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⑤④ **Manufacturing process of a nozzle for air looms.**

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⑤⑥ References cited :  
**EP-A- 0 066 012  
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**EP 0 393 469 B1**

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## Description

The technique of shuttleless looms is known to include the so-called air looms, wherein the weft yarn is drawn into the warp shed by a controlled air stream. Said air stream is produced by a main blow nozzle - positioned at the yarn inlet end of the loom, and through which the weft yarn is fed - and is maintained and controlled by a plurality of secondary nozzles, each of which produces a so-called secondary jet. A regular air stream is thus maintained in order to draw the weft yarn along the shed, starting from the yarn inlet end where the main blow nozzle is positioned, to the opposite end.

The production of secondary nozzles of the aforementioned type is started at present from small steel tubes which are cut to size and welded at one end (see DE-A-2 740 108). A hole of gauged diameter is then formed in correspondence of the welded end, and through said hole is blown the secondary jet apt to maintain the air stream drawing the weft yarn. Commercial tubes are normally used, with fairly wide tolerances, for instance of +/- 10% on the nominal diameter. Nevertheless, the end welding produces some variations in the outer and inner shape of the tubes. Hence, the nozzles thus obtained have - also on account of the subsequent machinings and strains - dimensional and thus operational features which are not sufficiently constant. This creates obvious difficulties in setting up the loom, whereby it is not possible to adopt standard principles, but it is rather necessary to resort to manual operations which are strongly tied to the skill of the testing expert.

The object of the present invention is to propose a method allowing to produce secondary nozzles for air looms of extremely uniform characteristics, that is, with centesimal tolerances not only on the nominal diameter, but also on all the other dimensions of the finished piece. This result is obtained with the manufacturing method according to the present invention, which is essentially characterized in that it comprises the following steps:

- cutting to size a steel rod and finishing its outer surface with centesimal tolerance;
- drilling said steel rod with an axial dead hole of gauged dimensions with centesimal tolerance; and
- permanently deforming on a die said drilled steel rod, with flattening of at least one part thereof near its closed end and shaping of this end according to an inclined plane, and subsequently forming a gauged hole on said inclined end surface.

A preferred embodiment of the invention is now described in further detail, with reference to figs. 1 to 6 of the accompanying drawings, which illustrate as many steps of the nozzle manufacturing method according to the invention.

The method according to the invention hence comprises, in further detail, the following steps:

- cutting a steel rod section and machining the same in a lathe to the required diameter D;
- rounding off one of the section ends into a semi-spherical shape (fig. 1) by means of a tool and subsequently a grinding wheel;
- precision cutting the other end of said section to a set size (fig. 2);
- forming a small tube closed at one end, by drilling (fig. 3) a hole along the axis of said rod section with a tool of diameter  $d-\delta$  and up to a depth  $p-\delta 1$ , and subsequently boring said axial hole (fig. 4) to the diameter  $d$  and to the depth  $p$ ;
- permanently deforming on a die (figs. 5a, 5b, 5c) said drilled steel rod, with flattening of at least one part A thereof near its closed end, and shaping said part A according to a plane inclined by a suitable angle in respect of the median axial plane of said flattened part;
- trimming the deformed steel rod;
- locking the steel rod by its open non-flattened end, and forming (fig. 6) a hole on said inclined end surface; and finally
- tumbling and subsequently cloth-polishing the finished piece.

## Claims

1. Manufacturing method of a secondary nozzle to produce secondary jets in air looms - of the type consisting of a tubular element open at one end and having a gauged hole in correspondence of the opposite end - characterized in that it comprises the following steps:
  - cutting to size a steel rod and finishing its outer surface with centesimal tolerance;
  - drilling said steel rod with an axial dead hole of gauged dimensions with centesimal tolerance; and
  - permanently deforming on a die said drilled steel rod, with flattening of at least one part thereof near its closed end and shaping of this end according to an inclined plane, and subsequently forming a gauged hole on said inclined end surface.
2. Manufacturing method as in claim 1), wherein the cutting to size operation of the steel rod includes:
  - cutting a steel rod section and machining the same in a lathe to the required diameter D;
  - rounding off one of the section ends into a semi-spherical shape by means of a tool and subsequently a grinding wheel; and
  - precision cutting the other end of said sec-

tion, to a set size, in respect of the rounded end.

3. Manufacturing method as in claim 1) or 2), wherein the drilling operation of the steel rod includes: 5
- drilling said section along its axis, with a tool of diameter  $d-\delta$  and up to a depth  $p-\delta_1$ ;
  - subsequently boring said axial hole to the diameter  $d$  and to the depth  $p$ .
4. Manufacturing method as in claim 1), 2) or 3), wherein the operation of permanent deformation of the drilled steel rod includes: 10
- permanently deforming on a die said drilled steel rod, with flattening of at least one part thereof near its closed end; 15
  - shaping said end part according to a plane inclined in respect of the median axial plane of said flattened part;
  - trimming the deformed steel rod; 20
  - forming a gauged hole on said inclined end surface, after having locked the steel rod by its open, non-flattened, end; and
  - tumbling and subsequently cloth-polishing the finished piece. 25

#### Patentansprüche

1. Verfahren zum Herstellen einer Sekundärdüse zum Erzeugen von Sekundärstrahlen in Luftwebmaschinen - von der Art bestehend aus einem rohrförmigen, an einem Ende offenen und mit einer in Übereinstimmung mit dem gegenüberliegenden Ende eingestellten Bohrung versehenen rohrförmigen Element - dadurch gekennzeichnet daß es die folgenden Schritte aufweist: 30
- Schneiden eines Stahlstabes auf Länge und Bearbeiten dessen äußerer Oberfläche auf hundertstel Toleranz; 40
  - Drillen des Stahlstabes mit einer axialen Sackbohrung mit einer genauen Erstreckung mit einer hundertstel Toleranz;
  - permanentes Deformieren des gedrillten Stahlstabes auf einer Form unter Abflachen wenigstens eines Teiles von diesem in der Nähe des geschlossenen Endes und Formen dieses Endes entsprechend einer geneigten Ebene und nachfolgendes Ausbilden einer Maßbohrung in der geneigten Endfläche. 45 50
2. Verfahren zur Herstellung nach Anspruch 1, wobei der Vorgang des Schneidens des Stahlstabes auf Länge aufweist: 55
- Schneiden eines Stahlstababschnitts und dessen Bearbeiten auf einer Drehbank auf den

erforderlichen Durchmesser  $D$ ;

- Abrunden eines der Abschnittsenden halbkreisförmig mittels eines Werkzeugs und anschließend eines Reibrades;

Präzisionsschneiden des anderen Endes des Abschnitts auf eine eingestellte Länge bezüglich des abgerundeten Endes.

3. Verfahren zur Herstellung nach Anspruch 1 oder 2, wobei der Drillvorgang des Stahlstabes aufweist:
- Drillen des Abschnitts entlang seiner Achse mittels eines Werkzeugs vom Durchmesser  $d-\delta$  und auf eine Tiefe  $p-\delta_1$ ;
  - anschließendes Bohren der Axialbohrung auf den Durchmesser  $d$  und auf die Tiefe  $p$ .
4. Verfahren zur Herstellung nach Anspruch 1, 2 oder 3, wobei der Vorgang der andauernden Deformierung des gedrillten Stahlstabes aufweist:
- permanentes Deformieren der gedrillten Stahlstäbe auf einer Form unter Abflachen wenigstens eines Teiles von diesem nahe seinem geschlossenen Ende;
  - Formen des Endteils entsprechend einer bezüglich der mittleren Axialebene des abgeflachten Teiles geneigten Ebene;
  - Zurechtschneiden des deformierten Stahlstabes;
  - Bilden einer Maßbohrung in der geneigten Endfläche nach dem Einspannen des Stahlstabes an seinem offenen, nicht abgeflachten Ende; und
  - Runden und abschließendes Tuch-Polieren des endbearbeiteten Werkstücks.

#### Revendications

1. Méthode de fabrication d'une tuyère secondaire pour produire des jets secondaires dans des métiers à tisser pneumatiques - du type consistant en un élément tubulaire ouvert à une extrémité et possédant un orifice calibré correspondant à l'extrémité opposée
- caractérisée en ce qu'elle comprend les étapes suivantes:
- découper à dimensions une tige en acier et finir sa surface externe avec une tolérance centésimale;
  - percer un orifice axial à fond plein de dimensions calibrées avec une tolérance centésimale dans ladite tige en acier; et
  - déformer de manière permanente sur une matrice ladite tige en acier percée, aplatir au moins une partie de celle-ci près de son extrémité fermée et façonner cette extrémité selon un plan incliné pour ensuite percer

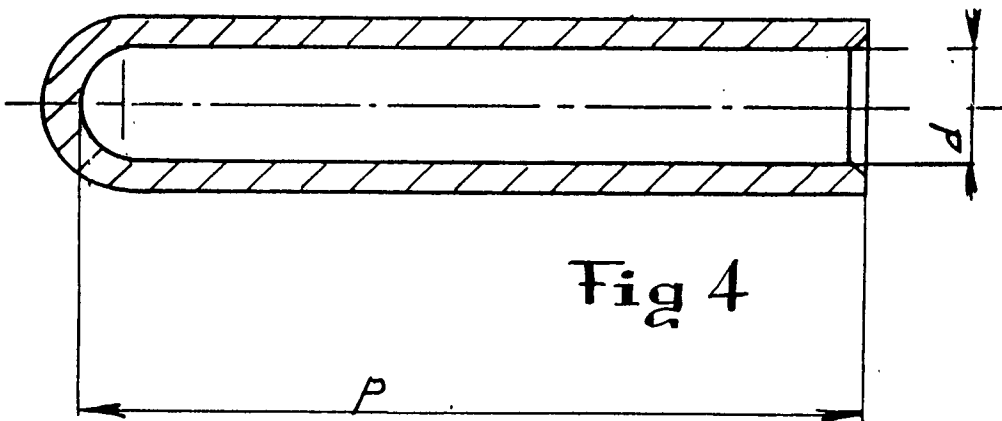
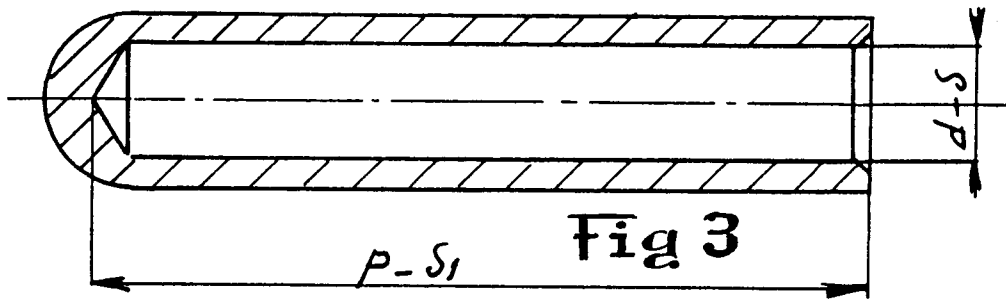
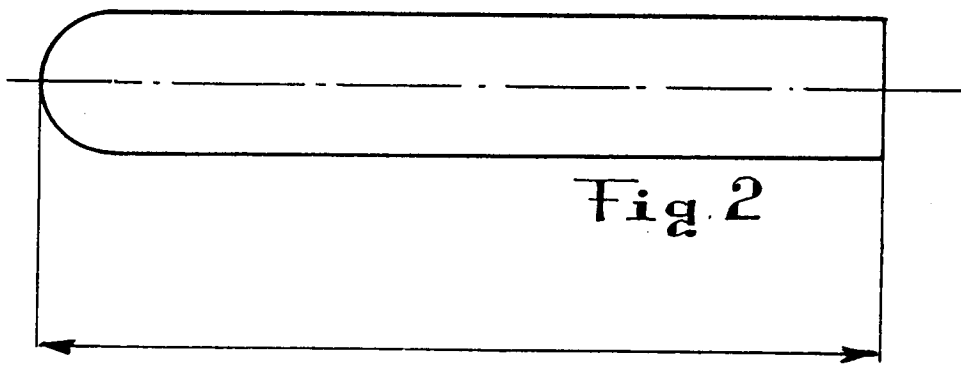
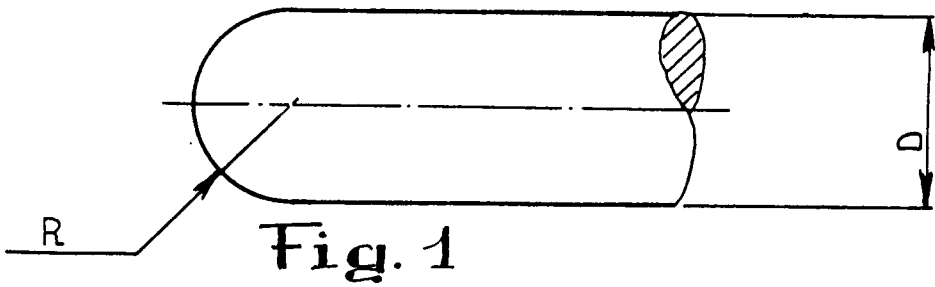
un orifice calibré sur ladite surface d'extrémité inclinée.

2. Méthode de fabrication selon la revendication 1) dans laquelle le découpage à dimensions de la tige en acier comprend: 5
- découper une portion de tige en acier et usiner celle-ci dans un tour au diamètre D requis; 10
  - arrondir l'une des extrémités en forme semi-sphérique au moyen d'un outil et ensuite d'une meule; et
  - découper avec précision l'autre extrémité de ladite portion, à une dimension donnée, par rapport à l'extrémité arrondie. 15
3. Méthode de fabrication selon la revendication 1) ou 2) dans laquelle le perçage de la tige en acier comprend: 20
- percer ladite portion le long de son axe avec un outil d'un diamètre  $d-\delta$  et d'une profondeur maximale  $p-\delta 1$ ;
  - aléser ensuite ledit orifice axial à un diamètre  $d$  et à une profondeur  $p$ . 25
4. Méthode de fabrication selon la revendication 1), 2) ou 3) dans laquelle l'opération de déformation permanente de la tige en acier percée comprend: 30
- déformer de manière permanente sur une matrice ladite tige en acier percée, en aplatir au moins une partie près de son extrémité fermée;
  - façonner ladite extrémité selon un plan incliné par rapport au plan axial médian de ladite partie aplatie; 35
  - tailler la tige en acier déformée;
  - percer un orifice calibré sur ladite surface d'extrémité inclinée après avoir bloqué la tige en acier par son extrémité non aplatie ouverte; et 40
  - polir au tambour et ensuite au chiffon la pièce finie. 45

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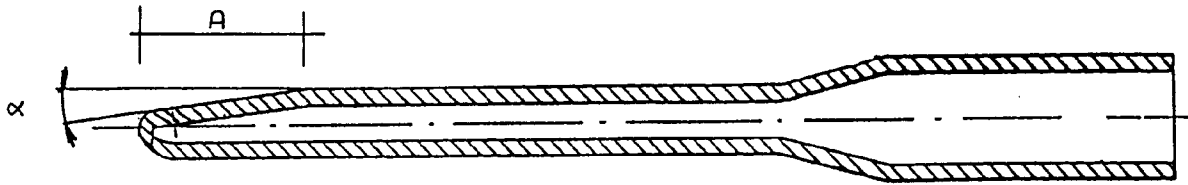


Fig. 5a

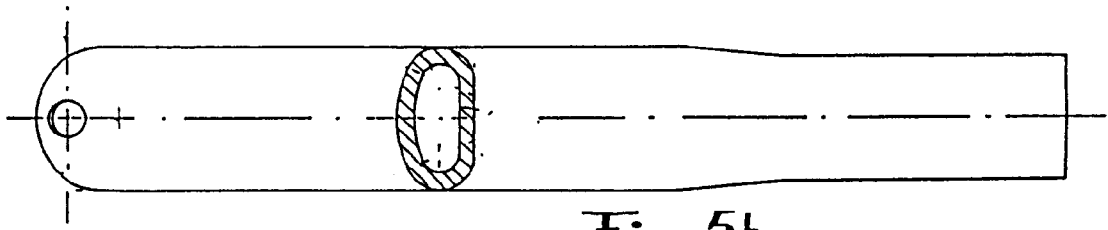


Fig. 5b

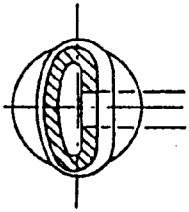


Fig. 5c

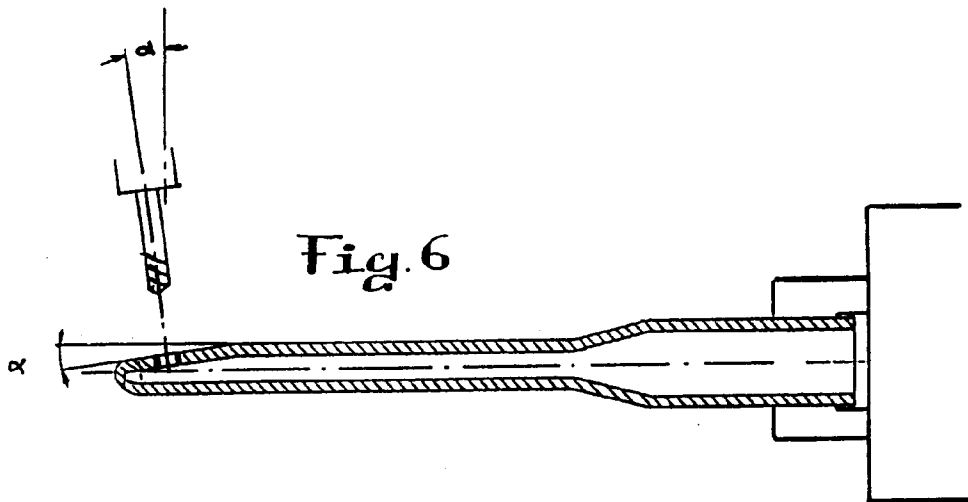


Fig. 6