(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 614 785 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.01.2006 Bulletin 2006/02

(51) Int Cl.:
D03D 47/30 *(2006.01)*

(21) Application number: **04425491.0**

(22) Date of filing: **05.07.2004**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL HR LT LV MK

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Remarks:
In accordance with the last part of Article 14 (2) EPC the applicant has filed a text with which it is intended to bring the translation into conformity with the original text of the application.

(54) Secondary nozzle for air-jet weaving looms

(57) A secondary nozzle for air-jet weaving looms consists of a lengthened element inside which a cavity for the flow of compressed air is formed, said cavity communicating with the outside through a port comprising multiple tiny holes formed on a side wall of said lengthened element, with mutually converging axes, to send a compressed-air jet devoid of air dispersions inside the launch channel formed in the loom reed, thereby contributing to weft transport.

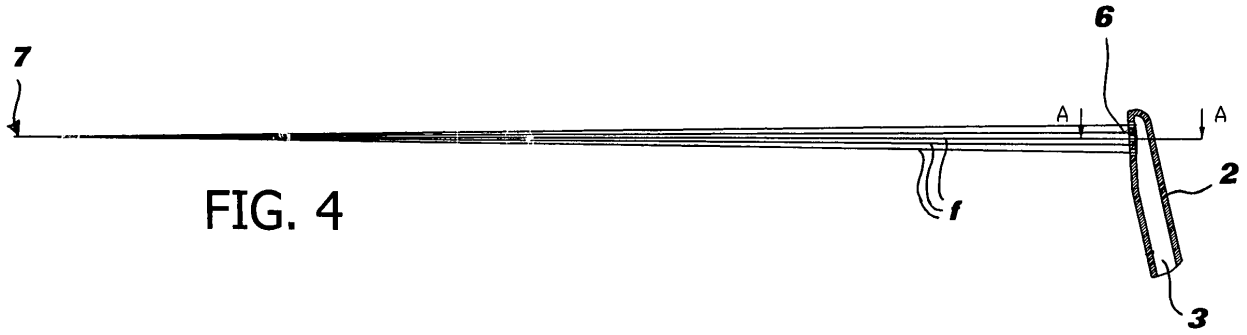

FIG. 4

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Description

[0001] The present invention relates to an improved nozzle for air-jet weaving looms. More specifically, it relates to a secondary nozzle which allows efficient weft transport with reduced air consumption.

[0002] As is known to experts in the field, in air-jet looms the transport of weft yarn through the shed formed between the warp yarns is accomplished through a pneumatic launch system, outside the loom, and through a subsequent system for pneumatic weft transport, which operates throughout the loom width.

[0003] The launch system (fig. 1) generally consists of a prenozzle/launch nozzle 1 assembly, arranged sideways to the loom, by which the weft yarn T is shot into the shed through a jet of compressed air. The energy imparted to the weft yarn by the main nozzle 1, however, is not sufficient to allow the weft yarn to cross the whole loom width; for this reason, inside the shed there is provided a system for pneumatic weft transport consisting of a plurality of secondary nozzles 2 arranged at an even distance along the shed. Such secondary nozzles blow jets of compressed air in the direction of advancement of the weft yarn, which jets are sufficient to impart to the weft yarn the energy necessary to cover the entire length through the weaving loom.

[0004] Said secondary nozzles generally consist of internally-drilled, lengthened cylindrical elements, the internal cavity of said elements being linked to a source of compressed air. Said nozzles are secured to the weaving loom in a position below the warp yarns and, when the shed is open, their free end rises from the lower bed of warp yarns and positions itself in correspondence of the launch channel 4 formed within the loom reed. In correspondence of said free end a hole is formed which connects said inner cavity of said nozzle with the outside, from which a jet of compressed air (fig. 2) hence comes out, which is oriented in a direction substantially parallel to the longitudinal axis of the reed launch channel. The assembly of the jets of compressed air blown out by the series of secondary nozzles thereby determines a continuous airflow inside channel 4 of the reed which allows correct advancement of the weft yarn through the loom.

[0005] To obtain improved restraint of the air jets blown out by the secondary nozzles inside the launch channel, and hence increased working efficiency of the same, it is already known to manufacture the compressed-air exit port of the secondary nozzles 2 through a plurality of small-diameter holes (normally 19 small holes), symmetrically arranged in circular arrays (rosette) (fig. 3), rather than through a single hole, as was traditionally the case. Such arrangement allows to obtain an air jet with a smaller dispersion of air outside launch channel 4 of reed 5. However, even taking into account this improvement, the consumption of compressed air required to feed the secondary nozzles is positively high and contributes remarkably to the loom running costs, especially in countries where the power cost is very high, such as in Europe, for example.

[0006] It is hence an object of the present invention to provide an improved nozzle for air-jet weaving looms, capable of allowing - without affecting the efficiency of weft yarn transport - a noticeable reduction of air consumption on the part of the weaving loom and hence a substantial reduction of the running costs of the same.

[0007] According to the present invention, such object is achieved through a secondary nozzle for air-jet weaving looms, of the type consisting of a lengthened element inside which a cavity for the flow of compressed air is formed, said cavity communicating with the outside through a port comprising one or more holes formed on a side wall of said lengthened element, characterised in that said port is formed by a plurality of tiny holes having mutually converging axes.

[0008] Further features and details of the present invention will in any case be more evident from the following description of a preferred embodiment of the same, illustrated in the accompanying drawings wherein:

fig. 1 is an elevation side diagrammatic view of the insertion area of an air-jet weaving loom in which the positions of the main launch nozzle and of the secondary nozzles are shown;
fig. 2A and 2B are two elevation side diagrammatic views, according to two orthogonal planes, of a secondary nozzle of a known type with a single-hole exit port;
fig. 3 is a similar view to fig. 2 showing a secondary nozzle of a known type with an exit port having coaxial multiple holes;
fig. 4 is an elevation side view of a secondary nozzle according to the present invention, which shows the converging airflow coming out of the nozzle; and
fig. 5 is a section view of the nozzle of fig. 4, according to line A-A of said drawing.

[0009] As already mentioned in the preliminary remarks of the present description, in the art secondary nozzles for the transport of the weft yarn throughout the loom width are known, wherein the compressed-air exit port is manufactured in the shape of a plurality of holes, generally arranged in a rosette array with a symmetrically-centred arrangement.

[0010] This arrangement of the compressed-air exit port has been suggested to reduce the phenomenon of the dispersion of compressed air outside the launch channel 4 formed in the reed, which air is of course of no use for weft transport, but contributes instead of course to the needless increase of power costs related to air compression.

[0011] This solution, however, has not fully delivered the hoped-for results, so that still today single-hole and multiple-hole secondary nozzles are used interchangeably in weaving mills. Such unsatisfactory results probably depend on the fact that dispersion of compressed air outside the launch channel is essentially due to the

fact that the compressed-air jet coming out of the secondary-nozzle port does not take up a cylindrical shape, but rather a conical one, the angle of which is the more open, the smaller the through hole and the higher the air pressure. Changing from a single-hole port to a multiple-hole port, a first positive effect is hence obtained due to the fact that the air jets coming out of the individual holes have a smaller diameter and increased speed, so that their directional ability is improved; there is also a second positive effect due to the fact that conical air dispersions of the jets coming out of the holes arranged in the inner part of the rosette tend to interfere with each other forming a more concentrated flow; however, there is also a negative effect due to the fact that the conical shape of the jets coming out of the holes arranged on the outer edge of the rosette has a larger angle, and hence greater dispersion, due to the small size of the holes. The overall effect of this hole distribution does hence not produce effects as positive as might have been expected.

[0012] According to the fundamental idea of the present invention, it is proposed to overcome this drawback of known secondary nozzles by changing the inclination of the axes of the tiny holes of a multiple-hole secondary nozzle, with respect of the perfectly-parallel condition which has always been used in the prior art up until today. In particular, and as is clearly shown in figures 4 and 5, the axes of the tiny holes arranged in a rosette array are formed with mutually converging inclinations, with respect of the axis of the central tiny hole of the rosette, preferably so as to converge into a single point which, when the secondary nozzle is mounted on the weaving loom, arranges itself in an area inside launch channel 4. Preferably, the convergence angle of the axes of the outer tiny holes of the rosette is of a similar value to half the opening angle of the exit cone of the compressed-air jets, so as to reduce or completely eliminate dispersion of compressed air due to the jets coming out of the outer holes of the rosette.

[0013] The first practical experimental applications of secondary jets with ports having converging-axes multiple holes according to the teachings of the present invention have given very interesting results concerning the possibility of effectively and safely guiding the weft yarn, even using compressed-air pressure values much lower than those employed in the prior art. By providing weaving looms with this type of secondary nozzles, it is hence possible to achieve a remarkable reduction of power consumption due to air compression, thereby fully achieving the object of the present invention.

[0014] The experimental tests carried out have shown in particular that the best results can be obtained with an inclination angle of the outer holes of the rosette comprised between 0,3° and 1°, which means that the convergence point of the different jets is located at a distance between 150 and 60 mm from the nozzle. Finally, the tiny holes of said port preferably have a diameter comprised between 100 and 400 μm.

[0015] Furthermore, the manufacture of the nozzle according to the present invention does not show any particular complication compared to the current manufacturing techniques of traditional multiple-hole nozzles. The technology used for drilling the holes is in fact still spark erosion, in which, however, the device is programmed so as to drill the holes at different inclinations, and then obtain the desired convergence effect. Please notice, in this respect, that the inclination of the different holes of the rosette is such that the beam of the axes of the holes is suitably biased laterally, as shown in fig. 4 and 5, so that the convergence point of the axes of the different holes when the secondary nozzle is mounted on the weaving loom, is located within launch channel 4.

[0016] The present invention has been described with reference to a preferred embodiment thereof, to which of course a number of minor changes can be made by an expert in the field without departing from the scope of protection of the invention, which is defined exclusively by the definitions contained in the accompanying claims.

Claims

1. Secondary nozzle for air-jet weaving looms, of the type consisting of a lengthened element inside which a cavity for the flow of compressed air is formed, said cavity communicating with the outside through a port comprising one or more holes formed on a side wall of said lengthened element to send a compressed-air jet into the launch channel formed in the loom reed, thereby contributing to weft transport, **characterised in that** said port is formed by a plurality of tiny holes having mutually converging axes.

2. Nozzle as claimed in claim in 1), wherein the axes of said tiny holes converge into a single point.

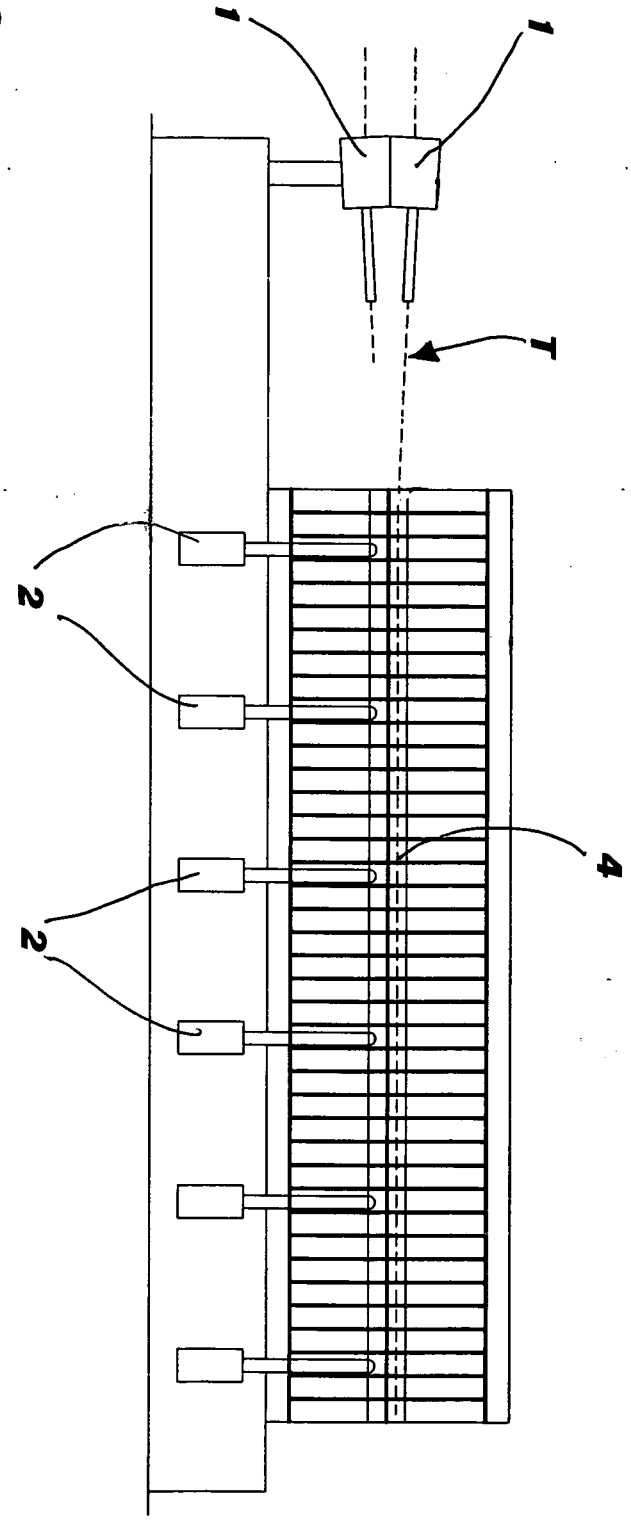
3. Nozzle as claimed in claim 2), wherein the converging point of said axes, when the nozzle is mounted on the weaving loom, is located inside said launch channel formed in the loom reed.

4. Nozzle as claimed in claim 2), wherein the angle formed by the axes of the tiny holes arranged outside the rosette, with respect of the axis of the central hole of the rosette is comprised between 0,3° and 1°.

5. Nozzle as claimed in claim 2), wherein the distance between the convergence point of said axes and said multiple-hole port is comprised between 60 and 150 mm.

6. Nozzle as claimed in claim 2), wherein the tiny holes of said port have a diameter comprised between 100 and 400 μm.

FIG. 1



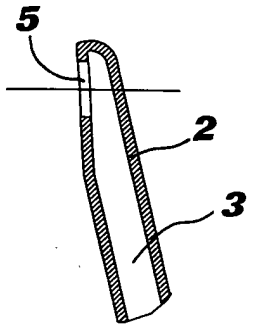


FIG. 2A

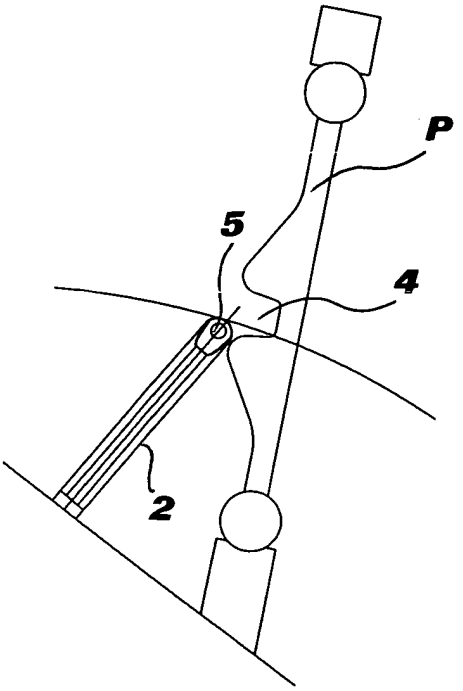


FIG. 2B

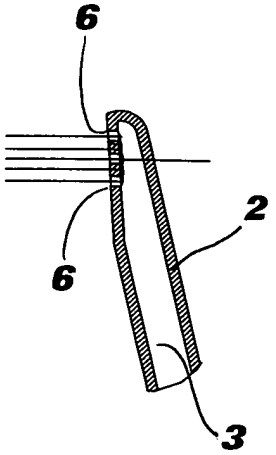


FIG. 3A

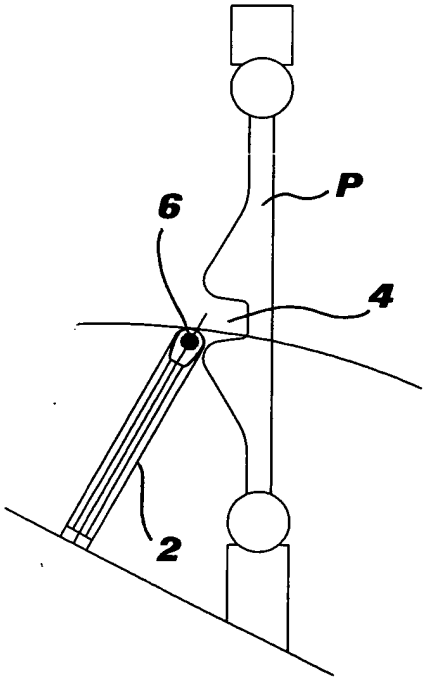


FIG. 3B

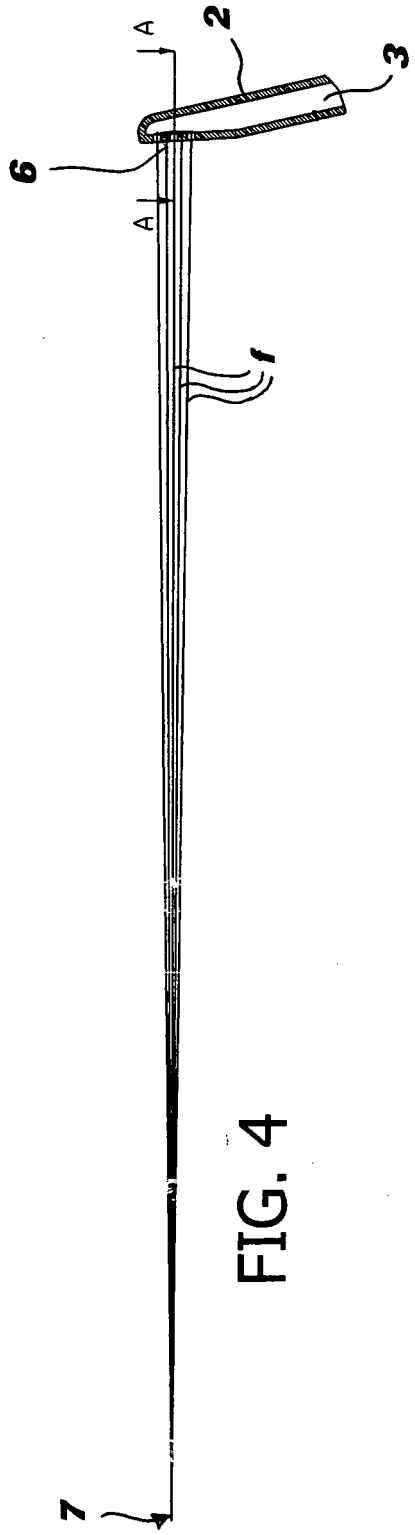


FIG. 4

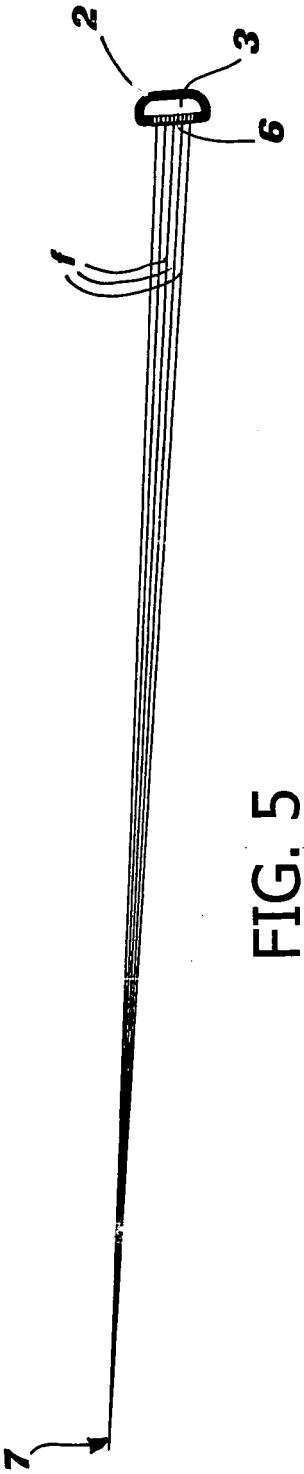


FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 04 42 5491

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 308 754 A (FOERY HERMANN JOSEF) 29 March 1989 (1989-03-29) * abstract * * column 3, line 55 - line 22; figures 2,4,5 *	1-6	D03D47/30
X	DE 32 04 363 A (GUENNE WEBMASCHF GMBH) 11 August 1983 (1983-08-11) * abstract * * page 5, line 13 - line 20 * * page 5, line 35 - line 17; figures 3,4 *	1-6	
X	EP 0 516 587 A (TOYODA AUTOMATIC LOOM WORKS) 2 December 1992 (1992-12-02) * column 1, line 35 - line 43 * * column 1, line 55 - column 2, line 3 * * column 3, line 55 - column 4, line 13; figures 4,5 *	1-6	
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

D03D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 December 2004	Louter, P

CATEGORY OF CITED DOCUMENTS

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