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(71) Applicant: **Kabushiki Kaisha Toyota Jidoshokki**
Kariya-shi, Aichi 448-8671 (JP)

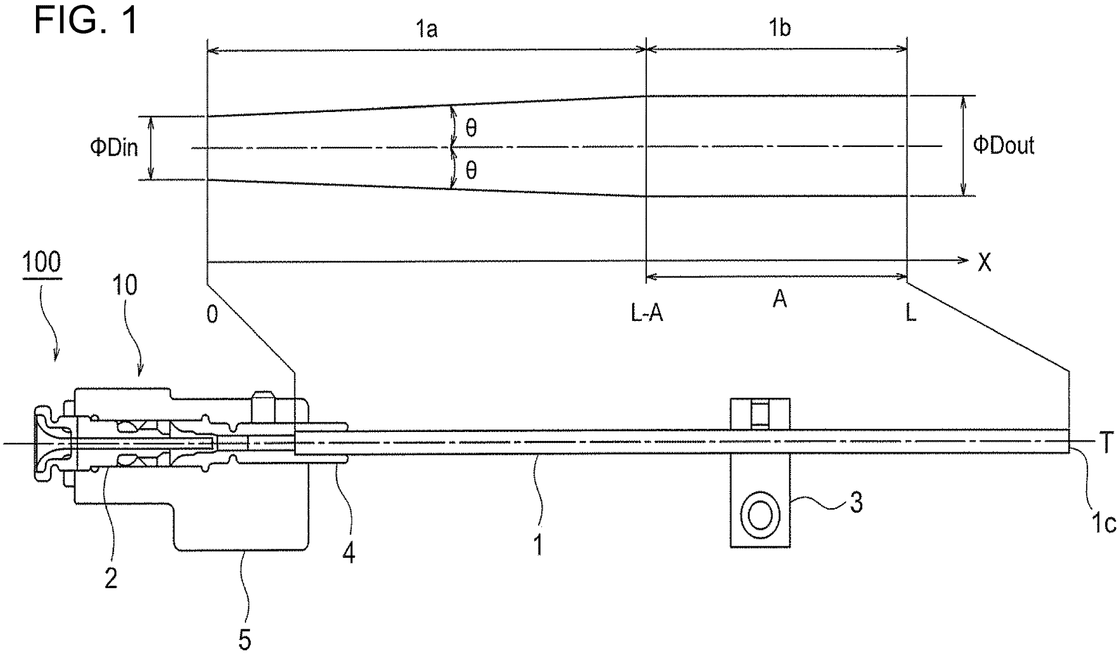
(72) Inventors:
- **KIGUCHI, Yuichiro**
  Kariya-shi,
  Aichi 448-8671 (JP)
- **MAKINO, Yoichi**
  Kariya-shi,
  Aichi 448-8671 (JP)

(74) Representative: **TBK**
Bavariaring 4-6
80336 München (DE)

(54) AIR JET LOOM

(57) An air jet loom (100) includes a reed (7) having a tunnel (7a) and a main nozzle (10) flying a weft yarn (20) into the tunnel (7a) by air jet injection to perform weft insertion. An accelerating tube (1) of the main nozzle (10) has a tapered portion (1a) and a straight portion (1b). Yarn speed ratio (q) of the weft yarn (20) is defined by a speed ratio (U1/U2) of a speed (U1) with respect to a speed (U2). The yarn speed ratio (q) is obtained by relationship among an entire length (L) of the accelerating tube (1), a ratio (A/L) of a length (A) of the straight portion (1b) with respect to the entire length (L) of the accelerating tube (1), and an inclination angle (θ) of an inner surface of the tapered portion (1a). The entire length (L), the ratio (A/L), and the inclination angle (θ) are determined such that the yarn speed ratio (q) is smaller than a maximum value (qmax) that is obtained by Expression 1, qmax = (c2 / c1) + 1.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to an air jet loom.

[0002] In an air jet loom, a main nozzle flies a weft yarn by compressed air to perform weft insertion and includes an accelerating tube to accelerate and fly a weft yarn. Japanese Patent Application Publication No. 2004-156162 discloses a tube having a tapered nozzle shape. The inner surface of the tube has a tapered shape that is continuously enlarged from the fluid inlet toward the fluid outlet. As shown in the description of the paragraph in the above Application, when starting weft insertion, the leading end of the inserted weft yarn may be uncontrolled in the tube and damaged due to the contact with the inner surface of the tube, so that filling knot that is one of weaving defects may occur. In the above Application, the main nozzle in the air jet loom has the tube that is 150 mm or less in length to prevent filling knot from occurring.

[0003] However, in the main nozzle of the air jet loom in the above Application, since the length of the accelerating tube is limited to 150 mm or less, force for flying a weft yarn cannot be increased.

[0004] The present invention, which has been made in light of the above-identified problems, is directed to providing an air jet loom that can keep high force for flying a weft yarn while preventing filling knot from occurring.

SUMMARY OF THE INVENTION

[0005] In accordance with an aspect of the present invention, there is provided an air jet loom including a reed having a tunnel extending in a direction of weft insertion and a main nozzle flying a weft yarn into the tunnel by air jet injection to perform weft insertion. The accelerating tube of the main nozzle has a tapered portion formed such that an inner diameter of the tapered portion is continuously enlarged from upstream toward downstream in the direction of weft insertion and a straight portion that is disposed in contact with an end of the tapered portion located downstream in the direction of weft insertion and extends from upstream toward downstream so as to have a constant inner diameter. A yarn speed ratio of the weft yarn is defined by a speed ratio of a speed of the weft yarn at a given point of the weft yarn with respect to a speed of the weft yarn at a leading end of the weft yarn located downstream in the direction of weft insertion. The yarn speed ratio is obtained by relationship among an entire length of the accelerating tube, a ratio of a length of the straight portion with respect to the entire length of the accelerating tube, and an inclination angle of an inner surface of the tapered portion with respect to a center axis of the accelerating tube. The entire length of the accelerating tube, the ratio of the length of the straight portion with respect to the entire length of the accelerating tube, and the inclination angle of the inner surface of the tapered portion are determined such that the yarn speed ratio is smaller than a maximum value that is obtained by a following Expression 1 expressed relationship between a distance between an end of the accelerating tube located downstream in the direction of weft insertion and the reed and a shortest distance between the center axis of the accelerating tube and the tunnel of the reed.

$$\text{Expression 1} \ldots q_{max} = (c2 / c1) + 1$$

[0006] Other aspects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The invention together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

FIG. 1 is a schematic sectional view of an accelerating tube of a main nozzle in an air jet loom according to an embodiment of the present invention;

FIG. 2 is a schematic perspective view of an end of the accelerating tube and the reeds in the air jet loom of FIG. 1;

FIG. 3 is a schematic side view of the end of the accelerating tube and the reeds in the air jet loom of FIG. 2, showing the positional relationship between the end of the accelerating tube and the reeds;

FIG. 4 is a schematic sectional view of the reeds and the accelerating tube of FIG. 2, taken along the line IV-IV of

FIG. 3, showing the positional relationship between the reeds and the center axis of the accelerating tube;

FIG. 5A is a schematic view of the accelerating tube and the reeds in the air jet loom of FIG. 1, showing a state of a weft yarn in the accelerating tube when starting weft insertion;

FIG. 5B is a schematic view of the accelerating tube and the reeds in the air jet loom of FIG. 2, showing a state of a weft yarn when the leading end of the weft yarn reached the inlet of a tunnel of the reeds;

FIG. 6A is a schematic view of a weft yarn showing a state in which the leading end of the weft yarn bends;

FIG. 6B is a schematic view of a weft yarn showing a state in which the length of the bent portion adjacent to the leading end of the weft yarn becomes maximum;

FIG. 7 is a graph showing the relationship between a ratio p of force for flying a weft yarn and a ratio A/L that are calculated by the estimation expression f (L, A/L, θ) that is obtained by multivariate analysis;

FIG. 8 is a graph showing the relationship between a speed ratio q of a weft yarn and the ratio A/L that are calculated by the estimation expression f (L, A/L, θ) that is obtained by multivariate analysis; and

FIG. 9 is a graph showing the relationship between the ratio A/L and an evaluation function F0.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0008] The following will describe an air jet loom according to an embodiment in the present invention with the accompanying drawings. Referring to FIG. 1, an air jet loom 100 includes a main nozzle 10. The main nozzle 10 includes an accelerating tube 1, a first main nozzle bracket 3 supporting the accelerating tube 1, and a second main nozzle bracket 5 located upstream of the first main nozzle bracket 3 in the direction of weft insertion and supporting the accelerating tube 1 via a sleeve 4. The second main nozzle bracket 5 has a thread guide 2. The thread guide 2 communicates with the accelerating tube 1 through the sleeve 4. The thread guide 2 guides a weft yarn such that the weft yarn is aligned with the center axis T of the accelerating tube 1 and conveyed.

[0009] As shown in FIG. 1, the accelerating tube 1 has a tapered portion 1a and a straight portion 1b. The tapered portion 1a is formed such that the inner diameter of the tapered portion 1a is continuously enlarged from upstream toward downstream in the direction of weft insertion. The inclination angle of the inner surface of the tapered portion 1a is denoted by θ with respect to the center axis T of the accelerating tube 1. The straight portion 1b is disposed in contact with the end of the tapered portion 1a located downstream in the direction of weft insertion and extends from upstream toward downstream so as to have a constant inner diameter. That is, the inner surface of the straight portion 1b is formed in a straight shape with respect to the center axis T of the accelerating tube 1. The accelerating tube 1 injects a weft yarn from a top end 1c of the accelerating tube 1 located downstream in the direction of weft insertion. The length of the straight portion 1b is denoted by A and the entire length of the accelerating tube 1 is denoted by L.

[0010] Referring to FIG. 2, the air jet loom 100 includes reeds 7. Each reed 7 has a tunnel 7a extending in the direction Y of weft insertion. The accelerating tube 1 flies a weft yarn 20 by air jet injection of compressed air from the top end 1c thereof, so that the weft yarn 20 flies into the tunnels 7a along the center axis T of the accelerating tube 1 to perform weft insertion.

[0011] Referring to FIG. 3, the distance between the top end 1c of the accelerating tube 1 and an inlet of the tunnels 7a of the reeds 7 is denoted by c1. Referring to FIG. 4, the distance between the tunnels 7a of the reeds 7 and the center axis T of the accelerating tube 1 is denoted by c2. A circle E shown in FIG. 4, which is indicated by a broken line, shows the position of the accelerating tube 1.

[0012] The following will describe how to decide the range of the length A of the straight portion 1 b of the accelerating tube 1 with reference to FIGS. 5A 5B, 6A, 6B, 7, 8, and 9. Referring to FIG. 5A, the weft yarn 20 is schematically illustrated by two points indicated by P1 and P2. The speed of the weft yarn 20 at a given point P1 is denoted by U1. The speed of the weft yarn 20 at a leading end P2 of the weft yarn 20 located downstream in the direction of weft insertion is denoted by U2. When starting weft insertion, the speed U1 at the point P1 is larger than the speed U2 at the leading end P2. As shown in FIG. 5A, when in starting weft insertion, the leading end P2 of the weft yarn 20 is located at the same position as the top end 1 c of the accelerating tube 1, the distance between the point P1 and the leading end P2 is denoted by D1. As shown in FIG. 5B, when the leading end P2 of the weft yarn 20 reaches the inlet of the tunnels 7a of the reeds 7, the distance between the point P1 and the leading end P2 decreases from D1 to D2. That is, the portion of the weft yarn 20 adjacent to the leading end P2 of the weft yarn 20 is loosened.

[0013] Thus, when the weft yarn 20 is loosened, bending of the weft yarn 20 occurs as shown in FIG. 6A. The length of the bent portion of the weft yarn 20, or a bent length is denoted by S. The distance between the center axis T of the accelerating tube 1 and the leading end P2 of the weft yarn 20, or a bent distance is denoted by h. As shown in FIG. 6B, when the bent distance h is approximately the same as the bent length S, that is, when the weft yarn 20 is bent at right angle and the distance between the point P1 and the leading end P2 is approximately the same as the bent length S, the bent distance h becomes the maximum value hmax. Such bending of the weft yarn 20 occurs mainly just after starting weft insertion in the air jet loom 100. That is, this phenomenon occurs in an initial stage in which air pressure rises.

[0014] When a yarn speed ratio q of a weft yarn is defined by q = U1 / U2 where U1 / U2 denotes a speed ratio, the following Expression 2 is established. The time until the leading end P2 of the weft yarn 20 reaches the inlet of the tunnels 7a of the reeds 7 is denoted as t2. The speed ratio U1/U2 of the weft yarn 20 is obtained by the ratio of increase of kinetic energy of the weft yarn 20 with respect to work, or energy that air carries out while the weft yarn 20 travels by the distance D1, for example, by 20 mm.

$$\begin{aligned}\text{Expression 2} \ldots\ S &= (U1 - U2) * t2 \\ &= U2 * (q-1) * (c1 / U2) \\ &= (q - 1) * c1\end{aligned}$$

[0015] If the leading end P2 of the bent weft yarn 20 contacts with the inner wall of the tunnels 7a of the reeds 7, filling knot may occur in the woven cloth. The condition in which the leading end P2 of the bent weft yarn 20 does not contact with the inner wall of the tunnels 7a of the reeds 7 is expressed as the following Expression 3.

$$\text{Expression 3} \ldots\ c2 > hmax = S = (q - 1) * c1$$

[0016] When Expression 3 is deformed with respect to the yarn speed ratio q, the following Expression 4 is obtained.

$$\text{Expression 4} \ldots\ q < (c2 / c1) + 1$$

[0017] Accordingly, when the yarn speed ratio q is smaller than the maximum value qmax, or (c2 / c1) + 1, the leading end P2 of the bent weft yarn 20 does not contact with the inner wall of the tunnels 7a of the reeds 7. That is, the condition in which the leading end P2 of the bent weft yarn 20 does not contact with the inner wall of the tunnels 7a of the reeds 7, or the maximum value qmax of the yarn speed ratio q depends on the positional relationship between the reeds 7 and the top end 1c of the accelerating tube 1.

[0018] Referring to FIG. 7, a graph shows the relationship between a ratio p of force for flying a weft yarn and a ratio A/L that are calculated by an estimation expression f (L, A/L, θ) that is obtained by multivariate analysis. The ratio A/L denotes a ratio of the length A of the straight portion 1b with respect to the entire length L of the accelerating tube 1. When injection fluid applies to the weft yarn 20 per unit length, the ratio p of the force for flying a weft yarn denotes a ratio of the force for flying a weft yarn at the inclination angle θ of the inner surface of the tapered portion 1a with respect to the force for flying a weft yarn when the inclination angle θ of the inner surface of the tapered portion 1a is zero. The minimum value pmin of the ratio p of force for flying a weft yarn is determined according to the pressure of compressed air supplied to the main nozzle 10 or the target opening period of the valve supplying compressed air to the main nozzle 10. According to the graph in FIG. 7, when the ratio p of force for flying a weft yarn in the accelerating tube 1 becomes the minimum value pmin, or = 1.2, the ratio A/L is 0.76.

[0019] Referring to FIG. 8, a graph shows the relationship between a yarn speed ratio q for flying a weft yarn and the ratio A/L that are calculated by the estimation expression f (L, A/L, θ) that is obtained by multivariate analysis. When the distance c1 is 20 mm and the distance c2 is 3 mm and then the yarn speed ratio q becomes the maximum value qmax, or = 1.15, the ratio A/L is 0.13.

[0020] Referring to FIG. 9, a graph shows the evaluation function F0 for the ratio A/L when L = 240 mm and θ = 0.10 are satisfied. The evaluation function F0 for the ratio AL is denoted by a dimensionless numeral which is from 0 to 1 and expressed by the following Expression 5. The evaluation function F1 for the ratio p of force for flying a weft yarn is a ratio with respect to a sufficiently large value of the ratio p of force for flying a weft yarn. When the ratio p of force for flying a weft yarn is smaller than the minimum value pmin, F1 = 0 is satisfied. The evaluation function F2 of the yarn speed ratio q, or = U1 / U2 is a ratio with respect to a sufficiently large value of the yarn speed ratio q. When the yarn speed ratio q is larger than the maximum value qmax, F2 = 0 is satisfied.

$$\text{Expression 5} \dots F0 = (F1 * F2) \wedge 0.5$$

[0021] Accordingly, as shown in FIG. 9, when θ = 0.1, L = 240 mm are satisfied, an expression, 0.13 < A/L ≤ 0.76 is established.

[0022] As described above, in the air jet loom 100 according to the present embodiment in the present invention, the accelerating tube 1 includes the tapered portion 1a and the straight portion 1b that is disposed in contact with the end of the tapered portion 1a located downstream in the direction of weft insertion. The yarn speed ratio q of a weft yarn is obtained by the relationship among the entire length L of the accelerating tube 1, the ratio A/L that is a ratio of the length A of the straight portion 1b with respect to the entire length L of the accelerating tube 1, and the inclination angle θ of the inner surface of the tapered portion 1a. The entire length L, the ratio A/L, and the inclination angle θ are determined such that the maximum value qmax of the yarn speed ratio q is obtained by the following Expression 6 expressing the relationship between the distance c1 between the end of the accelerating tube 1 located downstream in the direction of weft insertion and the reeds 7 and the shortest distance c2 between the center axis T of the accelerating tube 1 and the tunnels 7a of the reeds 7.

$$\text{Expression 6} \dots qmax = (c2 / c1) + 1$$

[0023] The ratio p of force for flying a weft yarn applied by the accelerating tube 1 is obtained as in the yarn speed ratio q by the relationship among the entire length L of the accelerating tube 1, the ratio A/L that is a ratio of the length A of the straight portion 1b with respect to the entire length L of the accelerating tube 1, and the inclination angle θ of the inner surface of the tapered portion 1a. The entire length L , the ratio A/L, and the inclination angle θ are determined such that the ratio p of force for flying a weft yarn is larger than the minimum value pmin that is determined according to the pressure of compressed air supplied to the main nozzle 10 or the target opening period of the valve through which compressed air is supplied to the main nozzle 10. The inner surface of the tapered portion 1a is formed inclined at the inclination angle θ, so that the ratio p of force for flying a weft yarn increases. Thus, the pressure of compressed air supplied to the main nozzle 10 and the opening period of the valve through which compressed air is supplied to the main nozzle 10 are reduced, thereby contributing to energy saving.

[0024] Specifically, the ratio p of force for flying a weft yarn and the yarn speed ratio q are calculated by the estimation expression f (L, A/L, θ) that is obtained by multivariate analysis. The ratio A/L that is a ratio of the length A of the straight portion 1b with respect to the entire length L of the accelerating tube 1 is determined in the range in which the ratio p of force for flying a weft yarn is larger than the minimum value pmin and the yarn speed ratio q is smaller than the maximum value qmax. One example of the ratio A/L determined is shown as follows. When θ = 0.1, L = 240 mm, qmax = 1.15, and pmin = 1.2 are satisfied, an expression, 0.13 <A/L ≤ 0.76 is established, which denotes the range of the ratio A/L that is a ratio of the length A of the straight portion 1b with respect to the entire length L of the accelerating tube 1.

[0025] Thus, the range of the length A of the straight portion 1b is determined appropriately. As a result, since the leading end of the inserted weft yarn can be controlled appropriately, the occurrence of filling knot can be prevented while the main nozzle 10 can keep high force for flying a weft yarn.

[0026] The accelerating tube 1 and the sleeve 4 may be integrally formed, so that the number of the parts of the air jet loom 100 can be reduced. A second accelerating tube having a straight shape via a connecting member may be connected to the straight portion 1b of the accelerating tube 1. As a result, since the entire length L of the accelerating tube can be enlarged, the force for flying a weft yarn can increase more.

[0027] An air jet loom (100) includes a reed (7) having a tunnel (7a) and a main nozzle (10) flying a weft yarn (20) into the tunnel (7a) by air jet injection to perform weft insertion. An accelerating tube (1) of the main nozzle (10) has a tapered portion (1a) and a straight portion (1b). Yarn speed ratio (q) of the weft yarn (20) is defined by a speed ratio (U1/U2) of a speed (U1) with respect to a speed (U2). The yarn speed ratio (q) is obtained by relationship among an entire length (L) of the accelerating tube (1), a ratio (A/L) of a length (A) of the straight portion (1b) with respect to the entire length (L) of the accelerating tube (1), and an inclination angle (θ) of an inner surface of the tapered portion (1a). The entire length (L), the ratio (A/L), and the inclination angle (θ) are determined such that the yarn speed ratio (q) is smaller than a maximum value (qmax) that is obtained by Expression 1, qmax = (c2 / c1) + 1.

Claims

1. An air jet loom (100) comprising:

a reed (7) having a tunnel (7a) extending in a direction (Y) of weft insertion; and
a main nozzle (10) flying a weft yarn (20) into the tunnel (7a) by air jet injection to perform weft insertion,
wherein an accelerating tube (1) of the main nozzle (10) has a tapered portion (1a) formed such that an inner diameter of the tapered portion (1a) is continuously enlarged from upstream toward downstream in the direction (Y) of weft insertion and a straight portion (1b) that is disposed in contact with an end of the tapered portion (1a) located downstream in the direction (Y) of weft insertion and extends from upstream toward downstream so as to have a constant inner diameter,
characterized in that a yarn speed ratio (q) of the weft yarn (20) is defined by a speed ratio (U1/U2) of a speed (U1) of the weft yarn (20) at a given point (P1) of the weft yarn (20) with respect to a speed (U2) of the weft yarn (20) at a leading end (P2) of the weft yarn (20) located downstream in the direction (Y) of weft insertion, wherein the yarn speed ratio (q) is obtained by relationship among an entire length (L) of the accelerating tube (1), a ratio (A/L) of a length (A) of the straight portion (1 b) with respect to the entire length (L) of the accelerating tube (1), and an inclination angle (θ) of an inner surface of the tapered portion (1a) with respect to a center axis (T) of the accelerating tube (1), and wherein the entire length (L) of the accelerating tube (1), the ratio (A/L) of the length (A) of the straight portion (1 b) with respect to the entire length (L) of the accelerating tube (1), and the inclination angle (θ) of the inner surface of the tapered portion (1a) are determined such that the yarn speed ratio (q) is smaller than a maximum value (qmax) that is obtained by a following Expression 1 expressed by relationship between a distance (c1) between an end of the accelerating tube (1) located downstream in the direction (Y) of weft insertion and the reed (7) and a shortest distance (c2) between the center axis (T) of the accelerating tube (1) and the tunnel (7a) of the reed (7).

$$\text{Expression 1} \ldots \; q_{max} = (c2 / c1) + 1$$

2. The air jet loom (100) according to claim 1,
characterized in that a ratio (p) of force for flying the weft yarn (20) applied by the accelerating tube (1) is obtained by the relationship among the entire length (L) of the accelerating tube (1), the ratio (A/L) of the length (A) of the straight portion (1b) with respect to the entire length (L) of the accelerating tube (1), and the inclination angle (θ) of the inner surface of the tapered portion (1a), and wherein the entire length (L) of the accelerating tube (1), the ratio (A/L) of the length (A) of the straight portion (1b) with respect to the entire length (L) of the accelerating tube (1), and the inclination angle (θ) of the inner surface of the tapered portion (1a) are determined such that the ratio (p) of force for flying the weft yarn (20) is larger than a minimum value (pmin) that is determined according to pressure of compressed air supplied to the main nozzle (10) or a target opening period of a valve through which compressed air is supplied to the main nozzle (10).

3. The air jet loom (100) according to claim 2,
characterized in that the ratio (p) of force for flying the weft yarn (20) and the yarn speed ratio (q) are calculated by an estimation expression f(L, A/L, θ) that is obtained by multivariate analysis, and wherein the ratio (A/L) of the length (A) of the straight portion (1b) with respect to the entire length (L) of the accelerating tube (1) is determined in a range in which the ratio (p) of force for flying the weft yarn (20) is larger than the minimum value (pmin) and the yarn speed ratio (q) is smaller than the maximum value (qmax).

4. The air jet loom (100) according to claim 3,
characterized in that when $\theta = 0.1$, L = 240 mm, qmax = 1.15, and pmin = 1.2 are satisfied, an expression of $0.13 < A/L \leq 0.76$ is established.

FIG. 1

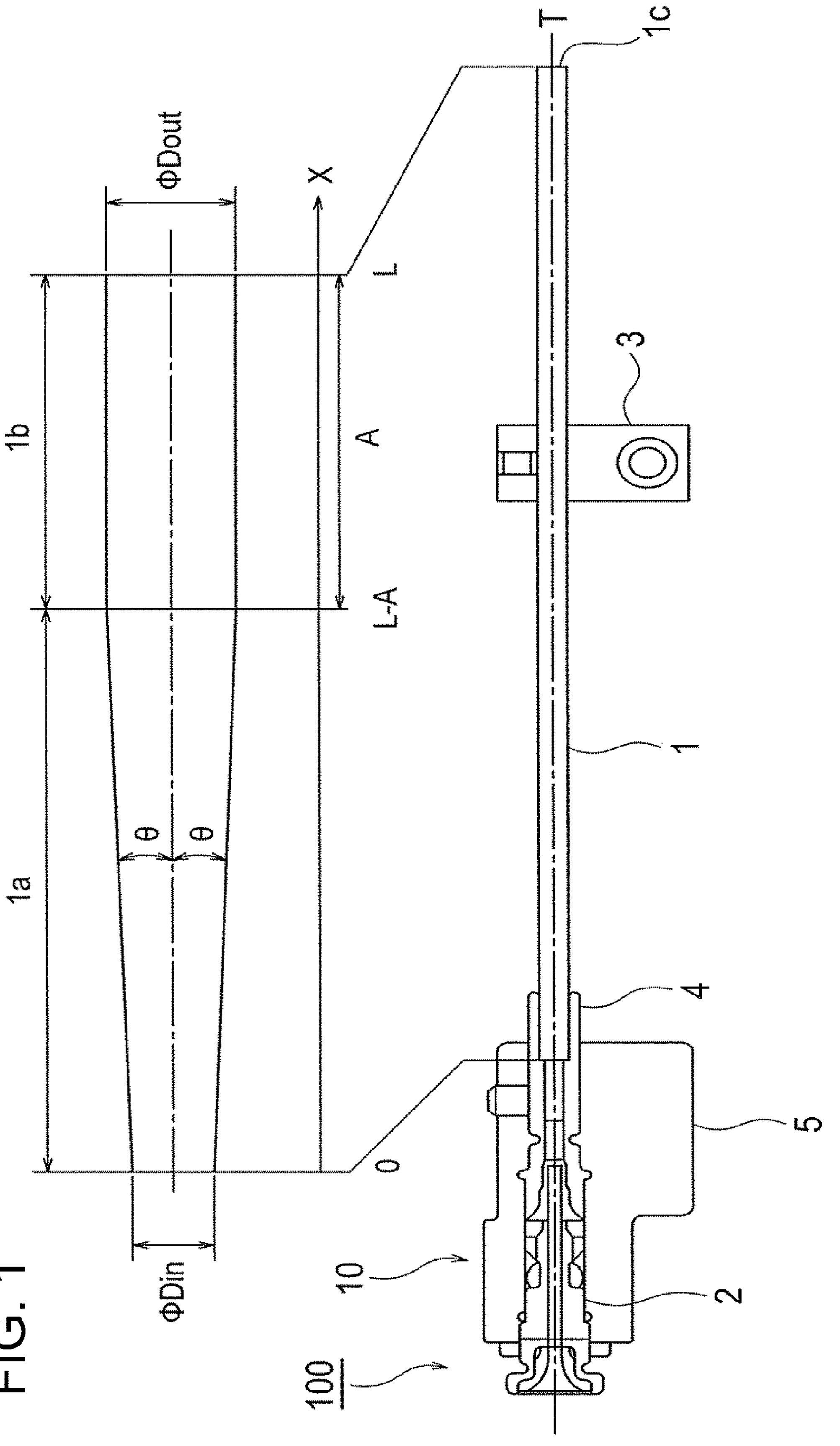


FIG. 2

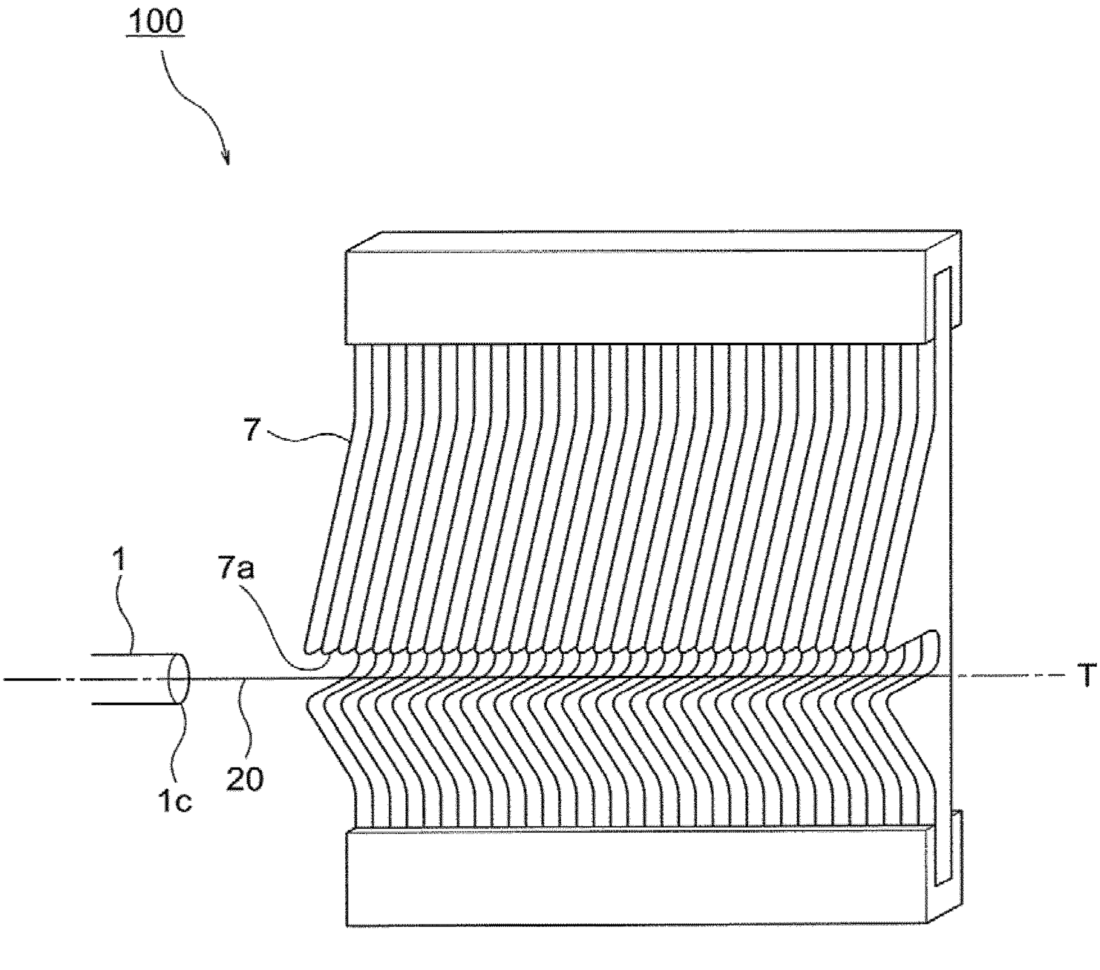


FIG. 3

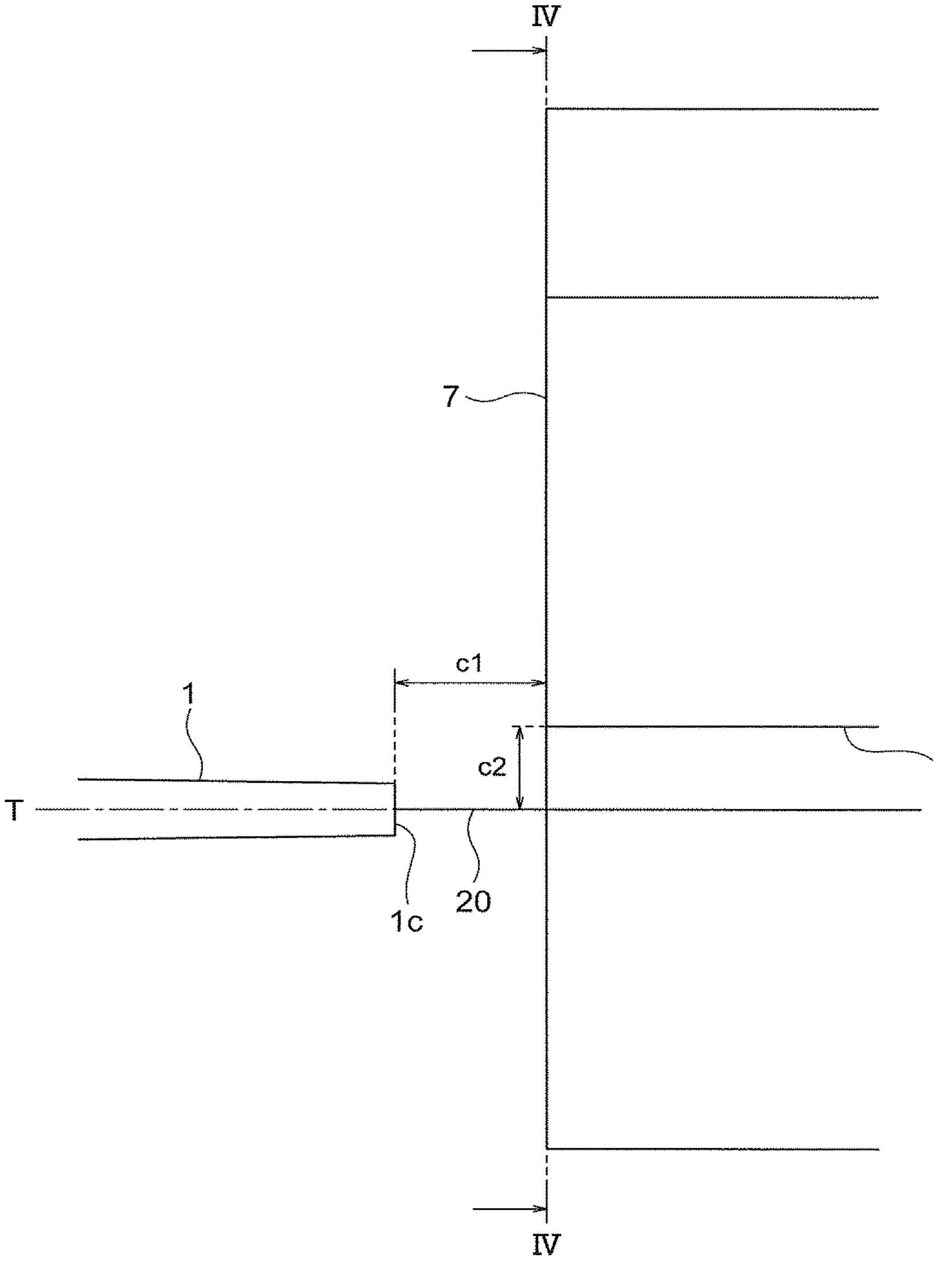


FIG. 4

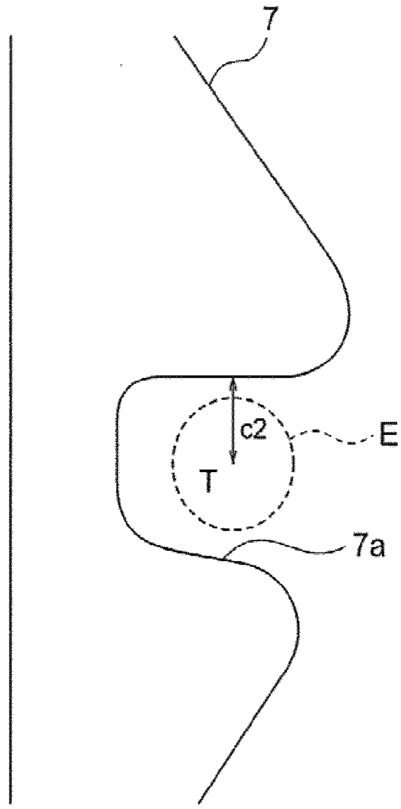


FIG. 5A

FIG. 5B

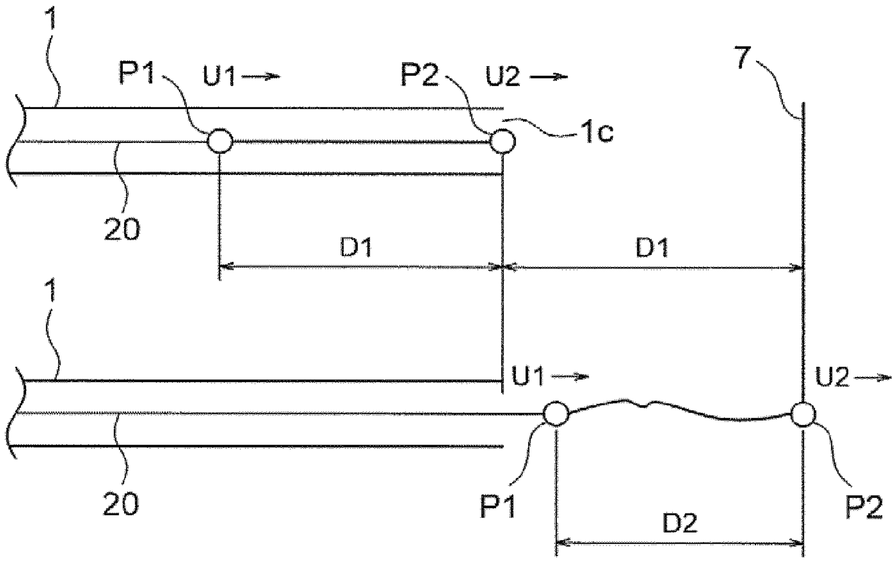


FIG. 6A

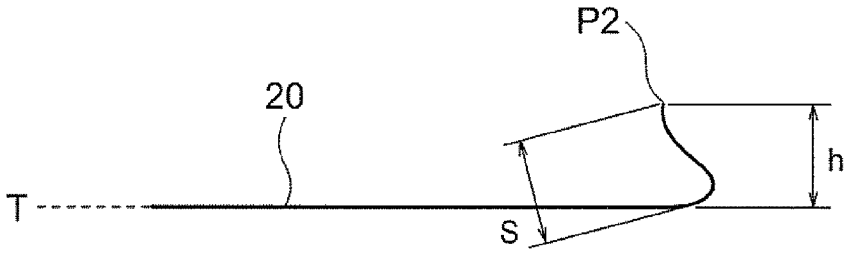


FIG. 6B

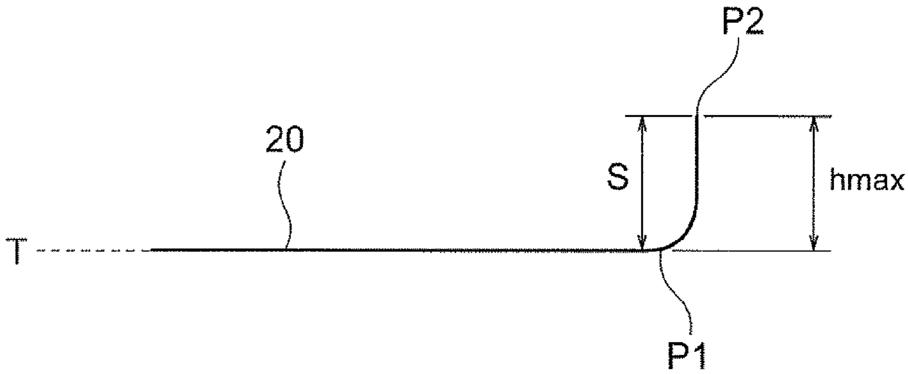


FIG. 7

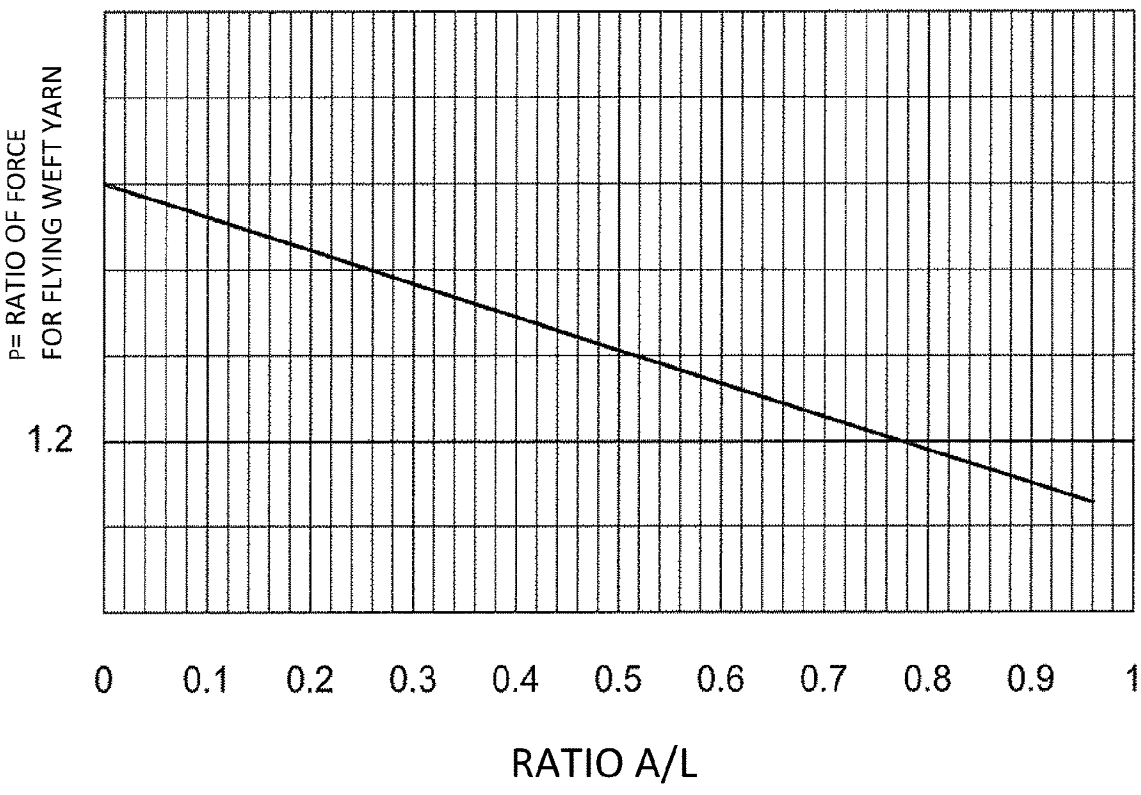
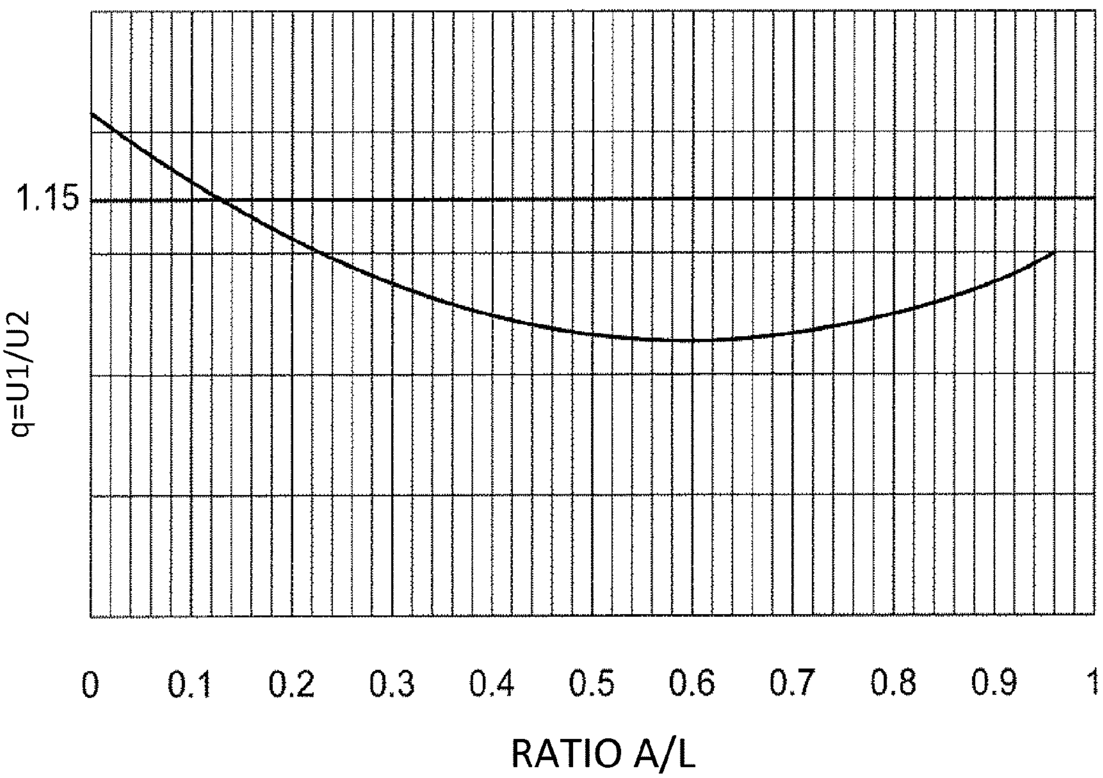


FIG. 8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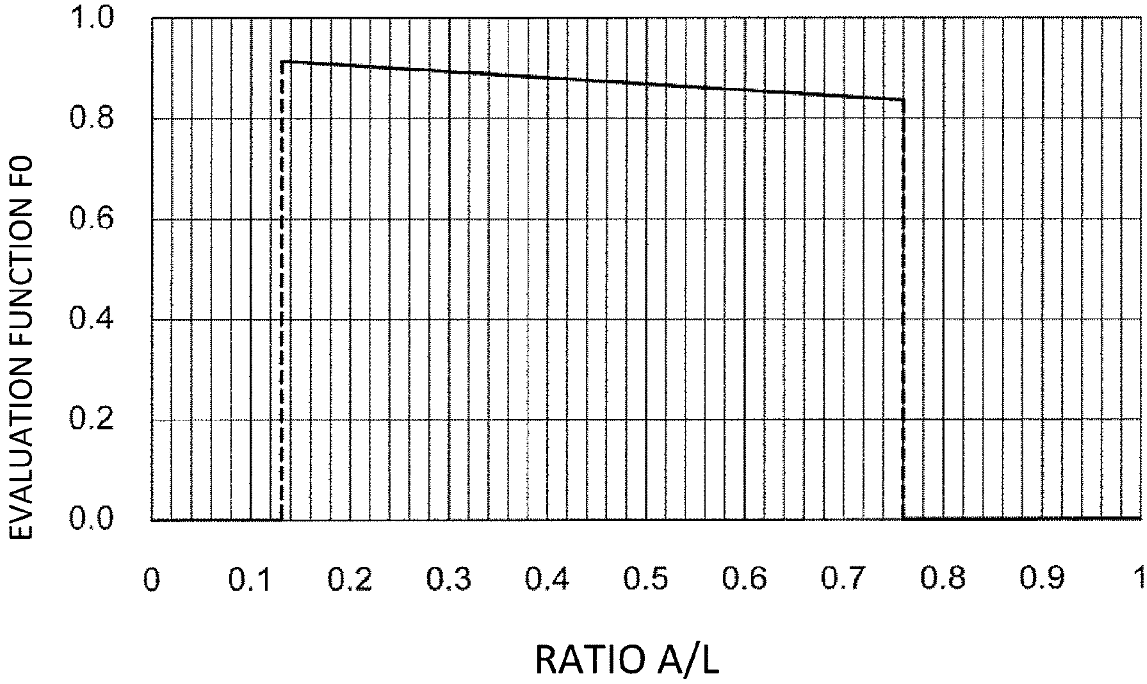
RATIO A/L

FIG. 9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RATIO A/L

Europäisches Patentamt
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EUROPEAN SEARCH REPORT

Application Number
EP 18 17 3755

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	EP 1 418 262 A1 (TSUDAKOMA IND CO LTD [JP]) 12 May 2004 (2004-05-12) * abstract; figures 1-8 * * paragraphs [0033] - [0036] * -----	1-4	INV. D03D47/30
X	CN 2 789 289 Y (OUYANG CHENGDE [CN]) 21 June 2006 (2006-06-21) * abstract; figures 1,2 * -----	1-4	
			TECHNICAL FIELDS SEARCHED (IPC)
			D03D

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	1 October 2018	Louter, Petrus

CATEGORY OF CITED DOCUMENTS

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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01-10-2018

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 1418262	A1	12-05-2004	CN 1548596	A	24-11-2004
			EP 1418262	A1	12-05-2004
			JP 2004156162	A	03-06-2004
CN 2789289	Y	21-06-2006	NONE		

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- JP 2004156162 A **[0002]**