the group consisting of methol-ethyl-ketone and cyclohexanone.

2. A plug for closing an opening formed in a workpiece comprising a body member having a periphery of a shape which is complementary to that of said opening, and a plastic coating disposed on said periphery for creating a seal between said plug and said opening when said plug is positioned therein, wherein said body member is cup-shaped, and has a substantially cylindrical outer periphery which is adapted to be closely fitted within said opening and wherein said plastic coating is plastically deformed for creating a seal between said opening and the outer periphery of said plug.

3. A plug as claimed in claim 2, wherein the outer periphery of said cup-shaped member forms an edge which diverges outwardly from said cup-shaped member to engage said opening.

4. The plug as claimed in claim 2 in which said plastic coating is comprised of a polyvinylidene chloride and a solvent selected from the group consisting of methol-ethyl-ketone and cyclohexanone.

5. A plug for closing an opening formed in a workpiece comprising a body member having a periphery of a shape which is complementary to said opening, and a plastic coating disposed on said plug periphery for creating a seal between said plug and said opening when said plug is positioned therein, wherein said body member is cup-shaped with an edge reversely bent to form an outer peripheral wall, said outer peripheral wall having said plastic coating disposed thereon and said plug being press fitted within said opening wherein said plastic coating formed on said outer peripheral wall is plastically deformed creating a seal between said opening and said outer peripheral wall of said body member.

6. The plug as claimed in claim 5, wherein said reversely bent edge diverges outwardly from said cup-shaped body member to engage said opening.

7. The plug as claimed in claim 5, wherein said plastic coating is comprised of a polyvinylidene chloride and a solvent selected from the group consisting of methol-ethyl-ketone and cyclohexanone.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,635,369 Dated January 18, 1972

Inventor(s) TULL C. LASSWELL ET AL

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

IN THE SPECIFICATION

Column 1, line 11, change "os" to - - of - -

line 15, change "the" to - - The - -

line 29, change "On" to - - One - -

line 52, change "leadage" to - - leakage - -

Column 2, line 70, change "he" to - - the - -

Column 4, line 61, change "examples" to - - EXAMPLES - -

line 65, change "example" (both occurrences) to - - EXAMPLE - -

change "and" to - - a - -

line 66, change "example" to - - EXAMPLE - -

lines 71-72, change "examples" to - - EXAMPLES - -

Signed and sealed this 4th day of July 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents