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(54) **Ring for spinning machineries**

Ring für Spinnmaschinen

Anneau pour des métiers à filer

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(73) Proprietor: **KANAI JUYO KOGYO COMPANY LIMITED**
Itami Hyogo (JP)

(72) Inventor: **Kibe, Shigeru**
Amagasaki Hyogo (JP)

(74) Representative: **Lange, Gerd, Dipl.-Ing.**
Patentanwalt,
Nachtigallenweg 8
32425 Minden (DE)

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DE-A- 3 026 210 **US-A- 4 698 958**

- **PATENT ABSTRACTS OF JAPAN vol. 11, no. 89 (C-411)(2536) 19 March 1987, & JP-A- 61 245320 (HIROYUKI KANAI)**
- **PATENT ABSTRACTS OF JAPAN vol. 12, no. 5 (C-467)(2852) 08 January 1988, & JP-A- 62 161995 (HIROYUKI KANAI)**

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Description

The present invention relates to a ring for use in a spinning machine according to the limitations set out in the preamble part of the main claim.

Heretofore, low carbon steel is used in a ring for spinning machinery, and carburizing hardening treatment is applied thereon. However, when such a ring is used with a fine spinning machine having a spindle revolution of 20,000 r.p.m. or more, there have been problems that the friction resistance between the ring and the traveller increases and the frictional heat rapidly increases to bring about the baking and blow off the traveller in an early period, to make continuous operation impossible.

In order to avoid the above problems it is known from the US-A-4 698 958 which document represents the closest prior art to use a ring having the flange surface of it contacting to a traveller, said ring being covered by a composite plated layer with hard fine particles being dispersed in the matrix of a nickel-phosphorous alloy, which is crystallized by heating the ring, and - furthermore - having a smooth surface finish of said composite plated layer by subjecting the surface to a mechanical polishing process, by use of lapping to attain a surface roughness of less than 1 µm max, e. g. between 0,5 - 1,0 µm max.

The object of the present invention is to improve the above characteristics of wear resistance of the ring and the sliding properties between the ring and the traveller especially in high speed fine spinning.

To attain the above object and according to the invention the mechanical polishing process has been performed such

a) that part of the hard fine particles are dropped off,
b) that part of the hard fine particles on the surface are exposed in an area percentage of 5 to 40 %, and
c) that the surface has a roughness of less than 0.2 µm in the center line.

Particular embodiments of the oresent invention are set out in the claims 2 and 3.

The nature and advantage of the present invention will be understood more clearly from the following description made with reference to the accompanying drawings, in which:

Fig. 1 is a partly broken sectional diagram showing an embodiment of the ring for use in a spinning machine according to the present invention.

Fig. 2 is the enlarged view diagram for the essential part of the ring for use in a spinning machine according to the present invention.

Fig. 3 is curve showing the relationship between the heat treatment temperature and the hardness of the nickel-phosphorous alloy coated layer.

Fig. 4a is a curve showing the surface roughness of the composite plated layer before the polishing process.

Fig. 4b is a curve showing the surface roughness of the composite plated layer after the polishing process.

Fig. 5a is an explanatory diagram showing the surface state of the composite plated layer before the polishing process, and Fig. 5b is an explanatory diagram showing the surface state after the polishing process.

Fig. 6 is a curve showing the relationship between the spindle revolution number and the index of the wear resistance, and

Fig. 7 is a curve showing the relationship between the distance from the surface of the ring according to the present invention and the Vickers hardness thereof.

A steel material (S15 CK) of cylindrical shape was cut and processed to form a ring 1 (Fig. 1), and the ring was subjected to carburizing hardening and surface treatment.

The above-described ring had such a structure that it had a collar 3 on the external circumferential surface of the cylindrically shaped trunk part, and further, had a ring flange 5 on which the ring traveller slides, at the top of the ring neck part 4.

The above-described ring 1 was, after being subjected to the pre-treatment of the plating such as degreasing and acid cleaning on at least the surface of the ring flange 5, was covered by forming a composite plated layer 6 dispersed and separated with silicon carbide as a co-separating substance in the matrix of a nickel-phosphorous alloy 7. (Fig. 2)

The composite plated layer 6 was formed by electroless plating with the dispersion of the silicon carbide 8 of a particle size of 1 µm as hard fine grains in such an amount that its content becomes approximately 4 % by weight, in the matrix of the nickel-phosphorous alloy 7.

The ring 1 on which the composite plated layer 6 was formed was subjected to heat treatment in a heat treating furnace at the heat treating temperature of 400 °C for about 1 hour to crystallize the nickel-phosphorous of the matrix. Due to this crystallization, the composite plated layer could obtain the high hardness of HV 1000. Moreover, the closely adhering properties of the co-separating substance, silicon carbide, to the matrix was strengthened.

The ring flange 5 to which the ring traveller of the ring 1 subjected to heat treatment contacts and slides was formed by subjecting it to the polish processing by use of lapping to be formed to have the thickness of the composite plated layer of 30 μm. By carrying out polish processing, hard fine grains were exposed on the surface of the ring flange 5, and the flange was finished to become a smooth surface with the surface roughness of less than 0.2 μm.

By carrying out the polishing process in such a manner as described above, a part of the hard fine grains was polished, or was dropped off to let the surface of the ring become smooth.

In Figs. 4a and 4b shown are the data of the surface roughness before and after the polishing process. Also, in Fig. 5a, the surface state of the ring flange 5 before the polishing process is shown, and in Fig. 5b, the surface state of the ring flange after the polishing process is shown. The most outside surface of the composite plated layer 6 shows the co-existence state of the hard fine particles of the silicon carbide 8 exposed in the matrix, nickel-phosphorous alloy 7.

The most preferable substance as the hard fine particles which is co-separated in the composite plated layer 6, is silicon carbide 8 having high hardness, large anti-chemical properties and anti-wearing properties, and good thermal conductivity. The ring 1 on which the above-described composite plated layer 6 is formed has such an advantage that it easily radiates the friction heat generated in the time when the ring traveller runs on the ring flange, and elongates the life of the traveller.

Although silicon carbide has been used as the hard fine particles, at least one kind or two or more kinds of tungsten carbide, boron nitride, or aluminium oxide can be also used. Also, the particle diameter of the hard fine particles is preferably in the range of 0.2 μm to 3 μm, and when it is less than 0.2 μm, the anti-wearing properties of the ring are inferior, and when it exceeds 3 μm, hard fine particles drop out from the composite plated layer, and the radiation of the friction heat becomes bad, to shorten the life of the traveller, and together with that, to lower the anti-wearing properties of the ring remarkably.

The content percentage of the hard fine particles included in the matrix of the composite plated layer is 2 to 15 % by weight. When the content percentage is less than 2 %, the anti-wearing property of the ring is inferior, and when it exceeds 15 %, the rate of occupation of the hard fine particles on the surface of the composite plated layer becomes large, and the sliding properties of the ring traveller deteriorates resulting in early traveller baking, and frequent yarn cut. The area percentage of the particles in the surface and in the cross section of the ring flange is observed to be 5 to 40 % preferably 10 to 30 %. The area percentage of the silicon carbide described in the above-described embodiment was 19.5 % in the cross section, and 25.6 % in the surface. When the area percentage of the silicon carbide is less than 5 %, the anti-wearing property of the ring deteriorates, and when it exceeds 40 % the sliding property of the ring traveller deteriorates to cause the baking of the traveller at an early time and frequent yarn cuttings.

Although the thickness of the composite plated layer 6 was taken as 30 μm, the thickness of 5 to 35 μm is preferable, and when it is less than 5 μm, the anti-wearing properties at the spindle revolution of more than 20,000 r.p.m. deteriorate , and when it exceeds 35 μm, the treating time of the composite plating becomes extremely long to make the production cost of the ring high.

It is more desirable that the thickness of the composite plated layer is taken as 16 to 35 μm, since the life in the high speed spinning can be prolonged.

The heat treatment conditions of the ring 1 formed with the composite plated layer 6 were such that the heat treatment time at the heat treatment temperature of 400 °C was about 1 hour, but the heat treatment may be effected at the heat treatment temperature of 320 to 420 °C and for the heat treatment time of about 1 to 2 hours.

By effecting heat treatment under the above-described heat treating conditions, high hardness of the coated layer hardness of Hv 900 to 1200 could be obtained and moreover, could obtain the mother material hardness of Hv 500 to 550 from the surface of the ring to the depth of about 0.3 mm, and the anti-wearing properties of the ring could be improved (Figs. 3 and 7).

The hardness of the mother material immediately below the composite plated layer is preferably at Hv 500 to 650.

The surface of the ring on which the ring traveller contacts and slides was polish processed to make the surface roughness of the surface of the ring becomes less than Ra 0.2 μm. When the surface roughness of the composite plating exceeds 0.2 μm in Ra, the running of the ring traveller is disturbed, and high speed operation becomes unable to be carried out. As described above, by making the surface roughness be less than Ra 0.2 μm, not only the running of the ring traveller was made smooth, but also the friction resistance of the ring traveller in the high speed revolution zone of the spindle revolution was reduced, since it made the hard fine particles having high hardness and excellent anti-wearing properties be exposed on the most external surface of the composite plated layer to form the coexistence state with the matrix.

For the nickel alloy to be used as the matrix, nickel-phosphorous alloy, nickel-tungsten-phosphorous alloy, and the like are used.

Comparative test was carried out by using the ring (A) for spinning machine of the present invention, the ring (B) for spinning machine obtained by effecting case hardening carburizing hardening to the conventional low carbon steel, and the conventional ring (C) which was subjected to the above described composite plating and having the surface roughness of Ra 0.4 μm.

Test conditions:

Yarn:	ester/cotton 45's
Ring:	3.2 mm F 41 mmϕ x 57.5 mmϕ
Ring traveller:	YS-2/hf 11/10 (nickel plated material)
Spindle revolution number:	16,000 to 30,000 r.p.m.

In Fig. 6 are shown the friction resistance indices of the ring traveller and the ring at the revolution number of each spindle under the above-described spinning conditions.

Up to the spindle revolution of 16,000 to 18,000 r.p.m., thereis is no large difference between the ring (A) of the present invention and the conventional rings (B) and (C), and no remarkable difference could be perceived in the friction resistance indices also.

When the spindle revolution number exceeded 18,000 r.p.m., the friction resistance indices rose remarkably in the conventional ring (B), but in the ring of the present invention, there was perceived no abrupt rise, and the rise was slow. Further, when the revolution of the conventional ring (B) becomes more than 22,000 r.p.m., the friction resistance indices rapidly rise, and when it is more than 24,000 r.p.m., the baking and wear of the ring traveller proceeds to make the continuous spinning impossible. Also, in the conventional ring (C), frictional indices rapidly rise at the high speed revolution zone of more than 24,000 r.p.m. to increase the number of yarn cut remarkably. In the ring (A) of the present invention, even in the high speed revolution zone of the spindle revolution of 24,000 to 30,000 r.p.m., no rapid rise of the index was seen, and stabilized low friction resistance indices were shown, and the wear of the ring traveller was almost not generated, and continuous spinning could be carried out (Fig. 6).

In the present invention, a composite plated layer is formed by making hard fine particles as a co-separating substance and the nickel-phosphorous containing nickel alloy as a matrix, and the hardness of the matrix is made be Hv 900 to 1200, and hard fine particles are exposed on the surface thereof, and the surface roughness is made be less than Ra 0.2 μm, so that the ring traveller shows good fit even in the super high speed revolution zone of the spindle revolution of more than 24,000 r.p.m., and stabilized continuous operation can be carried out. Moreover the baking of the ring traveller is prolonged.

Since hard fine particles are exposed on the contact surface to the ring traveller in such an amount that it becomes 5 to 40 % in area percentage, the anti-wearing properties of the ring are improved, and the life of the ring is prolonged.

By carrying out the plating pretreatment sufficiently, and by effecting heat treatment after the plating treatment, the peel out of the composite plated layer does not occur, and the performance of the ring can be maintained for a long period.

Further, since the hardness of the ring mother material immediately below the composite plated layer is made as Hv 500 to 650, there is such excellent effects that the wear amount of the ring is little, the life of the ring is prolonged, and the like.

Claims

1. A ring for use in a spinning machine

- having the flange surface of the ring contacting to a traveller, said ring being covered by a composite plated layer (6) with hard fine particles (8) being dispersed in the matrix of a nickel-phosphorous alloy (7), which is crystallized by heating the ring, and having a smooth surface finish of said composite plated layer (6) by subjecting the surface to a mechanical polishing process by use of lapping to attain a surface roughness of less than 1 μm max

characterized in that
the mechanical polishing process has been performed such

a) that part of the hard fine particles are dropped off,
b) that part of the hard fine particles on the surface are exposed in an area percentage of 5 to 40 %, and
c) that the surface has a roughness of less than 0.2 μm in the center line.

2. A ring for use in a spinning machinery according to claim 1,
wherein the thickness of said composite plated layer (6) is within the range of 5 to 35 μm.

3. A ring for use in a spinning machinery according to claim 1,
wherein the diameter of particle of said hard fine particles (8) is within the range of 0.2 μm to 3 μm and is selected from at least one of the group consisting of silicon carbide, tungsten carbide, boron nitride and aluminium oxide.

Patentansprüche

1. Spinnring für Spinnmaschinen mit einer Flanschfläche für die Läuferführung,

    - der Spinnring ist mit einer Beschichtung (6) versehen, die aus einer Nickel-Phosphor-Legierung (7) als Matrix besteht, in die harte, kleine Partikel (8) dispergiert sind und die durch eine Wärmebehandlung des Ringes kristallisiert ist,
    - die Beschichtung besitzt eine glatte Oberfläche, die durch einen mechanischen Poliervorgang erreicht wird, bei dem die Oberflächenrauhigkeit durch Läppen auf einen Wert geringer als 1 μm max reduziert worden ist,

    dadurch gekennzeichnet,

    - daß der mechanische Poliervorgang derart ausgeführt worden ist,

        a) daß Teile der harten Partikel herausgebrochen worden sind,
        b) daß Teile der harten Partikel an der Oberfläche der Beschichtung freigelegt worden sind und zwar in einem Flächenanteil von 5 bis 40 %,
        c) und daß die Rauhigkeit der Oberfläche der Beschichtung in der Mittellinie der Läuferführung geringer als 0,2 μm ist.

2. Spinnring für Spinnmaschinen nach Anspruch 1,
    dadurch gekennzeichnet,

    - daß die Schichtdicke der Beschichtung (6) 5 bis 35 μm beträgt.

3. Spinnring für Spinnmaschinen nach Anspruch 1,
    dadurch gekennzeichnet,

    - daß die harten Partikel einen Durchmesservon 0,2 μm bis 3 μm aufweisen
    - und zumindest aus einer Gruppe von Siliziumkarbid, Wolframkarbid, Borkarbid und Aluminiumoxid ausgewählt sind.

Revendications

1. Une bague destinée à être utilisée dans une machine textile à filer, la surface de flanc ou de flasque de la bague venant en contact avec un traveler ou chariot ou curseur. ladite bague étant recouverte par une couche composite de placage (6) présentant des particules dures et fines (8) dispersées dans la matrice d'un alliage nickel-phosphore. qui est cristallisé par chauffage de la bague, et présentant un fini de surface lisse sur ladite couche composite de placage (6), en soumettant la surface à un processus de polissage mécanique, en utilisant le rodage pour obtenir une rugosité de surface inférieure à 1 μm max, caractérisé en ce que le processus mécanique de polissage est réalisé de telle façon:

    (a) qu'une partie des particules dures et fines soit éliminée,
    (b) qu'une partie des particules dures et fines sur la surface soit exposée selon un pourcentage surfacique de 5 à 40%, et
    (c) que la surface présente une rugosité inférieure à 0,2 μm sur la ligne centrale.

2. Une bague destinée à être utilisée dans une machine textile à filer selon la revendication 1, dans laquelle l'épaisseur de ladite couche composite plaquée (6) est comprise dans la gamme entre et 35μm.

3. Une bague destinée à être utilisée dans une machine textile à filer, selon la revendication 1, dans laquelle le diamètre de particule desdites particules fines et dures (8) est compris dans la gamme entre 0.2 μm et 3 μm, et est choisi parmi au moins l'un dans le groupe comprenant le carbure de silicium. le carbure de tungstène. le nitrure de bore et l'oxyde d'aluminium.

Fig. 1

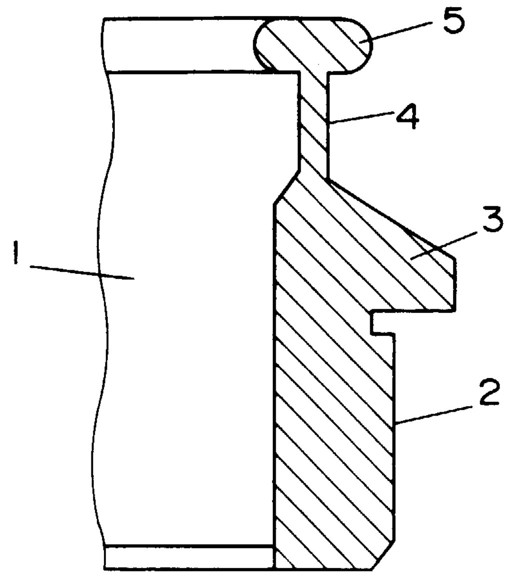


Fig. 2

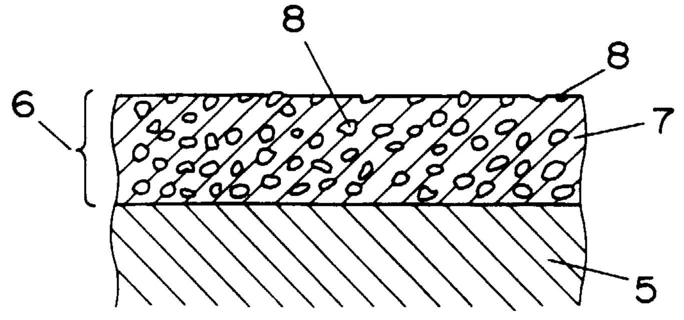


Fig. 3

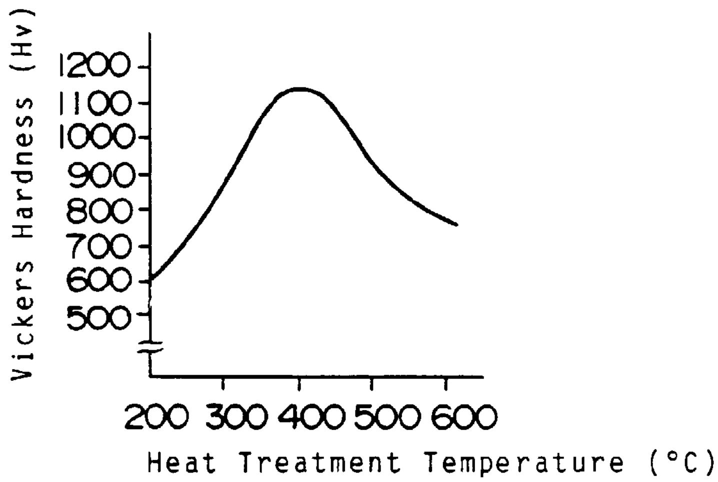


Fig. 4A Surface Roughness before Polish Processing

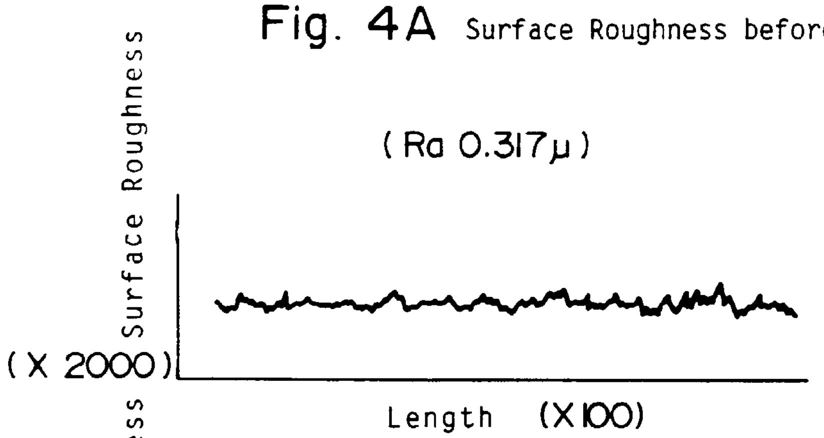


Fig. 4B Surface Roughness after Polish Processing

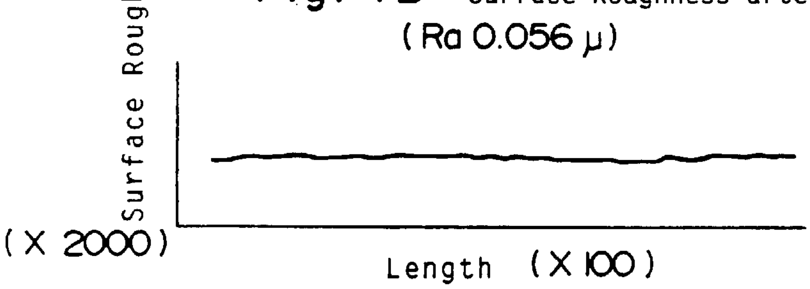


Fig. 5A

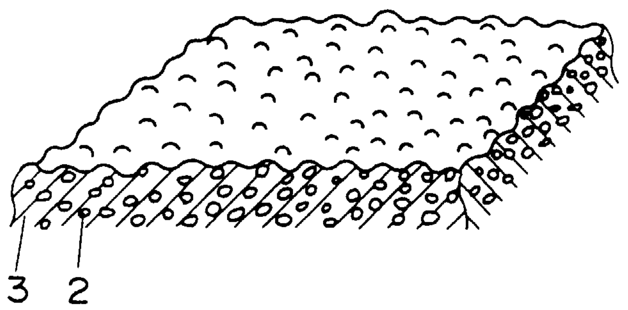


Fig. 5B

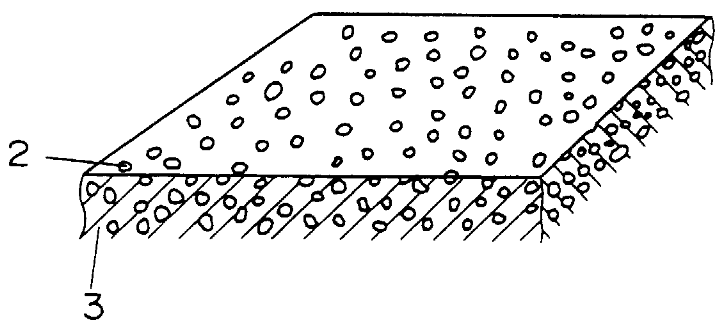


Fig. 6

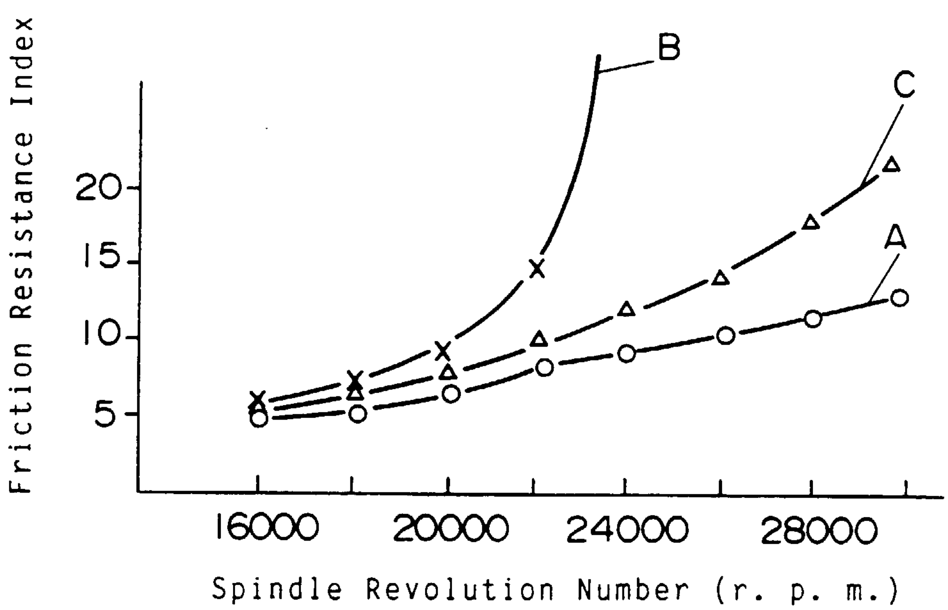
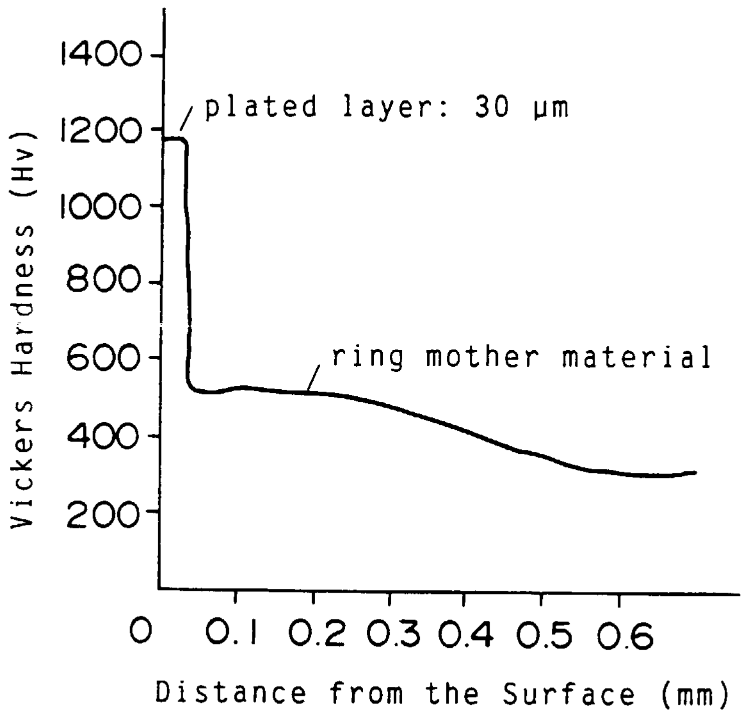


Fig. 7


1400
1200
1000
800
600
400
200
Vickers Hardness (Hv)
plated layer: 30 μm
ring mother material
0
0.1
0.2
0.3
0.4
0.5
0.6
Distance from the Surface (mm)