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

(11) EP 1 291 458 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
12.03.2003 Bulletin 2003/11

(51) Int Cl.[7]: **D06C 7/02**, F26B 13/10

(21) Application number: **02002569.8**

(22) Date of filing: **04.02.2002**

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

(30) Priority: **07.09.2001 JP 2001272157**

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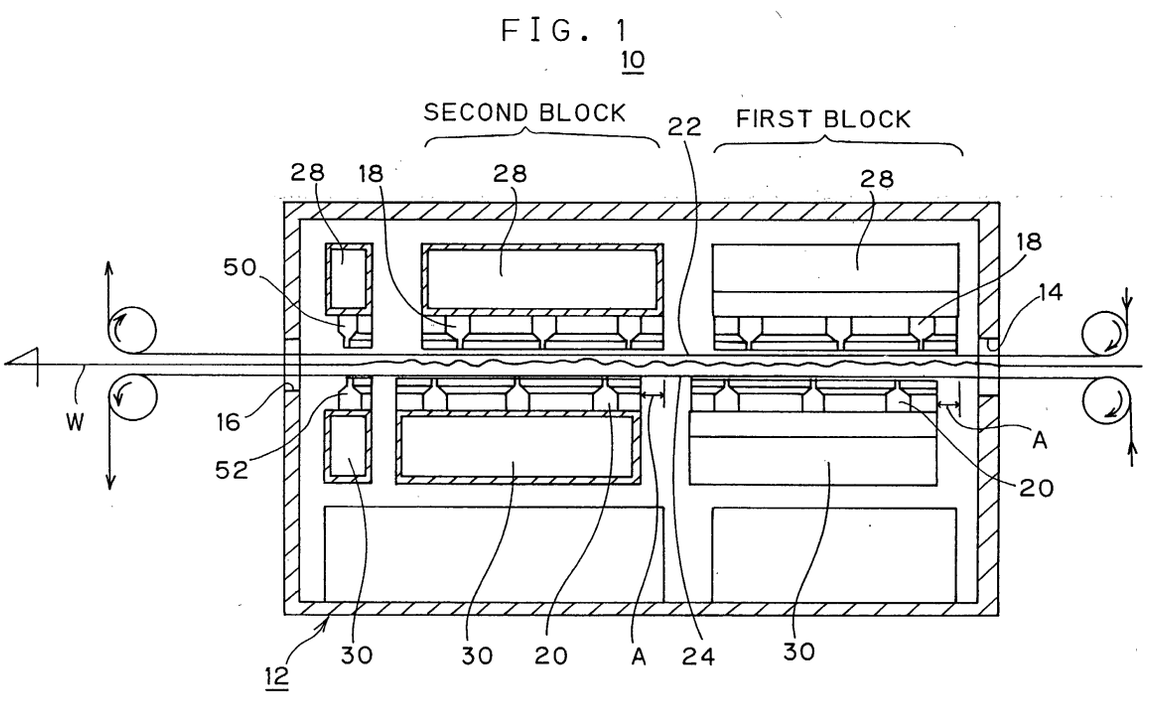
(54) Web heat treatment apparatus

(57) A rubbing effect is imparted to a long or continuous web (W) not only in its lengthwise direction but also in its widthwise direction. A heat treatment apparatus comprises: a pair of upper and lower conveyer nets (22, 24) adapted to run in a front-back-wise direction in a heat-treatment chamber (12); upper and lower nozzles (18, 20) provided above and below of these conveyer nets (22, 24); upper blow-off ports (47) of the upper nozzles (18) being disposed obliquely relative to a widthwise direction of the web (W); and lower blow-off ports (46) for hot air blasting from the lower nozzles (20) being disposed obliquely relative to the widthwise direction of the web (W) and in same time relative to the upper blow-off ports (47).

FIG. 1



EP 1 291 458 A2

Description

TECHNICAL FIELD

[0001] The invention relates to a web heat treatment apparatus for heat-treating or drying a long or continuous web of woven or knitted textile fabric, non-woven fabric, film or the like.

BACKGROUND ART

[0002] There has been proposed a heat treatment apparatus for heat-treating or heat-drying a web, in a manner that; a hot air is blown against upper and lower surfaces of the web over its entire width; while the web being interposed between a pair of upper and lower conveyer nets and being conveyed as to run together with these conveyer nets (Japanese Registered Patent No. 2764197).

[0003] In such heat treatment apparatus, a hot air blown from nozzles, which are provided above and below the pair of upper and lower conveyer nets, strikes against the upper and lower surfaces of the web as to impart a rubbing or wrinkling effect onto the web that is loosened or in an overfeed state.

OBJECT OF THE INVENTION

[0004] The heat treatment apparatus in the prior art has disadvantage in that, onto the web in an overfed state, only a rubbing effect in a lengthwise direction of the web may be imparted by hot air blasting from the nozzles; while a rubbing effect in a widthwise direction of the web is not achievable.

[0005] In view of this problem, it is aimed to provide a heat treatment apparatus capable of imparting on a web a rubbing effect not only in a lengthwise direction of the web but also in a widthwise direction of the web.

BRIEF SUMMARY OF THE INVENTION

[0006] The invention-wise web heat treatment apparatus comprising: a pair of upper and lower conveyer nets adapted to run in a front-back-wise direction in a heat-treatment chamber; a plurality of upper nozzles provided above the pair of upper and lower conveyer nets to jet a hot blast against a web, which runs in a overfed state between the pair of upper and lower conveyer nets in the front-back-wise direction, from above; a plurality of lower nozzles provided below the pair of upper and lower conveyer nets to jet a hot blast against the web from under; upper blow-off ports on the upper nozzles for hot-air blasting, at least a part of which ports are dispsed obliquely relative to a widthwise direction of the web; and lower blow-off ports on the lower nozzles for hot air blasting, at least a part of which ports are disposed obliquely relative to the widthwise direction of the web and at same time relative to the upper blow-off ports.

[0007] In a second aspect of the invention, the upper and lower blow-off ports on the nozzles are formed as slits extended along straight lines; the upper blow-off ports being disposed in parallel to one another; and the lower blow-off ports being disposed in parallel to one another and as to intersect the upper blow-off ports.

[0008] The invention-wise web heat treatment apparatus enables to impart, on a web by hot air blasting, a rubbing effect not only in the lengthwise direction of but also in the lengthwise direction of theweb. This is because the upper blow-off ports on the upper nozzles are disposed obliquely relative to widthwise direction of the web.

[0009] Moreover, the web on heat treatment is prevented from meandering or width-wise winding. This is because the lower blow-off ports for hot air blasting on the lower nozzles are disposed obliquely relative to the upper blow-off ports for hot air blasting on the upper nozzles.

[0010] With the web heat treatment apparatus of the second aspect, rubbing effects both in widthwise and lengthwise directions of the web are effectively and simultaneously imparted on the web. This is because; the upper blow-off ports for hot air blasting from the upper nozzles are provided in parallel to one another; and the lower blow-off ports on the lower nozzles are provided in parallel to one another and as to intersect the upper blow-off ports. Moreover, meandering of the web is surely prevented because of intersecting arrangement of upper and lower slit-form blow-off ports.

BRIEF DESCRIPTION OF THE DRAWING

[0011]

Fig. 1 is a vertical, cross sectional view, as viewed laterally, of a heat treatment apparatus according to First embodiment of the invention;

Fig. 2 is a vertical, cross sectional view, as viewed rearwardly, in the First embodiment;

Fig. 3 is a perspective view showing lower nozzles in a first block, in the First embodiment;

Fig. 4 is a plan view showing web-spreading nozzles in first and second blocks, in the First embodiment;

Fig. 5 is a plan view showing upper and lower nozzles in Second embodiment;

Fig. 6 is a plan view showing upper and lower nozzles in Third embodiment;

Fig. 7 is a plan view showing upper and lower nozzles in Fourth embodiment;

Fig. 8 is a vertical, cross sectional view showing upper and lower nozzles in the First embodiment;

Fig. 9 is a perspective view showing nozzles in First modified embodiment; and

Fig. 10 is a perspective view showing nozzles in Second modified embodiment.

DETAILED DESCRIPTION OF THE INVENTION

<First embodiment>

[0012] An explanation will be given to a heat treatment apparatus according to a first embodiment, which is for heat-treating a long or continuous web W of woven or knitted textile fabric, non-woven fabric, film or the like.

(1) An overall construction of a heat treatment apparatus 10

[0013] Fig. 1 is a longitudinal, cross sectional view as viewed from laterally of the heat treatment apparatus 10; and Fig.2 is a longitudinal, cross sectional view as viewed in rearward direction of the apparatus.

[0014] As shown in Figs. 1 and 2, an entrance 14 is provided on a front surface of a heat insulating structure while an exit 16 is provided on a back surface of the heat insulating structure.

[0015] The web W is conveyed into a heat-treatment chamber 12 from the entrance 14, is subjected to heat treatment and then, after completing the treatment, conveyed out from the exit 16.

[0016] A plurality of upper nozzles 18 are arranged above a passage of conveying the web W within the heat-treatment chamber 12 and a plurality of lower nozzles 20 are arranged below the conveyance passage.

[0017] Further, a pair of upper and lower web-spreading nozzles 50, 52 are provided near the exit 16. The construction of these upper and lower nozzles 18, 20 and upper and lower web-spreading nozzles 50, 52 will be described later in detail.

[0018] An upper endless conveyer net 22 for conveying the web W runs below the upper nozzles 18 in a front-to-back direction; and a lower endless conveyer net 24 runs above the lower nozzles 20 also in the front-to-back direction in a similar manner. The web W runs, in a length-wisely loosened or overfed state, between the upper conveyer net 22 and the lower conveyer net 24.

(2) An inner construction of the heat-treatment chamber 12 will be described below.

[0019] The upper nozzles 18 and the lower nozzles 20 are disposed as divided into a first block and a second block in order from the entrance 14, at inside of the heat-treatment chamber 12.

[0020] As shown in Fig. 1, the first block with the upper and lower nozzles 18, 20 are disposed near the entrance 14. In following, explanation is made with reference to Fig. 2 that shows a right-left-wise cross section of the heat-treatment chamber 12 as being crossed at the first block.

[0021] As shown in Fig. 2, provided along a right-hand side surface of the heat-treatment chamber 12 and above an air-blasting port of a blast fan 38 is a stream-splitting duct 26 for vertically splitting a stream of hot air. An upper duct 28 is connected to an upper portion of the stream-splitting duct 26 by joining in a right-to-left direction of the heat-treatment chamber 12; and a lower duct 30 is connected to a lower portion of the stream-splitting duct 26 also by joining in the right-to-left direction. Top surface of the upper duct 28 is leftwardly inclined such that the smaller in height or volume per length, the farther away from the stream-splitting duct 26; and six upper nozzles 18 are provided on a bottom surface of the upper duct 28. Meanwhile, bottom surface of the lower duct 30 is rightwardly inclined such that the smaller in height or volume per length, the farther away from the stream-splitting duct 26; and six lower nozzles 20 are provided on a top surface of the lower duct 30.

[0022] A recovery duct 32 is provided on a left side surface of the heat-treatment chamber 12, on a side opposite to a side where the stream-splitting duct 26 is provided; and a filter 34 is provided at a lower portion of the recovery duct 32, below which filter is provided a heating section 36 comprised of burners.

[0023] From the heating section 36, a circulating duct 40 extends to a hot-air stream inlet of the blast fan 38 that is disposed underneath of the stream-splitting duct 26.

[0024] Hereto-mentioned construction will be further explained in view of airflow. Hot-air stream produced by the blast fan 38 is divided vertically by the stream-splitting duct 26 to be flown into upper and lower ducts 28, 30. Hot air flowing through the upper duct 28 is blown out downwardly from the upper nozzles 18; and hot air flowing through the lower duct 30 is blown out upwardly from the lower nozzles 20.

[0025] Hot air having used for heat-treating the web W, which runs between the upper and lower conveyer nets 22, 24, is recovered by the recovery duct 32 and then is sent, through the filter 34, to the heating section 36. Thus recovered air is again heated there, and returns to the blast fan 38 by flowing through the circulating duct 40.

[0026] The second block is constructed in the same manner as the first block is; and the web W passes through the first block and then through the second block.

[0027] Additionally, the pair of upper and lower web-spreading nozzles 50, 52 for width-wisely spreading the web W are provided at rear of the second block. A mechanism for supplying hot air to the pair of upper and lower web-spreading nozzles 50, 52 is same as above.

(3) Construction of upper nozzles 18 and lower nozzles 20

[0028] An explanation will be given to the construction of the upper nozzles 18 and the lower nozzles 20 with reference to Figs. 3, 4 and 8.

[0029] Fig. 3 is a perspective view showing how the lower nozzles 20 in the first block are arranged; Fig. 4

being a plan view showing the first block, the second block, and the web-spreading nozzles 50, 52; Fig. 8 being a vertical cross section view showing the upper nozzles 18 and the lower nozzles 20.

[0030] As shown in Fig. 8, each of the upper nozzles 18 is comprised of; a base or main body 43 that is attached on a bottom surface of the upper duct 28 and is downwardly tapered at lower portion thereof; and a blow-off portion 45 that is downwardly extending from the tapered portion of the main body 43. At lower end of the blow-off portion 45, blow-off port 47 is provided in a form of a linear slit, while a pair of flanges 49 is formed along the blow-off port 47 so as to facilitate downward flowing of the hot air.

[0031] In same manner as above, each of the lower nozzles 18 is comprised of; a base or main body 42 that is attached on a top surface of the lower duct 30 and is upwardly tapered at upper portion thereof; and a blow-off portion 45 that is downwardly extending from the tapered portion of the main body 42. At upper end of the blow-off portion 44, blow-off port 48 is provided in a form of a linear slit, while a pair of flanges 48 is formed along the blow-off port 46 so as to facilitate upward flowing of the hot air.

[0032] First characteristic feature of the embodiment resides in a manner of arranging the six upper nozzles 18 and the six lower nozzles 20 in each block; that is, the lower nozzles 20 and the upper nozzles 18 are disposed obliquely relative to the widthwise direction of the web W. This is contrary to the prior art where the upper and lower nozzles are arranged in parallel to the widthwise direction of the web W (Japanese Registered Patent No. 2764197).

[0033] As shown in Fig. 4, in a plan-view illustration of the first block, the six lower blow-off ports 46 and six lower nozzles 20 are arranged in parallel to one another; and they are arranged at a slant angle $\theta 1$ (where $0° < \theta 1 < 90°$) relative to the widthwise direction of the web W.

[0034] Meanwhile, in the plan-view illustration of the first block, the upper blow-off ports 47 and the upper nozzles 18 are arranged in parallel to one another; and they are arranged obliquely relative to the widthwise direction of the web W and relative to the lower nozzles 20. Concretely, the upper blow-off ports 47 and the upper nozzles 18 are arranged at a slant angle $\theta 2$ (where $0° < \theta 2 < 90°$) relative to the widthwise direction of the web W as shown in Fig. 4.

[0035] Further; as shown in Figs. 1 and 4, the upper duct 28 and the lower duct 30, which are in a same size, are disposed as shifted to each other in the web-conveying direction, by a dimension "A".

[0036] The upper nozzles 18 and the lower nozzles 20 in the second block are arranged in the same manner as those in the first block except that arranging directions of the upper nozzles 18 and the lower nozzles 20 are reversed, relative to the widthwise direction of the web W. More specifically, the lower nozzles 20 have an angle $-\theta 1$ relative to the widthwise direction of the web W and the upper nozzles 18 are arranged at an angle $-\theta 2$ relative to the widthwise direction of the web W.

(4) Construction of the web-spreading nozzles 50, 52

[0037] Second characteristic feature of the embodiment resides in that the pair of upper and lower web-spreading nozzles 50, 52 for putting the web W in open width are provided at rearward of the second block.

[0038] The pair of upper and lower web-spreading nozzles 50, 52 are distinguished from the upper and lower nozzles 18,20 in configuration of blow-off ports 53 whereas other constructions are substantially in common. As shown in Fig. 4, the blow-off ports 53 has a wide-angle v-shaped configuration in a plan view in a manner that a straight line is bent as angled at a center line of the conveyance passage of the web W. The blow-off ports 46 on the left side are constructed to blow hot blast leftward; and the blow-off ports 46 on the right side are constructed to blow hot blast rightward.

(5) Operation

[0039] An explanation will be given how the web W is subjected to heat treatment in the here-to-mentioned heat treatment apparatus 10.

[0040] The web W is conveyed in an overfed or lengthwise loosened state as interposed between the upper conveyer net 22 and the lower conveyer net 24. In order to convey the web W in an overfed state, the web W must be fed faster than the running speed of the upper conveyer net 22 and the lower conveyer net 24 and must be conveyed without application of tension.

[0041] When the web W is carried in from the entrance 14 of the heat-treatment chamber 12 to reach the first block, the upper nozzles 18 and the lower nozzles 20 blow hot blast against the web. The upper nozzles 18 and the horizontally elongated lower nozzles 20 are disposed obliquely relative to the widthwise direction of the web W; accordingly, the hot blast strikes against the web at along lines oblique to the widthwise direction of the web W, from above and below; thereby achieving the rubbing effect on the web not only in the lengthwise direction of the web W but also in the widthwise direction of the web. Since the upper nozzles 18 and the lower nozzles 20 are disposed to intersect each other in a plan view, the rubbing effect can be given without having the web W meandering in one direction. As shown in Figs. 1 and 4, the rubbing effect is increased because the upper duct 28 and the lower duct 30, which are same in size, are disposed as shifted with each other by a dimension "A" in the web-conveying direction.

[0042] The web W having passed through the first block then passes through the second block.

[0043] In this occasion, since the upper nozzles 18 and the lower nozzles 20 are arranged at different slanting directions from those in the first block, a different rub-

bing effect from that in the first block can be imparted to the web W. Thus, the rubbing effect can be given in the widthwise direction of the web W as well as in the lengthwise direction of the web W, in a same manner as in the first block.

[0044] The web W having passed through the second block then passes between the upper and lower web-spreading nozzles 50, 52. In this occasion, since the hot blast is blown out rightward on the right side of the apparatus and leftward on the left side thereof, the web W is width-wisely spreaded and conveyed out from the exit 16 in such a width-wisely spreaded state.

[0045] As described above, the heat treatment apparatus 10 according to the embodiment can impart the rubbing effect to the web W not only in the lengthwise direction of but also in the widthwise direction of the web W.

[0046] Moreover, the web W may be conveyed out in a width-wisely spreaded state, by passing between the pair of the upper and lower web-spreading nozzles 50, 52.

<Second embodiment>

[0047] A second embodiment of the invention will be described with reference to Fig. 5, which differs from the first embodiment in configuration of blow-off ports 46, 47 on the upper nozzles 18 and the lower nozzles 20.

[0048] In plan view as shown in Fig. 5, each of blow-off ports 46, 47 in this embodiment extends along a smooth curve (for example, an arc) whreas blow-off ports 46, 47 in the first embodiment extends along a straight line. The curved blow-off ports 46, 47 are disposed as oblique to the widthwise direction of the web W; and the upper nozzles 18 and the lower nozzles 20 are arranged in a manner to intersect each other.

[0049] Also in this embodiment, the rubbing effect can be imparted to the web W not only in the lengthwise direction of but also in the widthwise direction of the web W.

[0050] To easy to be understood, Fig. 5 illustrates the blow-off ports 46 of the lower nozzles 20 in solid lines, the blow-off ports 47 of the upper nozzles 18 in dotted lines, and the lower conveyer net 24 and the web W in two-dot chain lines. Such way of illustration is also made in Fig. 6 showing a third embodiment as well as Fig. 7 showing a fourth embodiment.

<Third embodiment>

[0051] A third embodiment of the invention will be described with reference to Fig. 6, which differs from the first embodiment in planar configuration of blow-off ports 46, 47 of the upper nozzles 18 and the lower nozzles 20.

[0052] As shown in a plan view of the Fig. 6, each of lower blow-off ports 46 on lower nozzles 20 has av-shaped orwide-angle v-shaped configuration which is left-to-right-wise symmetric about a widthwise-center line of the web W. In a same manner, each of upper blow-off ports 47 on upper nozzles 18 has a v-shaped or wide-angle v-shaped configuration which is left-to-right-wise symmetric about a widthwise-center line of the web W, while the blow-off ports 47 intersect the blow-off ports 46 in the lower nozzles 20, in a plan view.

[0053] Also in this embodiment, the rubbing effect can be imparted to the web W not only in the lengthwise direction of but also in the widthwise direction of the web W.

<Fourth embodiment>

[0054] A fourth embodiment of the invention will be described with reference to Fig. 7.

[0055] Each of the blow-off ports 46 in this embodiment is modified from that of the third embodiment having a v-shaped or wide-angle v-shaped configuration, in a way that a width-wise linear portion is interposed on a central portion of the wide-angle v-shaped configuration, as shown in Fig. 7.

[0056] At right and left portions of the web W, the blow-off ports are disposed also as oblique to the widthwise direction of the web W, so that the rubbing effect can be given in the widthwise direction of the web W.

<Fifth embodiment>

[0057] Only either of the above or below web-spreading nozzles 50, 52 is provided along the conveyance passage; while, in the above-mentioned embodiments, the web-spreading nozzles 50, 52 are provided in pair above and below the conveyance passage of the web W.

<First and second Modified embodiments>

[0058] Modified embodiments of the invention will be described with reference to Figs. 9 and 10.

[0059] While the above-mentioned embodiments utilize the upper nozzles 18 and the lower nozzles 20 constructed in the manner shown in Fig. 8, an arrangement shown in Fig. 9 may be instead employed, in which two slit-shaped blow-off ports 54 are disposed as in parallel to each other, on upper and lower nozzles 1. Alternatively, an arrangement shown in Fig. 10 may be employed, in which a plurality of punched holes 56 are provided on the nozzles 18, 20.

<Third Modified embodiment>

[0060] The upper nozzles 18 and the lower nozzles 20 may be constructed such that; rotary dampers, which are provided at inside of nozzles, are rotated to permit hot blast to be intermittently blown out of the upper and lower nozzles 18, 20, in a manner as disclosed in Japanese Registered Patent No. 2860441; thus presenting a further rubbing effect.

<Fourth Modified embodiment>

[0061] The pair of upper and lower web-spreading nozzles 50, 52 for spreading the web W may be omitted if the web W is adequately put in open width; whereas such web-spreading nozzles 50, 52 are provided in foregoing embodiments.

<Fifth Modified embodiment>

[0062] In foregoing embodiments, the upper duct 28 and the lower duct 30 are disposed as shifted by a dimension "A" in web-conveying direction, as shown in Figs. 1 and 4. Nevertheless, the upper duct 28 and the lower duct 30 may be instead disposed as symmetric with respect to the horizontal web-conveyance passage (that is, "A = 0"), so as to continuously subject the web W to hot blasts both from above and underneath.

INDUSTRIAL APPLICABILITY

[0063] According to the invention-wise web heat treatment apparatus, a rubbing effect is imparted to a long or continuous web (W) not only in its lengthwise direction but also in its widthwise direction.

Claims

1. A web heat treatment apparatus comprising

a pair of upper and lower conveyer nets adapted to run in a front-back-wise direction in a heat-treatment chamber;

a plurality of upper nozzles provided above the pair of upper and lower conveyer nets to jet a hot blast from above and against a web, which runs in an overfed state between the pair of upper and lower conveyer nets in the front-back-wise direction;

a plurality of lower nozzles provided below the pair of upper and lower conveyer nets to jet a hot blast against the web from under;

upper blow-off ports on the upper nozzles for hot-air blasting, at least a part of which ports are disposed obliquely relative to a widthwise direction of the web; and

lower blow-off ports on the lower nozzles for hot air blasting, at least a part of which ports are disposed obliquely relative to the widthwise direction of the web and at same time relative to the upper blow-off ports.

2. The web heat treatment apparatus according to claim 1, wherein the upper and lower blow-off ports on the nozzles are formed as straight slits; the upper blow-off ports being disposed in parallel to one another; and the lower blow-off ports being disposed in parallel to one another and as to intersect the upper blow-off ports.

FIG. 1

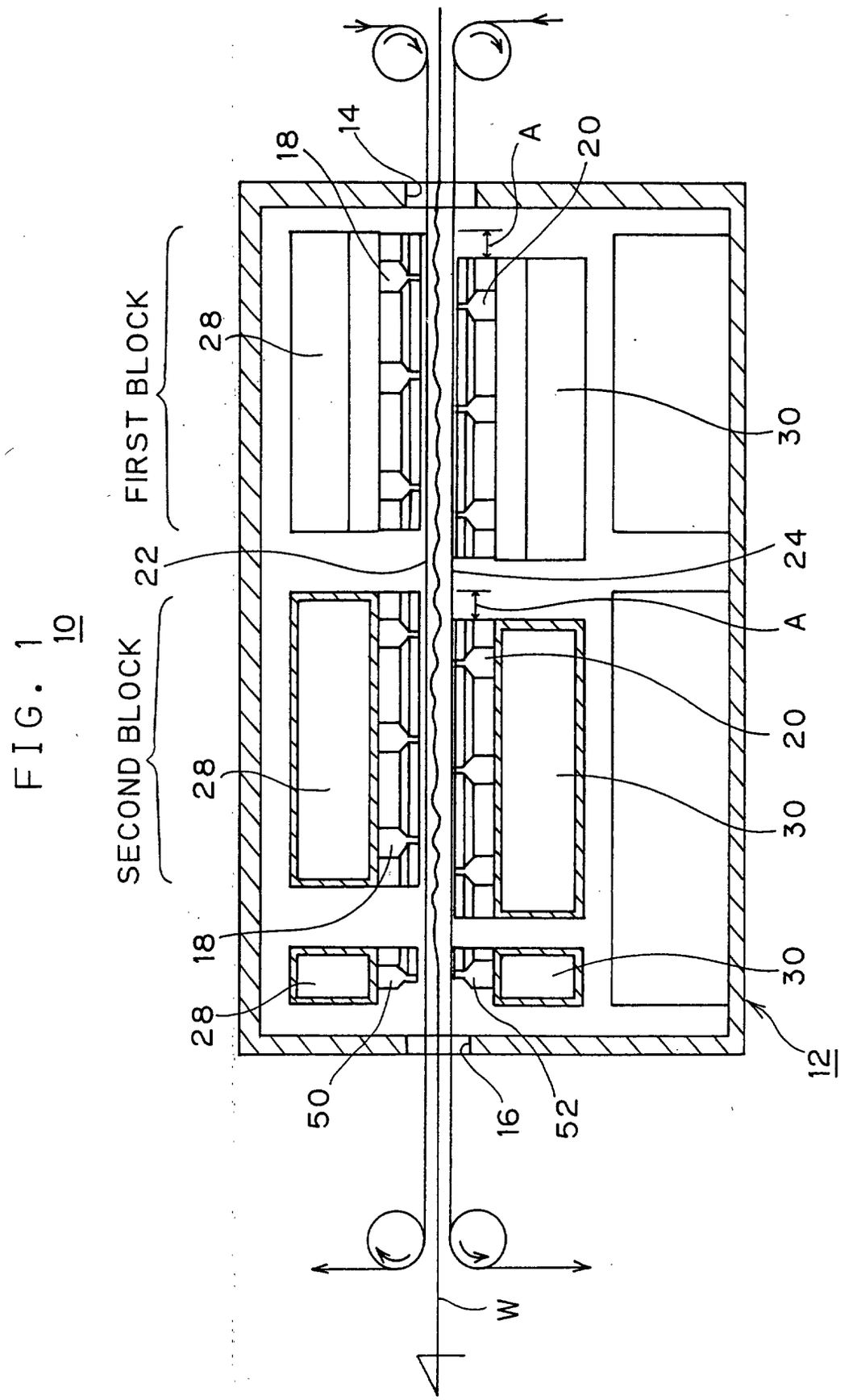
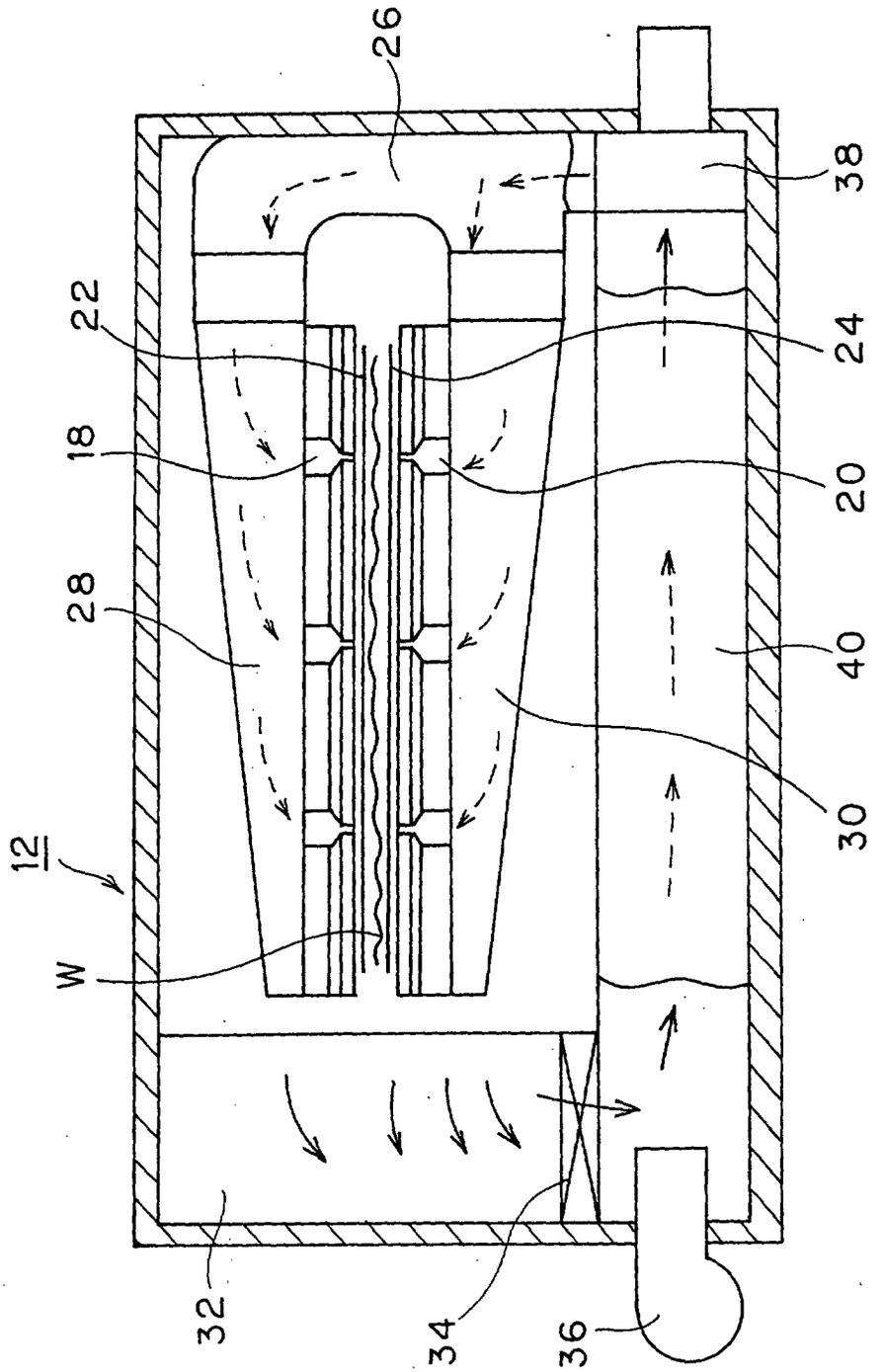


FIG. 2



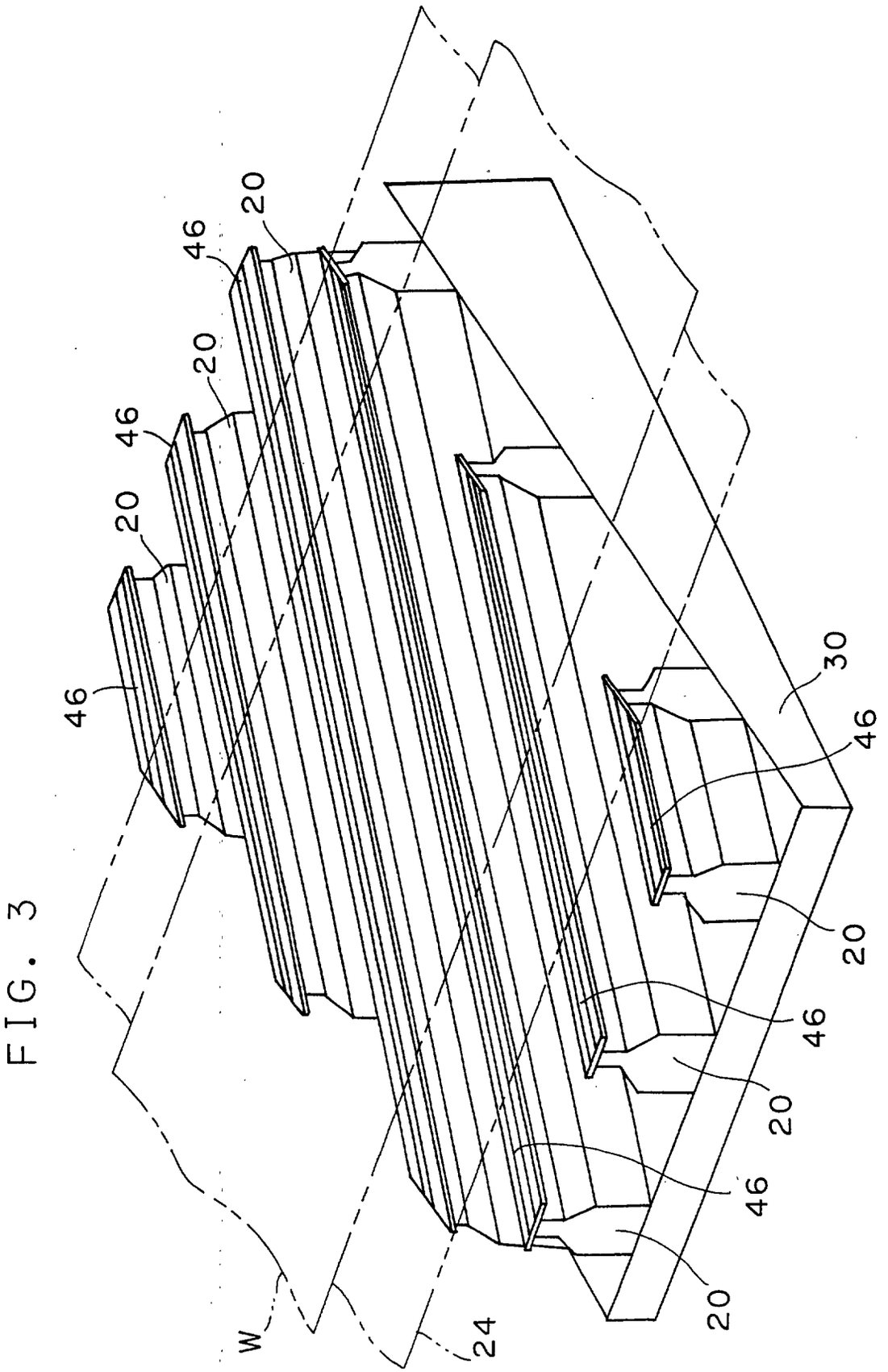


FIG. 3

FIG. 4

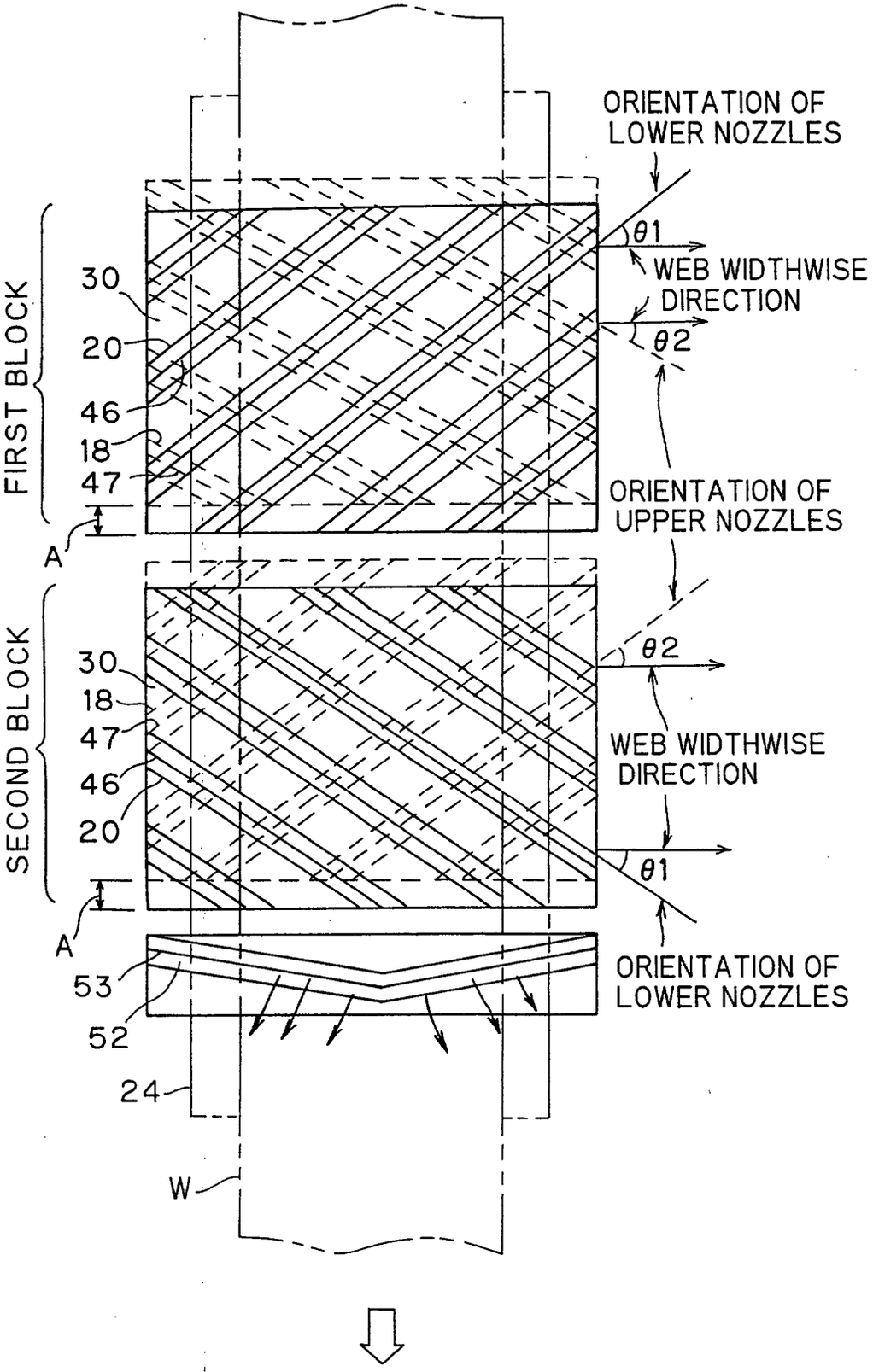

ORIENTATION OF LOWER NOZZLES
θ1
WEB WIDTHWISE DIRECTION
θ2
FIRST BLOCK
30
20
46
18
47
A
ORIENTATION OF UPPER NOZZLES
θ2
SECOND BLOCK
30
18
47
46
20
A
WEB WIDTHWISE DIRECTION
θ1
ORIENTATION OF LOWER NOZZLES
53
52
24
W

FIG. 5

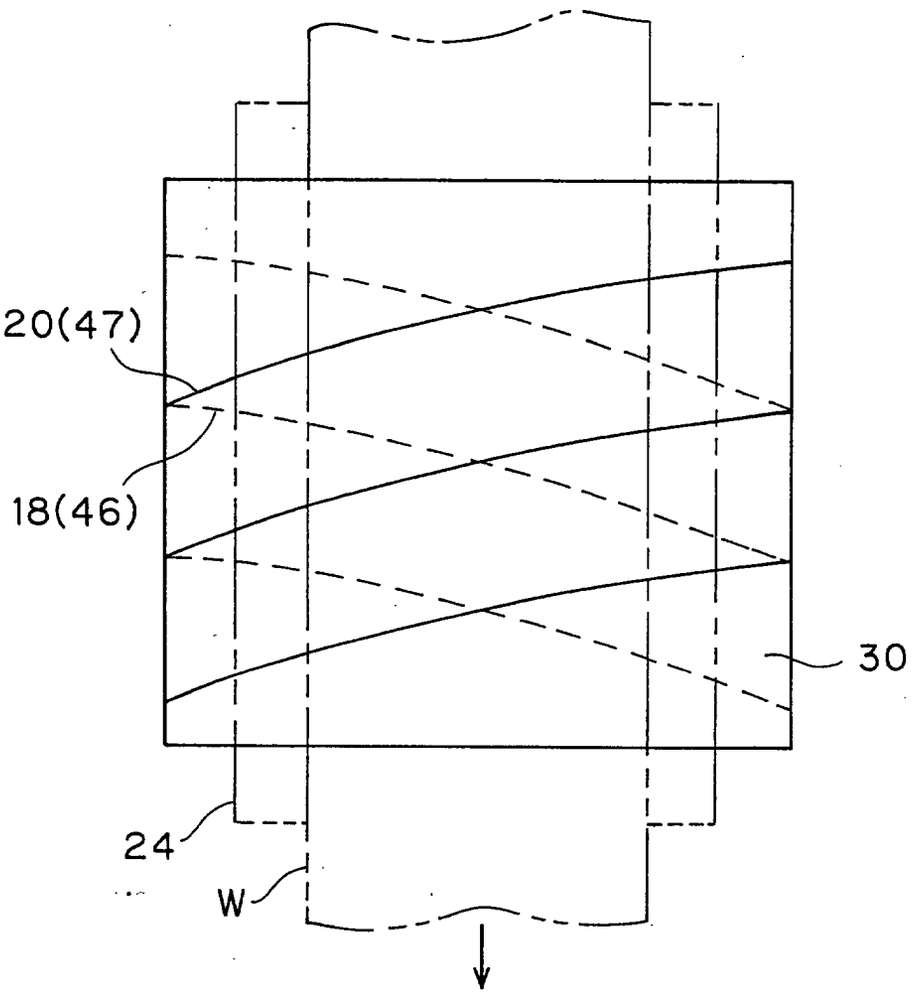


FIG. 6

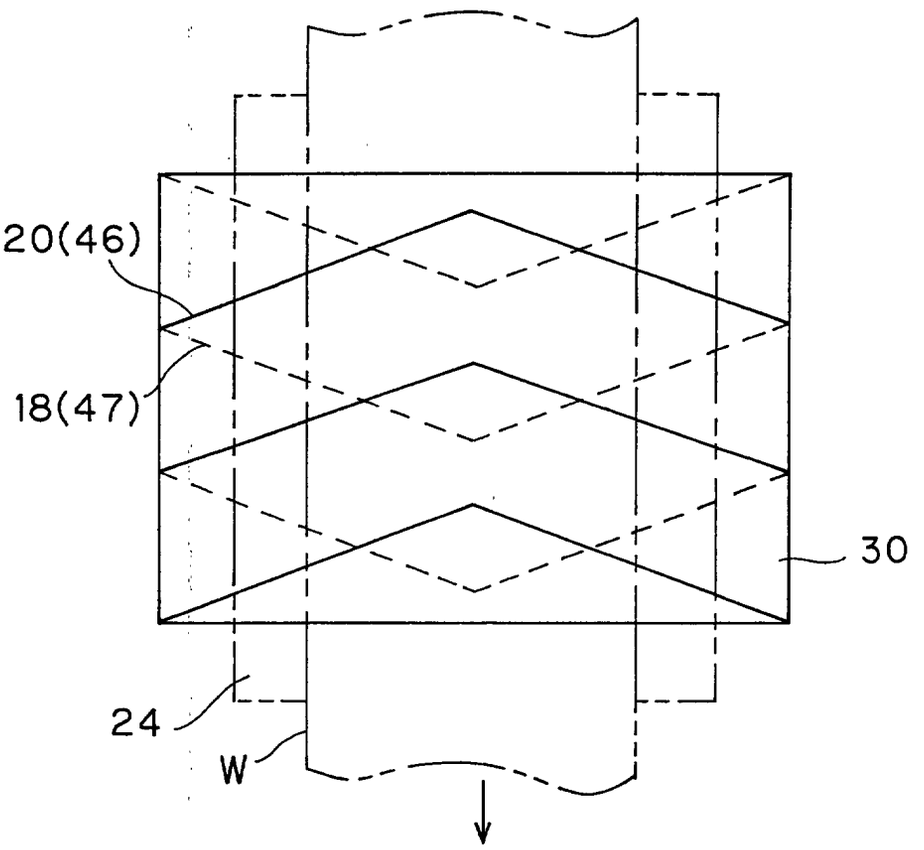


FIG. 7

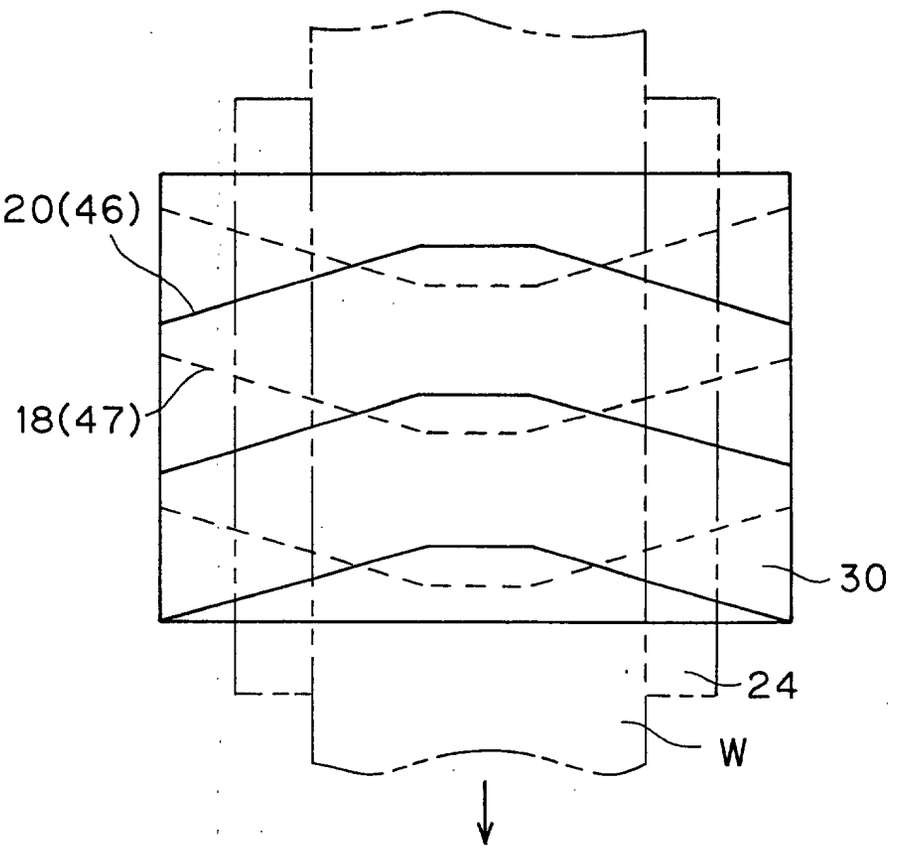


FIG. 8

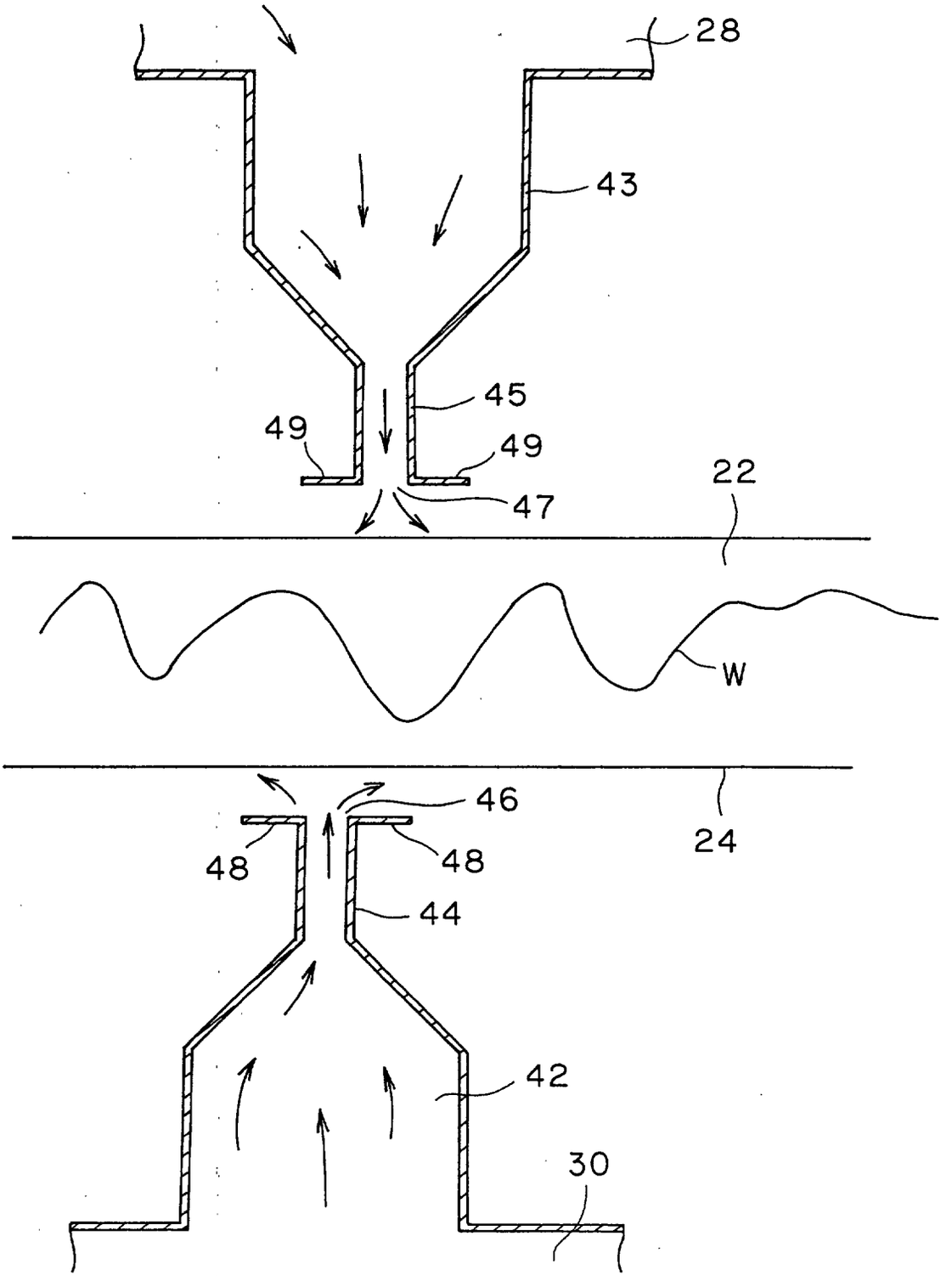


FIG. 9

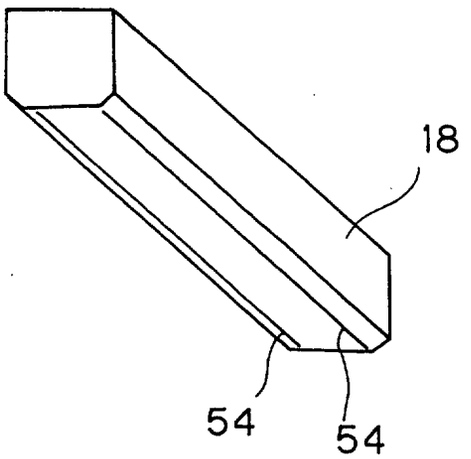


FIG. 10