Feb. 4, 1930. C. F. MERRILL 1,745,835

SPINNING RING AND TRAVELER

Filed July 2, 1929

Fig. 1.

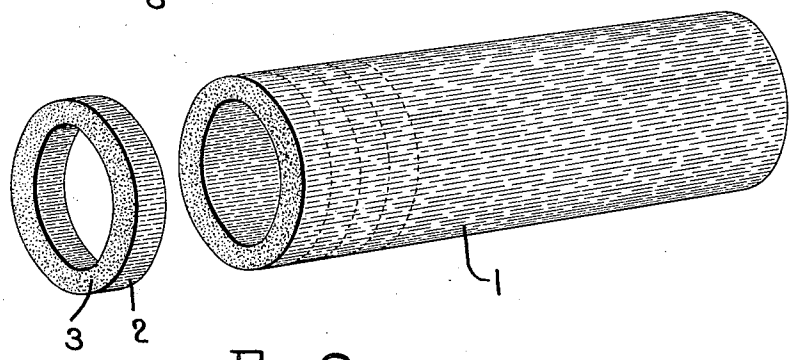


Fig. 2.

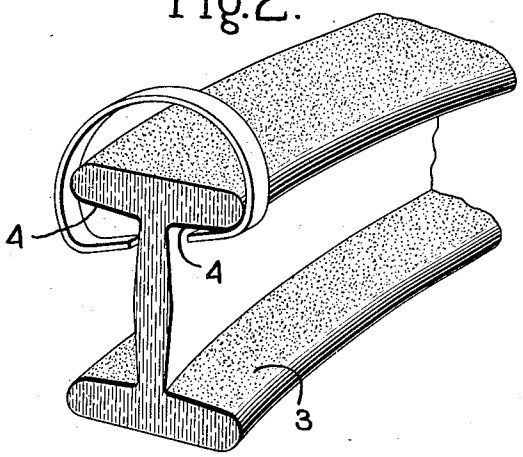
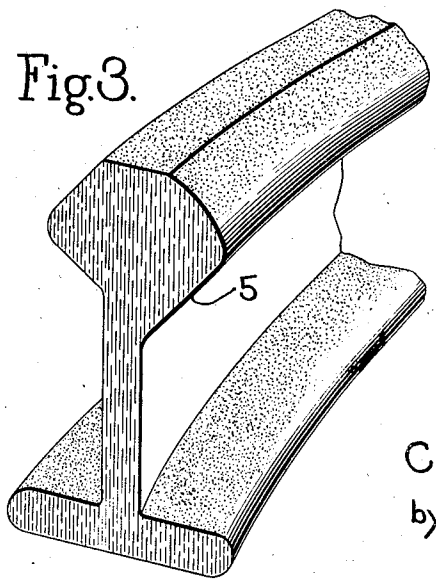


Fig. 3.



Inventor.
Charles F. Merrill
by Heard Smith & Tennant.
Attys.

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UNITED STATES PATENT OFFICE

CHARLES F. MERRILL, OF HOPEDALE, MASSACHUSETTS, ASSIGNOR TO DRAPER CORPORATION, OF HOPEDALE, MASSACHUSETTS, A CORPORATION OF MAINE

SPINNING RING AND TRAVELER

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This invention relates to improvements in spinning rings and travelers and the general object thereof is to provide ring and traveler-engaging surfaces, the mutual frictional and wear-resisting properties of which will permit the proper functioning of the traveler during the usual spinning operation, with a minimum of destructive abrasion of the contacting metallic surfaces.

One of the objects of the invention is to provide a spinning ring composed of an alloy comprising steel and a metal having the property of inhibiting grain growth when subjected to high temperatures of carburizing, hardening or tempering, and thereby presenting wearing surfaces of greater homogeneity and uniformity of hardness, and which has greater resistance to destructive abrasion by the traveler than the compositions heretofore used for spinning rings.

Another object of the invention is to provide a spinning ring comprising a ferrous alloy containing carbon and molybdenum in such proportions as to provide a material possessing abrasion-resisting qualities after suitable hardening.

A further object of the invention is to provide a spinning ring, and preferably also a traveler, comprising a ferrous alloy containing molybdenum as the principal and effective alloying element, together with carbon, and with or without other elements which may be introduced to modify and promote the beneficial properties contributed by the molybdenum, to produce a composition capable of acquiring the hardness and surface finish desired in co-operating spinning rings and travelers.

A further object of the invention is to provide a spinning ring and traveler formed respectively of metal alloys which after suitable hardening have materially different "frictional properties" operable when mated to produce sufficient friction to cause the proper functioning of the traveler, while minimizing the abrasion which would result if the frictional properties of the traveler and ring respectively were the same.

Another object of the invention is to provide a spinning ring of fibrous metallic structure having flanges presenting traveler-engaging surfaces representing transverse sections of the fibrous structure, minimizing the cross sectional areas of the individual structural units exposed to engagement by the traveler.

More particularly the object of the invention is to provide a spinning ring having a cylindrical web with flanges extending laterally therefrom, comprising a fibrous ferrous alloy containing molybdenum, with the fibrous structure disposed in substantial parallelism with the axis of the ring, and with the traveler-engaging surfaces of the flanges representing transverse sections of the fibrous structure minimizing the cross sectional areas of the individual units thereof. Such transverse sections in spinning rings may be either normal or conic cross sections of the fibrous structure according to the type of spinning ring employed.

Spinning rings embodying the present invention and a preferred method of producing such spinning rings are illustrated in the accompanying drawings, in which,

Fig. 1 is a perspective view of a bar or tube of fibrous steel preferably alloyed with molybdenum, with a spinning ring blank severed from the end thereof;

Fig. 2 is a view partially in vertical section and partially in elevation of a spinning ring and traveler illustrating the fibrous structure of the material extending in such direction that the traveler-engaging surfaces of the ring represent transverse sections of the fibrous structure exposing minimum cross sectional areas of the individual units thereof, and also illustrating the exposed ends of such units as condensed to produce a substantially homogeneous smooth traveler-engaging surface; and,

Fig. 3 is a similar view of a different form of spinning ring and traveler.

In order accurately to describe the novel features of the invention it is desirable to review briefly the practical considerations which obtain in the manufacture and operation of spinning rings.

The traveler, which co-operates with the spinning ring, is guided and restrained in a

circular path of motion by its engagement with a flange or the flanges on the ring.

Many years of practice have established the desirability of avoiding the use of a lubricant applied to the ring or traveler. The ring and traveler are, therefore, exposed to highly destructive conditions; that is, sliding metallic contact at high speed and perceptible pressure without appreciable lubrication. Another destructive agency is introduced when the ring and traveler cooperate in the presence of moisture, such as the usual humidity maintained in a spinning room, and it is well known that under certain conditions of speed and pressure between the traveler and ring, frictional resistance and resulting heat and abrasion increases with the increase in humidity of the surrounding atmosphere.

The abrasion which occurs between the traveler and the spinning ring is mainly dependent upon the character and condition of the contacting surfaces, and one of the objects of the invention is to provide a spinning ring with a substantially homogeneous surface of such smoothness, hardness and frictional characteristics that when mated to a suitable traveler will produce only sufficient friction to cause proper functioning of the traveler with a minimum of destructive abrasion of the contacting metal surfaces.

This is accomplished in the present invention by providing a spinning ring made of a special alloy which is adapted to provide a metallic surface finely grained and otherwise having beneficial frictional properties and further by constructing the ring from a stock of fibrous structure so disposed that the traveler-engaging surfaces represent substantially transverse sections of the fibrous structure minimizing the cross sectional areas of the individual structural units exposed to engagement by the traveler.

Ordinary spinning rings and travelers are made of ferrous material in which the principal components are iron and carbon, either without alloying elements, or with alloying elements introduced mainly for the purpose of producing hardness.

One of the principal features of the invention consists in providing a spinning ring formed of an alloy containing a metal which, when the ring is subjected to the temperatures of carburizing and hardening, will inhibit grain growth so that the ring instead of having a coarse grain surface will present a fine grain surface adapted to receive a superior finish and polish.

I have discovered that an alloy of steel, preferably low carbon steel, having a proper percentage of molybdenum, providing a material which will inhibit grain growth when heated to high temperatures, and which will be free cutting, is especially adapted to the formation of the difficult cross sections of spinning rings; that it will widen the range of temperatures that may be used in heating for carburizing, hardening or tempering, and will, when suitably hardened, possess abrasion-resisting qualities superior to other materials which have heretofore been used in spinning rings.

All of these features are of specific and economic advantage in the practical operation of producing spinning rings and in the functioning of the rings so produced.

I have found that a very satisfactory alloy for spinning rings, which are to be carburized in the preparation for hardening, comprises a steel containing approximately .15% to .25% carbon and .25% to 1% molybdenum. Nickel may also be alloyed with the above in the proportion of 1.5% to 3.5% for the purpose of increasing the strength of the metal, and otherwise beneficially modifying the properties of the alloy.

Spinning rings made of the above compositions when hardened and finished present traveler-engaging surfaces of great homogeneity and uniformity of hardness and very resistant to destructive abrasion by the action of the traveler.

It is a well known principle of mechanical construction that rubbing surfaces of unlike composition are generally more resistant to mutual abrasion than surfaces which are substantially identical in character. This principle is employed in the present invention by using for one member, preferably the spinning ring, a ferrous alloy containing molybdenum which when suitably hardened has inherent surface qualities which are more abrasive-resistant than an iron-carbon composition without molybdenum, and for the other, preferably the traveler, a ferrous alloy containing molybdenum in such relatively smaller proportions as to produce, after suitable hardening, a material having different frictional properties from those of the member with which it is to co-operate. The traveler, however, may be of any suitable material having different frictional properties from those of the spinning ring.

I have demonstrated in practice that the introduction of a considerable proportion of molybdenum into one of the members, particularly the ring, and considerably less molybdenum in the other member, affects the frictional phenomena at the point or line of contact in such a manner as to minimize the tendency of metallic surfaces to "seize" or adhere particularly in a humid atmosphere, while at the same time sufficient resistance is offered to the traveler movement to permit the traveler to perform the function of maintaining proper tension in the yarn being spun. A very satisfactory alloy for travelers, which are to be carburized, when used with spinning rings having a proportion of molybdenum above described, comprises iron

containing approximately 0% to .05% carbon and .01% to .03% of molybdenum.

The invention, therefore, comprises a cooperating ring and traveler combination which by virtue of the relative differences in the composition of its members provides contacting surfaces having different frictional properties and thereby minimizes the abrasion of the contacting metal surfaces under usual conditions of spinning.

In the usual manufacture of spinning rings the blanks for making the rings are commonly produced by forging, the methods in use being: (1) A bar of forged steel of proper length is bent into circular shape and the ends welded together, making a continuous ring which is afterwards turned and finished. (2) A small rectangular section of forged metal is pierced at its center when hot and in a malleable condition, and by means of suitable mandrels and rollers, is expanded and formed to the desired diameter and cross section. (3) A flat bar of rolled material is compressed between suitable dies which expand the metal and force it into the die impressions, thereby providing a ring having a solid central web, and also a web extending from the periphery thereof. These webs are cut away and rings turned and finished as aforesaid.

Each of the processes above described has a definite and recognizable effect upon the arrangement of the structural components of the metal. It is well known that commercial steel and iron contain impurities and inclusions which are distributed irregularly throughout the mass of the material. They may be non-metallic inclusions, as slag, or seggregated metallic compounds as iron sulphides, phosphides, oxides, etc. In rolled or drawn bars or plates, these impurities exist as streaks, threads, or striations, enclosed within the metal, forming a structure which is termed the "fibre" of the steel.

It follows that when such bars are subjected to the forming treatments above described, the fibre structure is distorted. In the first mentioned method, the fibrous structure follows substantially circular lines, except for a more or less confused and irregular formation at the welded junction. The second and third methods produce different forms, but are somewhat similar to each other in that the fibres which were parallel in the original bar have been divided and spread within the outer boundary of the ring and made to assume a variety of directions. A ring produced by either the second or third methods has a fibrous structure which progressively changes from two extreme orientations in each quadrant of its circumference. At opposite points on the axis of the original bar, the fibres are disposed substantially radially. Half-way between these points, the fibres approximate a circular direction, or concentric with the circumference. Between these four points, the fibres lie in progressively changing directions from one extreme to the other.

The term "fibrous structure," therefore, is used herein as descriptive of the elongated form and substantially parallel arrangements of the structural components of commercial metallic compositions such as the steel alloy above described which have been compressed and extended by usual processes of rolling, drawing, forging, etc.

It is well known that non-metallic inclusions are not capable of being hardened to the same degree as steel, if at all. Also that impurities, such as sulphides and phosphides of iron may be affected by heat treatment to produce different degrees of hardness from that of the surrounding metal.

It is obvious that the arrangement of the fibrous structure of the ring, formed by any of the methods above described, lies in a pattern which, when intersected by the circular inner and outer peripheral surfaces of the ring, exposes irregular and widely varying sectional areas of elongated structural components of the metal. Also that as a result of this condition, the surface may have relatively large areas of different degrees of hardness, frictional and wear-resisting properties, and be subject to non-uniform wear under the abrasive influence of the traveler.

The present invention contemplates the reduction of such objections to a minimum by so forming the spinning rings that the ends of the fibrous structural components are exposed at the surfaces of the flanges which are engaged by the traveler, thereby presenting minimum individual units of area of the fibrous structural components.

By this means it becomes possible to fabricate spinning rings from a material (1) which has a high degree of metallic purity, or conversely, a minimum of undesirable non-metallic impurities, and (2) so to section the material in cutting that minimum areas of unavoidable impurities and structural irregularities are exposed at the traveler-engaging surface.

A further refinement may be obtained by condensing and consolidating the exposed fibrous ends preferably by rolling pressure in accordance with the method disclosed in my prior Patent No. 1,555,685, granted September 29, 1925, thereby effectively obliterating the exposed ends of non-metallic impurities and providing a substantially homogeneous surface capable of being accurately finished and highly polished and which may be tempered to a uniform hardness.

The blank for forming rings in this manner is illustrated in the drawing, in which Fig. 1 illustrates a metal bar 1 which has been bored axially to provide a hollow cylinder, or which may be a metal tube from which

blanks 2 have been cut of a proper size to be turned into the form of spinning rings. The bar or tube 1 may be of rolled or drawn stock in which the fibrous structure extends longitudinally of the bar or tube and in substantial parallelism with the axis thereof, thereby presenting the ends 3 of the fibrous structure at the ends of the ring.

When a usual form of spinning ring, such as that illustrated in Fig. 2, is produced from the blank 2 shown in Fig. 1, the machining of the blank produces a construction in which the flanges present traveler-engaging surfaces 4 representing transverse sections of the fibrous structure substantially normal thereto, thereby exposing minimum cross sectional areas of the individual structural units, and consequently minimizing the area of impurities and inclusions exposed at such traveler-engaging surfaces, so that the traveler-engaging surfaces are more nearly homogeneous than those heretofore produced by usual methods, and are capable of being more uniformly hardened.

Where spinning rings are made from the steel and molybdenum composition above described, metal of greater purity may be used with less impurity and a finer grain exposed at the traveler-engaging surfaces of the ring, so that such surfaces are inherently substantially homogeneous and capable of being very uniformly hardened. Such surfaces are also more resistant to destructive abrasion than the traveler-engaging surfaces of rings heretofore produced. The fibre ends, which are exposed at the traveler-engaging surfaces, may be further condensed and consolidated as above described to provide a surface which when finished is of great homogeneity and uniform hardness.

In Fig. 3 a spinning ring of a different type is illustrated in which the traveler-engaging surfaces 5 represent transverse conic sections of the fibrous structure, thereby minimizing the cross sectional areas of the individual units exposed to engagement by the traveler.

It will, therefore, be obvious that the present invention is applicable to spinning rings of different types.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is:

1. A spinning ring composed of an alloy comprising steel and molybdenum in such proportions as to facilitate free cutting and substantially to inhibit grain growth when subjected to high temperatures of carburizing, hardening or tempering, and thereby presenting wearing surfaces of great homogeneity and uniformity of hardness.

2. A spinning ring comprising an alloy of steel having approximately .15% to .25% of carbon and with approximately .25% to 1% of molybdenum subsequently to be hardened.

3. A spinning ring comprising an alloy of steel having approximately .15% to .25% of carbon and with approximately .25% to 1% of molybdenum, and with approximately 1.5% to 3.5% of nickel, subsequently to be hardened.

4. A spinning ring and traveler comprising different alloys of steel with molybdenum, the percentage of carbon and molybdenum in the alloys of the ring and traveler being sufficiently different to cause the ring and traveler to have, after suitable hardening, different frictional properties, operable when mated to produce sufficient friction to cause proper functioning of the traveler with a minimum of destructive abrasion of the contacting metallic surfaces.

5. A spinning ring and traveler comprising different alloys of steel with molybdenum, the relative proportions of carbon and molybdenum in the ring and traveler being, before carburization, respectively, for the spinning ring .15% to .25% carbon, .25% to 1% molybdenum, and for the traveler .0% to .05% carbon and .01% to .03% molybdenum.

6. A spinning ring comprising a fibrous alloy of steel and molybdenum having flanges presenting traveler-engaging surfaces representing transverse sections of the fibrous structure minimizing the cross sectional areas of the individual structural units exposed to engagement by the traveler.

7. A spinning ring composed of a fibrous alloy of steel and molybdenum having traveler-engaging surfaces representing transverse sections of the fibrous structure minimizing the cross sectional areas of the individual structural units exposed to engagement by the traveler, and having said exposed units condensed, consolidated and tempered to present a substantially homogeneous metallic wearing surface of uniform hardness.

8. A spinning ring comprising a fibrous alloy of steel, molybdenum and nickel having flanges presenting traveler-engaging surfaces representing transverse sections of the fibrous structure minimizing the cross sectional areas of the individual structural units exposed to engagement by the traveler, and having said exposed units condensed, consolidated and tempered to present a substantially homogeneous metallic wearing surface of uniform hardness.

In testimony whereof, I have signed my name to this specification.

CHARLES F. MERRILL.