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METHOD AND DEVICE IN THE REELING OF PAPER

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(56) Prior Art Documents  
AU 581351 65534/86 B65H 18/16, 18/22, 18/14, 18/06  
US 4541585  
US 4485980

(57) Claim

1. Method in the reeling of a paper web or equivalent, whereby the web is reeled by supporting the roll to be formed from its circular cylindrical outer circumference by means of at least two supporting units, of which the first one, in the direction of arrival of the web is a carrier roll provided with a mechanical rotating drive, over whose sector the web is passed to reeling and which said carrier roll forms a reeling nip supporting the roll from below, and above which said roll, <sup>an upper</sup> a press member is used, by means of which the roll is kept, for its part, stably in its reeling position, wherein the making of the roll out of the web passed over the said carrier roll onto a core or equivalent comprises a combination of the following steps:

a) the roll is grown around the core or

equivalent under a nip support between the said carrier roll, a first belt roll, and ~~an~~<sup>the</sup> upper press member;

- b) when the roll grows and becomes larger than a certain radius, the reeling goes on further under the nip support between the carrier roll and the upper press member and, in addition to this supporting, on a belt supporting zone placed as a direct extension of a nip support zone of the said belt roll;
- c) the final stages of the reeling are carried out up to full radius of the roll in accordance with the preceding step as the roll radius is increased and extends the belt supporting zone and, at the same time, adjusts the tensioning of a support belt or belts *of a belt support unit,* so that the linear loads in the various supporting nips of the roll remain within suitable limit values in view of the progress of reeling and of quality of roll.

11. Reel-up for paper web or equivalent, which said reel-up includes at least two supporting units, of which the first one, in the direction of arrival of the web, is a carrier roll provided with a mechanical rotating drive, over whose sector the web is passed to reeling and which said carrier roll forms a reeling nip supporting the roll from below, and which said reel-up includes a press member unit, by means of which the roll is, for its part, kept stably in its reeling position, wherein the reel-up comprises a combination of:

- a) a belt support unit placed as a latter lower supporting unit in the direction of arrival of the web, by means of which the web is supported from below together with the said carrier roll,
- b) the said belt support unit includes first and second belt rolls, around which carrier belts or belt are fitted, whose upper run supports the roll from below at least in the final stages of the reeling with larger roll radii, and
- c) the said belt support unit includes a power unit arrangement, which is connected as effective between the said first and second belt rolls so as to adjust the tensioning of the said belt or belts and to be effective substantially in the direction of a plane placed through the axes of rotation of the said belt rolls.

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Complete Specification for the invention entitled:  
METHOD AND DEVICE IN THE  
REELING OF PAPER

The following statement is a full description of this invention  
including the best method of performing it known to me:-

# Method and device in the reeling of paper

The invention concerns a method in the reeling of a paper web or equivalent, wherein the web is reeled by supporting the roll to be formed from its circular cylindrical outer circumference by means of at least two supporting members, of which the first one, in the direction of arrival of the web, is a driven carrier roll, over whose sector the web is passed to reeling and which said carrier roll forms a reeling nip supporting the roll from below, and above which said roll a press member, preferably a press roll, is used, by means of which the roll is kept, for its part, stably in its reeling position.

The invention further concerns a reel-up for paper web or equivalent, which said reel-up includes at least two supporting units, of which the first one, in the direction of arrival of the web, is a carrier roll provided with a mechanical rotating drive, over whose sector the web is passed to reeling and which said carrier roll forms a reeling nip supporting the roll from below, and which said reel-up includes a press member unit, preferably a press roll unit, by means of which the reel is, for its part, kept stably in its reeling position.

In respect of the prior art related to the invention, reference is made to the following patent literature: US Patents Nos. 3,098,619, 3,346,209, 4,456,190, 4,485,979, 4,485,980, GB Pat. Appl. No. 2,142,909, German Offenlegungsschrift DE-OS 3,121,039, Finnish Patent No. 49,276, and Finnish Patent Applications Nos. 843184 and 844652.

In the making of paper rolls reeled while supporting the rolls by the circumference, a problem consists of internal damage in the large and heavy rolls. Damage is produced in particular underneath the surface layer. Some of the commonest damage consists of crêpe wrinkles in the transverse direction of the web and of

web cracking. The main cause of the damage has been ascertained to be an excessively high nip pressure between the paper roll and the carrier roll, resulting from the weight of the paper roll or from an excessive press-roll load.

In order that a roll of good quality could be obtained by means of a carrier-roll reel-up, it has been noticed that the linear load between the paper roll and the carrier roll shall be about 1...4 kN/m. Within this range of linear load, it is, as a rule, possible to accomplish the desired distribution of tension in the roll.

When a carrier roll of a short radius is used, with large rolls the above range of linear load is exceeded at the final stage of the reeling, whereby the contact pressure rises to a level higher than that tolerated by a printing-paper roll, which results from the narrow nip area between the paper roll and the carrier roll. In a way known in prior art, attempts have been made to eliminate this problem by making the carrier roll larger, which increases the costs of manufacture and operation of the reel-up.

From the Finnish Patent Application No. 843184 a soft-faced carrier roll is known, in which the nip face becomes larger, but a drawback is the dynamic problem of formation of two faces as well as the generation of heat during the reeling.

Attempts have also been made to solve said problems by dividing the load on carrier rolls of different sizes or on inclined carrier rolls. Distribution of the load between rolls does not reduce the maximum pressure, but it increases the pressure between one of the carrier rolls and the paper roll, depending on the diameters and on the inclination. The most uniform distribution of the roll pressure is obtained with equally large carrier rolls placed symmetrically underneath the paper roll by using the construction known from the US Patent No. 4,456,190.

The main object of the present invention is to provide such a method in a reel-up with support by the circumference by means of which a paper roll as good as possible is obtained, i.e. a roll with no reeling defects and with a desired distribution of density as a function of the roll diameter.

A further object of the present invention is to provide such a reeling method and reeling device by whose means the diameter and the weight of the rolls to be made can be increased, if necessary, as compared with rolls made by means of prior-art reel-ups with support by the circumference.

In view of achieving the objectives given above and those that will come out later, the method of the invention is mainly characterized in that the making of a roll out of a web passed over said carrier roll onto a core or equivalent comprises a combination of the following steps:

- (a) the roll is grown around the core or equivalent under a nip support between said carrier roll, a *first* belt roll, and an <sup>a</sup>~~upper~~ press member, preferably a press roll (Fig. 2A);
- (b) when the roll grows and becomes larger than a certain radius, the reeling goes on further under the nip support between the carrier roll and the ~~upper~~ press member and, in addition to this supporting, on a belt supporting zone placed as a direct extension of the nip support zone of said belt roll (Fig. 2B);
- (c) the final stages of the reeling are carried out up to full radius of the roll in accordance with the preceding step as the roll radius is increased and extends the belt support zone and, at the same time, adjusts the tensioning of the support belt or belts, so that the linear loads in the various supporting nips of the roll remain within suitable limit values in view of the progress of reeling and of quality of roll.



On the other hand, the device in accordance with the invention is mainly characterized in that the reel-up comprises a combination of:

- (a) a belt support unit placed as <sup>a</sup>~~the~~ latter lower supporting unit in the direction of arrival of the web, by means of which the web is supported from below together with said carrier roll,
- (b) said belt support unit includes <sup>first and second</sup> belt rolls, around which carrier belts or belt are fitted, whose upper run supports the roll from below at least in the final stages of the reeling with larger roll radii, and
- (c) said belt support unit includes a power unit arrangement, which is connected as effective between said belt rolls so as to adjust the tensioning of said belt or belts and to be effective substantially in the direction of a plane placed through the axes of rotation of said belt rolls.

By means of a reel-up in accordance with the invention, it is possible to produce a paper roll of higher quality, which has no defects and whose density is as desired, e.g. invariable. These advantages of the invention are achieved substantially by means of the novel method and belt-supporting device, wherein the support of the paper roll from underneath is regulated by adjusting the tension of the belts. Said adjustment of tension is carried out in such a way that it does not have a disturbing effect on the length of the support zone in the belt-supporting unit or on the distribution of the support pressure.

In the following, the invention will be described in detail with reference to some exemplifying embodiments of the invention illustrated in the figures in the accompanying drawing, the invention being by no means strictly confined to the details of said embodiments.

Figure 1A is a side view of a reel-up in accordance with the invention at the initial stage of reeling.





Figure 1B is a schematical illustration of a reel-up in accordance with the invention and of a control method for same at the final stage of reeling.

Figures 2A, 2B and 2C show different stages of the method of the invention with different roll diameters.

Figure 3 illustrates essential quantities related to the geometry and statics of the reel-up and of the support of the roll.

Figure 4 is a graphic and schematical illustration of the distribution of the pressures in the different support nips in the direction of the circumference of the roll.

Figures 1A and 1B are schematical side views of some advantageous exemplifying embodiments of the reel-up of the invention. The reel-ups shown in Figs. 1A and 1B comprise a rear carrier roll 10, which is provided with a mechanical rotating drive 10a. The roll 10 is mounted by its axle journals on bearing supports 11, which are attached to the frame part 40 of the device, which is shown only schematically. The reel-up further comprises a press roll 21, which may be provided with a drive 21a. The press roll is attached to arms 22, which are linked to the frame part 40 of the device permanently at the articulation point 23. The press roll 21 is loaded by cylinders 24, which are, at their articulation points 25, attached to the frame part 40. The piston rods 24a of the cylinders 24 are attached to the arms 22 at the articulation points 24b.

Besides by the carrier roll 10, the roll 30 that is being formed is also supported from underneath by a belt support unit 20, and therein directly by the upper run of the carrier belt 15, which runs between the belt rolls 12 and 13. The first belt roll 12 is provided with a rotating drive 12a. The roll 12 is mounted by its axle journals on supports 14a, which are attached to <sup>a first</sup> ~~an~~ intermediate part 16. The intermediate part 16 is, by



the intermediate of the articulated joint 20a, attached to the part 16a, which is supported on the frame part 40. The parts 14a,16 are pivoted around the articulated joints 20a by the hydraulic cylinders 17. The second belt roll 13 is mounted by its axle journals on supports 14b, which are fitted in connection with the <sup>second</sup> intermediate part 18. The intermediate parts 16 and 18 are interconnected by the arm 19, which is attached to said parts 16 and 18 by means of horizontal articulated joints 20a and 20b. To the upper ends of the parts 16 and 18, bearing supports 14a and 14b are attached, on which the belt rolls 12 and 13 are journaled. To the upper parts of the bearing supports 14a and 14b, flange parts 30 and 32 are attached, between which the hydraulic cylinder 26 and its piston rod 26a are attached by means of link pins 31 and 33. By means of the pair of hydraulic cylinders 26, the tension T of the belts 15 is adjusted. The parts 16,18,19 and 26 form a pair of rhomboids, which is provided with the articulation points 20a,20b,20c and 20d. When the belt 15 is tensioned by extending the cylinder 26,26a, pivoting takes place around the articulation points 20b and 20c, as the articulated joint 20a is immobilized by the cylinders 17.

The positions of the belt rolls 12 and 13 are substantially fixed, and the position of the belt roll 13 is altered in the direction of the runs of the belt 15 between the rolls 12 and 13, by the effect of the cylinder 26, only to the extent that is necessary in order to adjust the tensioning T of the belt 15 and to replace the belt 15.

Figures 1A and 1B are schematical side views, and it is understood that for the support of the various rolls 10,12,13,21 there are corresponding axle journals, supports, arms 22, cylinders 17,24,26 and 28, etc. also at the opposite side of the device.

The radius  $R_{KT}$  of the rear roll 10 must be chosen in accordance with the width and the running speed



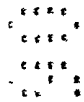
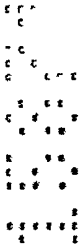
of the machine. As a rule,  $R_{KT}=500\dots1000$  mm, preferably  $500\dots850$  mm. The bending of the belt 15 and the durability of the bearings determine the radius  $R_{HT1}$  of the belt roll 12. As a rule,  $R_{HT1} \approx$  300...600 mm, preferably about 400 mm. The radius of the second belt roll 13 may be the same as  $R_{HT1}$ . The radius  $R_{PT}$  of the press roll 21 is determined by the radius of the core 31 and by  $R_{KT}$  and  $R_{HT1}$ , and  $R_{PT} \approx$  100...500 mm, preferably 200...300 mm. The articulation point x, y of the press roll 21 and the length L of its arm are determined so that it is possible to load and to support the roll 30. The distance  $D_1$  between the carrier roll 10 and the roll 12 is determined in accordance with the core 31, with said rolls, and with the press roll 21 so that it is possible to load the core 31 ( $\emptyset 90$ ), and  $D_1 \approx$  10...50mm, preferably about 30mm. The angle  $a_1$  of the roll 12 relative the carrier roll 10 determines the diameter with which the belt 15 starts supporting the roll 30. A large positive angle  $a_1$  causes a high nip load at the rear roll 10 (the weight of the roll tilts rearwards). A large negative angle  $a_1$  causes a necessity to load too much by means of the press roll 10. The angle  $a_1$  is within the range of  $-20^\circ < a_1 < 20^\circ$ . The angle  $a_2$  of the roll 13 relative the roll 12, together with  $D_2$ , determines the maximum diameter  $2R_0$  of the roll 30. If the roll 13 is shifted during running,  $a_2$  also affects the direction of the supporting force of the belt 15 during running and, consequently, the form of the tension function. The angle  $a_2$  is within the range of  $0^\circ < a_2 < 45^\circ$ , and preferably within the range of  $5^\circ < a_2 < 20^\circ$ .

Figs. 1A and 2A show the start of reeling. The core 31, onto which the roll 30 is reeled, has been brought by means of the core lock 31a into the



space between the rolls 10, 12 and 21 so that these rolls form the supporting nips for the core and for the roll that is about to start its growth. As is shown in Fig. 2B, the diameter  $2 \times R_k$  of the roll 30

5 has grown to about 400...700mm. Thereat the distribution of the nip pressure in the nip 10/30 in the direction S of the circumference of the roll



is  $p_{kt2}$  (Fig. 4), and the nip pressure in the extended nip 30/12,15 is  $p_{ht2} + p_{h2}$  (Fig. 4), so that the belt 15 has, on its portion  $S_{h2}$ , started carrying the roll 30 from below, and the length of this nip in the direction S of the circumference has increased. The length of the nip 10/30 has also increased from the length  $S_{k1}$  or the initial situation to the length  $S_{k2}$ , at the same time as the peak pressure  $p_{maxk1}$  has gone down to the pressure value  $p_{maxk2}$ .

As is shown in Fig. 2C, the roll has grown to its full diameter  $2 \times R_0$ , whereby the length of the nip 10/30 has increased, in accordance with Fig. 4, owing to the increase in the radius of the roll 30, to the length  $S_{k3}$  and the peak pressure has gone down to the pressure  $p_{maxk3}$ . At the same time, the length of the supporting zone of the belt unit 12,15,13 has increased to its full length  $S_{h3}$ , and the distribution of pressure  $p_{h3}$  is evenly flat.

It should be emphasized that Fig. 4 is an illustration of principle concerning the distribution of pressures and does not necessarily show the different distributions, pressure values or the lengths S of supporting nips in compliance with reality.

In the following, with reference to the denotations in Fig. 1, the geometry and statics of the reeling in accordance with the invention will be described. In a static examination, the roll weight G and the vertical component of the linear load  $F_{pt}$  of the press roll 21 are carried by the vertical components of the linear load  $F_{kt}$  of the carrier-roll nip 10/30, of the linear load  $F_{ht}$  of the first belt roll 12, and of the linear load  $F_h$  caused by the tensioning T (N/m) of the belt 15. The roll 30 and the second belt roll 13 do not necessarily have a loaded nip. A corresponding static equilibrium prevails in respect of the horizontal components of the linear loads  $F_{kt}$ ,  $F_{ht}$ ,  $F_h$  and  $F_{pt}$ . The geometry and statics of the system as well as the linear

loads optimal in view of the reeling keep changing all the time as the radius  $R$  of the roll increases.

The distribution of density of the roll 30 as a function of the radius  $R$  is determined mainly by the  
 5 distribution  $F_{kt}(R)$  of the linear load of the rear carrier roll 10. This is above all due to the fact that the web  $W_{in}$  is introduced onto the roll 30 exactly via the rear-roll nip 10/30. As a rule, what is aimed at is an invariable density of the roll 30 as a function of the  
 10 radius  $R$ . Thereat, the linear load  $F_{kt}$  in the nip 10/30 must be slowly rising along with the growth of the radius. With different paper qualities, the linear load  $F_{kt}$  in the nip 10/30 must be at different levels, and the steepness of the change as a function of the radius  $R$  is  
 15 preferably variable.

The linear loads  $F_{pt}$  and  $F_{ht}$  of the roll 21, which contacts the roll 30 directly, and of the first belt roll 12, which contacts the roll 30 through the belt  
 15 15, must be within certain limits, of which the lower limit is determined by the fact that the roll 30 must be supported adequately and stably during the reeling, and the upper limit by the fact that the rolls 12 and 21  
 20 must not sink into the roll 30 to a disturbing extent.

The bearing supports 14a and 14b of the belt  
 25 rolls 12 and 13 are interconnected by means of a pair 26 of hydraulic cylinders, whose direction of movement is parallel to the direction of the run of the belt 15 between the rolls 12 and 13. By passing a controlled pressure  $p_t$  into the cylinders 26, it is possible to  
 30 adjust the tension  $T$  of the belt 15. The pressure load caused by the tension  $T$  on the outer circumference of the roll 30 in the radial direction of the roll 30 can, in principle, be calculated from the formula  $p = T/R$ , so that this pressure load is also affected by the  
 35 radius  $R$  of the roll, in addition to the effects of changes in the geometry of the support.

The control of the reeling is governed by the measurement of the radius  $R$  of the roll 30 or of any other, equivalent quantity, because the geometry and the statics of the support and formation of the roll 30 depend on the radius  $R$  or equivalent. According to Fig. 1B, the radius  $R$  is measured by means of a revcounter 120 of the carrier roll 10 and by means of a revcounter 130 of the core lock 31a, whose signals  $r_1$  and  $r_2$  are passed to the central unit 100. From the signals  $r_1$  and  $r_2$ , the weight  $G$  of the roll 30 can also be derived directly if the grammage of the web  $W$  to be reeled has been fed to the system 100. In order to ensure the operation, the radius  $R$  of the roll is also measured by means of measurement of the angle  $\alpha$  of the loading arms 22 of the press roll 21, taking place in the unit 110, from which measurement it is possible to calculate the radius  $R$  of the roll, the corresponding signal  $\alpha$  being passed to the central unit 100.

The central unit 100 is either a controllable logic unit or a computer, in which the values of the adjustment quantities  $p_k$  and  $p_t$  of the system, as a function of the radius  $R$  of the roll or equivalent, such as weight or the like, have been stored as tables or as functions separately for each of the different quality groups and for the individual qualities in the groups as modified, e.g., by means of correction factors.

In the following a table is given, wherein the roll weight, the linear loads  $F_{pt}$ ,  $F_{kt}$ ,  $F_{ht}$  and  $F_h$ , the pressure  $p_t$ , and the belt tension  $T$  are given at the values of 100 to 1500 mm of the roll diameters  $2R$  with steps of 100 mm. The objective of said table is to illustrate a preferred exemplifying embodiment of the invention. The web  $W$  to be reeled is a SC or LWC paper of a density of  $1200 \text{ kg/m}^3$ , and the length of the roll is 3.6 m.

The data given in Table 1 are stored in the memory of the programmable logic unit or computer included in the central unit 100 as a table or as functions.

When the species is changed, new tables or functions stored in the memory can be taken into use, or the values of the preceding tables or functions can be modified by means of certain correction factors, which are obtained either from the program or from the unit 100.

TABLE 1

| 2R   | G            | $F_{pc}$ | $F_{kt}$ | $F_{ht}$ | $F_h$ | $P_k$ | $P_c$  | T     |
|------|--------------|----------|----------|----------|-------|-------|--------|-------|
| mm   | kg/<br>3,6 m | kN/m     | kN/m     | kN/m     | kN/m  | bar   | bar    | kN/m  |
| 100  | 34           | 1,20     | 1,46     | 1,29     | 0,00  | 41,88 | 95,49  | 20,00 |
| 200  | 136          | 1,45     | 1,55     | 1,18     | 0,00  | 32,37 | 95,49  | 20,00 |
| 300  | 305          | 1,40     | 1,59     | 1,35     | 0,00  | 32,75 | 95,49  | 20,00 |
| 400  | 543          | 1,45     | 1,65     | 1,81     | 0,00  | 33,30 | 95,49  | 20,00 |
| 500  | 848          | 1,45     | 1,70     | 1,96     | 0,56  | 33,82 | 95,49  | 20,00 |
| 600  | 1221         | 1,45     | 1,77     | 1,41     | 2,03  | 32,27 | 100,27 | 21,00 |
| 700  | 1663         | 1,45     | 1,85     | 1,29     | 3,27  | 30,65 | 100,27 | 21,00 |
| 800  | 2171         | 1,43     | 1,89     | 1,40     | 4,49  | 30,38 | 102,65 | 21,50 |
| 900  | 2748         | 1,40     | 1,90     | 1,62     | 5,79  | 31,27 | 107,43 | 22,50 |
| 1000 | 3393         | 1,40     | 1,95     | 1,83     | 7,30  | 29,00 | 114,59 | 24,00 |
| 1100 | 4105         | 1,30     | 2,00     | 1,85     | 9,12  | 28,71 | 124,14 | 26,00 |
| 1200 | 4886         | 1,10     | 2,03     | 1,94     | 10,97 | 32,88 | 131,30 | 27,50 |
| 1300 | 5734         | 0,65     | 2,08     | 1,82     | 12,99 | 41,99 | 137,03 | 28,70 |
| 1400 | 6650         | 0,01     | 2,12     | 2,20     | 14,53 | 52,30 | 133,69 | 28,00 |
| 1500 | 7634         | 0,01     | 3,34     | 2,35     | 16,25 | 49,80 | 123,19 | 25,80 |

30

From the above Table 1 as well as from Fig. 4 the following can be noticed. The weight G of the roll increases naturally in proportion to the second power of the radius R. As can be concluded from the column  $F_{kt}$ , the linear load  $F_{kt}$  is increased substantially evenly as the radius grows. What is aimed at hereby is an invariable distribution of the density in the roll 30.



The tension  $T$  of the carrier belt 15 has a certain upper limit, in consideration of the strength of the belt 15, which upper limit is not permitted by the control system to be exceeded in any situation. The linear load  $F_{pt}$  of the press roll 21 dominates the roll control with smaller radii  $R$ , and with larger radii  $R$  the linear load  $F_{pt}$  of the press roll 21 is lowered, because the weight  $G$  of the roll is increasing.

According to the invention, when the tension  $T$  of the belt 15 is used as the principal control quantity with larger roll diameters of  $2R > 500$  mm, the linear load  $F_{kt}$  can be controlled and the linear loads  $F_{ht}$  and  $F_{pt}$  be kept within the permitted limits, which are determined by the geometry of the reel-up and by the web  $W$  to be reeled. A further advantage is that thereat, when a sufficiently long ( $S_{h3}$ , Fig. 4) nip sector between the rolls 12 and 13 is used, the surface pressure ( $p_{h3max}$ , Fig. 4) caused by the linear load  $F_h$  between the outer circumference of the roll 30 and the tensioned belt 15 never becomes higher than permitted, but in respect of this surface pressure it is always possible to operate within an advantageous and safe area.

In the following, the patent claims will be given, whereat the various details of the invention may show variation within the scope of the inventive idea defined in said claims and differ from the details described above for the sake of example only.

## THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Method in the reeling of a paper web or equivalent, whereby the web is reeled by supporting the roll to be formed from its circular cylindrical outer circumference by means of at least two supporting units, of which the first one, in the direction of arrival of the web is a carrier roll provided with a mechanical rotating drive, over whose sector the web is passed to reeling and which said carrier roll forms a reeling nip supporting the roll from below, and above which said roll <sup>an upper</sup> ~~a~~ press member is used, by means of which the roll is kept, for its part, stably in its reeling position, wherein the making of the roll out of the web passed over the said carrier roll onto a core or equivalent comprises a combination of the following steps:

- a) the roll is grown around the core or equivalent under a nip support between the said carrier roll, a first belt roll, and <sup>the</sup> ~~an~~ upper press member;
- b) when the roll grows and becomes larger than a certain radius, the reeling goes on further under the nip support between the carrier roll and the upper press member and, in addition to this supporting, on a belt supporting zone placed as a direct extension of a nip support zone of the said belt roll;
- c) the final stages of the reeling are carried out up to full radius of the roll in accordance with the preceding step as the roll radius is increased and extends the belt supporting zone and, at the same time, adjusts the tensioning of a support belt or belts of a belt support unit,



so that the linear loads in the various supporting nips of the roll remain within suitable limit values in view of the progress of reeling and of quality of roll.

2. Method as claimed in claim 1 wherein the press member is a press roll.

3. Method as claimed in claim 1 wherein the upper press member is a press roll.

4. Method as claimed in any one of the preceding claims, wherein in the final stages of the reeling, with those radii of the roll that are close to the radius of complete roll, the roll is supported by means of <sup>said</sup> a belt support unit in such a way that the outer circumference of the roll is placed close to a second belt roll or forms a nip of a low linear load with said second belt roll.

5. Method as claimed in any one of the preceding claims, wherein the tensioning of the belt or parallel belts in said belt support unit are adjusted by shifting the oppositely placed said first and second belt rolls, relative to each other by means of power units, whose direction of effect is substantially parallel to the main direction of the runs of the belt between the said first and second belt rolls.

6. Method as claimed in claim 5, wherein said first and second belt rolls are shifted for the purpose of adjusting the tensioning of the belt in a plane which forms an angle with the horizontal plane and which said angle is within the range of  $0^{\circ}$ ... $45^{\circ}$ .

7. Method as claimed in claim 3 or 4, wherein said angle is  $5^{\circ}$ ... $20^{\circ}$ .



8. Method as claimed in any one of the preceding claims wherein the radius of the roll that is being formed is measured by means of revolution detectors of the carrier roll and of a core lock and the signals of said detectors are passed to a control system, the tensioning of said belt or belts being adjusted on the basis of tables and/or functions stored in the memory of said control system.

9. Method as claimed in claim 8, wherein the radius of the roll is measured by means of a detector of the position of support arms of the press roll or of a part attached to said support arms, the signals of the said detector being passed to <sup>said</sup> a control system.

10. Method as claimed in claim 8, wherein the pressure in relieving cylinders of the press roll is also adjusted.

11. Reel-up for paper web or equivalent, which said reel-up includes at least two supporting units, of which the first one, in the direction of arrival of the web, is a carrier roll provided with a mechanical rotating drive, over whose sector the web is passed to reeling and which said carrier roll forms a reeling nip supporting the roll from below, and which said reel-up includes a press member unit, by means of which the roll is, for its part, kept stably in its reeling position, wherein the reel-up comprise a combination of:

- a) a belt support unit placed as a latter lower supporting unit in the direction of arrival of the web, by means of which the web is supported from below together with the said carrier roll,



- b) the said belt support unit includes first and second belt rolls, around which carrier belts or belt are fitted, whose upper run supports the roll from below at least in the final stages of the reeling with larger roll radii, and
- c) the said belt support unit includes a power unit arrangement, which is connected as effective between the said first and second belt rolls so as to adjust the tensioning of the said belt or belts and to be effective substantially in the direction of a plane placed through the axes of rotation of the said belt rolls.

12. Reel-up as claimed in claim 11 wherein the press member unit is a press roll unit.

13. Reel-up as claimed in claim 11 or 12, wherein the first belt roll placed next to said carrier roll in the belt support unit is journaled as revolving and on a first intermediate part, and the second belt roll is attached to a second intermediate part, which is attached in connection with said first intermediate part by means of an articulated joint by the intermediate of an arm part, that a power unit, is attached in connection with said first intermediate part or with a part attached to same, the other end of effect of said power unit being attached in connection with said second intermediate part or with its projection part.

14. Reel-up as claimed in claim 13 wherein the first belt roll is provided with a mechanical drive.

15. Reel-up as claimed in claim 13 or 14 wherein the power unit is a pair of hydraulic cylinders.



16. Reel-up as claimed in any one of the claims 11 to 15, wherein said belt support unit has one single belt or several belts placed side by side.

17. Reel-up as claimed in any one of the claims 11 to 16, wherein the arm part included in side frames of the belt support unit in the reel-up is attached to the lower part of said first intermediate part pivotably by means of horizontal joints and that said arm part is supported on a frame part or foundation parts of a machine by means of support arms, by which the latter part in the belt support unit and the second belt roll can be displaced.

18. Reel-up as claimed in claim 17 wherein the support arms are power units.

19. Reel-up as claimed in claims 17 or 18 wherein the power units are hydraulic cylinders.

20. Reel-up as claimed in any one of the claims 11 to 19, wherein the belt support unit comprises only two belt rolls, between which there are power units arranged in such a way that adjustment of the tensioning of the belt or belts has no substantial effect on the length of the support zone of the belt unit or on the form of the distribution of the support pressure.

21. Reel-up as claimed in claim 20 wherein the power units are hydraulic cylinders.

DATED THIS 1ST DAY OF OCTOBER, 1990.

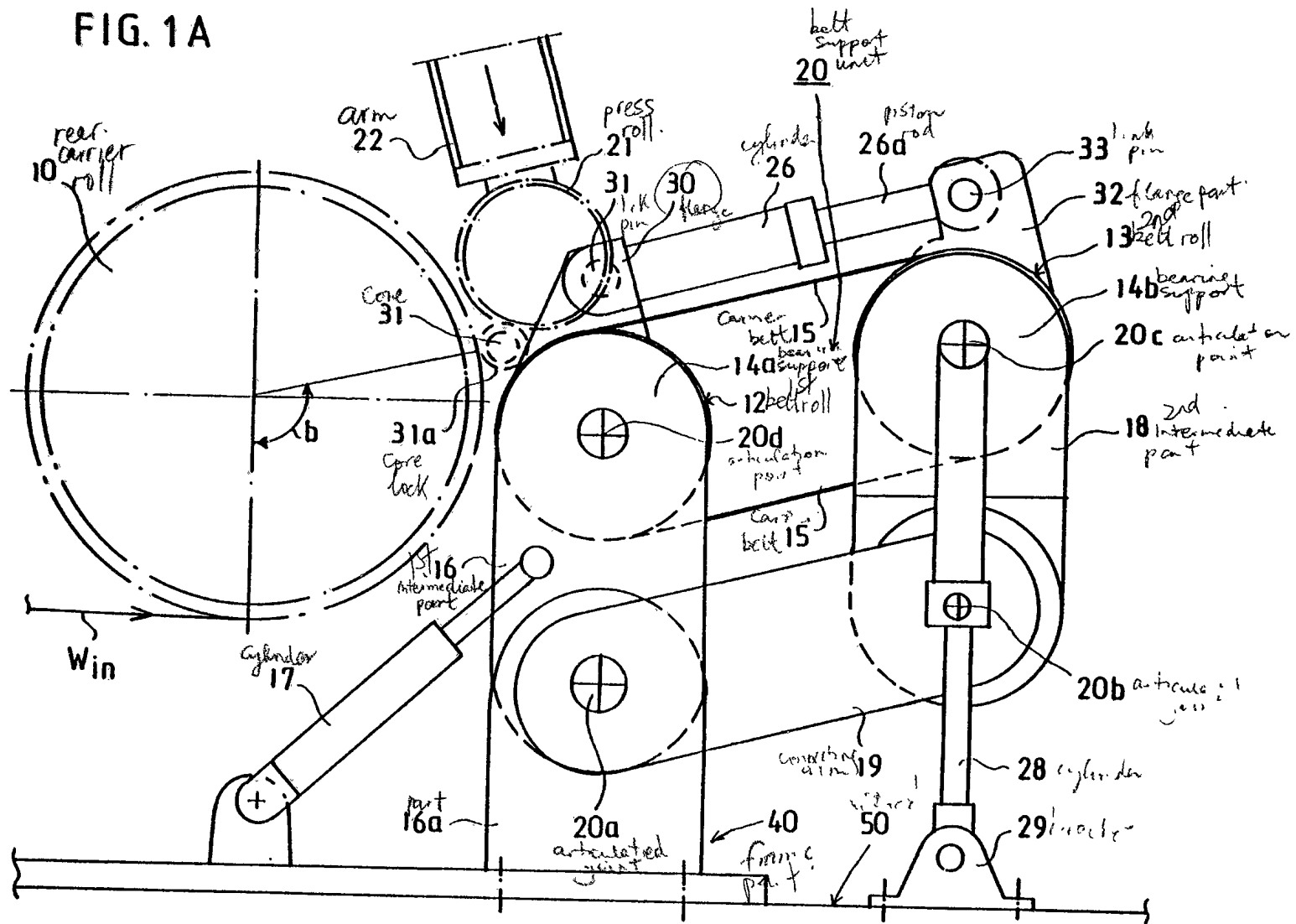
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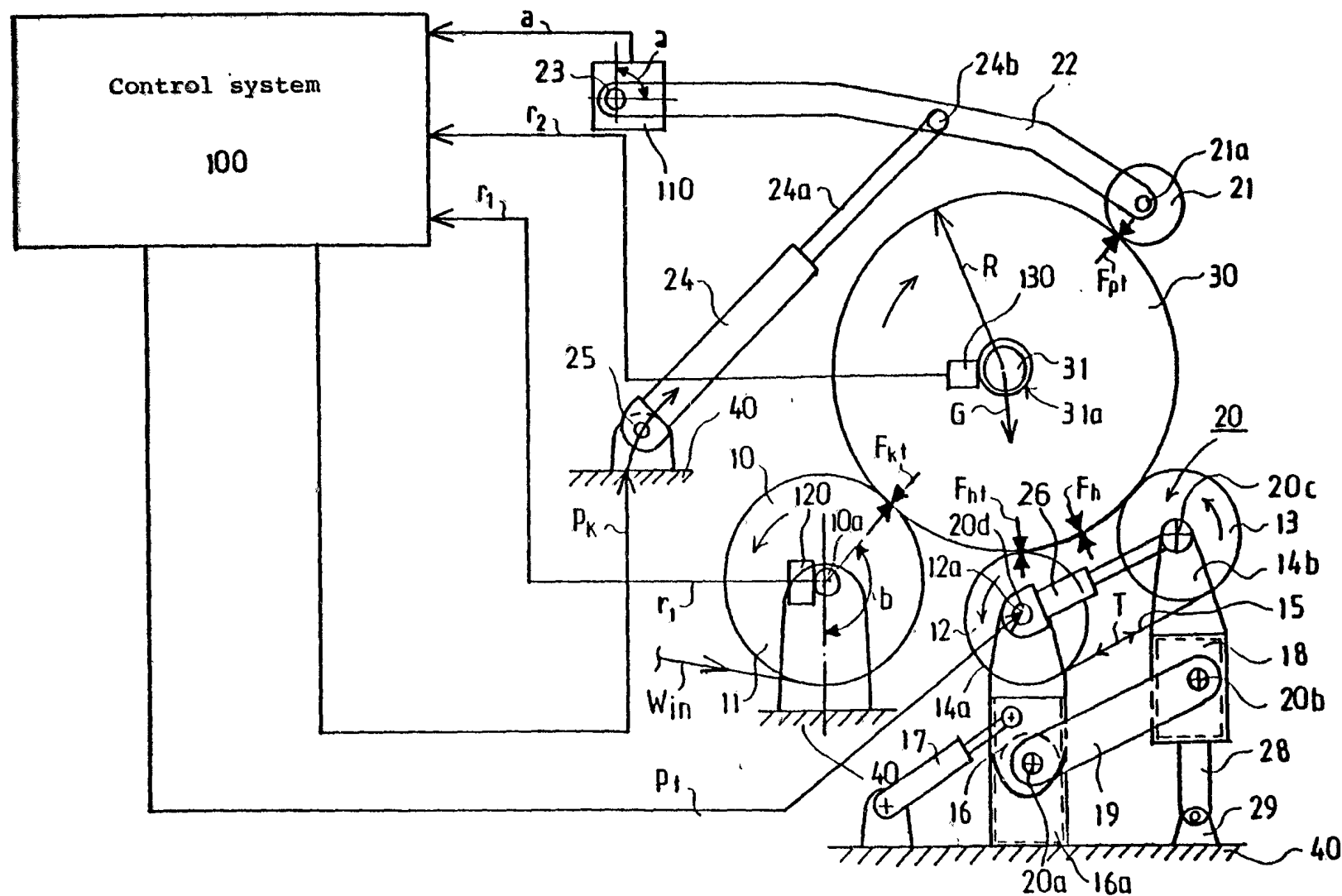


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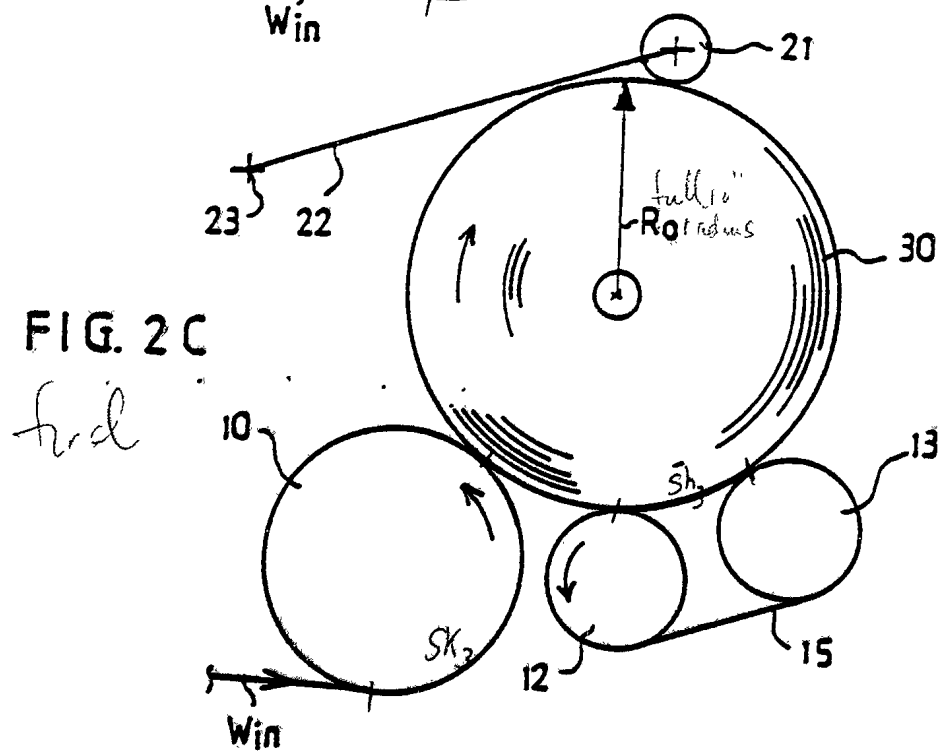
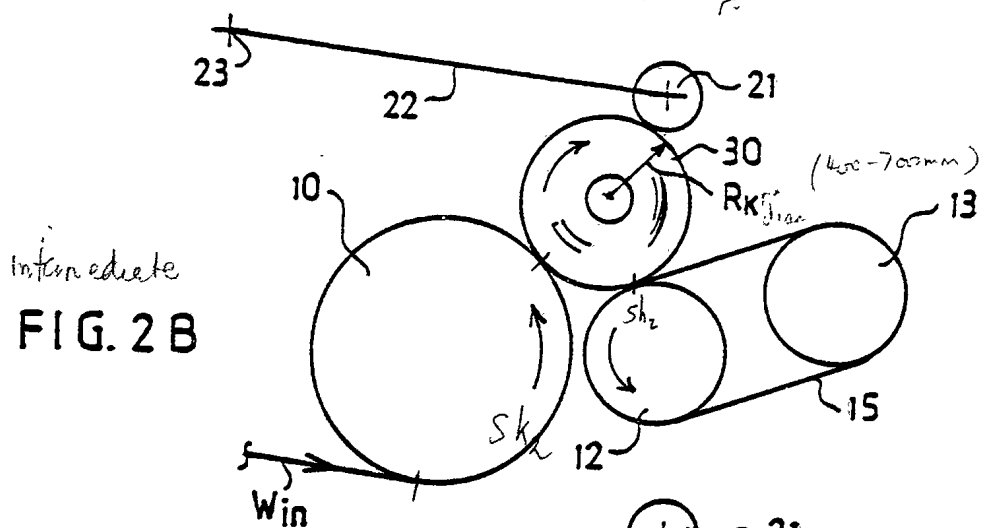
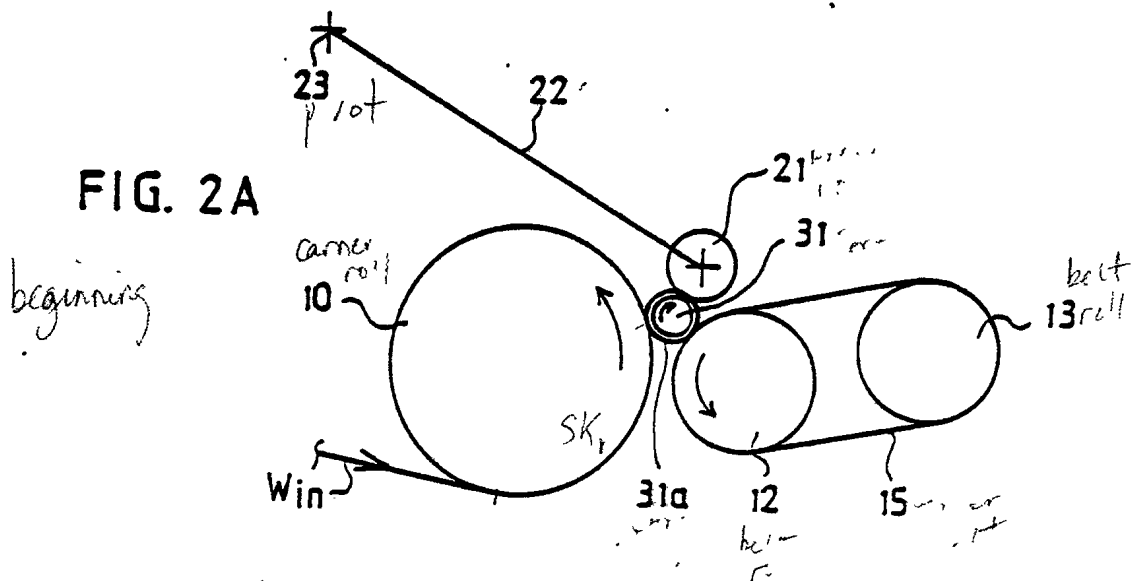
FIG. 1A



**FIG. 1B**







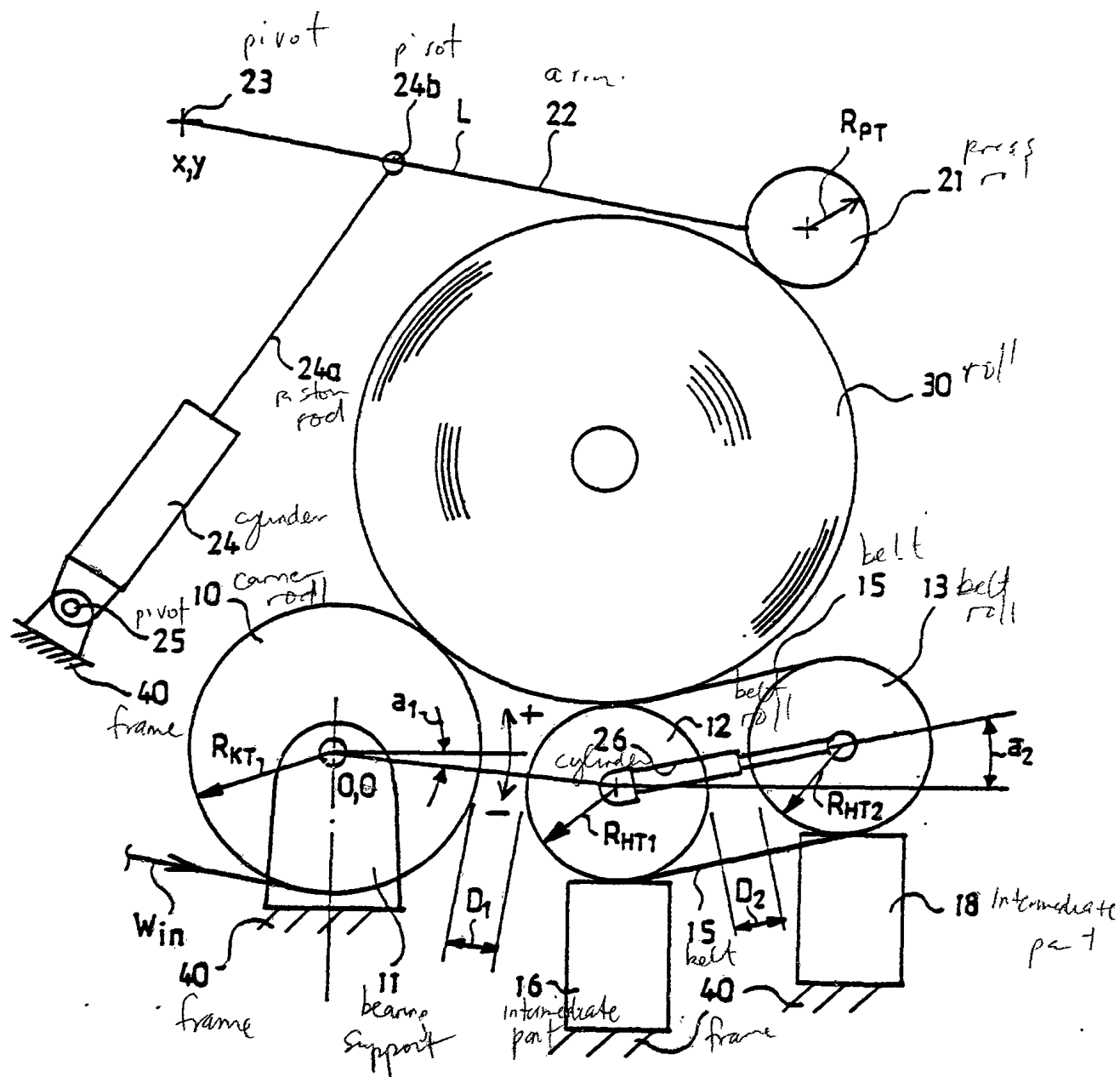


FIG. 3

10 5 00 1500

FIG. 4

