April 11, 1950 E. S. PEARCE ET AL 2,503,593

MEANS FOR DETERMINING AND RECORDING WHETHER OR NOT A RAILWAY AXLE CROWN BEARING HAS BEEN OPERATED AT A PREDETERMINED CRITICAL TEMPERATURE

Filed April 23, 1945

Fig:1.

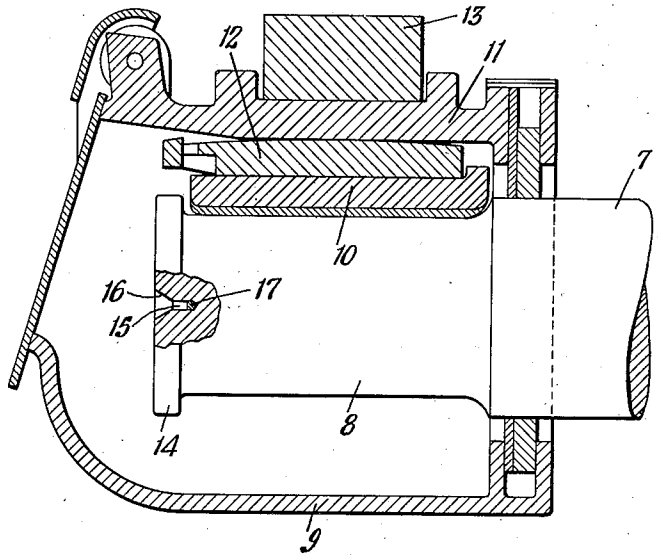

Fig:2.

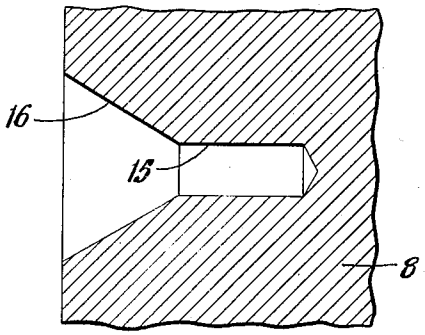

Fig:3.

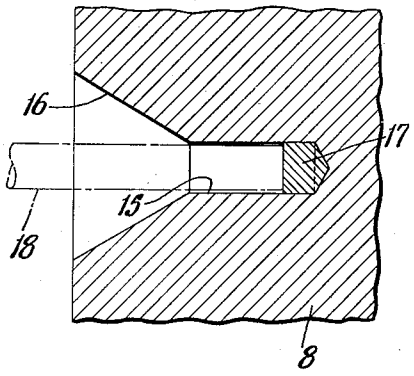

Fig:4.

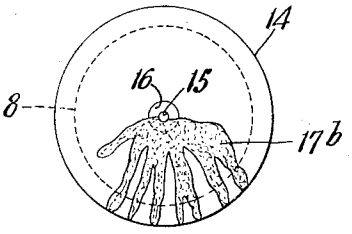

Fig:5.

Fig:6.

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Patented Apr. 11, 1950

2,503,593

UNITED STATES PATENT OFFICE

2,503,593

MEANS FOR DETERMINING AND RECORDING WHETHER OR NOT A RAILWAY AXLE CROWN BEARING HAS BEEN OPERATED AT A PREDETERMINED CRITICAL TEMPERATURE

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Application April 23, 1945, Serial No. 589,838

4 Claims. (Cl. 73—358)

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This invention relates to a method of spotting or predicting potential bearing failures and is particularly applicable to the field of railway vehicle journal bearings of the type in which the load is carried upon a crown bearing mounted in the familiar axle box. Failures in bearings of this type are referred to as "hot boxes" and before proceeding with a description of the nature of our invention we wish to refer briefly to the practices customarily followed by railroad operating departments in their efforts to prevent or at least to minimize the incidence of hot boxes. Regular inspections are made with a view to applying whatever corrective measures may be indicated by the appearance of the box and particularly of the oil soaked packing which is customarily used in lubricating the journals. This, of course, makes it a matter of individual judgment as to whether or not any given bearing or box requires attention and, since the early or preliminary indications of potential trouble are anything but clearcut and definite, many failures result which can be classified as "judgment hot boxes" no matter how careful or conscientious the inspector may have been.

In addition, there are so many causes for hot journals that it is not possible, without prohibitive train delays, to make periodical routine checks of all possible adverse conditions which may give rise to a hot box. In view of this, more frequent and casual rather than thorough and complete inspections are the general rule which naturally results in some measure, at least, of uneconomical or wasted effort since practically all boxes will receive some attention whether they need it or not whereas many boxes which actually require specific and immediate treatment do not receive the required attention because they are not detected.

Of course, not all hot boxes are the result of faulty operating conditions because some of them may occur as purely accidental failures. However, whether or not a hot box results from one or a combination of causes, the effect of such causes is finally reflected in the temperature of the journal so that, aside from accidental failures, bearings that run hot on the road after a period of satisfactory service do so after one or more previous periods of operation above a normal or average operating temperature. We have found that once a bearing has operated above such critical temperature, although it may run, apparently, quite normally for a considerable period of time thereafter, some damage has been done to the bearing surface so that it becomes

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a potential failure. Routine inspection cannot possibly gauge the temperatures that have prevailed in a bearing during operation of the train and without actual removal of the bearing and careful inspection thereof no indication of trouble will be apparent.

With the foregoing in mind it can be stated that the principal object of our invention is to provide a means for positively and visually predicting or determining potential bearing failure so that remedial action can be taken before a hot box actually occurs. Concomitantly it is an object of our invention to avoid the time and expense involved in unnecessary servicing operations. The attainment of these objectives naturally results in fewer hot boxes en route with a corresponding reduction in set-outs, cut and burned-off journals, as well as in wheel and bearing replacements.

Among the more specific objects of the invention are the provision of a means for predicting bearing failures which require absolutely no modifications or additions to existing equipment and which can be adopted with a minimum of expense and maintenance routine.

A still further object is to eliminate certain customary routine inspection at terminals for temperature of boxes and the manual marking of the same for later attention by packers in the repair yards, and to substitute therefor a system in which each journal requiring attention will have marked itself, as it were. Except for such self-marked journals this reduces or even completely eliminates routine free oiling, setting up the packing and/or tooling the packing which are now generally customary where anything like careful operating procedure or technique is pursued.

The invention also gives rise to the possibility of discontinuing routine servicing practices which are found to be ineffective in reducing the number of marked journals. In other words, it makes it possible to continue in effect only those routine maintenance practices which are found to be effective under any given set of operating conditions.

Stated still more specifically, it is an object of our invention to provide a material which can be applied or secured to the axle or to a closely associated part in the region of the bearing in a position to be affected by the temperature of operation, which material will maintain its integrity and position at temperatures below a predetermined critical maximum but which, at temperatures above said maximum, will lose its in-

tegrity and leave a permanent visual indication of the fact that said critical temperature has been exceeded. As a preferred embodiment, it is also an object of the invention to provide a plug of wax which is adapted to be inserted in the centering hole of the axle, the material of which plug will maintain its integrity and position in the centering hole at temperatures below a predetermined maximum but which will liquefy and run out of the hole at temperatures above such maximum and thus leave a visual indication thereof on the end of the axle, which indication will remain indefinitely and, therefore, does not require that it be observed at the moment of its occurrence.

Another object is to provide a plug of wax having sufficient plasticity at ordinary temperatures to permit of its being pressure fitted to the contour of the hole in which it is placed while at the same time providing for a relatively sharply defined melting point.

Another object is to provide an indicator of the character just described by means of which a series of marks can be placed upon the axle which are indicative of a series of gradually increasing temperatures in the approach to the critical or final temperature so that the inspector may know the degree of urgency with which the box requires attention.

In the following description of the invention reference may be had to the accompanying drawing wherein—

Figure 1 is a vertical longitudinal section through a car journal axle box of the customary type showing the manner in which our invention is applied thereto;

Figure 2 is an enlarged partial longitudinal section through the end of an axle showing more clearly the centering hole with which we prefer to associate our invention;

Figure 3 is a section similar to that of Figure 2 but illustrating the specific manner in which we prefer to apply our invention;

Figure 4 is an end elevation of an axle to which our invention has been applied illustrating the way in which the axle is marked when a potentially dangerous bearing temperature has been reached;

Figure 5 is a side or edge view of a preferred form of wax plug which is used in connection with our invention; and

Figure 6 is a face or front elevational view of the plug of Figure 5.

In the drawings we have illustrated one end of a railway vehicle axle 7 having the customary journal 8 which projects into the usual axle or journal box 9. Resting on top of the journal is the usual crown-type journal bearing 10 between the upper surface of which and the top of the box 11, is located the familiar wedge 12. The load of the vehicle is transmitted through the truck structure 13 to the top of the box and from thence to the top of the wedge and then the bearing 10 which rests upon the journal 8. The wheel of the axle, of course, is located to the inside of the box in a manner familiar to those skilled in the art but not herein illustrated because it forms no part of the present invention.

At the outer end of the journal is the customary collar 14 and in the center of the end of the axle is formed the usual centering hole 15 having the flaring entrance portion 16.

The structure so far described is all familiar to the art and our invention makes no change whatsoever in any of these parts.

In a preferred manner of realizing our invention we place in the centering hole a plug of material which is adapted to retain its form and integrity at temperatures below a predetermined critical maximum but which will react to temperatures above said maximum in such a way as to mark the end of the axle and thereby afford a visual indication of the fact that such critical temperature has been reached or exceeded. This plug of material is indicated at 17 in Figures 1 and 3.

By preference we employ a wax, as will be more fully described below, which wax has sufficient plasticity at ordinary temperatures to permit of its being pressure molded or fitted to the contour of the centering hole but which has a relatively sharply defined melting point with a viscosity when melted which is sufficiently low to permit the wax to flow out of the hole and over the end of the axle. The wax should also have the ability to adhere to the end of the axle so as to mark the same and thus visually indicate the fact that the critical temperature has been reached or exceeded.

Of course other materials than wax might be employed to accomplish the same purpose but in order to realize the advantages of our invention to the fullest possible extent, any material which may be adopted should, preferably, possess the following characteristics:

1. A relatively definite and constant melting temperature.
2. A relatively narrow and sharply defined temperature range between its solid condition on the one hand and its liquid condition on the other hand.
3. A relatively low viscosity at the melting temperature.
4. Good adhesive properties.
5. A relatively high degree of plasticity over a wide range of ordinary temperatures, such as may be encountered under customary operating conditions.
6. Ready conformability to off-size or odd-sized diameter holes.
7. High visibility on the end of the journal or closely associated part.
8. Easy removability after serving its function.

As previously indicated the material which we prefer to use is a wax but before describing in detail the nature of this wax we wish to refer to the temperature which we have found to be critical in the matter of bearing operation. After much experimental work we have determined that a temperature in the neighborhood of 260° F. is the critical temperature which, if attained or exceeded during operation of the journal, will almost certainly lead to future trouble or the development of a hot box even though the bearing apparently is in perfectly satisfactory condition and may even run for a considerable period of time after such temperature has been reached without causing any trouble whatsoever. For example, if, in operation of a car, this temperature is attained and then subsequently the temperature drops below this point no immediate trouble may develop. However, once having attained this critical temperature, the bearing is far more liable to again attain it and each time that it is reached the potentiality of failure becomes more and more imminent until suddenly a hot box will develop. In other words the attainment of such critical temperature is sufficient to predict almost without fail that the box in

which it occurred will give trouble at a relatively early date.

We have found that a wax which will melt in the region of this critical temperature, while at the same time affording the characteristics above enumerated, can be prepared by blending a mixture of approximately 75% polychlornaphthalene and 25% Pentawax No. 286. The latter is an ester of a pentaerythritol-type alcohol with a softening point of about 120° C. as described on page 335 of the "Hand Book of Material Trade Names" by Doctors Zimmerman and Lavine. Such a blend of waxes has a relatively sharp melting point at approximately 260° F. with good plasticity over a wide range of ordinary temperatures, extremely low viscosity at the melting point and unusually high adhesive properties. The polychlornaphthalene (chlorinated naphthalene) of this mixture has a constant melting point of approximately 275° F. and a very narrow range between the solidus and liquidus temperatures as well as a very low viscosity at the melting point. However, this material by itself does not have sufficient plasticity at ordinary temperatures but has a tendency to crumble when worked so that it cannot be applied to the axle without breaking up into small particles.

On the other hand the Pentawax No. 286 has excellent plasticity and a melting point which lies between approximately 239° F. and 243° F. However, it softens very considerably at relatively low temperatures and has a viscous flow far below the melting point and a rather high viscosity above the melting point. This lack of sharp definition between the liquidus and solidus temperatures precludes its use individually for the intended purpose.

However, as stated, we have found that a blend of these two, or what might be termed an alloy of the waxes, if this expression can be used, will yield all of the requirements which are demanded for the fullest realization of our invention and in manufacturing the material which we employ we adopt the following procedure.

The waxes in their proper proportions are melted and then blended by suitable agitation. The blending temperature is slightly higher than the highest melting temperature. After blending, the material is cast in a multiple mold into strips ¼ x ½ x 11⅝" long. After cooling, the strips are placed in an especially designed machine and mechanically sheared and formed into individual corrugated plugs, *17a*, as shown in Figures 5 and 6. These plugs have a diameter over all of .4025" and a root diameter of .2550" and a length or thickness of .2550". The reason for the corrugated surface is to provide a means for allowing the air to escape from the journal centering hole during application of the plug.

Although any suitable tool may be employed for applying the plugs, we prefer a special tool which is indicated in dot and dash lines at *18* in Figure 3, the details of which, however, are omitted from the present application. The outside diameter of the plug is greater than the diameter of the centering hole and the tool is used to force the plug into the hole. The plasticity of the material causes the corrugations on the plug to completely disappear when the plug is properly compressed into its place in the journal's center. At the same time, however, during the operation of applying the plug, the air in the hole can escape through the channels formed by the corrugations. It will be understood, of course, that some other irregularity in the outer surface of the plug can be adopted for allowing the air to escape although we prefer the corrugations indicated in the drawing.

A plug of the material which we have just described will retain its position and integrity in the hole at all temperatures below the critical temperature so that it will remain visibly unaffected at such low temperatures but after the critical temperature has been reached or exceeded it will lose its integrity by melting and running out over the end of the axle and since it adheres well to the metal of the axle it will serve to permanently mark the axle so that, at any regular inspection of the box, the potentially dangerous condition of the bearing will immediately be noticed so that remedial measures can be taken before the train is again permitted to move. In Figure 4 we have illustrated the manner in which the material runs out over the end of the axle marking it in irregular streaks *17b*.

While we prefer to associate our invention with the centering hole of an axle, yet its principles can be employed by applying the indicator to some bearing part which is closely associated with the bearing itself so that it can be affected by the temperature of operation. For example, the indicator might be applied directly to the bearing or even to the superimposed wedge instead of to the axle as in the practice which we prefer. Of course, under such circumstances it might be necessary to vary slightly the temperature at which the indicator will melt due to the fact that the critical temperature in such other parts may not be exactly the same as the temperature in the centering hole of the axle.

As a modification or extension of the usefulness of our invention we wish to call attention to the fact that the wax may carry a suitable pigment or other coloring medium which will serve to accent the visual marking. In this connection also it is possible to use pigments of various colors and to employ a series of plugs which will melt at different temperatures. The plug with the highest melting point and its respective color would, of course, go into the bottom of the centering hole. This would be followed by a series of plugs of different colors with decreasing melting points with the lowest melting point the last in the hole or the one nearest the opening. In this way as the temperature rises there would be a series of warnings indicated by the presence of the respective colors on the end of the axle. By this means the inspector could be appraised of the degree of seriousness of the potentially dangerous condition existing in the bearing.

In conclusion we wish to point out that our invention is not a hot box signal in the ordinary sense that that term has been used in the art. We are aware that many devices have been suggested for signalling the existence of a hot box. This is not what our invention accomplishes. Our invention actually predicts the possibility of a hot box sufficiently far in advance so that measures can be taken to prevent its occurrence. With our invention the journal is marked and the marking is permanent until intentionally removed. Furthermore, it is not necessary to rely on the immediate presence of some person as is the case with all of the hot box signalling devices with which we are familiar. It frequently happens that such signalling devices go off and their signal is not noticed because no one happens to be avail-

able or in a position to notice it. With our invention the potential trouble is detected at any regular inspection point and remedial measures taken. This results in taking hot boxes off the road where they cause train delays and even more serious consequences such as dangerous breakages and even wrecks and putting them in the terminals where they are adequate and permanent facilities for servicing and correcting the trouble.

We claim:

1. As a new article of manufacture, an indicator for recording the attainment of a predetermined temperature in a railway axle bearing, being a plug of material adapted to be inserted in the axle centering hole, said plug being formed to provide a channel for escape of air from the hole, the material from which the plug is made having sufficient plasticity at ordinary temperatures to permit of its being forced into the hole and conformed to the contour thereof and also having a relatively sharply defined melting point with a viscosity sufficiently low to permit the material to flow out of the hole and leave a visible mark on the end of the axle when said temperature is reached.

2. The article of claim 1 wherein the material

of the plug is a mixture of polychlornaphthalene and Pentawax No. 286.

3. The article of claim 2 wherein the mixture consists of approximately 75% polychlornaphthalene and 25% Pentawax No. 286.

4. The article of claim 1 wherein the channel for the escape of air is a groove in the wall of the plug.

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