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HOLLOW STAYBOLT

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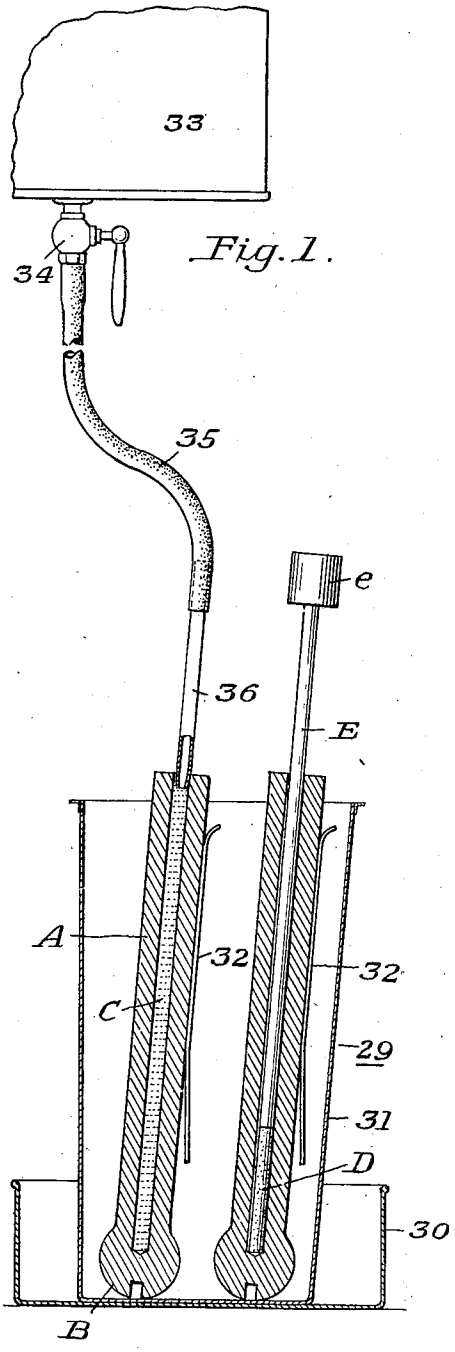
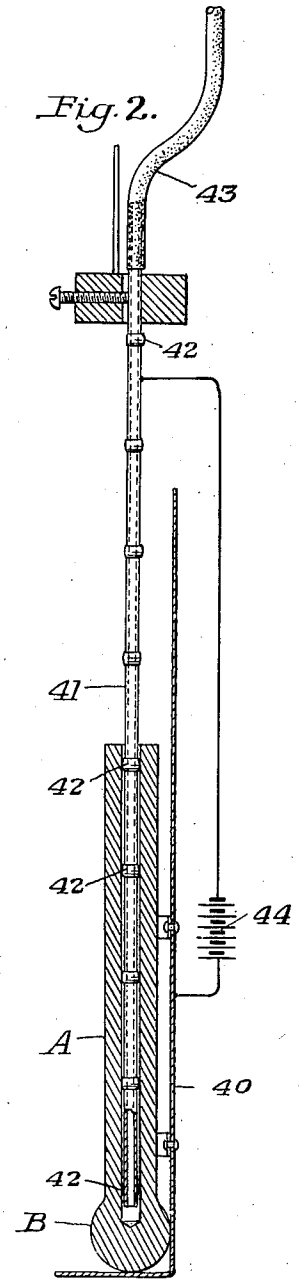


Fig. 1.

Fig. 2.



INVENTOR

Grover R. Greenslade

Frederick K. Landgraf

by their attorneys

Stebbins, Blanke & Parmelee

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HOLLOW STAY BOLT

Grover R. Greenslade, Scott Township, Allegheny County, and Frederick K. Landgraf, Crafton, Pa., assignors to Flannery Bolt Company, Bridgeville, Pa., a corporation of Delaware

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4 Claims. (Cl. 85—1.5)

This invention relates to hollow staybolts. The invention pertains especially to the protection of hollow staybolts having the hollow interior thereof coated with a relatively low melting point metal as for example, lead or terne.

Boiler staybolts are usually made of wrought iron or steel. They are commonly provided with a longitudinally extending opening that passes part way or entirely through the length of the bolt and which is referred to in the trade as a telltale hole. If the bolt becomes cracked or fractured, water will leak from the boiler into the hole where its presence may be noted, possibly during the operation of the boiler or when the boiler is put under hydrostatic test. In the operation of the bolts, rust and scale may form in the holes or various accumulations of foreign materials may become impacted in the holes. Such an accumulation of foreign matter may be sufficient to clog the telltale hole and prevent the leakage of water through a fractured bolt from being indicated during inspection. Therefore it is necessary to test the bolts from time to time to make sure that the holes are open. This is accomplished by an electrical probing instrument that is inserted into the hole.

In order to prevent the formation of rust in the holes it is common practice to copperplate the interior of the bolt by an electroplating process. Bolts are quite long as compared to the diameter and they may be as much as 30'' or more in length while the telltale hole is of a diameter much less than the full diameter of the bolt. The copperplating of the interior of such a long small hole is difficult, and it is not practical to make any adequate inspection to determine how completely the copperplating covers the interior of the hole. It sometimes happens that the copper is not deposited on some portion of the interior of the hole. This is especially true where the wrought iron contains an exposed seam of slag in the wall of the hole.

When copperplating alone is employed and there is some defect in the copperplating, corrosive water entering the telltale hole attacks the iron or steel of the bolt by getting underneath the copperplated layer at the lines of discontinuity caused by the slag seams. The copper is, therefore, undermined in such cases and the corrosion is accelerated by the electrolytic action caused by two dissimilar metals in contact in the presence of an electrolyte. In many cases this degenerative action continues until the telltale hole has filled up with a hard deposit of products of corrosion.

According to the present invention the interior of the holes are hot coated with a low melting point metal as for example, lead or terne coating. The lead or terne coating forms a continuous film over the interior of the hole of the bolt. If the ternecoated bolt then has the interior wall electroplated with copper, the copper film will be continuous. The ternecoating of the interior of the bolt thus assures that any copperplating which is done will be continuous. Even though the copperplating were not continuous, the terne would resist rusting or corrosion of the bolt from the inside out, and even though only the terne coating is used without the copper, the terne or like coating will be more satisfactory than a copperplated coating alone would be for the reason that the terne coating will be continuous and free of defects and because it will prevent leakage where there is a slag seam of the character above referred to.

In the manufacture of staybolts it is frequently the practice to carburize or case harden the heads of the bolts by a cyaniding process requiring of course the heating of the bolts and the immersion of the ends of the bolts in a molten cyanide bath. According to the present invention the coating of the interior of the holes with a metal such as terne is accomplished in conjunction with the cyaniding process. This enables the same equipment to be used that is used in connection with the cyaniding, and the low melting point metal which is used as a coating material is heated and melted while the bolts are being raised to a temperature to be carburized.

The nature of our invention may be more fully understood by reference to the method of producing the bolts. In practice, after they have been drilled and when they are prepared for cyaniding they are filled with a fluxing solution as for example a zinc chloride solution. A piece of solid coating metal as for example a short rod of lead or of terne-forming alloy is dropped into the hole of each bolt. A long rod which is weighted at its upper end is then inserted in the hole to rest on the slug or piece of metal which has previously been charged into the hole and the bolt is placed in a basket along with other bolts which have been similarly treated, and the bolts, particularly the lower ends of them, are heated up in preparation for the cyaniding process. The first heating of the bolts evaporates the flux from the bolts and the slug of coating metal is of course melted. The weighted rod which is of a diameter closely approximating the diameter of the hole in the bolt then serves to displace the molten metal in

the bottom of the hole so that the molten metal is forced upwardly around the rod and spread over the sides of the hole to form a coating. Preferably enough coating metal is used so that a slight excess will flow out the top of the bolt thus assuring the complete formation of a coating over the entire surface of the hole. In order to prevent the coating metal from flowing back into the bottom of the hole the rods are left in place and the bolts are transferred to the cyaniding furnace where the ends of the bolts are immersed in molten cyanide. When the bolts are removed from the cyaniding furnace and before they have had a chance to cool, the operator withdraws the weighted iron rods from the holes in the bolts and plunges the heads of the bolts into a bath of water or cooling fluid. Before quenching the head of the bolt the operator usually inverts it and strikes it against a metal block while so inverted to remove any excess of the terne coating. It is of course important that the weighted rods be withdrawn before the bolts have cooled as otherwise the lead or other metal used for coating the interior of the holes would freeze and solder the rods in the holes. After the holes have thus been coated with a low melting point metal, they may, if desired, be electroplated with copper. Our invention may be more fully understood by reference to the accompanying drawing in which

Figure 1 is a detailed view illustrating the manner of preparing the bolts for coating; and

Figure 2 is a detailed view showing the step of electroplating the interior of the hole which has been previously hot coated with lead or other metal.

A rack **29**, illustrated in Figure 1, is used in preparing the bolts. It comprises an elongated pan **30** of relatively shallow depth and set into this pan is an elongated trough-like structure **31**. Within the trough **31** are longitudinally extending plates or guides **32** which are slightly inclined with reference to a vertical plane, the arrangement being such that the bolts designated A may be stood endwise in rows in the trough **29**, the bolts leaning against the supports **32**.

In the practice of our invention the bolts, after they have been formed, are arranged in rows in the rack **29**. Located above the rack is a reservoir **33** which holds a liquid flux such as a zinc chloride solution. At the bottom of the tank or reservoir **33** is a valved outlet **34** to which is connected a rubber tube **35**, having a nozzle **36** at its free end. When the rack **29** has been filled with bolts, the operator in turn fills the interior of each bolt with solution from the fluxing tank. This solution is designated C in Figure 4. As the bolts are filled with solution, a slug D of coating metal is dropped into each one. The slug is preferably formed from a length of rod or wire of a diameter such that it may easily be dropped into the hole in the bolt. It may be of lead or a lead alloy such as is used in forming terneplate, tin, solder, or any other desired low melting point metal, although the coating metal should of course be one that does not have a melting point lower than the temperature to which the bolt is subjected in operation which, in the case of high pressure boilers may be in excess of 400° F. After the slug has been charged into the bolt, a rod E is set into the open end of the bolt, this rod preferably having a small weight *e* at the upper end thereof, the rod being of a length greater than the depth of the hole in the bolt and of a diameter slightly less than the hole in the bolt so that the rod will easily fit into this hole. When the bolts have been thus prepared they are charged into a carrier (not shown) and the coating of the interiors of the bolts and the carburizing of the heads is proceeded with. The method and apparatus which is preferably used is fully shown and described in our copending application Serial No. 376,600, filed Jan. 30, 1941. Upon being placed in the carrier as above indicated, the bolts are first initially heated. In this initial heating all of the liquid flux in the bolts is evaporated and the bolts are heated to a temperature sufficient to melt the slug of coating metal. As the slugs of coating metal melt, the rods E exert a pressure on the molten metal forcing the molten metal from the bottoms of the bolts up around the rods to thereby coat the holes in the bolts throughout their entire length. The slugs D are preferably cut to a length such that some of the liquid metal will flow out of the top of the bolt when the lowermost end of the rod sinks to the bottom of the hole. The provision of an excess of metal assures of there being an adequate coating formed throughout the entire length of the bolt. After the initial heating has been completed, they are brought up to a normalizing temperature, which in the case of wrought iron, is around 1700° F. Upon being heated to this temperature, the carrier is lowered into a cyanide bath to case harden or carburize the heads B of the bolts. During the cyaniding operation the rods E keep the molten solder spread over the interiors of the holes of the bolts and prevent the solder from running back down into the bottoms of the holes.

After the cyaniding operation has been completed the bolts are kept hot until such time as the operator has an opportunity to remove the rods E. The operator removes the rods E, one at a time, from the bolts. As he removes each bolt he withdraws the rod E therefrom, inverts the bolt manipulating it so as to dump out any excess of the coating metal, preferably striking the bolt when so inverted against a solid metal block in order to assure of the excess metal running out after which he quenches the head of the bolt.

After the bolts have been thus treated, it may be desirable to coppercoat the interior of the holes. The method of copperplating now generally employed for coating the interior of staybolts may be used. According to this method the staybolts are arranged on a rack **40**. In Figure 2 a single staybolt designated A is shown. A hollow plating electrode **41** is entered into the hole in the bolt, the electrode having insulating rings **42** thereon at regularly spaced intervals, the purpose being to hold the electrode centrally positioned in the hole of the bolt. Electrolyte is supplied to the interior of the bolt through a tube **43** at the top of the hollow electrode **41**. One side of a source of plating current indicated at **44** is connected to the rack **40** and the other side of this source of current is connected through a wire to the plating electrode **41**. The electrodes are weighted and they are suspended in such manner that they may be adjusted vertically and also in such manner that they may be moved up and down a slight distance to shift the position of the insulators **42** with respect to the areas being coated, the electroplating mechanism per se forming no part of the present invention. The electrode is adjusted vertically so that while its lowermost end will be close to the bottom of the hole, it will never in fact contact the bottom

of the hole. By electroplating the interior of a bolt which has been previously terneplated or otherwise coated with a low melting point metal, the bolt will have a maximum resistance to corrosion and the interior will have a surface of good electrical properties for the testing of the bolt. Since the ternecoating will completely cover areas to which the electroplating would not adhere and the copper will cover completely the ternecoating, a continuous protective film of copper is assured over the entire interior of the bolt and as heretofore explained, this cannot be secured with assurance where the hot metal coating is not first applied to the interior of the hole.

The metal referred to as ternecoating metal is an alloy of lead and tin in which the lead very greatly predominates. Alloys for terneplating are extensively used in the steel industry and its composition is well known to those skilled in the art. It is of course contemplated that in lieu of a terne-forming alloy, other metals could be used as for example, lead or tin or zinc or various mixtures thereof, bearing in mind that the coating metal should be one which is not melted at the temperature reached inside the boiler. Usually a metal of the class comprising lead, tin and zinc would be employed.

In some cases it may be desirable to first electroplate the bolts and then coat them with the coating metal, and my invention contemplates a bolt made where there is such a reversal of the process, although the present preferred method is to first apply the coating metal and then electroplate until the coating metal will cover those surfaces which may contain seams and which would interfere with the continuity of the layer of electroplated metal if the terne or similar coating were not first provided.

While we have described the preferred method of constructing a bolt embodying our invention, the bolt may be made by other methods than the typical one herein described.

The method and apparatus herein disclosed constitute the subject of our co-pending application Serial No. 376,600 filed January 30, 1941, as a continuation-in-part of the present application and in which the method and apparatus are more fully and completely described and claimed.

While we have illustrated and described certain specific embodiments of our invention, it will be understood that various changes and modifications may be made therein and that different apparatus may be substituted for the apparatus illustrated within the scope of the following claims.

We claim:

1. As a new article of manufacture, a hollow staybolt having the interior thereof hot coated with a non-ferrous metal and having a protective coating electrically deposited over said first coating.

2. As a new article of manufacture, a hollow staybolt having the interior thereof hot coated with a non-ferrous metal to provide a lining over the interior of the bolt, and an electrically deposited film of copper over said first film.

3. As a new article of manufacture, a ferrous staybolt having a telltale hole therein, the hole having a non-ferrous hot-applied metal coating over the walls thereof and having an electrodeposited coating over the walls thereof of a non-ferrous metal different from the hot coating, one of said coatings overlying the other, a portion of the staybolt being carburized.

4. As a new article of manufacture, a staybolt having a carburized head and having a tell-tale hole therein of small diameter, the interior walls of the hole being completely hot coated with a metal of the group comprising lead, zinc and tin forming a continuous corrosive resistant coating.

GROVER R. GREENSLADE.
FREDERICK K. LANDGRAF.