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(54) Reel-up and method for regulation of the nip pressure in a reel-up.

(57) The invention concerns a reel-up, comprising a first revolving roll (15) and a second revolving roll (20), which form a nip (N), into which nip (N) the web (W) is introduced. In the nip (N) a nip pressure (Gr) acts upon the web (W), and after the nip (N) the web (W) is reeled onto said second revolving roll (20). The second revolving roll (20) is supported on reeling rails (10) or equivalent. For the purpose of regulation of the nip pressure (Gr), the reel-up comprises members (30) for alteration of the positions of the first revolving roll (15) and the second revolving roll (20) in relation to one another. The invention also concerns a method for regulation of the nip pressure in a reel-up. In the method, the positions of the first revolving roll (15) and the second revolving roll (20) in the reel-up in relation to one another are changed and/or additional forces (F) are applied to the ends of the second revolving roll (20) in a direction perpendicular to the direction of the axis of the roll.

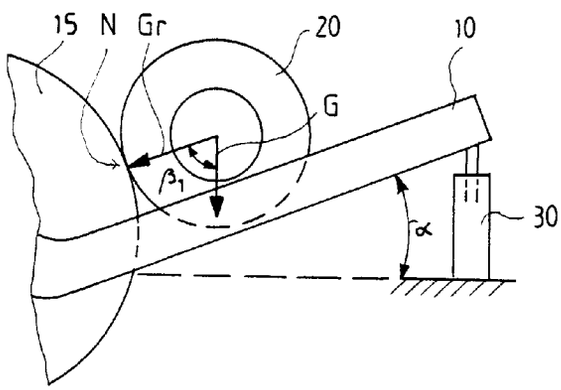

FIG. 3

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The invention concerns a reel-up, comprising a first revolving roll and a second revolving roll, which form a nip, into which nip the web is introduced and in which nip a nip pressure acts upon the web and after which nip the web is reeled onto said second revolving roll, which said second revolving roll is supported on reeling rails or equivalent.

The invention also concerns a method for regulation of the nip pressure in a reel-up, which comprises a first revolving roll and a second revolving roll, which form a nip, into which nip the web is introduced and in which nip a nip pressure acts upon the web and after which nip the web is reeled onto said second revolving roll, which said second revolving roll is supported on reeling rails or equivalent.

During reeling, at the beginning of the reeling, owing to bending of the reeling drums, it is difficult to produce a uniform linear load or nip load between the reeling drum and the reeling cylinder by means of the prior-art methods. In primary reeling, owing to the supporting of the reeling drum, the linear load becomes considerably higher in the middle than at the edges. In secondary reeling, the loading effect of the reeling forks produces a higher linear load at the edges than in the middle.

In the case of some reel-ups, such as Pope-type reel-ups, in the process of changing from the primary rails to the secondary rails, points of discontinuity are readily produced between the reeling cylinder and the reeling drum, such as peaks of linear load, which produce broke in the reel bottom.

The object of the present invention is to provide a reel-up in which the problems mentioned above do not occur. It is a particular object of the invention to provide a reel-up in which the nip load between the reeling drum and the reeling cylinder is uniform. A further object of the invention is to provide a reel-up in which points of discontinuity that produce broke in the reel bottom do not occur.

In view of achieving the objectives stated above and those that will come out later, the reel-up in accordance with the invention is mainly characterized in that, for the purpose of regulation of said nip pressure, the reel-up comprises members for alteration of the positions of the first revolving roll and the second revolving roll in relation to one another.

The method in accordance with the invention is mainly characterized in that, in the method, the positions of the first revolving roll and the second revolving roll in the reel-up in relation to one another are changed and/or additional forces are applied to the ends of the second revolving roll in a direction perpendicular to the direction of the axis of the roll.

According to the invention, the linear load can be made uniform in the transverse direction of the machine by placing the reeling drum on support in relation to the reeling cylinder so that the force component of the force of gravity of the earth that passes through the centre points of the reeling drum and the reeling cylinder forms the force that is needed for the linear load or nip load. The linear load is adjusted by altering the position of the reeling drum in relation to the reeling cylinder, and in this way, at the same time, the magnitude of the force component that produces the linear load is altered. Thus, a suitable linear load or nip load is produced by means of the own weight of the reeling drum and of the web reeled onto said drum. In the invention, the reeling of the web onto the reeling drum is started against the reeling cylinder at a point at which the force component of the force of gravity of the earth applied to the reeling drum that is directed at the centre point of the reeling cylinder is suitable and forms the linear load.

The alteration of the force component is produced in a number of different ways, for example by adjusting the inclination of the reeling rails or forks. When the size of the jumbo roll becomes larger, the inclination is reduced to a suitable level.

The discontinuities occurring in connection with the change or transfer from the primary rails to the secondary rails in a paper reel-up can be eliminated, according to the invention, for example, by starting the reeling directly from the rails.

When a full jumbo roll revolves on the secondary rails, the roll is shifted into the braking position, whereupon the primary rails can be shifted into an optimal position of inclination, in view of the linear load, so that the linear load, i.e. the line pressure, becomes uniform across the whole machine in the transverse direction. When the size of the jumbo roll becomes larger as the reeling makes progress, the angle of inclination of the primary rails is made smaller. The change, i.e. the shifting onto the secondary rails, takes place by shifting the secondary rails to the same angle of inclination with the primary rails, whereby the replacing reeling drum rolls over the joint, and during and after that time the primary rails and the secondary rails move as synchronized and regulate the linear load by altering the angle of inclination.

Also, according to the invention, additional forces can be applied to the ends of the reeling drum in a direction perpendicular to the axial direction of the roll, whereby the nip load or linear load in the transverse direction of the machine, i.e. in the axial direction of the reeling drum, can also be controlled and regulated by means of the additional forces. If it is desirable, for example by means of adjustment operations, to act upon the transverse profile of linear loading while at the same time keeping the level of overall linear loading unchanged, the angle of inclination can be regulated so that the effect of the additional forces on the level of overall linear load is compensated for.

The method of the invention is well suitable for application when the reeling is started directly from the rails. In such a case it is possible to make use of regulation of loading based on the geometry. When

the paper roll formed on the reeling drum becomes larger, the effect of increasing the linear load of the force of gravity is lowered.

By means of the arrangement in accordance with the invention, other advantages are also achieved. For example, at the beginning of reeling there is no process of exchange, and the loading situation is seen naturally by observing the inclination of the rails. Further, by means of the solution of the invention, sudden changes in linear loads and in other loads are avoided, and regulation of the linear loads in accordance with the invention is mechanically easy, and its control is technically easy.

In the following, the invention will be described in more detail with reference to the figures in the accompanying drawing, the invention being, however, in no way strictly confined to said figures.

Figures A and B are schematic illustrations of some problems of nip loads or linear loads known in prior art, the solution of these problems being an object of the present invention.

Figure 1 is a schematic illustration of the reeling process at the initial stage of the reeling.

Figure 2 is a schematic illustration of the reeling process at the final stage of the reeling.

Figure 3 is a schematic illustration of an arrangement in accordance with the invention in view of providing a uniform linear load or nip pressure.

Figure 4 is a schematic illustration of a further exemplifying embodiment of the invention.

Figure 5 is a schematic illustration of an embodiment of the arrangement in accordance with the invention which is suitable for use in continuous reeling.

Figure 6 is a schematic illustration of a second embodiment of the arrangement in accordance with the invention which is suitable for use in continuous reeling.

Figure 7 is a schematic illustration of an arrangement in accordance with the invention as fitted in connection with the process of exchange of reeling drum.

As is shown in Fig. A, in primary reeling, the linear load between the reeling cylinder 15 and the reeling drum 20 is formed higher in the middle than at the edges. The linear load in the middle is denoted with the arrows Z. The higher linear load in the middle results from the effect of supporting of the reeling drum 20, which effect is denoted schematically with the arrows X.

From Fig. B it comes out how, in secondary reeling, the loading effect of the reeling drum 20, which effect is denoted schematically with the arrows X 2 in the figure, produces a higher loading Z2 at the edges than in the middle.

As is shown in Fig. 1, in the reel-up the web, e.g. a paper web W, is reeled from the first roll, i.e. the reeling cylinder 15, onto the second roll, i.e. the reeling drum 20, both of which rolls 15, 20 are revolving and form a nip N, into which nip the web W is passed and after which nip N the web W is reeled onto the second revolving roll, i.e. the reeling drum 20, which is supported by reeling rails 10.

As is shown in Fig. 1, the reeling of the web W onto the reeling drum 20 against the reeling cylinder 15 is started at a point at which the component Gr of the force of gravity G of the earth directed at the centre point of the reeling cylinder 15 is suitable. In such a case, the linear load effective in the nip N is uniform across the whole machine in the transverse direction and does not become excessively high at the middle. In the figure, the sense of rotation of the reeling cylinder 15 is denoted with the reference S1, and the sense of rotation of the reeling drum 20 with the reference S2. The reeling drum 20 is supported by means of the reeling rails 10.

As is shown in Fig. 2, regulation of loading based on geometry is utilized. When the web roll that is reeled onto the reeling drum 20 becomes larger, the effect of producing linear load of the force of gravity G becomes lower, i.e. the angle $\beta 1 < \beta 2$.

As is shown in Fig. 3, the linear load in the transverse direction of the machine, i.e. in the axial direction of the reeling drum 20, can be made uniform at the nip N by placing the reeling drum 20 on support in relation to the reeling cylinder 15 so that the force component Gr of the force of gravity G that passes through the centre points of the reeling drum 20 and the reeling cylinder 15 forms the force component that is required for the linear load. The linear load is regulated by altering the position of the reeling drum 20 in relation to the reeling cylinder 15 so that the nip point N is changed and, at the same time, the magnitude of the force component Gr that produces the linear load is altered. The alteration of the force component Gr takes place most easily by adjusting the inclination of the reeling rails 10, i.e. the angle α. In such a case, the linear load is $Gr = G \cdot \sin \alpha$, the own weight of the reeling drum 20 and the weight of the web reeled onto the drum produce the linear load or nip load at the point N. When the size of the jumbo roll 20 becomes larger, the angle α of inclination is, of course, made smaller to maintain a uniform linear load or nip load, preferably from about 20° to 1°.

The angle α of inclination of the reeling rails 10 is adjusted by means of an actuator, e.g. a screw jack 30, a cylinder, or some other, corresponding member. A great number of well-known arrangements are suitable for members 30 of adjustment of the angle α of inclination. The reeling rails 10 are attached pivotally to the reeling cylinder 15, and the reeling rails 10 are preferably mounted to the centre point of the reeling cylinder 15.

As is shown in Fig. 4, additional forces F are applied to the ends of the reeling drum 20 in a direction perpendicular to the axial direction of the roll by means of suitable members 35, e.g. means for sup-

porting and shifting the reeling drum, in which case it is possible to control and to regulate the nip load or linear load in the transverse direction of the machine, i.e. in the axial direction of the reeling drum 20. If it is desirable to act upon the transverse profile of linear load by means of the above regulation operation and by the intermediate of the additional forces F while, at the same time, keeping the level of overall linear load unchanged, the angle α of inclination can be adjusted so that the effect of the additional forces F on the level of overall linear load is compensated for.

The linear load or nip load in the transverse direction of the machine, i.e. in the axial direction of the reeling drum 20, is regulated in the middle by changing the positions of the reeling cylinder 15 and the reeling drum 20 in relation to each other, e.g., by altering the angle α of inclination of the rails 10. When the angle α of inclination is made larger, the linear load or nip load is increased in the middle, and when the angle α of inclination is made smaller, the linear load or nip load is reduced in the middle. By means of the additional forces F, the nip load or linear load is increased or reduced in the lateral areas. Thus, the overall linear load can be regulated in the desired way in the nip.

As is shown in Fig. 5, the arrangement of the invention is suitable for use when the reeling is continuous. In Fig. 5, a construction is shown in which two systems of reeling cylinders 15 and rails 10 are employed. In Fig. 5, the web W guide rolls are denoted with the reference numeral 25. As is shown in the figure, when the size of the jumbo roll 20 becomes larger, the angle α is made smaller. After the first jumbo roll 20 has become complete, the web W is passed to the other reeling system, which operates in a similar way.

In Fig. 6, a second possibility is illustrated for a system in which two systems of reeling cylinders 15 and rails 10 are employed. The web W is passed over the guide rolls 25 onto the reeling cylinder 15, and from there further onto the reeling drum 20 supported on the rail 10. Upon completion of the reeling, the web W is guided to the other reeling system. In Fig. 6, the dashed lines indicate the positions of the rails 10 and the reeling drums 20 when the jumbo rolls are complete.

As is shown in Fig. 7, for example, in a Pope-type reel-up, the exchange of drum from the primary rails 10 onto the secondary rails 11 is carried out so that the exchange is carried out by means of the primary rails 10 while the full jumbo roll 20 revolves on the secondary rails 11. The full jumbo roll 21 is shifted to the braking position, whereupon the primary rails 10 can be shifted to a position optimal in view of the linear load. The linear load or line pressure Gr is uniform across the whole machine in the transverse direction, $Gr = G \cdot \sin \alpha$. When the jumbo roll 20 becomes larger, the angle α is made smaller while the diameter of the jumbo roll 20 continues to become larger. The shift onto the secondary rails 11 takes place by shifting the secondary rails 11 to the same angle α with the primary rolls 10, whereby the replacing reeling drum rolls over the joint, during and after which time the primary rails 10 and the secondary rails 11 move as synchronized while adjusting the linear load. The secondary rails 11 may also be fixed stationarily, in which case the regulation of the linear load takes place on said rails normally by means of reeling forks.

Above, the invention has been described with reference to some of its preferred embodiments only. This is, however, by no means supposed to confine the invention to these exemplifying embodiments only, but many variations and modifications are possible within the scope of the inventive idea defined in the following patent claims.

Claims

1. Reel-up, comprising a first revolving roll (15) and a second revolving roll (20), which form a nip (N), into which nip (N) the web (W) is introduced and in which nip (N) a nip pressure (Gr) acts upon the web (W) and after which nip (N) the web (W) is reeled onto said second revolving roll (20), which said second revolving roll (20) is supported on reeling rails (10) or equivalent, **characterized** in that, for the purpose of regulation of said nip pressure (Gr), the reel-up comprises members (30) for alteration of the positions of the first revolving roll (15) and the second revolving roll (20) in relation to one another.

2. Reel-up as claimed in claim 1, **characterized** in that the reel-up further comprises members (35) for the application of additional forces (F) to the ends of the second revolving roll (20) so as to regulate the linear loads in the direction of the axis of the second revolving roll (20).

3. Reel-up as claimed in claim 1 or 2, **characterized** in that the nip pressure (Gr) is acted upon by means of members by whose means the position of the second revolving roll (20) is altered in relation to the first revolving roll (15).

4. Reel-up as claimed in any of the claims 1 to 3, **characterized** in that the members by whose means the position of the second revolving roll (20) is altered in relation to the first revolving roll (15) comprise members (30) which change the inclination (α) of the reeling rails (10) or equivalent.

5. Reel-up as claimed in any of the claims 1 to 4, **characterized** in that the members that change

the inclination (α) of the reeling rails (10) or equivalent are screw jacks (30).

6. Reel-up as claimed in any of the claims 1 to 5, **characterized** in that the reel-up is fitted to be used in continuous reeling (FIG. 5, FIG. 6).

7. Reel-up as claimed in any of the claims 1 to 5, **characterized** in that the reel-up is fitted to be used in connection with the exchange of the second revolving roll (20) (FIG. 7).

8. Method for regulation of the nip pressure in a reel-up, which comprises a first revolving roll (15) and a second revolving roll (20), which form a nip (N), into which nip (N) the web (W) is introduced and in which nip (N) a nip pressure (Gr) acts upon the web (W) and after which nip (N) the web (W) is reeled onto said second revolving roll (20), which said second revolving roll (20) is supported on reeling rails (10) or equivalent, **characterized** in that, in the method, the positions of the first revolving roll (15) and the second revolving roll (20) in the reel-up in relation to one another are changed and/or additional forces (F) are applied to the ends of the second revolving roll (20) in a direction perpendicular to the direction of the axis of the roll.

9. Method as claimed in claim 8, **characterized** in that, in order to alter the positions of the first revolving roll (15) and the second revolving roll (20) in relation to one another, the reeling rails (10) or equivalent are inclined.

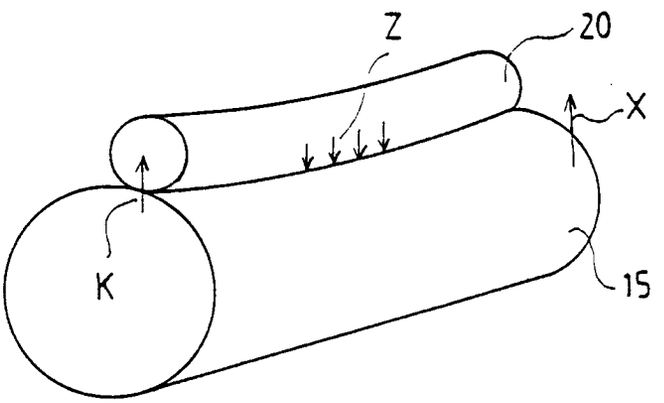

FIG.A **PRIOR ART**

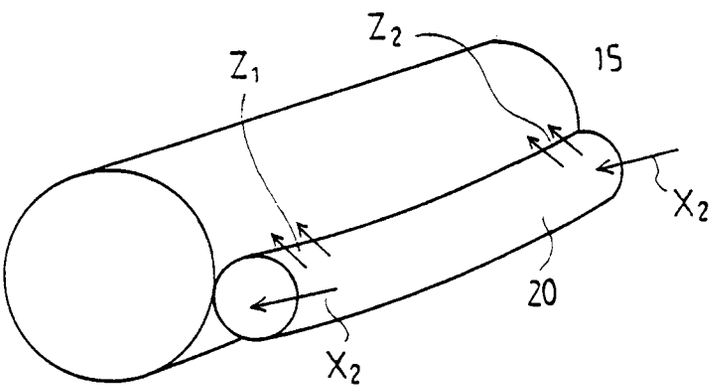

FIG.B **PRIOR ART**

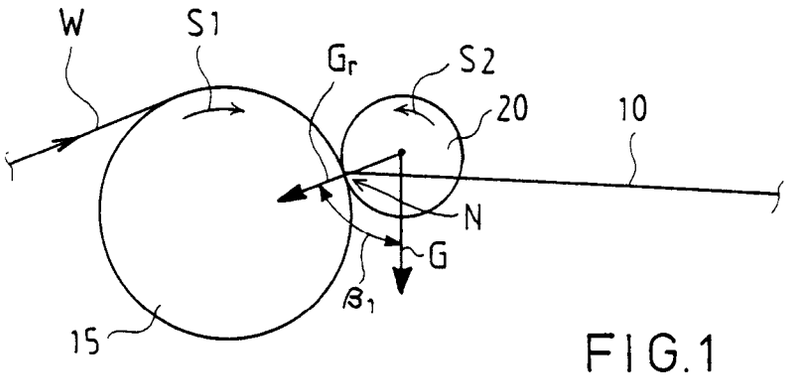

FIG.1

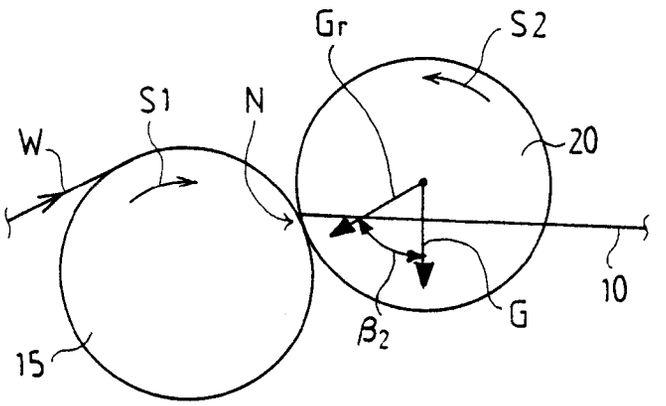

FIG.2

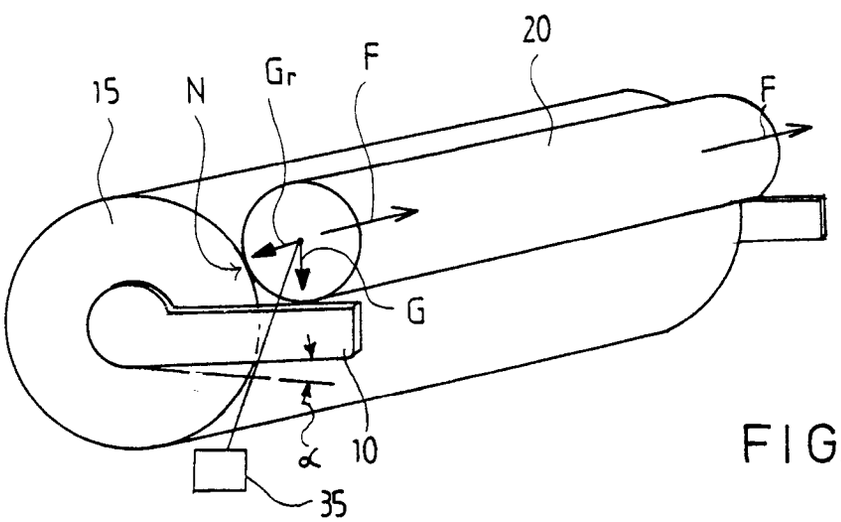

FIG.4

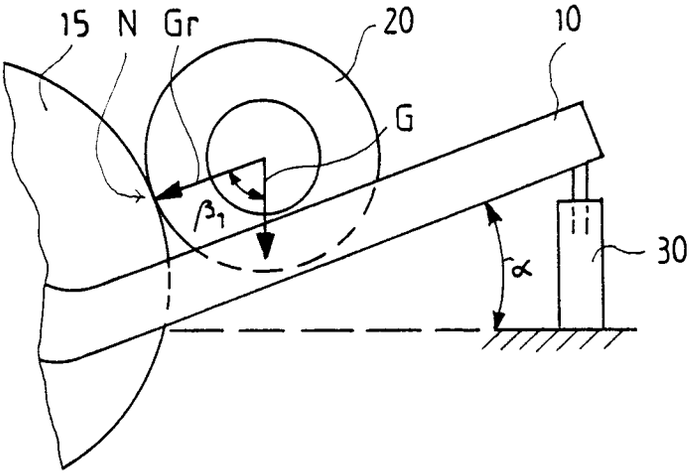
15
N
Gr
20
10
G
β_1
α
30

FIG. 3

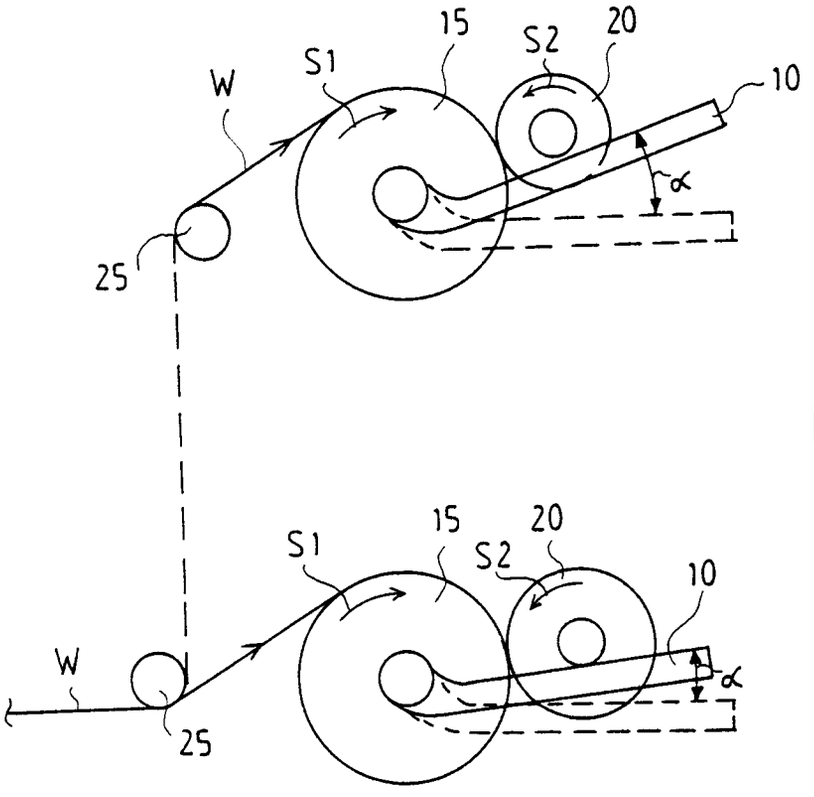
W
S1
15
S2
20
10
α
25
W
S1
15
S2
20
10
α
25

FIG. 5

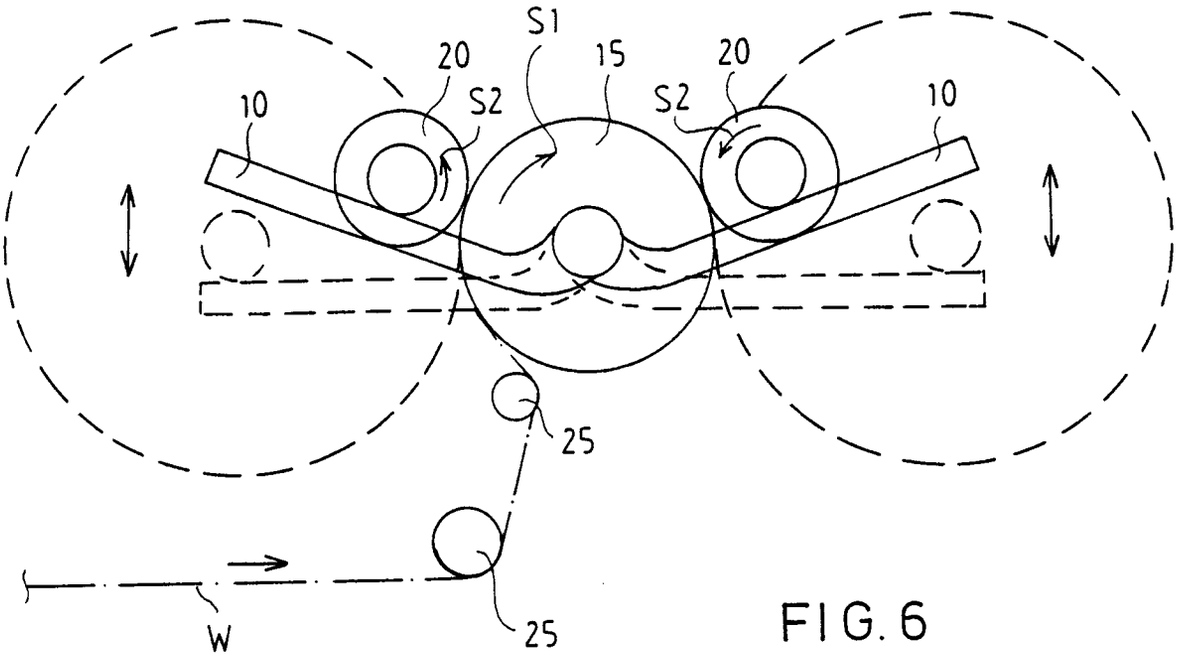

FIG. 6

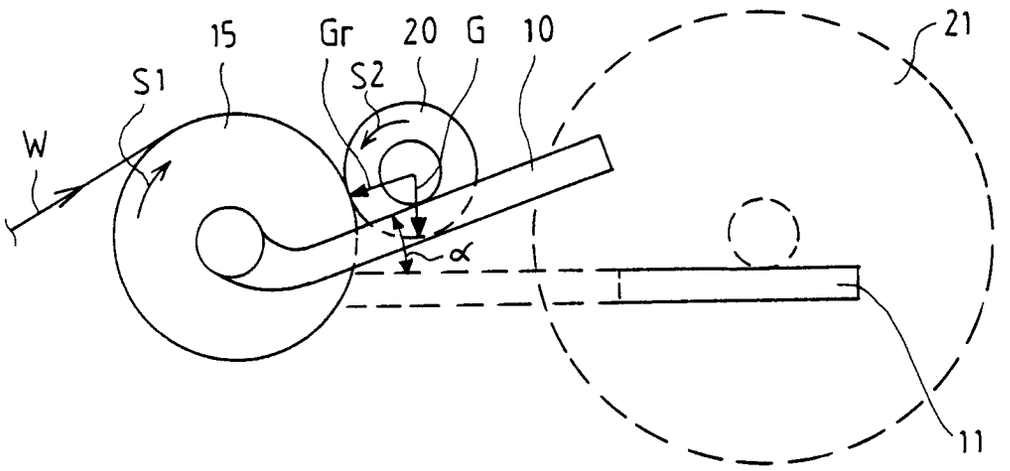

FIG. 7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 85 0261

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.5)
X	US-A-2 528 713 (THOMSON W.R.) * column 4, line 22 - line 63; figure 1 *	1,3-5	B65H18/26
Y		2	
X	US-A-1 950 159 (BELOIT IRON WORKS) * page 2, right column, line 126 - page 3, left column, line 18; figures 1,2,5 *	1,3,4, 6-9	
X	FR-A-1 175 214 (C. & A. HOLWEG (S.A.R.L.)) * page 2, right column, paragraph 1; figures 1-3 *	1	
Y	US-A-2 176 198 (BELOIT IRON WORKS) * page 3, left column, line 56 - right column, line 4; figure 3 *	2	
Y	GB-A-2 168 040 (VALMET OY) * page 2, line 84 - line 100; figures 2,4 *	2	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	03 FEBRUARY 1992	THIBAUT E.E.G.C.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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