United States Patent Office 3,398,443
Patented Aug. 27, 1968

3,398,443

METHOD OF MANUFACTURING AN ASSEMBLY OF FRICTION ELEMENTS

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No Drawing. Filed Oct. 4, 1965, Ser. No. 492,863
Claims priority, application France, Apr. 12, 1965, 12,868
5 Claims. (Cl. 29—149.5)

ABSTRACT OF THE DISCLOSURE

A steel element having a layer of iron carbide and iron nitride over a layer for diffusing nitrogen into the steel and a cuprous metal element having a layer containing sulfur and nitrogen are movable relative to each other. At least one of said elements is provided with a plurality of flutings inclined to the direction of relative movement between the elements.

This application relates to improvements to my copending application Ser. No. 350,080, filed Mar. 6, 1964, now abandoned.

The copending application relates to a metallic friction unit for machines which comprises a steel member and a cuprous-metal member which slide over or rotate within each other.

The surface friction area of the steel member is nitrided and that of the cuprous-metal member contains sulphur and nitrogen introduced by a thermal treatment utilizing a salt bath or a gaseous medium. The copending application referred to also includes in its scope metallic units of this type treated by different nitridation and sulphur and nitrogen introduction methods, as well as units in which the cuprous metal is bronze.

The invention according to the copending application also comprises the surface treatment for obtaining said layer, this treatment resulting from the association of two operations already known per se which consist in applying to the friction zone of the steel element a mild nitriding known under the trade name of "Tenifer" in France or "Tufftride" in Anglo-Saxon countries, and the other element, which is a cuprous alloy, a process causing the diffusion of sulphur and nitrogen into said surface zone, this last-named method being known in France under the trade name of "Sulfinuz."

To simplify the disclosure the verbs "tufftridize" and sulfinuze" are used throughout same for designating the application of the first and second process respectively, but it is obvious that these terms cover all similar or identical salt-bath or gaseous-medium processes capable of forming surface layers having structures and compositions similar or identical with those obtained by applying the "Tenifer" or "Tufftride" and "Sulfinuz" processes mentioned in the preceding paragraph.

The active surface zone of the other friction element consists of an outer layer comprising iron carbide and iron nitride covering a layer for diffusing the nitrogen into the steel these layers being obtained by tufftridizing the steel element. The latter may be tufftridized for example by immersion during a predetermined time period sufficient for building up said layers in a salt bath heated at a temperature ranging from 550° to 580° C. and containing from about 32 to 40% of potassium cyanate and

from about 50 to 55% of potassium cyanide, the bath being stirred by blowing air through it.

The active surface zone of the other friction element of cuprous alloy contains sulphur and nitrogen which are introduced by diffusion by sulfinuzing the element. This sulfinuzing step may be carried out, for example, by preheating the part at about 300° to 350° C. and subsequently immersing same during 1 to 6 hours in a salt bath kept at a temperature of about 570° C. and consisting of an inert base such as alkaline and alkaline-earth chlorides and carbonates permitting the reduction of the melting point to a value below 500° C., of sulphured compounds having a preponderant action and of buffer cyanides or cyanates protecting the sulphured compounds by maintaining the bath in a reducing medium.

According to the present invention, the resistance to wear of said unit is substantially increased by a knurling or peening of the rubbing area of at least one of the two members. This knurling or peening must be carried out so as to obtain flutings which are heavily inclined to the direction of sliding or rotation.

By way of a non-limitative example of the improvement according to the present invention, a ring with an inner diameter of 40 mm. and a length of 50 mm., made of a copper alloy containing about 88% of copper and 12% of tin, was first knurled internally with knurls which were inclined at about 60° to the direction of the designed motion, appproximately 0.1 mm. deep and approximately 1.5 mm. apart, after which the ring was sulfinuzed. The non-alloy steel shaft of category XC 32 f (as per French Standard NP A 02–001) was knurled or peened in the same way, then treated in a "Tenifer" bath of nitriding cyanide-cyanate salts at 570° C.

This shaft was fitted through the ring with a clearance of 0.1 mm. and proved capable of oscillating in water without any lubricant for three hundred hours without appreciable wear. The frequency of the oscillations was one cycle per second and their amplitude was one hundred degrees. The load exerted by the shaft in the ring was approximately 15,000 Newtons and the coefficient of friction was 0.22.

I claim:

1. In a method of manufacturing a friction-metal assembly having a steel element and a cuprous metal element movable relative to each other in surface contact, comprising the steps of forming on the surface contact area of at least one of said members a plurality of flutings which are inclined to the direction of relative movement, immersing said steel element in a first salt bath heated at a temperature ranging from 550° to 580° C., and blowing air through said bath to stir it, said bath comprising approximately 32 to 40% potassium cyanate and approximately 50 to 55% of potassium cyanide, thus forming a layer of iron carbide and iron nitride covering another layer for diffusing nitrogen into the steel, and forming a layer containing sulphur and nitrogen on said cuprous metal element comprising preheating said cuprous metal element to a temperature of approximately 300° to 350° C., and subsequently immersing said metal element in a second salt bath at a temperature of approximately 570° C., said bath comprising alkaline and alkaline-earth chlorides and carbonates, and sulphur compounds, and assembling said steel and said cuprous metal element in frictional engagement whereby the resistance to wear of each element is substantially increased as they slide or rotate over one another.

2. The method according to claim 1, wherein said

alkaline and alkaline-earth chlorides and carbonates are present in amounts sufficient to maintain reducing medium in said second bath.

3. The method according to claim 1, wherein said flutings are formed by the step of knurling.

4. The method according to claim 1, wherein said flutings are formed by the step of peening.

5. The method according to claim 1, wherein flutings are formed in said cuprous metal element.

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