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FRICTION ELEMENTS ESPECIALLY RESISTANT TO WEAR BY ABRASION

Jacques Jean Caubet, Saint-Etienne, France, assignor to Automobiles M. Berliet, Lyon, Rhone, and Hydromecanique et Frottement, Saint-Etienne, Loire, France

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ABSTRACT OF THE DISCLOSURE

A method is described for producing frictionally engaging metallic parts in which one of the members is cold-hardened such that striations are produced perpendicular to the friction direction and the member is then subjected to a case hardening treatment. The second member is produced by rolling a metal sheet submitted to laminating such that the member has a superficial hardness superior to about Vickers at a load of 50 g. and at a depth of about 0.005 mm. some suitable metals are austenitic stainless steels, Hadfield steels, titanium and titanium alloys. The case may consist of any of the group of nitrogen, carbon, sulphur, selenium, and tellurium.

The invention relates to methods for producing friction elements especially resistant to wear by abrasion.

Reference is made to my U.S. Pat. No. 3,321,338 granted on May 23, 1967.

Said patent discloses a method for producing metallic parts in rubbing frictional contact and having a high resistance to seizure and to wear by friction with no or doubtful lubrication, wherein the parts are made from a metallic material chosen from the group of metals capable of hardening by cold-hammering while exhibiting in its superficial crystalline structure a high density of planes of shear, and consisting of austenitic stainless steels, hypereutectoid alloy steels containing at least 11% by weight of manganese, titanium and titanium alloys containing a major part of titanium, are subjected to a deep cold-hardening executed in such manner that it produces, on the surface of the part, striations substantially perpendicular to the direction of the friction. Following this hardening the part is subjected to the superficial incorporation of at least one element chosen from the group of the metalloids and transition metals, which metalloids and transition metals possess one of the two properties consisting firstly in the capacity of depositing at the surface of the parts an ionic compound by reaction with the underlying metal, and secondly of the capacity of inserting its atoms into the structure of the underlying metal while forming a solid insertion solution. The metalloid group consists of nitrogen, carbon and sulphur and the transition metal group of selenium and tellurium. The superficial incorporation is obtained by maintaining a contact during a period comprised between 1 and 6 hours at a temperature from 400 to 590° C. between said part and a fluid such as a salt bath or a gaseous atmosphere, which contains the element to be incorporated.

As pointed out in my above mentioned prior patent, said deep cold-hardening may be effected by hammering with a striated hammer or by knurling.

As pointed further out in said patent, in the case where the element is sulphur, the parts may be subjected to a thermal treatment of at least two hours in a sulphurizing bath or a sulphurizing atmosphere at a temperature higher than 500° C.

A treatment of this kind can for example be applied by means of a process known in France under the commercial name of "Sulfinuz." However, all the identical or similar processes using salt baths or a gaseous medium producing superficial structure layers of compositions similar or identical with those which are obtained by the "Sulfinuz" process may be employed.

In the case of the "Sulfinuz" process, the parts are preheated to about 300 to 350° C. and are then immersed for a period of 2 to 6 hours in a salt bath maintained at an approximate temperature of 570° C. and are composed of an inactive base such as the alkali and alkaline-earth chlorides and carbonates, permitting a melting point to be obtained of less than 500° C. of sulphur compounds, the action of which is preponderant and buffer cyanides or cyanates which protect the sulphur compounds by keeping the bath in a reducing medium. In certain particular cases, the treatment temperature in salt baths or in a gaseous atmosphere may, depending on the composition of the bath, for example when it contains a sulphide and a ferro-cyanide, be less than 570° C., the sulphuretting action being then capable of taking place from 400° C.

The approximate composition of a "Sulfinuz" bath is given below by way of two examples:

(1)

	Percent
Sulphide	0.5
Alkaline cyanides	8
Alkaline cyanates	27
Alkaline chlorides	33
Alkaline carbonates	31.5

(2)

SNa_2	0.5
CNa	4
CNK	4
CNONa	16
CNOK	17
$CO_3Na_2+CO_3K_2$	31
CINa+CIK	27.5

In the case of incorporation of nitrogen, e.g. as regards ferrous alloys, the said incorporation may be obtained by means of any nitriding process which is effective below a maximum temperature of 580° C. It is also possible to make use of the process known by the commercial name of "Tenifer" or of all identical or similar processes using salt baths or gaseous media producing superficial layers of structures and of compositions similar or identical to those which are obtained by the "Tenifer" process.

The latter, also known in the Anglo-Saxon countries by the name of "Tufftride" is a process of mild nitridation which makes it possible to obtain on the steel parts, an outer layer comprising iron carbide and iron nitride covering a diffusion layer of nitrogen in the steel. This result can be obtained for example by immersing the part for a sufficient pre-determined period, for example for two hours, in a salt bath heated to a temperature comprised between 550° and 580° C., for example 565° C., comprising about 32 to 35% of alkali cyanates, for example 45% of potassium cyanate, and 50 to 55% approx. of alkali cyanides, for example 55% of potassium cyanide, the bath being stirred by blowing-in air.

Furthermore, and again in accordance with my above mentioned patent, the cold hardened parts can advantageously be successively subjected to a nitridation such as the "Tenifer" treatment and then to a sulphurizing treatment, for example according to the "Sulfinuz" process.

In accordance with the present invention, it has been found that it is possible to produce metallic parts in rubbing frictional contact having a good resistance to seizure and to wear by friction with no or doubtful lubrication wherein only one part, i.e. a journal, is submitted to the above mentioned treatments described in my U.S. Pat.

No. 3,321,338, the other part being a bushing formed by rolling a metal sheet submitted to a laminating, said laminating and said rolling being carried out with a pressure sufficient to give the metal of said bushing a superficial micro-hardness superior to about 450 Vickers for a charge of about 50 g. and at a depth of about 0.005 mm. Advantageously, the metal of said journal as well as of the sheet will be a hypereutectoid steel containing at least 11% of manganese, commonly known as "Hadfield steel."

What is claimed is:

1. A method for producing metallic parts in rubbing frictional contact and having a high resistance to seizure and to wear by friction, wherein the parts are made from a metallic material chosen from the group of metals capable of hardening by cold-hammering while exhibiting in its superficial crystalline structure a high density of planes of shear, and consisting of austenitic stainless steels, hyper-eutectoid alloy steels containing at least 11% by weight of manganese, titanium and titanium alloys containing a major part of titanium, one of the parts being a journal subjected to a deep cold-hardening executed in such manner that it produces, on the surface of the part, striations substantially perpendicular to the direction of the friction, following which the part is subjected to the superficial incorporation of at least one element chosen from the group of the metalloids and transition metals, which metalloids and transition metals possess one of the two properties consisting firstly in the capacity of depositing at the surface of the parts an ionic compound by reaction with the underlying metal, and secondly of the capacity of inserting its atoms into the structure of the underlying metal while forming a solid insertion solution, the metalloid group consisting of nitrogen, carbon and sulphur and the transition metal group of selenium and tellurium, the superficial incorporation being obtained by maintaining a contact during a period comprised between 1 and 6 hours at a temperature from 400 to 590° C. between said part and a fluid such as a salt bath or a gaseous atmosphere, which contains the element to be incorporated, the other part being a bushing formed by rolling a metal sheet submitted to a laminating, said laminating and said rolling being carried out with a pressure sufficient to give the metal of said bushing a superficial microhardeness superior to about 450 Vickers for a charge of about 50 g. and at a depth of about 0.005 mm.

2. A method according to claim 1, wherein said metal is a hypereutectoid steel containing at least 11% of manganese.

3. A method according to claim 1, wherein the deep cold-hardening is effected by knurling.

4. A method according to claim 1, wherein the deep cold-hardening is effected by hammering with a striated hammer.

5. A method according to claim 1, wherein in the case where the element is sulphur, the journal is subjected to a thermal treatment of at least two hours in a sulphurizing bath or a sulphurizing atmosphere at a temperature higher than 500° C.

6. A method according to claim 1, wherein in the case of incorporation of nitrogen, the said incorporation is obtained by means of any nitriding process which is effective below a maximum temperature of 580° C.

7. A method according to claim 6, wherein after the nitridation, the journal is subjected to a treatment for at least two hours in a sulphurizing bath at a temperature of at least 400° C.

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L. DEWAYNE RUTLEDGE, Primary Examiner

W. W. STALLARD, Assistant Examiner

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