July 16, 1929. V. BENDIX 1,720,815

BRAKE DRUM

Filed May 2, 1928

FIG. 1.

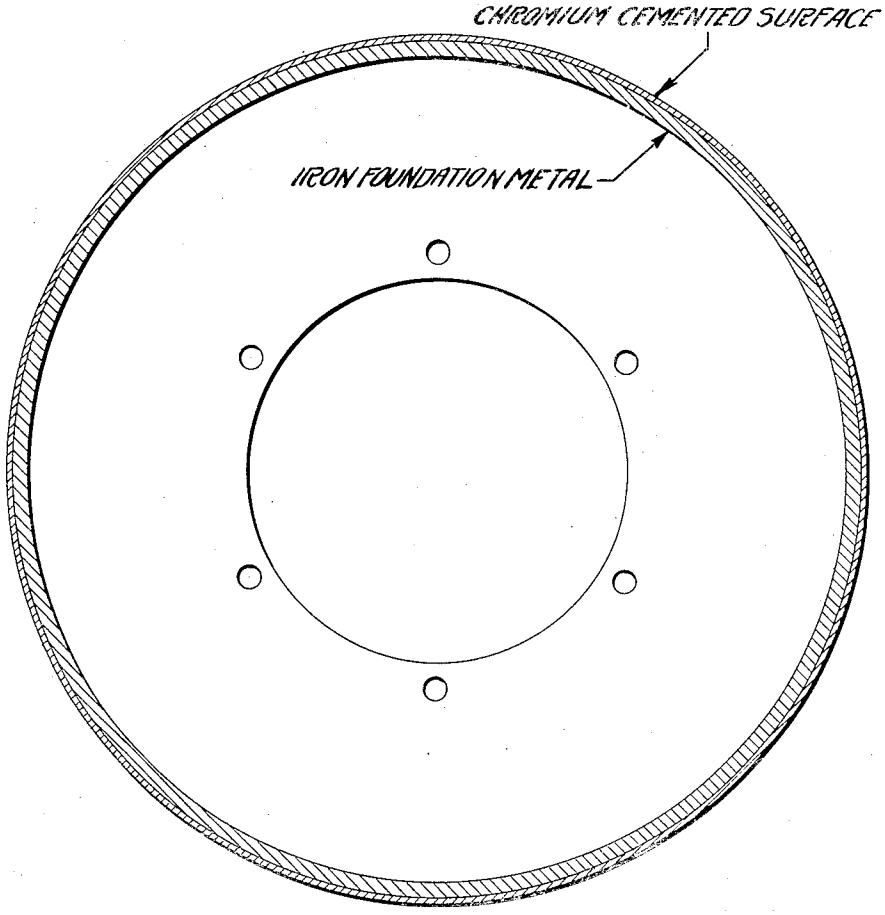


FIG. 2.

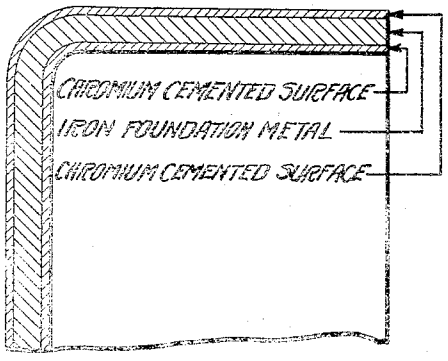
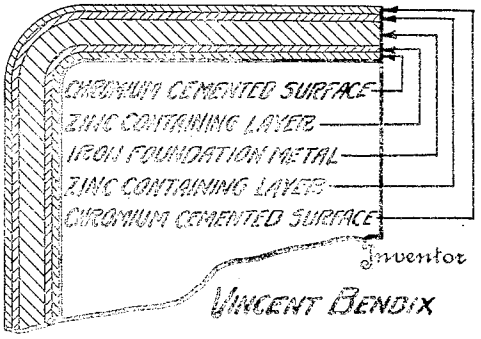


FIG. 3.



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BRAKE DRUM.

Application filed May 2, 1928. Serial No. 274,677.

This invention relates to improvements in automotive structures and more particularly to brake drums.

In the past, brake drums have been made of corrodible material such as irons and steels. As the ferruginous base metal corrodes, not only does it become unsightly, but it also becomes seriously weakened by reason of the fact that the iron of relatively high tensile strength is replaced by a deposit of iron oxide which possesses substantially no strength. This corrosion or oxidation is accelerated during use because of the fact that the temperature of the drum is raised by the generated frictional heats. Upon continued use of a brake drum it is found that it tends to distort and loses its initial circular shape. This materially lowers the braking efficiency. The corrosion of the drum, as will be appreciated, lowers the strength and hence accentuates this distortion.

It is a major object of this invention to provide a structural material particularly well adapted to the manufacture of brake drums which is of a low corrodibility and of a desirable high tensile strength.

Another object of this invention is to provide a brake drum of high strength, low corrodibility and hardness.

Another object is to provide a novel composite brake structure of a ferruginous material and another metal.

A further object is to provide a brake drum of a ferruginous base metal with which are combined certain other metals which increase the strength and lower the corrosion.

The availability, ease of manufacture, and machining, and the relative cheapness of steel, recommends its use in brake drum structures. Ordinary steel, however, is relatively easily corroded. When used in brake drums it is subjected to constant wettings and corrosion sets in. This, as is known, consists of oxidation of the iron and, as has been pointed out, is accelerated by the frictional heats. This corrosion is practically cumulative; in fact the iron which is formed not only does not provide a protective coating but accelerates subsequent corrosion or oxidation of the underlying body. As intimated hereinbefore this corrosion results in a weakened and unsightly structure.

This disadvantage may be largely cured by manufacturing a drum from chromium, vanadium, zirconium, or other alloy steels. These materials not only are characterized by extremely low corrodibility but are also of high tensile strength. As is known the particular characteristics of these structural metals may be greatly modified by heat treatment. While these materials do present major advantages they are considerably more expensive than the ordinary steel employed.

According to the purpose of this invention, a brake drum may be produced which presents all of the advantages of the alloy steels and in addition have a desirable luster.

The invention comprehends the concept of plating or cementing on a ferruginous base a protective metal in such a manner as to improve the strength and appearance of the drum and to minimize corrosion of the underlying metal.

The invention is illustrated diagrammatically in the accompanying drawing in which:

Fig. 1 is a longtudinal secton of a brake drum embodying the invention.

Fig. 2 is an enlarged detail view of a brake drum having interior and exterior surfaces.

Fig. 3 is an enlarged detail of a further modification.

The advantages of the invention may be secured by electrodepositing a chromium coating on a ferruginous drum. Preferably the drum is first stamped out or cast to the desired shape. In carrying out the process the base metal object, such as a steel stamping, is made smooth and clean. This may be done by any of the established methods, such as buffing pickling to remove oxides, immersion in suitable solvents such as benzine to remove the grease, or electrolytic cleaning. If desired the base metal may also be degasified before being subjected to the plating operation.

The base metal may be immersed in any of the usual electrolytic baths. These contain trivalent and hexavalent chromium, to-

gether with a suitable acid such as boric, phosphoric and hydrofluoric acids.

The actual conditions of the plating operation such as the composition, concentration and temperature of the electrolyte, current density and shape of the anode may be varied. Because of the relatively poor throwing power of chromium solutions, it is preferable to shape the insoluble anode to conform to the general shape of the cathode. For the present purpose it is highly desirable to secure a " hard file " coat, since the higher hardness, wear and abrasion resistance of this type of coat are desiderata in brake drum construction.

The importance of the current density in its relation to the crystalline character and adherence of the coat and the depletion of the anodic solution is now well established. This may vary approximately from 4 or 5 to 20 amperes per sq. decimeter of cathode depending on the results desired and the chosen value of the other governing factors. The plating operation is continued at the given temperature until the deposit is built up to the desired thickness, which may range from about .25 to .5 mils.

Chromium has been utilized as a plate on a number of different metal bases. A value of this material resides in the fact that it serves as a protective coating for the base metal and not only does not readily tarnish but maintains a high luster over a considerable period of time. It is a fact, however, that chromium plated articles are susceptible to a certain type of corrosion. As a general rule the coatings employed are very thin. These coatings, like coatings of nickel, contain small perforations which may permit the penetration or permeation of moisture to the underlying ferruginous metal. This iron in contact with moisture and oxygen oxidizes or corrodes. While the chromium layer itself is unattacked it may be detached by the rusting of the iron underneath. This disadvantage may be obviated by increasing the thickness of the coat so as to obtain a continuous and unperforated coated surface. Because of the relatively high cost of chromium, however, the deposit is made as thin as is practical.

It will be appreciated that the plating may be limited to the exterior surface of the drum; to the exterior surface and the interior surface of the braking flange, or it may be extended over the entire inner and outer surfaces. A drum having a chromium exterior surface and a plated interior braking flange provides a member which is of desirable low corrodibility and one which is highly resistant to abrasive wear. These interior and exterior chromium platings materially strengthen the drum structure and hence minimize drum distortion.

It will be understood that while the improved drum has been described as comprising a chromium plated member, the novel article may be produced by other specific methods. Thus, in lieu of utilizing an electro deposited plate the article may be produced by a chromizing process. In such a method the member to be coated is first thoroughly cleaned and then packed in a container with a suitable chromizing mixture, such for example as fifty-five parts of chromium powder and forty-five parts of alumina. The container is then heated in vacuo or in an atmosphere of an inert gas such as hydrogen. It is important that no free oxygen or water vapor be present, since at the high temperatures employed the chromium powder would quickly be rendered inactive by the formation of a protective film of oxide. It should be remembered that in treating high carbon steel it is necessary first to decarburize the surface which is to be chromized.

The described treatment may be continued for about four hours in the neighborhood of about 1350° C. During this period the chromium alloys with the iron in such a manner as to cement the coating metal to the base metal. The resulting chromized iron will resist corrosion as well as sherardized iron, and in addition possesses superior tensile and torsional strengths.

Similarly the major principles of the invention may be effectuated by utilizing a cast drum structure. In this case the face of the mold may be covered with a paste comprising powdered ferro-chromium and a suitable binder, as for example sodium silicate. When the molten metal is poured into the mold it alloys to a considerable extent with the chromium facing. In each of the above described methods the chromium, as an outer metal layer, is firmly cemented to the ferruginous base member.

The advantages of the low cost of a thin coating of chromium, or similar relatively non-oxidizable metals, may be combined with the highly protective features of a thick coating of these metals. One preferred method of accomplishing this as shown in Fig. 3 will serve to indicate the underlying principles of the invention. These advantages may be achieved by treating a brake drum, or the material from which a brake drum is to be made, with metallic zinc so as to form a coating of zinc over the outer or exposed surface of the drum. It will be understood, of course, that, if desired, the interior surface of the drum may be similarly treated or the treatment localized to any desired area. To cement the zinc and the iron, the iron plate may be galvanized or sherardized in the well known manner.

In the electrochemical series zinc is given as electropositive to iron. This is tanta-

mount to saying that it has a greater solution pressure or tendency to dissolve. Therefore when it is in contact with moisture the zinc becomes the dissolving electrode and the iron the electrode on which deposits are formed. As a result the zinc not only mechanically protects the iron, that is to say forms a protective coating thereover, but it also provides chemical protection.

The sherardizing or metallic cementation, as has been indicated, may be carried out according to any accepted practice. These methods in general consist in cleaning the metal to be treated and then packing it in zinc dust within an air-tight metal drum. The container is then heated and tumbled. As a general rule "blue dust" or mixtures of blue dust and zinc oxide are employed. These processes are generally carried out at temperatures ranging from about 350° to 375° C., the temperatures employed being dependent upon the desired iron content of the alloy and the composition of the zinc dust. For the present use it is preferable that the treatment be continued for a sufficient period of time so as to insure a substantial quantity of zinc in the outer coating after diffusion has taken place. The resulting structure then comprises a composite metallic member made up of iron and a zinc iron alloy, the outer surface of which has a large percentage of zinc. During continued use, particularly at high temperatures, the zinc tends to diffuse through the iron and decreases the concentration of zinc in the outer layer. Since the zinc iron alloy, like the zinc, is anodic to iron, it is necessary only to carry out the process sufficiently long to insure a zinc content which will adequately protect the iron.

After the ferruginous material has been treated with the zinc so as to form a coating or skin of a zinc alloy, the surface may then be plated with the desired metal of low corrodibility, in the present instance with chromium. This is carried out by the electrodeposition method.

It will be observed from the description hereinbefore given that the deposited film or deposit of chromium may be very thin and that no great care need be exercised to prevent perforations. If performations do occur they will have no deleterious effect since, as has been pointed out, the zinc provides electrochemical protection for the iron. If the moisture has access to the zinc coating this may tarnish slightly, but its unsightliness is in no way comparable to that of iron oxide.

The metal zinc has been described as merely indicative of a number of specific materials which may be used. As has been explained, the protective features of zinc depend in part on its electrochemical characteristics; thus in place of zinc, the iron may be coated with any suitable substance which is electro positive to it and upon which may be formed an adherent coating of the plating metal. Similarly in lieu of chromium, one may employ other metals such as nickel and cadmium which are depositable as lustrous and non-oxidizing films.

While I have described several embodiments of the invention, it is to be understood that these are given purely by way of example, for since the underlying features may be incorporated in other specific structures, I do not intend to be limited to those described except as such limitations are clearly imposed by the appended claims.

I claim:

1. A brake drum comprising a ferruginous foundation metal having a cemented coating containing a metal of lower corrodibility than the foundation metal.

2. A brake drum comprising a foundation metal at least one integral surface of which comprises an alloy of the foundation metal.

3. A brake drum comprising a ferruginous foundation metal at least one integral surface of which comprises an alloy of the foundation metal.

4. A brake drum comprising a foundation metal having cemented to at least one surface a metal composition of lower corrodibility than the foundation metal.

5. A brake drum comprising a foundation metal, the exterior surface of which comprises an alloy of the foundation metal.

6. A brake drum comprising a plurality of cemented metals of differential corrosion characteristics.

7. A brake drum comprising a foundation metal and a braking flange portion of a harder metal cemented to the foundation metal.

8. A brake drum comprising a ferruginous foundation metal the exterior surface of which comprises a metallic substance of lower corrodibility than the foundation metal.

9. A brake drum comprising a foundation metal and a surface therefor, comprising a different metallic substance cemented to the foundation metal.

10. A brake drum comprising a foundation metal and an integral braking flange portion of a harder metallic substance.

11. A brake drum comprising a foundation metal and a cemented second metal of greater wear resistance than the foundation metal.

12. A composite brake drum comprising a ferruginous foundation metal and a non-ferrous surface thereon.

13. A composite brake drum structure comprising a ferruginous foundation metal and a brake flange surface of a harder metallic substance cemented thereon.

14. A composite brake drum structure comprising a ferruginous member surfaced with a non-ferrous metal.

15. A brake drum comprising a ferruginous base having a surface of chromium plated thereon.

16. A brake drum comprising a ferruginous base having chromium incorporated therein adjacent the surface.

17. A brake durm comprising a ferruginous base and an integral braking flange of a chromium containing material.

18. A brake drum comprising ferruginous foundation metal having its exterior surface plated with a relatively nonoxidizable metal.

In testimony whereof, I have hereunto signed my name.

VINCENT BENDIX.