Jan. 10, 1961 K. RUTHARDT 2,967,792

SPINNERETTE

Filed Nov. 24, 1959

FIG. 1

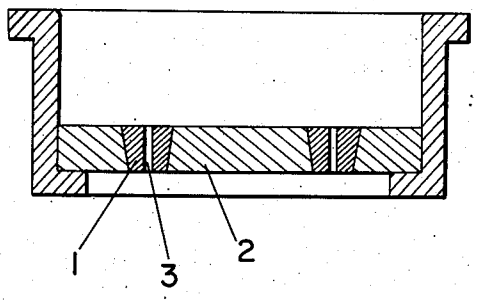
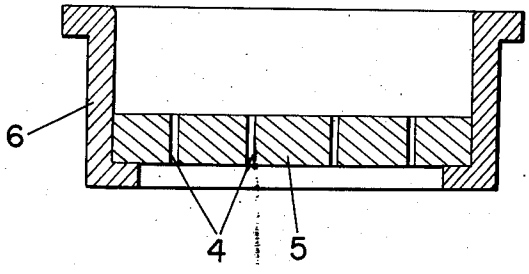


FIG. 2



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SPINNERETTE

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7 Claims. (Cl. 148—32.5)

The present invention deals with a spinnerette for the production of synthetic filaments and more particularly with a spinnerette compound of a palladium-rich alloy.

This application is a continuation-in-part of copending application Serial No. 670,293, filed July 5, 1957, now abandoned.

Spinnerettes for the production of artificial filaments such as rayon contain many extremely fine orifices formed therethrough which are difficult to machine and the orifice walls of the spinnerettes are subject to severe mechanical and chemical erosion and corrosion. To meet the critical conditions in the spinning of artifical filaments, the material forming the spinnerette is of utmost importance. The material must have a high degree of hardness and must be resistant to chemical attack. Platinum group metal alloys such as platinum-iridium and platinum-rhodium have been found quite suitable as spinnerette compositions in view of their high hardness and chemical resistance. There is a practical limit in the amount of rhodium and iridium which can be added to the platinum because otherwise the alloy can become so hard that minute orifices can be drilled through a disc composed of higher iridium and rhodium content only with the greatest difficulty and otherwise the shaping of the disc into a cup becomes more difficult.

Palladium-iridium and palladium-rhodium alloys are inferior to comparative platinum-iridium and platinum-rhodium alloys because of their lower hardness, however minute spinning orifices are more easily formed therethrough.

The present invention is concerned with palladium-rich platinum group metal alloys which in an age-hardened condition possess a hardness at least equal to percentage composition comparative platinum-rich platinum group metal alloys and are otherwise more easily machined in the annealed state prior to the age-hardened state.

It had been assumed that palladium forms an isomorphous system with iridium and rhodium and that the metals being completely soluble one in the other precludes the possibility of age-hardening the alloys. Contrary to such assumption, it has been discovered that there are solubility gaps in such alloys which permit them to become age-hardened.

It is an object of the invention to provide a spinnerette composed essentially of an age-hardened platinum group metal alloy which in the annealed state permits the formation of spinnerette orifices without difficulty and which in the age-hardened state provides for a spinnerette of desirable high hardness.

Other objects and advantages of the invention will become apparent from the description hereinafter following and the drawings forming a part hereof, in which:

Figure 1 illustrates a cross-sectional view of a spinnerette of the invention, and

Figure 2 illustrates a cross-sectional view of a modified spinnerette.

Figure 1 shows an insert member 1 mounted in a bottom plate 2 and with a spinning orifice 3 through the insert member.

Figure 2 shows orifices 4 formed through a bottom plate 5.

The plates 2 and 5 of Figures 1 and 2 are mounted in a cylindrical retaining collar 6.

The insert member 1 and plate 5 are composed of the alloy of the invention with the plate 2 and collar 6 being preferably composed of any suitable base metal, e.g. steel.

It has been found that work-hardened palladium-iridium alloys with an iridium content as high as 20% to 30% iridium are impractical for spinnerettes because of the difficulty in forming minute orifices in the spinnerette blank, but that such alloys in age-hardened conditions are very desirable because the minute orifices can be formed while the blank is in an annealed condition prior to age-hardening and in the age-hardened state have a hardness even exceeding comparative work-hardened alloys. Such spinnerettes are described in copending application Serial No. 716,517, filed February 20, 1958, now Patent No. 2,938,788, granted May 31, 1960.

It is now discovered that the high hardness of the age-hardened palladium-iridium spinnerettes can be maintained even with lower iridium content provided that rhodium is added. Accordingly, the present invention concerns spinnerettes composed of alloys of 7% to 15% iridium with from 5% to 30% rhodium, especially 10% to 25% rhodium, the rest being palladium. Such alloys proved to be equally well workable and easy to polish so that highly polished bores of extreme accuracy can be obtained. Furthermore, they excel in high chemical and mechanical resistance under operating conditions and after very long use still give uniform spinning results.

In making the spinnerette of the invention, a sheet of the alloy is prepared and discs are blanked from the sheet. The discs are annealed by heating them at a temperature between 1100° C. and 1250° C. After sufficient heating whereby the discs are annealed, the discs are quenched and at least one orifice, preferably a plurality of orifices are drilled therethrough. Since the blanks or discs are in an annealed condition, the orifices are formed without great difficulty. Then the spinnerettes are age-hardened at temperatures between 700° C. to 900° C., e.g. 700° C. to 800° C.

More specifically, a disc 0.01 inch in thickness and 1.2 inches in diameter was blanked from a sheet composed of 70% palladium, 10% iridium and 20% rhodium. The disc was annealed at a temperature of 1200° C. for 30 minutes and quenched in water. Then a plurality of orifices of 0.002 inch diameter was drilled through the disc. Then the spinnerette was age-hardened at a temperature of 800° C. for 60 minutes.

The Brinell hardness of the spinnerette produced by the above example was increased from 150 kg./mm.^{2} to 210 kg./mm.^{2} by the above age-hardening.

It was possible to age-harden the above-mentioned alloy because of the dispersed solubility gaps in the alloy.

It is possible in these alloys to replace up to 15% of the palladium with at least one of the metals gold, silver, rhenium and a metal of the platinum group other than iridium and rhodium. However, such replacement should generally not exceed 10% preferably 5% of the palladium.

A small percentage of the palladium may further be replaced by up to 10% and preferably not more than 2% to 3% of base metals of the group consisting of iron, cobalt, nickel, manganese, copper, indium and tungsten, which metals may be found in technical grade palladium alloys.

Various modifications of the alloys of the invention are contemplated within the scope of the appended claims.

What is claimed is:

1. A spinnerette comprising an age-hardened metal

member having at least one orifice formed therethrough and made from an alloy containing 7 percent to 15 percent iridium, 5 percent to 30 percent rhodium, the rest being palladium.

2. A spinnerette according to claim 1, wherein the rhodium content is from 5 percent to 25 percent of the alloy.

3. A spinnerette according to claim 1, in which up to 15 percent of the palladium is replaced by at least one of the metals selected from the group consisting of gold, silver, rhenium and a metal of the platinum group other than iridium and rhodium.

4. A spinning nozzle according to claim 1 in which up to 10 percent of the palladium is replaced by at least one of the base metals of the group consisting of iron, cobalt, nickel, manganese, copper, indium and tungsten.

5. A spinning nozzle according to claim 3 in which up to 10 percent of the palladium is replaced by at least one of the base metals of the group consisting of iron, cobalt, nickel, manganese, copper, indium and tungsten.

6. A spinning nozzle according to claim 4, in which up to 3 percent of the palladium is replaced by at least one of the base metals of the group consisting of iron, cobalt, nickel, manganese, copper, indium and tungsten.

7. A spinning nozzle according to claim 5, in which up to 3 percent of the palladium is replaced by at least one of the base metals of the group consisting of iron, cobalt, nickel, manganese, copper, indium and tungsten.

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