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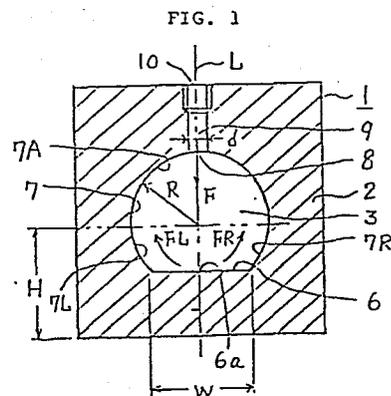
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⑸ Apparatus for interlacing multifilament yarn.

⑸ Yarn treating apparatus for producing an interlaced yarn by the use of compressed air comprises a body member (2) having a yarn treating chamber (3) having a first planar wall (6) and a second wall (7). In cross section the planar wall (6) is represented by the line (6a), and the second wall (7) shows a semicircular portion (7A) and two further portions (7R and 7L) extending from the ends of the semicircle respectively and ending at the sides of the line (6a). Each of the further portions may take the form of an arc having the same radius as the semicircle, a tangent to the semicircle and the segment of a curve which would be between the arc and the tangent. A fluid nozzle (9) for ejecting the compressed air has an outlet (8) at the top portion of the semicircle portion (7A) to eject the compressed air to the first planar wall (6).



APPARATUS FOR INTERLACING MULTIFILAMENT YARN

This invention relates to an apparatus wherein a fluid is ejected to a running multifilament yarn so that filaments constituting the running yarn are intermingled with each other by means of the energy of the fluid jet and so that the coherency of the yarn is increased. More specifically, this invention relates to
5 an improvement of a yarn treating apparatus comprising a shell body which has : a yarn treating chamber formed therein; an entrance of the chamber formed at its front end; an exit of the chamber formed at its rear end; and a jet nozzle, for ejecting a fluid jet, opening into a peripheral wall of the chamber.

10 A yarn treating apparatus of this type with a chamber which is circular in cross section is well known and in practical use for manufacture of an interlaced yarn. This type of interlacing apparatus will be referred to as a "circular chamber type" apparatus. In the circular type chamber, a fluid jet ejected from the jet nozzle
15 impinges on the opposite circular surface of the chamber and the fluid flows in separate directions to the right and to the left. The separated fluids are apt not to equal each other in amount, whereupon unbalance of fluid flow occurs in the chamber and this causes a rotation to be imparted to a yarn passing through the chamber.
20 Once the unbalance occurs it is difficult to return to a stable condition. The continuous rotation of the yarn continuously imparts a false twisting thereto and reduces the interlacing action to the yarn. In order to obtain an interlaced yarn which is uniformly interlaced at a high level, the rotation of the yarn during the

interlacing operation is required to be maintained as minimal as possible, and the yarn is required to be subjected to a stable periodical and sufficient opening operation. For this reason, an interlacing apparatus having a chamber of which a cross sectional configuration is a semicircle has been proposed. This type of interlacing apparatus will be referred to as a "semicircular chamber type" apparatus.

In the semicircular chamber type, the problem of the rotation of the yarn in the chamber during the interlacing operation is substantially eliminated, since the fluid jet ejected from the nozzle impinges upon a bottom flat surface of the chamber and the flat surface has a function of self revision to diminish the unbalanced flow of the fluid when it occurs.

The inventor of the present invention has conducted trials to produce an interlaced yarn by using the semicircular chamber type apparatus and has found that an interlaced yarn thus obtained has substantially no false twisted portions therein and uniform interlacing density. However, the interlacing pitch of the yarn is often undesirably large for the production of some kinds of woven fabrics such as a salt- and pepper-like fabric, a sprinkly coloured fabric, Melange fabric or Grandrelle fabric, which are manufactured by, for example, a water jet loom or an air jet loom. The inventor of the present invention has also found that the consumption of compressed fluid of the semicircular chamber type apparatus must be comparatively large in order to obtain an interlaced yarn having a certain extent of coherency factor (CF-value). Practically, since the compressed air is comparatively expensive and the selling price of an interlaced yarn is comparatively low, manufacturers of interlaced

yarns have been eagerly awaiting development of an interlacing apparatus which can produce a good quality interlaced yarn with small consumption of compressed air.

5 An object of the present invention is to provide an interlacing apparatus which enables the easy production of an interlaced yarn having substantially no false twisted portions therein and having a comparatively small interlacing pitch which is suitable for a fabric such as a salt- and pepper-like fabric or a sprinkly coloured fabric.

10 Another object of the present invention is to provide an interlacing apparatus which enables the production of an interlaced yarn with a comparatively small amount of consumption of compressed fluid.

A further object of the present invention is to provide an interlacing apparatus which is simple in construction and easy to
15 manufacture and assemble and which can be maintained easily.

The apparatus for interlacing multifilament yarn of the present invention is characterised in that:

(a) the peripheral wall of the chamber into which the jet nozzle opens includes: a first wall which lies on a plane extending
20 along the chamber and a second wall, the sides of which are connected to the sides of the first wall so that the circumference of the chamber is substantially enclosed by the first and second walls, except for a yarn string-up slit if this is provided;

(b) the second wall is substantially symmetrical with respect
25 to an imaginary standard plane which lies along the axis of the chamber, and which bisects and is perpendicular to the first wall;

(c) in a cross section through the chamber, taken along a plane

perpendicular to the axis of the chamber, the second wall has a portion which is semicircular and two further portions, joining the ends of the semicircle to the sides of the first portion, these further portions being either planar or curving inwardly;

5 (d) the fluid jet nozzle opens into the second wall substantially at a position intersecting the second wall and said imaginary standard plane; and

(e) the fluid nozzle communicates with a passage for introducing a jet of fluid, which passage is formed in the body member and
10 which is open to the outside of the body member.

As seen in the said cross section, the further portions of the second wall may each appear as an arc having the same radius as the semicircle and continuing the circumference of the semicircle, a tangent to the semicircle or part of a curve which would lie between
15 the arc and the tangent.

The apparatus having a chamber formed in one of such cross-sectional configurations is preferable for preventing a unidirectional and continuous rotation of a yarn and for imparting a periodic, stable and sufficient opening operation to a yarn during interlacing
20 treatment, and further for imparting interlacing having a comparatively small interlacing pitch to a yarn passing through the chamber. The apparatus having a chamber formed in one of such cross-sectional configurations is also preferable for imparting interlacing to a yarn with a comparatively small consumption of compressed air.

25 The cross-sectional shape and dimension of the chamber may be selected in accordance with the yarn treating conditions such as a yarn delivery speed, tension in the yarn, the total denier of the yarn, the number of the filaments, the filament denier or the material of the filament.

In an embodiment of the present invention which is most available, the cross-sectional configuration of the chamber consists of an arc which is more than a semicircle and a chord which subtends the arc, the arc representing the second wall and the chord represent-

5 ing the first wall. According to this embodiment, stability of the yarn motion within the chamber is enhanced. It is preferable that the width of the first wall is greater than half the diameter, more preferably larger than the diameter, of the outlet of the fluid jet nozzle, and that the distance between the line passing through
10 both ends of the semicircular portion and the first wall in a direction perpendicular to the first wall is greater than one twentieth, more preferably greater than one tenth, of the diameter of the semicircular portion, for obtaining much more enhanced stability of the yarn motion within the chamber.

15 As will be explained with reference to a further embodiment, in addition to the entrance and exit for delivering a yarn to be treated, it is preferable that a yarn string-up slit for introducing a continuous yarn to the chamber upon the commencement of the yarn treatment and for discharging the continuous yarn from the chamber
20 upon the stoppage of the yarn treatment is formed on the body member, so that the yarn can be handled easily upon the commencement and stoppage of the yarn treatment. In this case the string-up slit should be formed on the semicircle portion of the second wall along the axis of the chamber, preferably at the intersection of the second
25 wall and imaginary standard plane. If the string-up slit is formed on one of the further portions of the second wall or on the first wall, the stability of the yarn movement during the yarn treatment

may be decreased or the running yarn may be expelled to the outside of the body member through the string-up slit while the yarn is being treated. In the embodiment having the string-up slit, it is preferable that the diameter of the outlet of the fluid jet nozzle is larger than the width of the string-up slit in order to reduce the risk of yarn being expelled from the string-up slit.

As illustrated in a still further embodiment of the present invention, to facilitate the design, manufacture, assembly and dismantling of the apparatus, the body member may include a first wall piece on which the first wall is formed, and a second wall piece on which the second wall is formed and which includes an entrance circular wall portion and an exit circular wall portion, the first and second wall pieces being detachably assembled to form the chamber. In this embodiment, it is preferable that the first wall is made of ceramic which is durable against abrasion and the second wall is made of metal, such as brass, steel or stainless steel, which is easy to manufacture precisely, so that abrasion of the first wall because of the yarn contact and fluid contact is small and so that the fluid jet nozzle can be formed precisely on the second wall.

In another embodiment of the present invention, the body member includes: one wall piece on which the first wall and a part of the second wall are provided; and another wall piece on which the remaining part of the second wall is formed, the two wall pieces being detachably assembled to form the chamber, leaving between them a small gap to form the string-up slit for introducing and discharging yarn.

In an apparatus of the present invention, it is preferable that the chamber is formed from one body member made of ceramic,

so that there is no meeting line on the wall of the chamber formed by the interface between two different body elements, a meeting line which occurs when the body member consists of two or more body elements and which sometimes causes catching of a filament or filaments of the yarn passing through the chamber.

Some embodiment of the present invention will now be explained with reference to the accompanying drawings wherein;

Fig. 1 is a cross sectional elevational view of a first embodiment of the present invention, which view is taken along a plane perpendicular to the axis of the embodiment;

Fig. 2 is a cross sectional side view of the first embodiment shown in Fig. 1;

Figs. 3a, 3b and 3c are cross sectional elevational views of chambers in a second embodiment, the first embodiment and a third embodiment of the present invention, in order to explain the range of practical modifications of the configurations thereof;

Fig. 4 is a cross sectional elevational view of a fourth embodiment of the present invention;

Fig. 5 is a cross sectional elevational view of a fifth embodiment of the present invention;

Fig. 6 is a cross sectional view of a sixth embodiment of the present invention;

Fig. 7 is a fragmentary view taken in the direction of the arrows XI-XI of Fig. 6;

Fig. 8 is a side view of a lower housing member in a seventh embodiment of the present invention;

Fig. 9 is a fragmentary view taken in the direction of the arrows X2-X2 of Fig. 8;

Fig. 10 is a side view in the direction of arrows X3-X3 of Fig. 8;

Fig. 11 is a cross sectional elevational view of an eighth embodiment of the present invention;

5 Fig. 12 is a bottom end view of the eighth embodiment shown in Fig. 11;

Fig. 13 is a cross sectional elevational view of a ninth embodiment of the present invention;

10 Figs. 14a and 14b are respectively a partial cross sectional elevational view of a chamber of an interlacing apparatus in the prior art and a fragmentary view taken in the direction of the arrows X4-X4 of Fig. 14a;

15 Figs. 15a and 15b are respectively a partial cross sectional elevational view of a chamber of another interlacing apparatus in the prior art and a fragmentary view taken in the direction of the arrows X5-X5 of Fig. 15a;

Figs. 16a and 16b are respectively a partial cross sectional elevational view of a chamber of an interlacing apparatus of the present invention and a fragmentary view taken in the direction
20 of the arrows X6-X6 of Fig. 16a; and

Fig. 17 is a graph which shows experimental results on prior art apparatus and on the present invention.

25 Figs. 1 and 2 are cross sectional elevational and cross sectional side views of the first embodiment of the present invention. Referring to Figs. 1 and 2, an interlacing apparatus 1 of the present invention comprises a body member 2. The body member 2 has formed therein a yarn treating chamber 3 which is provided with an entrance 4 and an exit 5 (see Fig. 2). The chamber 3 is enclosed with a

planar rectangular first wall 6 and a part-cylindrical second wall 7. The first wall 6 is formed on a plane extending parallel to the axis of the chamber 3 and has a width W as shown in Fig. 1, and a length NL as shown in Fig. 2. As seen in cross section in Fig. 1, the second wall 7 may be regarded as having a semicircular portion 7A and two further segmental portions 7R and 7L. The lower ends of semicircular portion 7A are connected to the upper ends of the segmental portions 7R and 7L respectively. The lower ends of the segmental portions 7R and 7L are connected to the sides of the first wall 6 respectively. The radius of each of the segmental portions 7R and 7L is the same as the radius of the semicircular portion 7A. Each circumferential length of the segmental portions 7R and 7L in Fig. 1 is the same. As a result, the chamber 3 is symmetrical with respect to an imaginary standard plane L which passes through the centre 6a of the first wall 6 in a direction perpendicular to the first wall 6 and which extends along the axis of the chamber 3. The outlet 8 of a fluid jet nozzle 9 which is utilized to eject a fluid jet for treating a yarn Y (see Fig. 2) passing through the chamber 3 is located in the second wall 7. The outlet 8 of the fluid jet nozzle 9 lies at a position intersecting the imaginary standard plane L and the second wall 7 so that fluid jet flow F ejected from the outlet 8 is directed towards the first wall 6. The nozzle 9 for introducing the fluid jet is formed in the body member 2 and has an opening 10 at the external surface of the member 2. Referring to Fig. 2, a guide 11a is located upstream of the entrance 4 of the chamber 3 and a guide 11b is located downstream of the exit 5 of the chamber 3.

An interlacing operation in the chamber 3 will not be explained by way of example wherein the apparatus illustrated in Figs. 1 and 2 is utilized and a running yarn Y (Fig. 2) is delivered between the

guides 11a and 11b through the chamber 3 of the apparatus 1. Into this chamber air in a pressurized condition is ejected through the outlet 8 of the fluid jet nozzle so that the yarn Y is subjected to an interlacing operation by flow F created by the fluid jet. The fluid jet flow F proceeds along the imaginary standard plane L and impinges upon the first wall 6 to form a turbulent flow and then separates into two fluid flows FR and FL which advance along the first wall 6 and further along the second wall 7, as illustrated with arrows in Fig. 1. On the other hand, the yarn Y (Fig. 2) which is being delivered within the chamber 3 is conveyed to the imaginary standard plane L by means of the fluid jet flow F and then is pressed upon the flat surface of the first wall 6. On the flat surface of the first wall 6, the yarn Y is subjected to the turbulent flow formed by the fluid jet flow F, and then individual filaments constituting the yarn Y are separated from each other and the yarn is opened. Since at the same time the individual filaments constituting the yarn Y move freely, the yarn is exposed to an interlacing condition, wherein the individual filaments intermingle randomly with each other, and as a result, an interlaced yarn wherein the individual filaments are securely interlaced is obtained. Thereafter the yarn Y which has been subjected to the interlacing operation follows either one of fluid flows FR or FL flowing along the flat surface of the first wall 6 and is moved to either the right or left portion on the flat surface of the first wall 6. After the yarn Y is moved to the side of the first wall 6, it is raised along the wall of the segment portion 7R or 7L constituting the second wall 7. The yarn Y thus raised upwards is then conveyed again to the imaginary standard plane L by means of the fluid flow FR or FL, and the

movement is periodically and stably repeated in the foregoing manner. The yarn Y thus obtained after it is delivered from the chamber 3 is highly interlaced with a comparatively small interlacing pitch.

Figs. 3a, 3b and 3c are cross sectional elevational views of chambers, which are utilized to explain practical modifications of the configurations of the chamber in the present invention. Fig. 3a shows a chamber 3a in the second embodiment which is enclosed with a semicylindrical portion 7A having a radius R, two planar portions 7TR and 7TL which are tangential to the portion 7A, and a planar first wall 6 having a width W which as seen in cross-section is equal to twice the radius R. There is a distance H between the first wall 6 and the imaginary plane forming the bottom of the semicylindrical portion 7A. Fig. 3b shows a chamber 3b corresponding to the first embodiment shown in Fig. 1, which is enclosed with a semicylindrical portion 7A having a radius R, part-cylindrical portions 7R and 7L, each of which has a radius RR or RL, equal to the radius R of the semicircle 7A, and a planar first wall 6 having a width W. Fig. 3c shows a chamber 3c in the third embodiment which is enclosed with a planar first wall 6 and a second wall 7 having a semicylindrical portion 7A having a radius R, part-cylindrical portions 7CR and 7CL each of which has a radius RR or RL greater than the radius R, the axes of these part-cylindrical portions lying along the imaginary plane forming the bottom of the semicylindrical portion 7A. In Figs. 3b and 3c, as with Fig. 3a, H represents the distance between this imaginary plane and the first wall 6.

The fourth embodiment illustrated in Fig. 4 is a modification of the first embodiment shown in Figs. 1 and 2 as regards the

direction of the fluid jet ejected from the outlet 8. Fig. 4 is a cross sectional elevational view. In Fig. 4, the direction of the fluid jet which is defined by the angle Q is an acute angle. The fifth embodiment illustrated in Fig. 5 is also a modification of the first embodiment as regards the direction of the fluid jet ejected from the outlet 8. Fig. 5 is a cross sectional elevational view. In Fig. 5, the direction of the fluid jet which is defined by the angle Q is an obtuse angle.

Fig. 6 is a cross sectional elevational view of the sixth embodiment of the present invention and Fig. 7 is a fragmentary view taken in the direction of the arrows X1-X1 of Fig. 6. The sixth embodiment has an important difference from the first embodiment illustrated in Figs. 1 and 2 in that it is provided with a string-up slit 12. The string-up slit 12 is utilized for introducing a yarn Y therethrough into the chamber 3 upon the commencement of the yarn treating operation and for discharging the yarn Y therethrough from the chamber 3 upon the stoppage of the yarn treating operation. Referring to Figs. 6 and 7, the yarn treating apparatus 1 comprises two housing members 13 and 14. The housing member 13 has a chamber 3 therein which is the same construction as the chamber 3 shown in Figs. 1 and 2 and has the outlet 8 of a fluid jet nozzle at the top of the chamber 3, and a passage 9 which communicates with the outlet 8 and which has an opening 15 at the top surface of the housing member 13. The apparatus has a string-up slit 16a, 16b, which is L-shaped in cross-section as seen in Fig. 6, and which runs the whole length of the chamber 3. The vertical part 16a of the slit extends along the imaginary standard plane, and the horizontal part 16b, which is formed by lowering a portion 17 of the top surface of the housing member 13, joins the top of the part 16a to give

communication between the chamber 3 and the outside of the body formed by the housing members. The housing member 14 has a passage 18 therein for the fluid jet. One end of the passage 18 opens at the bottom surface of the housing 14 and the other end of the passage 18 communicates with an opening 19 provided on the top surface of the housing member 14. The diameter of the passage 18 in the housing member 14 is of smaller size than the diameter of the passage 9 in the housing member 13. The yarn treating apparatus 1 is constructed by assembling and fastening the top end of the housing member 13 and the bottom end of the housing member 14 into one body by means of a screw bolt 20 which is threaded into a female screw 21 formed in the housing member 14. A yarn Y can be threaded into the chamber from the outside of the yarn treating apparatus 1 by passing the yarn Y through the opening 12 into the string-up slit 16b, 16a. In the sixth embodiment illustrated, the diameters of the passages 9 and 18 are selected to be larger than the width of the string-up slit 16a, as shown in Figs. 6 and 7.

The seventh embodiment of the present invention will be explained with reference to Figs. 8, 9 and 10. Figs. 8, 9 and 10 show a lower housing member 22 which is a modification of the lower housing member 13 utilized in the yarn treating apparatus illustrated in Figs. 6 and 7. Fig. 8 is a side view of a lower housing member which is available as a lower housing member in the seventh embodiment mentioned above. Fig. 9 is a fragmentary view taken in the direction of the arrows X2-X2 of Fig. 8, and Fig. 10 is a side view in the direction of the arrows X3-X3 of Fig. 8. Referring to Figs. 8, 9 and 10, the lower housing 22 comprises two parts. One of the parts is a first wall body member 22a and the other is a second wall body

member 22b. In the manufacture of the second wall body member 22b a cylindrical hole 25 has been bored therethrough from the entrance side 25A to the exit side 25B and thereafter the lower portion of the body has been cut out to form a recess which is substantially rectangular as seen in orthogonal cross-sections, so that the hole 5 25 has an opened portion 23 along the axis of the hole 25 and non-opened portions 24a and 24b at the two end portions of the body along the axis of the hole. The second wall body member 22b also has the vertical part of a string-up slit 16a, a fluid jet passage 9 10 and a lowered surface portion 17 on the top surface of the lower housing member in the same manner as shown in Figs. 6 and 7. The first wall body member 22a is made from a plate and is assembled and fastened to the opened portion 23 of the second wall body member 22b so as to form a chamber 3 for yarn treating having a first wall 15 provided by the flat surface of the first wall body member 22a and a second wall provided by the circular surface of the hole bored in the second wall body member 22b. In this seventh embodiment, there are an entrance circular wall portion 25a and an exit circular wall portion 25b formed by the full circular wall portions of the 20 hole 25 remaining at the two ends thereof. The yarn treating apparatus of the seventh embodiment of the present invention is obtained by assembling and fastening the lower housing member 22 shown in Figs. 8, 9 and 10 and the upper housing member 14 shown in Figs. 6 and 7 at the top surface of the former and at the bottom surface of the 25 latter and by fastening the top surface of the first wall body member 22a to the bottom surface of the second wall member 22b by a bolt 20.

Figs. 11 and 12 are a cross sectional elevational view and a bottom end view of the eighth embodiment of the present invention

respectively. Referring to Figs. 11 and 12, a second wall body member 26 has a cylindrical hole 27 bored therethrough from one side to the opposite side. A fluid jet passage 28 is provided in the member 26 so that the one end thereof communicates with the outlet 29 of a fluid jet nozzle provided at the top of the hole, and the other end communicates with an opening 30 provided on the top surface of the member 26.

A string-up slit 31 is provided not at the top of the hole but at the upper semicylindrical portion of the hole as shown in Fig. 11, communicating with the hole 27 and the outside of the second wall body member 26, and a rectangular cut off portion 32 is provided on the bottom surface of the second wall body member 26 so that the cut off plane intersects with the lower portion of the hole 27 and the hole is opened to the outside on this cut off portion. A first wall body member 33 is made of a plate which is secured into the rectangular cut off portion 32 of the second wall body member 26. In this embodiment, a yarn treating chamber 3 is enclosed by the first wall formed by the plate 33 and the second wall which is the wall of the hole 27 and can be regarded as consisting of a semicylindrical portion 7A and two part cylindrical portions 7R and 7L having the same radius and the same axis. In this embodiment, there are an entrance portion 34a and an exit portion 34b each of which has a circular wall, at the two end portions of the second wall body member 26.

Fig. 13 is a cross sectional elevational view of the ninth embodiment of the present invention. Referring to Fig.13, the yarn treating apparatus 1 comprises three housing members 35, 36 and 37. The housing member 35 serves as a piece for forming a first wall 38 having a flat surface, a part of the second wall having a part

cylindrical surface and one side surface 40a of a string-up slit 40. The housing member 36 serves as a piece for forming a remaining part of second wall 41, the other side surface 40b of the string-up slit 40 and a part of fluid jet passage 42. The housing member 37 serves
5 as a piece for forming a remaining part of fluid jet passage 43.

The three housing members 35, 36 and 37 are assembled and are fastened in one body member by means of screw bolt 44 which is threaded with a female screw thread 45 formed in the housing 37 to form the chamber 3, the string-up slit 40 and the full fluid jet passage 46.

10 With reference to some examples, dimensions in actual apparatus according to the present invention, especially dimensions to the chamber, will be given hereinbelow. It should be noted that the dimensions should be selected at appropriate values based on yarn treating conditions, such as the kind of yarn to be treated, yarn speed, tension in the
15 yarn and the pressure of fluid, taking into consideration the basic technical concept of the present invention.

COMPARATIVE EXAMPLES A1 and B1, and EXAMPLE 1

Yarn to be treated: False twisted yarn of polyethylene terephthalate having a total denier of 150 denier and constituted by 48
20 filaments.

Yarn speed: Feeding to the chamber at 450 m/min,
Drawing from the chamber at 450 m/min. There is no positive relax.

Fluid to be ejected: Amount of fluid supplied is shown in
Fig. 17.

25 Shape of chambers: The shape of chamber A (prior art) used in COMPARATIVE EXAMPLE A1, which has a circular cross section, is shown in Figs. 14a and 14b. The shape of chamber B (prior art) used

in COMPARATIVE EXAMPLE B1, which has a semicircular cross section, is shown in Figs. 15a and 15b. The shape of chamber C (present invention) used in EXAMPLE 1, which has the same construction as shown in Figs. 6 and 7, is shown in Figs. 16a and 16b.

Main dimensions in the various apparatus are as follows. (Note that the symbols are illustrated in Figs. 14a, 14b, 15a, 15b, 16a and 16b).

	R(mm)	H(mm)	W(mm)	d(mm)	d ₁ (mm)	SL(mm)	NL(mm)
A	1.65	1.65	0	1.4	-	0.26	19
B	1.65	0	3.3	1.6	-	-	25
C	1.2	0.5	2.18	1.3	1.2	0.2	15

Note: R -- radius of circular portion of the chamber,
H -- distance between the line passing through the ends of semicircle
and the bottom of the chamber, W -- width of the bottom flat portion
of the chamber, d -- diameter of the nozzle, d₁ -- diameter of the
conduit to the nozzle, SL -- width of the string-up slit, and
NL -- length of the chamber along the axis of the chamber. The ex-
periments were conducted by changing the amount of fluid supplied
to the chambers and the CF value of the obtained interlaced yarns
were measured. The results are shown in Fig. 17 with a graph. In
Fig. 17 the ordinate represents a CF value while the abscissa represents
the volume of consumption of fluid, and the curves A, B and C show
the results of the COMPARATIVE EXAMPLES A1 and B1 and EXAMPLE 1
respectively.

The CF value was measured by "AUTOMATIC YARN-ENTANGLEMENT TESTER TYPE R-2040" produced by Rothschild Co. in Switzerland.

It will readily be understood from the results obtained in the experiments which are shown in Fig. 17, the consumption of the fluid in the yarn interlacing apparatus C of the present invention is smaller
5 than the consumption of the fluid in the yarn interlacing apparatus A and B of the prior art to produce an interlaced yarn having the same CF value. For example, to obtain an interlaced yarn having CF value of 200, the consumption of the interlacing apparatus C of the present invention is 34 normal-litres/min, the consumption of the
10 interlacing apparatuses A and C of the prior art A1 and B1 are 64 normal-litres/min and 45 normal-litres/min respectively.

COMPARATIVE EXAMPLES A2 and B2, and EXAMPLE 2

The same interlacing treatments mentioned in the above experiments were conducted except that there was used a false twisted yarn
15 of polyethylene terephthalate having a total denier of 300 and constituted by 96 filaments as the yarn to be treated. The lengths of the opening portion of the obtained interlaced yarns were measured by an optical method. The mean value L(cm) of the length of the opening portion was calculated on each of the samples. CFP value defined by a formula
20 $CFP = 100 / L$ was calculated on each of the samples.

	Consumption of air (normal-litres/min)	CFP	comments	
	A	61	51	there are many omissions of entangled portions
5	B	60	71	there are very many omissions of entangled portions
	C	53	79	substantially free from omission of entangled portions

10 From the CFP values appearing the the above table, it can be understood that the yarn interlacing apparatus A of the present invention enables the production of an interlaced yarn having a small interlacing pitch compared with those produced by the yarn interlacing apparatuses A and B of the prior art, moreover using a small consumption of compressed air.

15

CLAIMS:

1. A yarn treating apparatus comprising a body member which has:
a yarn treating chamber formed therein; an entrance of said chamber
formed at the front end thereof; an exit of the chamber formed at
the rear end thereof; and a jet nozzle for ejecting a fluid jet opening
5 into a peripheral wall of the chamber, characterized in that:

(a) the said peripheral wall of the chamber includes: a first
wall which lies on a plane extending along the chamber; and a second
wall, the sides of which are connected to the sides of the first wall
so that the circumference of the chamber is substantially enclosed
10 by the first and second walls,

(b) the second wall is substantially symmetrical with respect to
an imaginary standard plane which lies along the axis of the chamber,
and which bisects and is perpendicular to the first wall,

(c) in a cross section through the chamber, taken along a plane
15 perpendicular to the axis of the chamber, the second wall has a portion
which is semicircular and two further portions, joining the ends of
the semicircle to the sides of the first portion, these further portions
being either planar or curving inwardly,

(d) the fluid jet nozzle opens into the second wall substantially
20 at a position intersecting the second wall and said imaginary standard
plane, and

(e) the fluid nozzle communicates with a passage for introducing
a jet of fluid, which passage is formed in the body member and which
is open to the outside of the body member.

2. A yarn treating apparatus according to claim 1 wherein each of the two further portions, seen in the said cross-section comprises an arc having the same radius as said semicircle, so that the second wall is part cylindrical.
- 5 3. A yarn treating apparatus according to claim 1 wherein, as seen in the said cross section, the further portions of the second wall appear as a tangent to the semicircle, or part of a curve which would lie between the tangent and an arc continuing the circumference of the semicircle.
- 10 4. A yarn treating apparatus according to any preceding claim, wherein the width of the first wall is greater than half of the diameter of the outlet of the fluid jet nozzle and the distance between the line passing through both ends of said semicircle and the first wall in a direction perpendicular to the first wall is greater than one
15 twentieht of the diameter of said semicircle.
5. A yarn treating apparatus according to claim 4 wherein said width is greater than the diameter of the outlet of the fluid jet nozzle and said distance is greater than one tenth of the diameter of said semicircle.
- 20 6. A yarn treating apparatus according to any preceding claim which further comprises a string-up slit which extends parallel to the axis of the chamber and which gives communication between a surface of said portion of the second wall which is semicircular in cross section and the outside of the body member.
- 25 7. A yarn treating apparatus according to claim 6 wherein the string-up slit extends along said imaginary standard plane.

8. A yarn treating apparatus according to claim 6 or 7 wherein the width of the slit is smaller than the diameter of the outlet of the fluid jet nozzle.
9. A yarn treating apparatus according to any preceding claim wherein
- 5 the middle of the fluid stream ejected from the fluid jet nozzle intersects with the first wall at a right angle.

FIG. 2

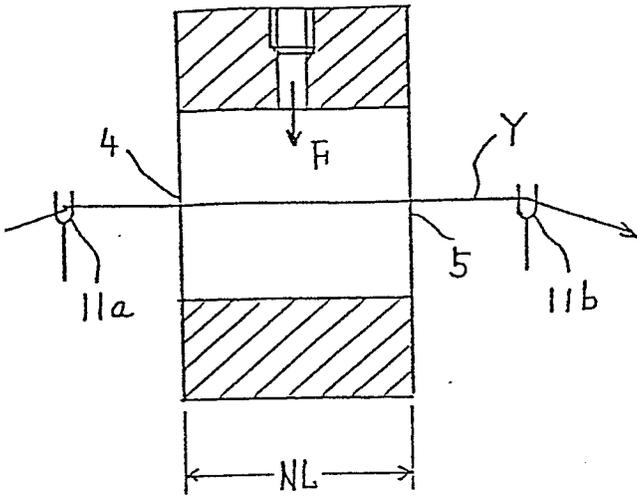


FIG. 1

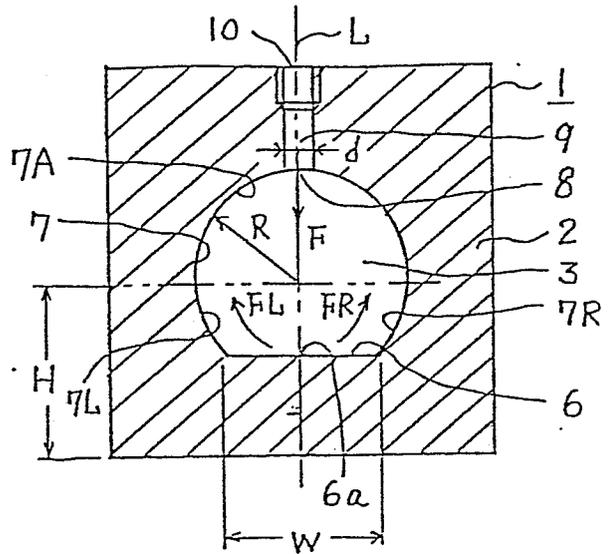


FIG. 3a

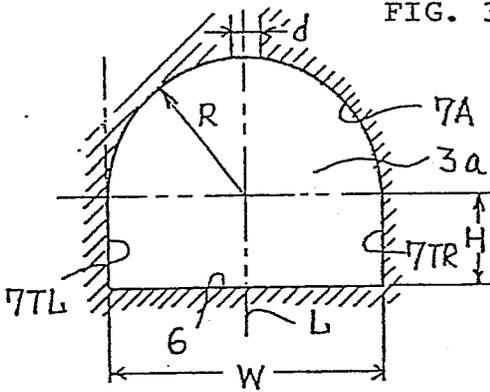


FIG. 4

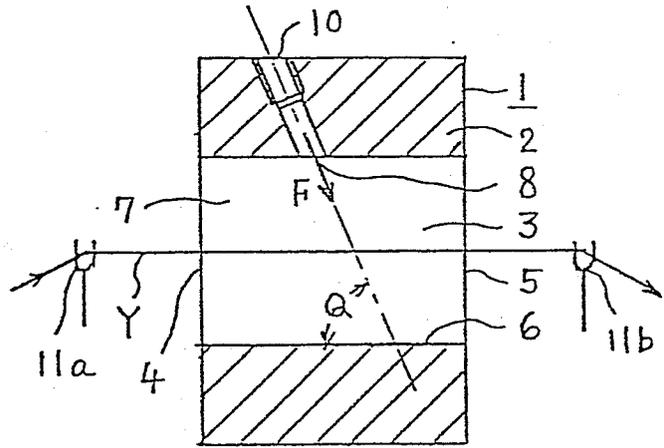


FIG. 3b

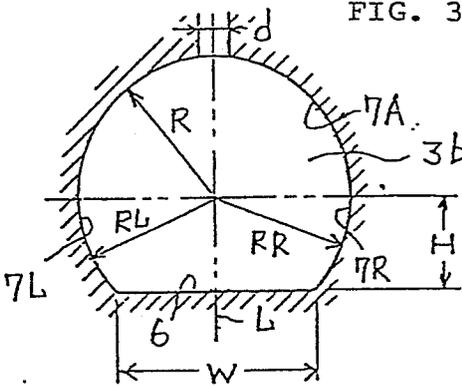


FIG. 5

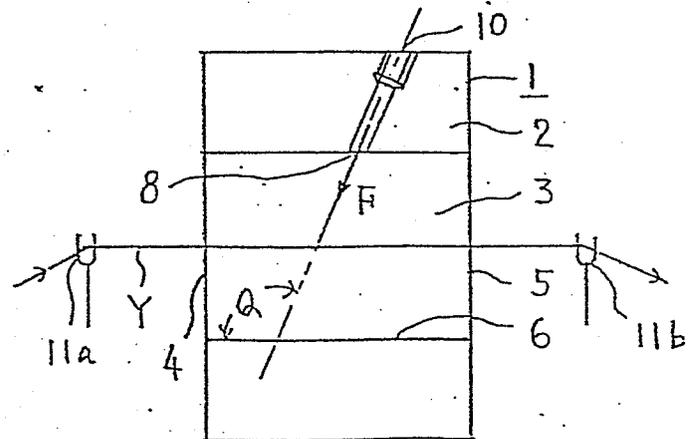


FIG. 3c

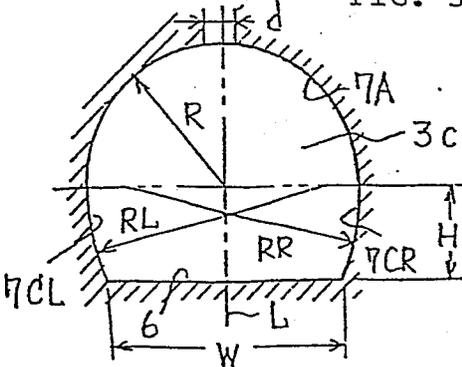


FIG. 6

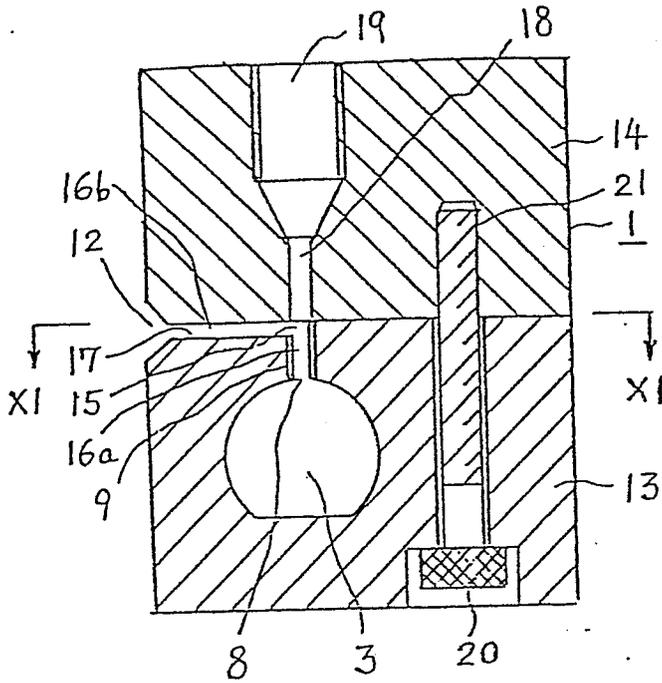


FIG. 7

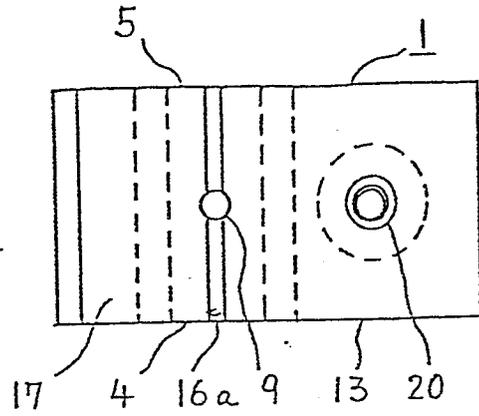


FIG. 9

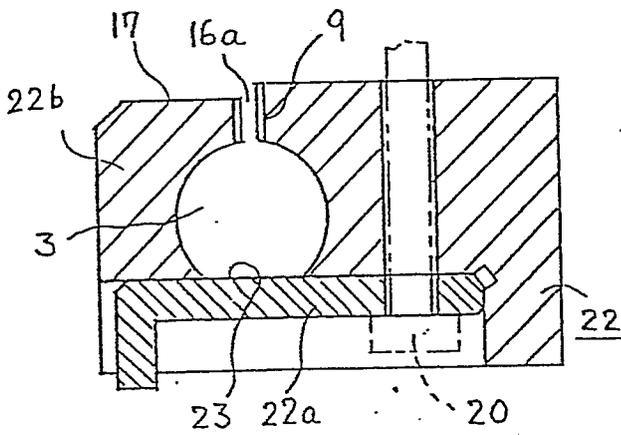


FIG. 8

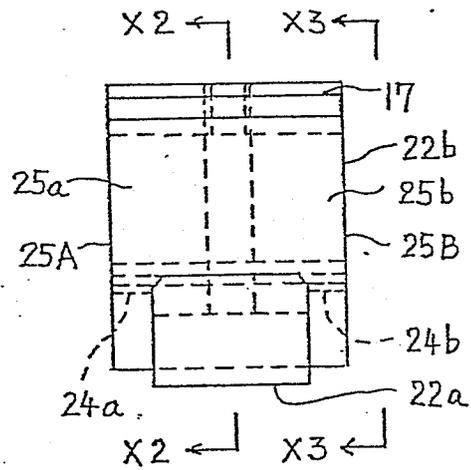


FIG. 10

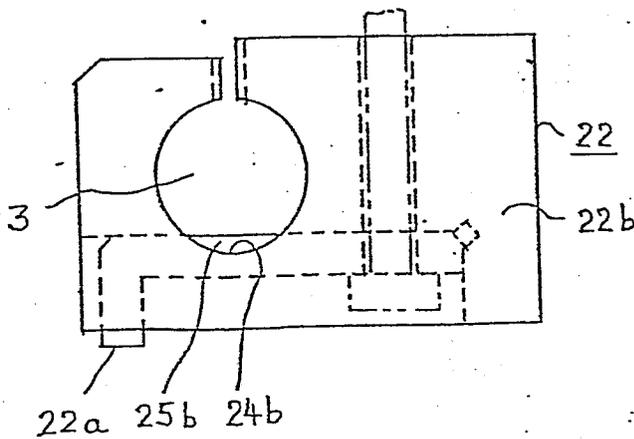


FIG. 11

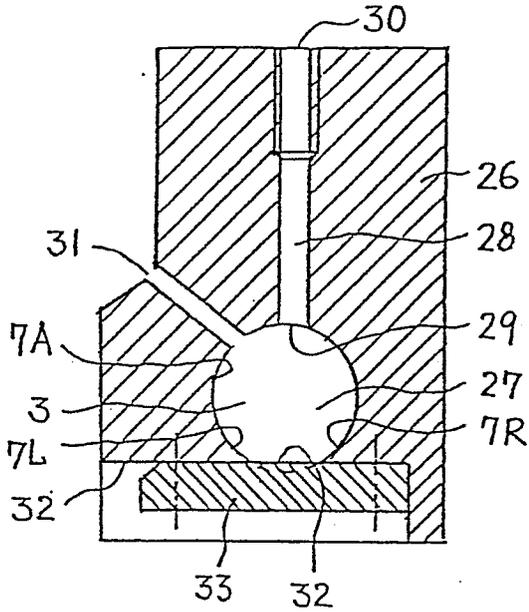


FIG. 13

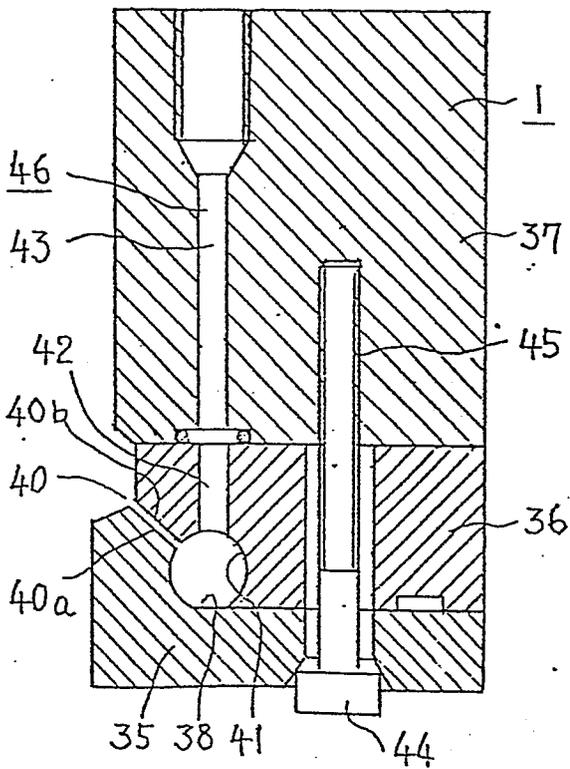


FIG. 12

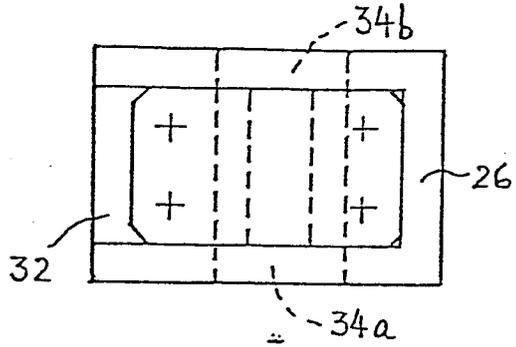


FIG. 14a (Prior Art)

FIG. 14b (Prior Art)

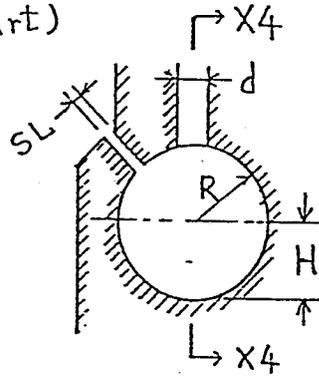
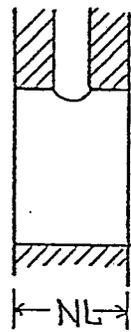


FIG. 15a (Prior Art)

FIG. 15b (Prior Art)

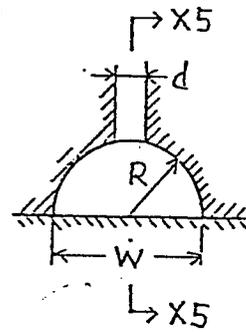
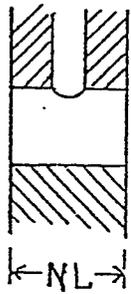
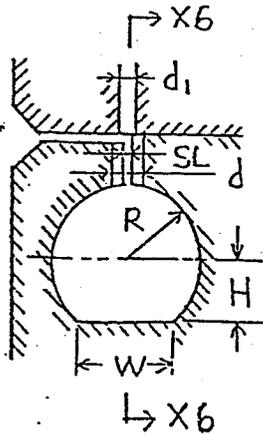
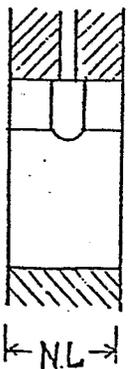


FIG. 16a

FIG. 16b

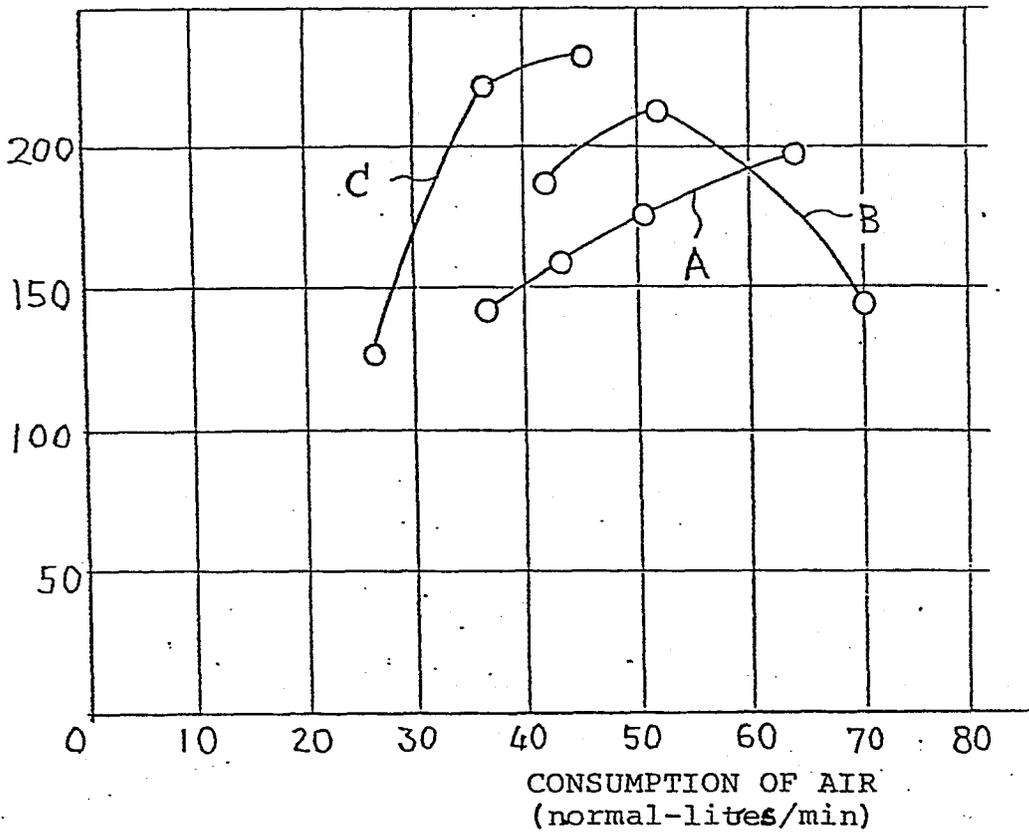


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0121010

FIG. 17

CF VALUE





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. 3)
A	US-A-3 971 108 (DU PONT DE NEMOURS) * Claims 1,6 *	1,9	D 02 G 1/16 D 02 J 1/08
A	US-A-3 333 313 (FMC) * Claim 1 *	1	
A	US-A-3 535 755 (KODAK) * Claim 1 *	1	
A	EP-A-0 011 441 (TORAY) * Claim 1 *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
			D 02 G D 02 J
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 29-11-1983	Examiner CATTOIRE V.A.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p>			