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(54) **Grouping of cylinders in the drying section of a paper machine**

Zylindergruppe in der Trockenpartie einer Papiermaschine

Groupe de cylindres dans la section de séchage d'une machine à papier

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Description

The invention concerns a grouping of the cylinders in the drying section of a paper machine, according to the preamble of claim 1.

In the prior-art constructions of drying sections in paper machines, see WO-A-90 12 150 on which the preamble of claim 1 is based, the drying section consists of drying groups. Each drying group comprises heated drying cylinders and cold leading cylinders placed in a level different from the level of the drying cylinders. Being supported by the wire, the paper web is passed meandering from a drying cylinder onto a leading cylinder and further from the leading cylinder onto the next drying cylinder. The drying cylinders are placed in two levels in relation to one another, those levels being different from the level of the leading cylinders.

In such a prior-art construction of drying sections, the overall length of the drying section becomes remarkably long. On the other hand, the overall length of the drying section affects the requirement of the building area of the paper mill. If it is possible to reduce the length of the drying section, it is also possible to lower the building cost required by the paper machine in the same proportion.

Thus, the object of the invention is to provide a drying section of a novel type for a paper machine, which is considerably shorter than a prior-art drying section with an equivalent drying capacity and with an equal number of cylinders.

The object of the invention has been achieved by the features of the characterizing clause of claim 1. As a result of the novel grouping, the overall length required by the drying section can be reduced considerably. However, the drying section in accordance with the invention has a drying capacity equal to that of a prior-art drying section with the same number of cylinders.

Thus, according to the invention, the drying section has been formed so that it comprises heated, in particular steam-heated, drying cylinders of two sizes. The drying cylinders of larger diameter are fitted to be placed at a height level of their own, and, in a corresponding way, the drying cylinders of smaller diameter are fitted to be placed at a height level of their own. Further, the drying section comprises cold leading cylinders, which are placed at two different height levels, i.e. at a height level Y_3 and at a height level Y_2' , the latter height level being substantially the same as that of the drying cylinders of smaller diameter. The paper web and the wire are passed meandering from a drying cylinder of larger diameter onto a leading cylinder and from the leading cylinder onto a drying cylinder of smaller diameter. From the drying cylinder of smaller diameter the paper web and the wire are passed onto a second leading cylinder and from the leading cylinder onto a second heated drying cylinder of larger diameter. By means of the above grouping of cylinders and choice of diameters of drying cylinders, it is possible to form, for example, a drying

section whose overall length is, compared with a prior-art 71-cylinder Sym-Run drying section, 18 metres shorter.

The invention will be described in the following with reference to some preferred embodiments of the invention illustrated in the figures in the accompanying drawings, the invention being, yet, not supposed to be confined to said embodiments alone.

Figure 1 shows a prior-art drying section.

Figure 2 shows a drying section in accordance with the invention.

Figure 3 is a more detailed illustration of the grouping of the cylinders in a drying section in accordance with the invention.

As is shown in Fig. 1, a prior-art drying section consists of groups $R_1, R_2, \dots, R_n$ of drying cylinders. Each group $R_1, R_2, R_3, R_4, \dots, R_n$ of drying cylinders comprises hot, preferably steam-heated drying cylinders of larger diameter and smaller cold, so-called leading cylinders placed at a level different from the level of the drying cylinders. In each group $R_1, R_2, \dots$, the paper web is passed, being supported by the wire H, from a drying cylinder K onto a leading cylinder V placed at a different level and further from the leading cylinder V back to the upper level onto a heated drying cylinder placed at said level.

The leading cylinders are preferably perforated Uno-Vac cylinders, into which an internal negative pressure is introduced and which negative pressure is allowed to act upon the entire space in the interior of the drying cylinder, whereby the web is kept in contact with the wire also in the web draws in which the web W is not supported by a wire. Fig. 1 shows a construction of a drying section that comprises seven groups of drying cylinders, of which the second group from the end is an inverted group, in which the steam-heated drying cylinders K are placed at a lower level and the cold leading cylinders V are placed at a higher level above them.

Fig. 2 shows an improvement over the prior art illustrated in Fig. 1. In the construction, it has been possible to reduce the length of the drying section by forming the drying groups by means of a novel grouping of the drying cylinders and leading cylinders. In the solution shown in Fig. 2, there are six drying groups $R_1 \dots R_6$, the second group R_5 from the end being a so-called inverted group, in which the steam-heated drying cylinders K are placed at the lowest levels and the leading cylinders V at a higher level above them.

The groups $R_1 \dots R_4$ and R_6 are provided with a grouping of the heated drying cylinders K and of the leading cylinders V in accordance with the invention. The whole drying section comprises 28 steam-heated drying cylinders K and 29 cold cylinders, i.e. leading cylinders V. In the way shown in Fig. 2, the heated drying cylinders K in a drying group R are placed in such a way in relation to one another that a drying cylinder K of smaller diameter is placed at a height level Y_2 , which is a height level different from the height level Y_1 of the

drying cylinders K of larger diameter. The leading cylinders V are placed at the height level Y_2' and at the height level Y_3 . The paper web W is passed, e.g. in the drying group R_1 , from the leading cylinder V_1 placed at the height level Y_2' onto the drying cylinder K_2 placed at the height level Y_1 and from the drying cylinder K_2 onto the leading cylinder V_2 placed at the height level Y_3 , and from said leading cylinder onto the heated drying cylinder K_3 of smaller diameter placed at the height level Y_2 . From the heating cylinder K_3 the web R is passed onto the leading cylinder V_3 placed at the height level Y_3 and from the leading cylinder V_3 onto the drying cylinder K_4 placed at the height level Y_1 . From the drying cylinder K_4 the web R is again passed onto the leading cylinder V_4 placed at the height level Y_2' .

In a corresponding way, the wire H_1 is passed so that in connection with the heated drying cylinders K_2 and K_4 the paper web W runs between the wire H_1 and the face of the drying cylinder K_2 and K_4 , and in connection with the leading cylinders V_2 and V_3 the web W runs outermost. Correspondingly, in connection with the drying cylinder K_3 with smaller diameter the paper web W runs between the drying cylinder K_3 and the wire H_1 .

Thus, in the groups R_1, R_2, R_3, R_4 and in the group R_6 the hot drying cylinders K and the leading cylinders V are placed at four different height levels Y_1, Y_2, Y_2', Y_3 so that the hot drying cylinders K are placed at two different levels Y_1, Y_2 and the leading cylinders V at the level Y_2' and at the level Y_3 . The height levels Y_2 and Y_2' are levels substantially equal to one another. The level Y_2' is placed slightly higher than the level Y_2 . The diameter dimensions of the leading cylinders V placed at the levels Y_2' and Y_3 are just slightly different from one another. The leading cylinders V at the level Y_2' have a slightly larger diameter than the leading cylinders V at the level Y_3 . The diameters of both of the leading cylinders V placed at the levels Y_3 and Y_2' are slightly smaller than the diameters of the heated drying cylinders K placed at the height level Y_2 . The diameter of the drying cylinder K placed at the middle height position Y_2 is smaller than the diameter of the drying cylinders K placed at the first height level Y_1 . In this way, between the drying cylinders K and the leading cylinders V, a novel grouping has been provided which results in considerable economies of space in the machine direction. The drying capacity is good and corresponds to that of a prior-art drying section of equal number of cylinders and larger length.

Fig. 3 is a more detailed illustration of the grouping in accordance with the invention between the heated drying cylinders and the cold cylinders, i.e. the leading rolls. In the way shown in Fig. 3, each drying group $R_1, R_2, \dots$ consists of cylinder groupings in which the heated drying cylinders are placed at two height levels, the levels Y_1 and Y_2 . The leading cylinders are placed at the height level Y_2' and at the height level Y_3 . Moreover, the diameter of the heated drying cylinder placed at the middle height level Y_2 is smaller than the diameter of the

drying cylinder placed at the level Y_1 .

Together with the wire H, the paper web W is passed from the leading cylinder V_{n-2} of the height level Y_2' onto the drying cylinder K_{n-2} of the level Y_1 . From the drying cylinder K_{n-2} , the web W is passed onto the leading cylinder V_{n-1} , and from the leading cylinder V_{n-1} further, with the wire H, onto the middle heated drying cylinder K_{n-1} . From the heated drying cylinder K_{n-1} the paper web W and the wire H are passed onto the second leading cylinder V_n of the level Y_3 . From the leading cylinder V_n the paper web W is passed onto the second heated drying cylinder K_n of larger diameter, placed at the height level Y_1 . From the drying cylinder K_n the web W is passed onto the leading cylinder V_{n+1} of the height level Y_2' . In a corresponding way, the wire H is passed from one cylinder onto the other. The paper web W runs in contact with the faces of the drying cylinders on the heated drying cylinders K. On the leading cylinders V the paper web W runs outermost, and the wire H is placed in contact with the cylinder V face. The leading cylinders V_{n-1} and V_n are placed symmetrically at the same distance from the vertical plane X drawn through the centre point of the heated drying cylinder K_{n-1} , of smaller diameter. The heated drying cylinders K_{n-2}, K_n of larger diameter are also placed symmetrically at equal distances from the vertical plane. In a corresponding way, the leading cylinders V_{n-2}, V_{n+1} of the height level Y_2' are placed symmetrically to the centre plane X and at equal distances from same.

Claims

1. Grouping of cylinders in the drying section of a paper machine, in which drying section the paper-web (W) and the wire (H) are carried meandering from a heated, preferably steam-heated, drying cylinder (K) onto a leading cylinder (V) and from this leading cylinder (V) onto the next heated drying cylinder (K), and in which construction of drying section the drying section consists of a number of drying groups ($R_1, R_2, R_3, \dots$). a drying group (R) consisting of a number of subsequent groupings of cylinders, whereby, in a grouping of cylinders, the drying cylinders (K_{n-2}, K_{n-1}, K_n) and the leading cylinders (V_{n-1}, V_n) are placed, in relation to one another, substantially at three different height levels, **characterized** in that said drying cylinders in the drying group (R) have different diameters, two of them being larger than the third, that the drying cylinders (K_{n-2}, K_n) with larger diameter are placed at the first height level (Y_1) and the drying cylinder (K_{n-1}) with the smaller diameter is placed at the second, middle height level (Y_2), while the leading cylinders (V_{n-1}, V_n) are placed at the third height level (Y_3), whereby the paper web (W) and the wire (H) pass said drying and leading cylinders in the following order: the first drying cylinder (K_{n-2}) of larger diameter, a first lead-

ing cylinder (V_{n-1}), the drying cylinder (K_{n-1}) of the smaller diameter, a second leading cylinder (V_n) and the second drying cylinder (K_n) of larger diameter.

2. Grouping of cylinders in the drying section of a paper machine as claimed in claim 1, **characterized** in that the paper web (W) is passed onto the first drying cylinder (K_{n-2}) of larger diameter from a third leading cylinder (V_{n-2}), which is placed substantially at the same height level (Y_2') as the drying cylinder (K_{n-1}) of smaller diameter, and that, in the grouping of cylinders, the paper web is passed from the second drying cylinder (K_n) of larger diameter onto a fourth leading cylinder (V_{n+1}), which is placed substantially at the same height level (Y_2') as the drying cylinder (K_{n-1}) of smaller diameter.
3. Grouping of cylinders in the drying section of a paper machine as claimed in claim 1 or 2, **characterized** in that, in the grouping, the leading cylinders (V_{n-1}, V_n) are placed symmetrically in relation to the vertical plane (X) drawn through the centre point of the drying cylinder (K_{n-1}) of smaller diameter at equal distances from the vertical plane (X) and that, in the grouping of cylinders, the heated drying cylinders (K_{n-2}, K_n) of larger diameter are also placed symmetrically in relation to the vertical plane (X).
4. Grouping of cylinders in the drying section of a paper machine as claimed in any of the preceding claims, **characterized** in that, in the grouping of cylinders, the heated drying cylinders (K_{n-2}, K_n) of larger diameter are placed at the highest height level, the drying cylinder (K_{n-1}) of smaller diameter is placed at the middle height level (Y_2), and the leading cylinders (V_{n-1}, V_n) are placed at the lowest height level (Y_3).

Patentansprüche

1. Zylindergruppe in der Trockenpartie einer Papiermaschine, in welcher Trockenpartie die Papierbahn (W) und das Sieb (H) meanderförmig von einem beheizten, vorzugsweise dampfbeheizten Trockenzylinder (K) auf einen Führungszylinder (V) und von diesem Führungszylinder (V) zu dem nächsten beheizten Trockenzylinder (K) gefördert werden, und in welcher Trockenpartiekonstruktion die Trockenpartie aus einer Anzahl von Trockengruppen ($R_1, R_2, R_3, \dots$) besteht, wobei eine Trockengruppe (R) aus einer Anzahl von aufeinanderfolgenden Zylindergruppen besteht, wobei in einer Zylindergruppe die Trockenzylinder (K_{n-2}, K_{n-1}, K_n) und die Führungszylinder (V_{n-1}, V_n) in Beziehung zueinander im wesentlichen in drei verschiedenen Höhenniveaus angeordnet sind, dadurch gekennzeichnet,

daß die Trockenzylinder in der Trockengruppe (R) verschiedene Durchmesser haben, wobei zwei davon größer als der dritte sind, daß die Trockenzylinder (K_{n-2}, K_n) mit größerem Durchmesser in dem ersten Höhenniveau (Y_1) und der Trockenzylinder (K_{n-1}) mit dem kleineren Durchmesser in dem zweiten mittleren Höhenniveau (Y_2) angeordnet ist, während die Führungszylinder (V_{n-1}, V_n) in dem dritten Höhenniveau (Y_3) angeordnet sind, so daß die Papierbahn (W) und das Sieb (H) die Trocken- und Führungszylinder in der folgenden Reihenfolge passieren: der erste Trockenzylinder (K_{n-2}) größeren Durchmessers, ein erster Führungszylinder (V_{n-1}), der Trockenzylinder (K_{n-1}) des kleineren Durchmessers, ein zweiter Führungszylinder (V_n) und der zweite Trockenzylinder (K_n) größeren Durchmessers.

2. Zylindergruppe in der Trockenpartie einer Papiermaschine gemäß Anspruch 1, dadurch gekennzeichnet, daß die Papierbahn (W) auf den ersten Trockenzylinder (K_{n-2}) größeren Durchmessers geleitet wird, und zwar ausgehend von einem dritten Führungszylinder (V_{n-2}), der im wesentlichen in dem gleichen Höhenniveau (Y_2') wie der Trockenzylinder (K_{n-1}) kleineren Durchmessers angeordnet ist, und daß in der Zylindergruppe die Papierbahn von dem zweiten Trockenzylinder (K_n) größeren Durchmessers auf einen vierten Führungszylinder (V_{n+1}) geleitet wird, der im wesentlichen in dem gleichen Höhenniveau (Y_2') wie der Trockenzylinder (K_{n-1}) kleineren Durchmessers angeordnet ist.
3. Zylindergruppe in der Trockenpartie einer Papiermaschine gemäß Anspruch 1 oder 2, dadurch gekennzeichnet, daß in der Gruppe die Führungszylinder (V_{n-1}, V_n) in Bezug zu der durch den Mittelpunkt des Trockenzylinders (K_{n-1}) kleineren Durchmessers gezogenen Vertikalebene (X) in gleichen Abständen von der Vertikalebene (X) aus symmetrisch angeordnet sind, und daß in der Zylindergruppe die beheizten Trockenzylinder (K_{n-2}, K_n) größeren Durchmessers ebenfalls in Bezug zu der Vertikalebene (X) symmetrisch angeordnet sind.
4. Zylindergruppe in der Trockenpartie einer Papiermaschine gemäß einem der vorangegangenen Ansprüche, dadurch gekennzeichnet, daß in der Zylindergruppe die beheizten Trockenzylinder (K_{n-2}, K_n) größeren Durchmessers in dem höchsten Höhenniveau angeordnet sind, der Trockenzylinder (K_{n-1}) kleineren Durchmessers in dem mittleren Höhenniveau (Y_2) angeordnet ist und die Führungszylinder (V_{n-1}, V_n) in dem untersten Höhenniveau (Y_3) angeordnet sind.

Revendications

1. Groupe de cylindres dans la section de séchage d'une machine à papier, section de séchage dans laquelle la bande de papier (W) et la toile (H) sont acheminées de manière sinueuse depuis un cylindre de séchage chauffé (K), de préférence chauffé à la vapeur, jusque sur un cylindre de guidage (V) et depuis ce cylindre de guidage (V) jusque sur le cylindre de séchage chauffé suivant, et dans lequel la construction de la section de séchage est constituée par un certain nombre de groupes de séchage ($R_1, R_2, R_3 \dots$), un groupe de séchage (R) étant constitué par un certain nombre de groupes de cylindres successifs, grâce à quoi, dans un groupe de cylindres, les cylindres de séchage (K_{n-2}, K_{n-1}, K_n) et les cylindres de guidage (V_{n-1}, V_n) sont placés, les uns par rapport aux autres, sensiblement à trois niveaux de hauteur différents, **caractérisé** en ce que lesdits cylindres de séchage du groupe de séchage (R) ont des diamètres différents, deux d'entre eux étant plus grands que le troisième, en ce que les cylindres de séchage (K_{n-2}, K_n) qui ont le plus grand diamètre sont placés au premier niveau de hauteur (Y_1) et le cylindre de séchage (K_{n-1}) qui a le plus petit diamètre est placé au second niveau de hauteur, intermédiaire, (Y_2), tandis que les cylindres de guidage (V_{n-1}, V_n) sont placés au troisième niveau de hauteur (Y_3), grâce à quoi la bande de papier (W) et la toile métallique (H) passent dans l'ordre suivant sur lesdits cylindres de séchage et de guidage : le premier cylindre de séchage (K_{n-2}) de plus grand diamètre, un premier cylindre de guidage (V_{n-1}), le cylindre de séchage (K_{n-1}) du plus petit diamètre, un deuxième cylindre de guidage (V_n) et le deuxième cylindre de séchage (K_n) de plus grand diamètre.
2. Groupe de cylindres dans la section de séchage d'une machine à papier selon la revendication 1, **caractérisé** en ce que la bande de papier (W) est amenée à passer sur le premier cylindre de séchage (K_{n-2}) de plus grand diamètre depuis un troisième cylindre de guidage (V_{n-2}), qui est placé sensiblement au même niveau de hauteur (Y_2') que le cylindre de séchage (K_{n-1}) de plus petit diamètre, et en ce que, dans le groupe de cylindres, la bande de papier est amenée à passer du deuxième cylindre de séchage (K_n) de plus grand diamètre à un quatrième cylindre de guidage (V_{n+1}), qui est placé sensiblement au même niveau de hauteur (Y_2') que le cylindre de séchage (K_{n-1}) de plus petit diamètre.
3. Groupe de cylindres dans la section de séchage d'une machine à papier selon la revendication 1 ou 2, **caractérisé** en ce que, dans le groupe, les cylindres de guidage (V_{n-1}, V_n) sont placés de manière symétrique par rapport au plan vertical (X) passant par le point central du cylindre de séchage (K_{n-1}) de plus petit diamètre à égale distance du plan vertical (X) et en ce que, dans le groupe de cylindres, les cylindres de séchage chauffés (K_{n-2}, K_n) de plus grand diamètre sont également placés de manière symétrique par rapport au plan vertical (X).
4. Groupe de cylindres dans la section de séchage d'une machine à papier selon l'une quelconque des revendications précédentes, **caractérisé** en ce que, dans le groupe de cylindres, les cylindres de séchage chauffés (K_{n-2}, K_n) de plus grand diamètre sont placés au niveau de hauteur le plus haut, le cylindre de séchage (K_{n-1}) de plus petit diamètre est placé au niveau de hauteur intermédiaire (Y_2), et les cylindres de guidage (V_{n-1}, V_n) sont placés au niveau de hauteur le plus bas (Y_3).

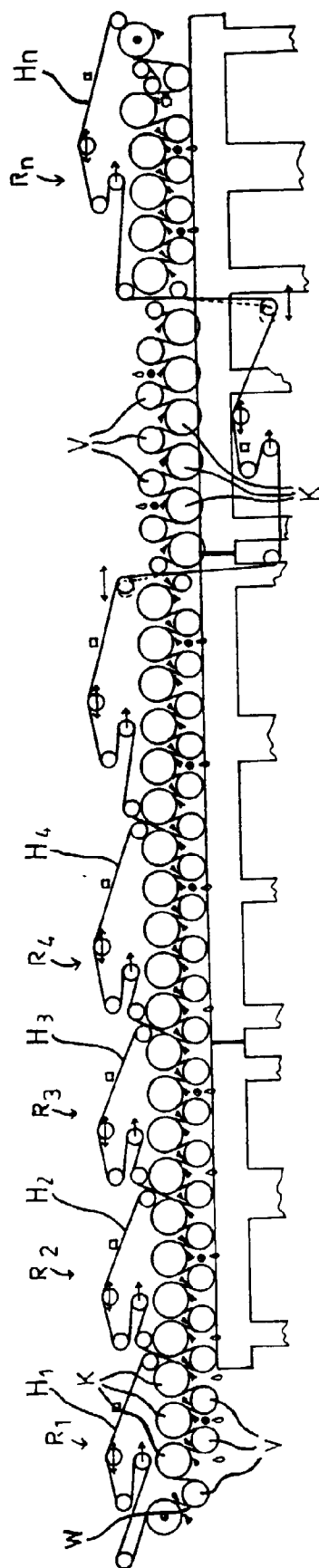
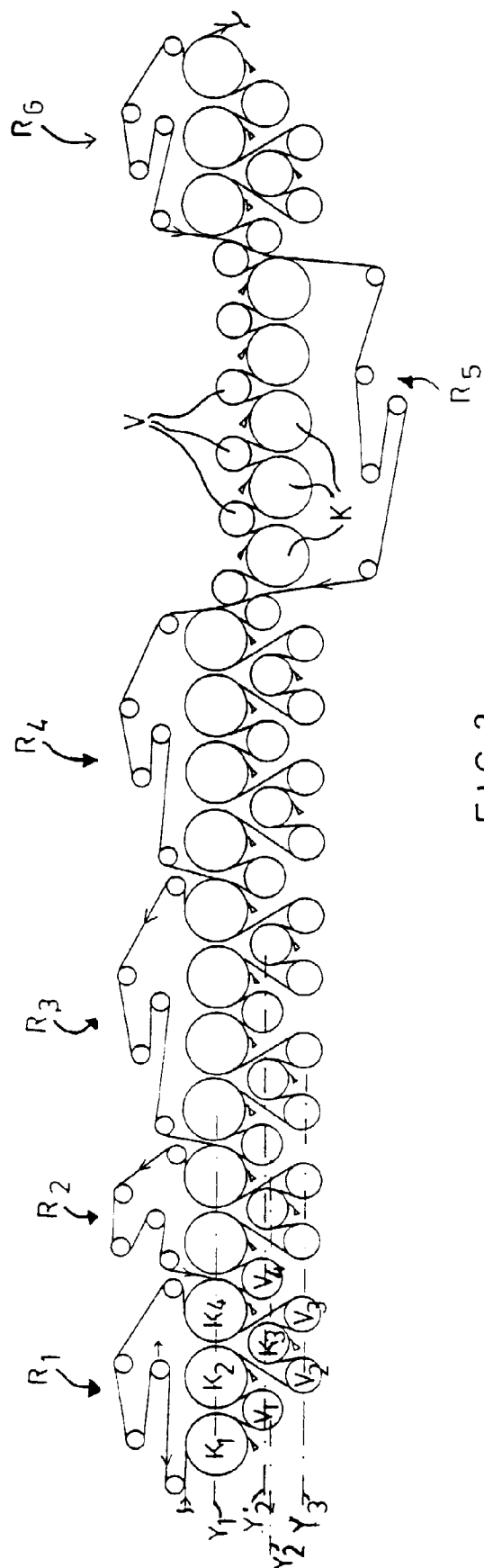


FIG. 1



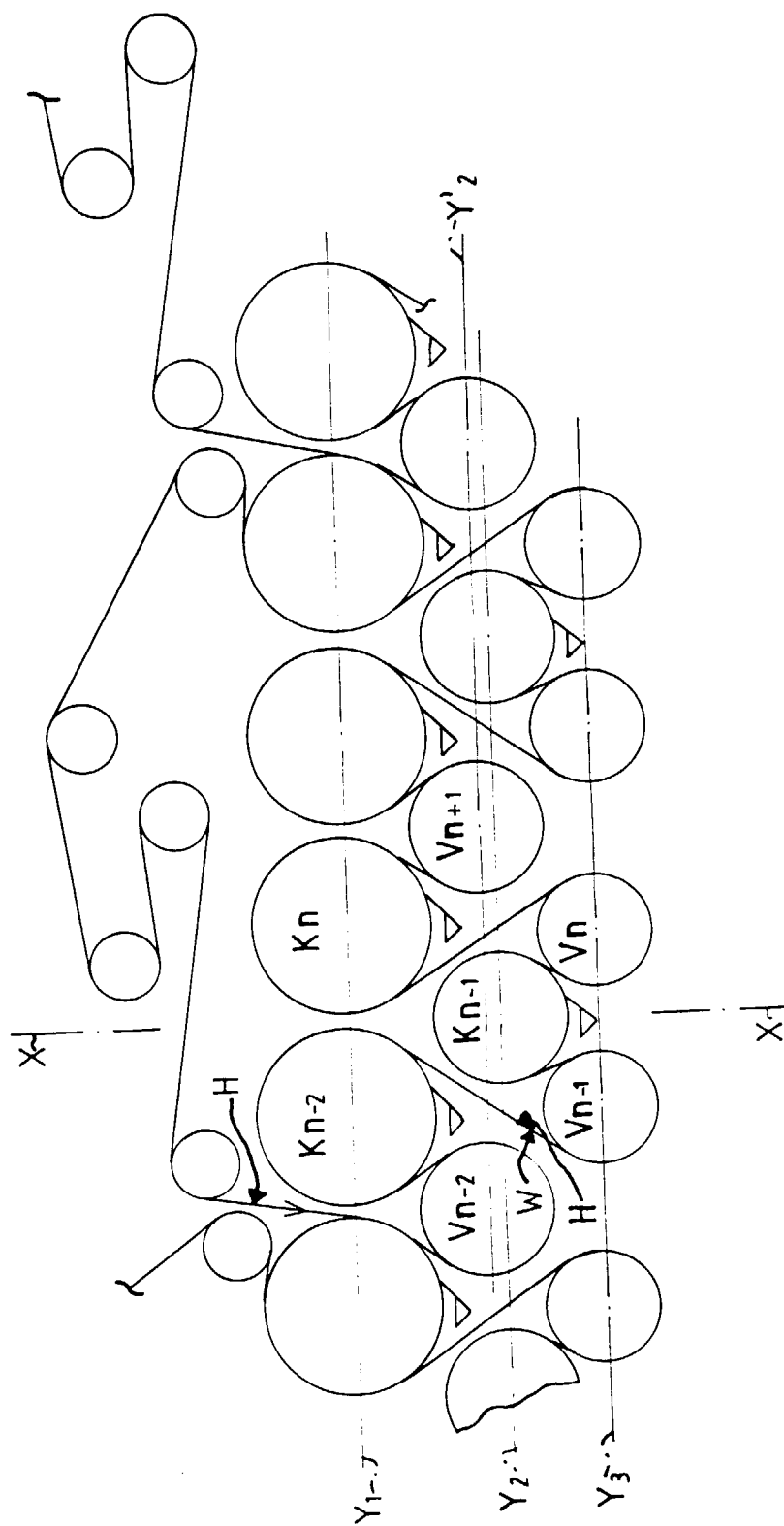


FIG. 3