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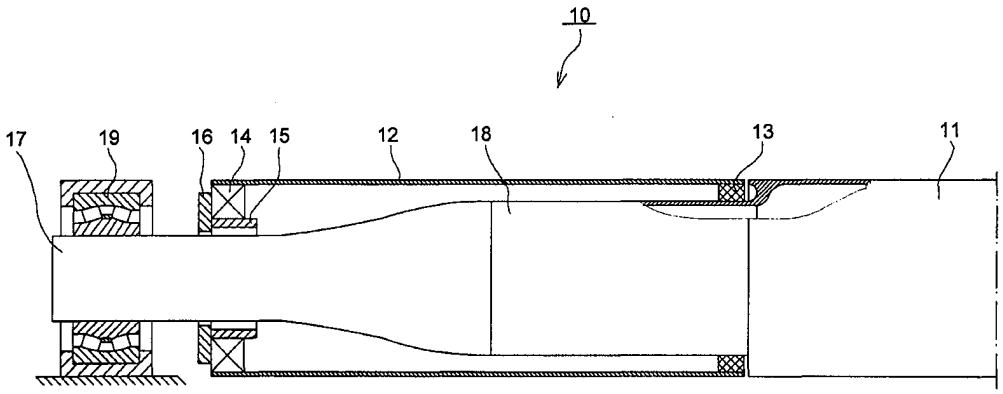
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(54) Title: TAKE–OUT ROLL, SPREADER ROLL, OR EQUIVALENT FOR A WEB–LIKE MATERIAL



(57) Abstract

The invention relates to a take–out roll, spreader roll, or equivalent for a web–like material, which roll (10) comprises three parts linked with one another, i.e. two end parts (12) and a middle part (11), which parts are pivotal with respect to one another for the purpose of bending the roll (10) into a desired curved shape. In the invention, the middle part (11) of the roll (10) is constructed to also operate as a revolving axle of the roll (10), which is mounted revolvingly on its support members by means of end bearings (19). The end parts (12) of the roll are mounted, in the area of their axial inner ends, on the middle part (11) by means of articulation devices (13). The end parts (12) of the roll are further mounted, in the area of their axial outer ends, revolvingly and in a radial direction movably on support parts (15), which are separate from the revolving parts of the roll, by means of bearings (14) fitted, in the axial direction of the roll, on the side of the inner side of the end bearings (19).

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Take-out roll, spreader roll, or equivalent for a web-like material

The invention relates to a take-out roll, spreader roll, or equivalent for a web-like material, which roll comprises three parts linked with one another, i.e. two end parts and a middle part, which parts are pivotal with respect to one another for the purpose of bending the roll into a desired curved shape.

Take-out rolls and spreader rolls have been formed most commonly so that they have a continuous axle and a roll mantle fitted on the axle, which roll mantle is in turn composed of a number of parts. The take-out roll can be made to be curved into a desired shape by shifting the outer journalling points of the roll mantle in the radial direction, whereby the mantle forms an arc or a broken line. Each of the mantle parts is generally journalled separately on the axle, in which case the arrangement comprises a number of bearings. The conventional arrangements involve a number of problems and drawbacks, which are, among other things, problems of journalling of the roll and peaks of heat produced by the journalling in the paper web. The making of the mantle of several parts may also constitute a considerable problem, because the gaps between the parts may mark the paper web and because the arc form of the roll is not optimal, but the line of shape of the roll is shaped as a broken line. Further, owing to the metallic roll mantle, problems of corrosion may arise. One such prior-art spreader roll is described, for example, in the *US Patent No. 4,692,971*. Attempts have been made to provide an improvement over such a prior-art spreader roll, for example, so that a coating layer of a resilient material has been fitted onto the metal mantle consisting of a number of parts, the objective of this arrangement being in particular to provide an improvement concerning the problem of marking of the paper web and concerning optimization of the arc form of the roll. However, the journalling system of the roll is similar to that described above, and, thus, also the problems related to the journalling are unchanged. Such a spreader roll is described, for example, in the *Canadian Patent No. 766,843*.

Previously, attempts have been made to find a solution to the problem arising from a roll mantle made up of several parts also so that, as the roll mantle, a continuous metal tube mantle has been used which has been provided with "cuts", i.e. into which slots have been formed in order to facilitate the bending of the roll mantle. This construction, however, causes its own problems, one worth noticing being the fact that, owing to its construction, the roll mantle becomes quite slack, i.e. excessively readily bending. In such a case, the roll mantle concerned must be supported on the roll axle by means of bearings at a number of points, for which reason the problems described above and arising from the journalling remain unchanged. Also, the cost of manufacture of the roll mantle is relatively high because of the mode of manufacture.

The greatest problems of present take-out rolls, spreader rolls and equivalent are mainly due to the construction of the roll in use, which is most commonly a construction of the kind in which the roll comprises a non-revolving roll axle and a roll mantle revolvingly journalled on it. In addition to the prior art publications already cited previously, reference is made in this connection to the *Finnish Patent Application No. 951921*, which fairly representatively describes the prevailing prior art. More specifically, said publication describes a roll comprising a continuous and non-revolving roll axle. A roll mantle made up of three parts, i.e. a middle part and end parts, is fitted on the axle. The middle part is journalled in the area of its both ends directly on the axle of the roll. The inner ends of the end parts are also journalled directly on the axle and the outer ends are similarly journalled on separate sleeve parts, whose inside diameter is larger than the diameter of the axle. The sleeve parts can be shifted radially, whereby the roll mantle curves or, more exactly, attains the shape of a broken line, when the outer ends of the end parts of the mantle move radially with respect to the inner ends. The roll is thus provided with a desired "curved" shape.

However, all the arrangements of today involve the drawback that there are journalling points in the inner area of the roll mantle, that is, in the area of the web. Firstly, arrangement of lubrication of these bearings is at least principally difficult

to provide. A second, even more serious drawback is that the bearings heat up during operation with the result that this heating up produces a thermal gradient in paper. Heat is transferred with the paper into a roll nip and, at worst, it may cause burning of a soft nip roll. In the *FI Application 951921*, for example, attempts have been made to solve this problem in such a way that thermal insulation material is provided in connection with the bearings situated in the area of the web for the purpose of reducing the transfer of heat from the bearings to the paper web. The structure of the roll has, however, become very complicated and expensive, and yet it has not been possible to eliminate all drawbacks.

The object of the present invention is to provide a novel construction of a take-out roll, spreader roll, or equivalent, by means of which the problems related to the prior art described above are avoided. With a view to achieving the objective of the invention, the invention is mainly characterized in that the middle part of the roll is constructed to also operate as a revolving axle of the roll, which is mounted revolvingly on its support members by means of end bearings, and that the end parts of the roll are mounted, in the area of their axial inner ends, on the middle part by means of articulation devices.

The invention provides quite a considerable advantage over the prior art, and of the advantages obtainable by means of the invention, for example, the following may be mentioned. The roll does not comprise across the width of the web any lubrication points that impede the use of the roll and make its use more difficult. Also, there has been no need to place any bearings in the roll in the area of the width of the web, thereby making it possible to avoid the problems of the prior art caused by heating up of bearings. Considerably smaller bearings may be used in the roll as compared with conventional take-out rolls, bearing frictions being then also smaller than previously. The number of bearings has been made smaller than previously, since the roll needs only four roller bearings, whereas the rolls in accordance with the prior art usually comprised at least six roller bearings and two glide bearings. The axle of the roll is substantially more rigid than in the previous arrangements, which employ a separate non-revolving axle. A possible drive is very easy to arrange by

coupling a drive means simply to the end of the roll axle. Owing to the construction in accordance with the invention, for example, a composite material may be used as the roll material. In that case, the roll is advantageously constructed as a shell structure, whereby the roll becomes fairly light in weight and its lowest specific frequencies can be raised so high that the support provided by the end journalling of the roll is sufficient for support of the entire roll. The further advantages and characteristic features of the invention come out from the following detailed description of the invention.

In the following, the invention will be described by way of example with reference to the figures in the accompanying drawing.

Figure 1 is a schematic partial sectional view of one end area of a roll in accordance with the invention.

Figure 2 shows, on a larger scale, an alternative embodiment of a joint between an end part and a middle part of the roll shown in Fig. 1.

Figure 3 is a schematic sectional view along the line III—III from Fig. 2.

Figure 4 is a further alternative embodiment of a joint between the end part and the middle of the roll as an illustration corresponding to Fig. 2.

Figure 5 fully schematically shows the principle of a mechanism of regulating the curvature of the roll in a partial sectional view.

Figure 6 shows the structure illustrated in Fig. 5 seen in the direction of an arrow A.

Fig. 1, then, shows one end area of a roll in accordance with the invention and, in said figure, the roll is generally denoted with the reference numeral 10. The other end of the roll 10 is similar. The roll 10 comprises a middle part 11, of which only

a small part is seen in the figure, and end parts 12. The roll 10 does not include separately an axle and a mantle rotating on it, but, instead, the middle part 11 also serves as a roll axle which is mounted by means of end bearings 19 on its support members. The end bearings 19 are preferably roller bearings, as shown in Fig. 1 of the drawing. In order that the end bearings 19 might be made suitable in size, that is, sufficiently small, an extension 17 of the middle part 11 functioning as an axle is substantially smaller in diameter than the middle part 11, corresponding in size to the conventional diameter of a non-revolving axle.

The end parts 12 of the roll are tubular parts, and they are mounted directly on the middle part 11 such that articulation devices 13 are fitted at the inner end of the end parts 12 inside the tubular end parts 12, which articulation devices in the illustration of Fig. 1 are, for example, flexible rubber sleeves or equivalent. Said articulation devices 13 are fitted to the bending or deflection point of the roll 10, and they are supported so as to rest on the middle part 11. Fig. 1 of the drawing shows that between the middle part 11 and its extension 17 there is an intermediate part 18, which is in diameter smaller than the middle part 11 and larger than its extension 17. The articulation devices 13 are disposed specifically on these intermediate parts 18. The intermediate parts 18 having a smaller diameter than the middle part 11 are needed in order that the outer diameter of the tubular end part 12 may be made the same as that of the middle part 11 of the roll. The structure may also be accomplished such that there is no separately identifiable intermediate part 18 and no extension 17, but, instead, the middle part 11 changes in shape smoothly into an extension 17, from which the roll is journalled by means of the end bearings 19. In the axial direction in the area of their outer ends, the tubular end parts 12 are carried on bearings, for example, on roller bearings 14 mounted on support parts 15 which are separate from the revolving parts of the roll. The support parts comprise sleeve-like parts which are in inside diameter larger than the extension of the middle part so that the position of the bearings 14 may be radially shifted and adjusted. In Fig. 1, attempts are made to illustrate this schematically by means of a regulating device denoted with the reference numeral 16. By adjusting the position of the bearings 14

of the tubular end parts 12 it is possible to regulate both the amount of curvature and the direction of curvature of the roll 10.

In summary of the structure illustrated in Fig. 1 it may be further stated that in the roll 10 in accordance with the invention there are no parts revolving with respect to one another, but, instead, the roll 10 is mounted as a whole revolvingly at its ends by means of the bearings 19. Thus, no bearings at all are needed inside the roll 10 in the area of the width of the web, but, instead, at the deflection point of the roll, i.e. at the point where the end parts of the roll are pivotal with respect to the middle part, there are arranged only the articulation devices 13, which, at their simplest, are rubber sleeves or equivalent as shown in Fig. 1.

Figs. 2 and 3 show an alternative embodiment of the articulation device illustrated in Fig. 1. In said figures2 and 3, the articulation device is generally denoted with the reference numeral 23. In this embodiment, the articulation device 23 is a structure of the articulation bearing type which comprises an outer ring 24 fitted to the end part 12 of the roll and an inner ring 25 fitted onto the intermediate part. Said outer ring 24 and inner ring 25 are constructed such that the tangential friction between them is sufficiently high so that the outer ring 24 is not able to rotate with respect to the inner ring 25. At its simplest, this is arranged in such a way that, for example, the inner ring 25 is provided with at least one tooth 26 and, similarly, the outer ring 24 is provided with a corresponding groove, into which said tooth 26 fits. In that case, the articulation device 23 operates in the fashion of a constant velocity universal joint.

Fig. 4 additionally shows an alternative arrangement for an articulation device which in Fig. 4 is denoted with the reference numeral 33. In the embodiment illustrated in this figure, the articulation device 33 constitutes a structural part of the roll itself. This kind of arrangement is easy to provide, for example, in rolls made of a composite material in which the middle part 11 and the end part 12 of the roll are linked to each other by means of the articulation device 33, which is of the same material both with the middle part 11 and with the end part 12, but which is

substantially more flexible and more elastic than these. In that case, the outer face of the roll is totally continuous without any gaps between the middle part 11 and the end part 12.

As was already previously briefly mentioned, for example, in the description relating to Fig. 1, both the amount of curvature and the direction of curvature of the roll in question can be regulated in a desired manner. In Figs. 5 and 6 of the drawing, attempts are made to illustrate this principle of the regulating mechanism. In said figures, the reference numeral 41 denotes a bearing housing, which contains, for example, the end bearing 19 of the roll shown in Fig. 1. For the curvature regulating device, a fixed internal bearing part 42 is fixedly mounted and secured to the bearing housing 41 or to some equivalent separate support structure (not shown) that is stationary in its mounting. A frame part 43 of the curvature regulating device is fitted on support of this fixed internal bearing part 42, which frame part thus operates as an external bearing part. Necessary bearing members (not shown) are fitted between the fixed internal bearing part 42 and the frame part 43 of the curvature regulating device, said bearing members enabling a rotational movement of the frame part 43 on the fixed internal bearing part 42. Thus, the frame part 43 is able to perform only a rotational movement with respect to the internal bearing part 42 around the centre axis of the roll, but no other movement. A support part 44 which includes a sleeve-like part 15 and on which the bearing 14 of the tubular end part 12 of the roll is fitted is in turn mounted to the frame part 43 in such a way that the support part 44 can perform a linear movement with respect to the frame part 43 in a radial direction of the roll. This linear movement is made possible such that guides have been machined to the frame part 43 and, similarly, counter-guides fitting these guides have been machined to the support part 44. The guides and counter-guides are illustrated in Fig. 6 by the reference numeral 46. The regulating member accomplishing adjustment of the curvature of the roll is illustrated in Figs. 5 and 6 by means of a regulating screw 45.

By means of the arrangement shown in Figs. 5 and 6, the curvature of the roll is adjusted so that the support part 44 is moved by means of the regulating member 45

in a radial direction of the roll with respect to the frame part 43. The direction of curvature is in turn adjusted so that the frame part 43 is rotated on the fixed internal bearing part 42. Furthermore, as already previously stated, Figs. 5 and 6 show the curvature regulating device fully schematically, and, thus, the figures do not show at all by what kind of members the frame part 43 can be rotated on the fixed internal bearing part 42. However, these members can be embodied in several different ways. The screw representing the regulating member 45 may also be replaced with some other member suitable for the purpose. Further, it shall be noted that the figures do not include the necessary measuring scales for the amount and direction of curvature, which may be fixedly secured to the structure.

Above, the invention has been described by way of example with reference to the figures in the accompanying drawing. The invention is, however, not intended to be confined to relating only to the examples illustrated in the figures, but different embodiments of the invention may vary within the scope of the inventive idea defined in the accompanying claims.

Claims

1. A take-out roll, spreader roll, or equivalent for a web-like material, which roll (10) comprises three parts linked with one another, i.e. two end parts (12) and a middle part (11), which parts are pivotal with respect to one another for the purpose of bending the roll (10) into a desired curved shape, **characterized** in that the middle part (11) of the roll (10) is constructed to also operate as a revolving axle of the roll (10), which is mounted revolvingly on its support members by means of end bearings (19), and that the end parts (12) of the roll are mounted, in the area of their axial inner ends, on the middle part (11) by means of articulation devices (13, 23, 33).

2. A roll as claimed in claim 1, **characterized** in that the tubular end parts (12) of the roll are mounted, in the area of their axial outer ends, revolvingly and in a radial direction movably on support parts (15,44), which are separate from the revolving parts of the roll, by means of bearings (14) fitted, in the axial direction of the roll, on the side of the inner side of the end bearings (19).

3. A roll as claimed in claim 1 or 2, **characterized** in that the diameter of the middle part (11) of the roll is made substantially smaller from the area of the deflection points of the roll in the axial direction outwards to both ends of the roll, and that the articulation devices (13,23,33) are fitted in said deflection points to connect the end parts (12) to the middle part (11).

4. A roll as claimed in any one of the preceding claims, **characterized** in that the articulation devices (13,23) are fitted on the middle part (18) made smaller in diameter inside the tubular end parts (12).

5. A roll as claimed in any one of the preceding claims, **characterized** in that the articulation devices (13) are flexible parts, such as rubber sleeves or equivalent.

6. A roll as claimed in any one of claims 1 to 4, **characterized** in that the articulation devices (23) comprise a structure of the articulation bearing type, whose parts (24,25) are able to pivot with respect to each other, but whose rotational movement with respect to each other around the centre axis of the roll is prevented.

7. A roll as claimed in any one of claims 1 to 4, **characterized** in that the articulation device (33) constitutes a structural part of the roll (10) itself, being more flexible than the areas of the roll situated, in the axial direction of the roll, outside the articulation device (33).

8. A roll as claimed in claim 7, **characterized** in that the articulation device (33) is of the same material with the other structure of the roll.

9. A roll as claimed in any one of the preceding claims, **characterized** in that the roll (10) is formed as a shell structure out of a composite material.

10. A roll as claimed in any one of the preceding claims, **characterized** in that the bearings (14) of the end parts (12) of the roll are fitted on sleeve parts (15) included in the support parts, which sleeve parts have an inside diameter that is larger than the diameter of the middle part (11) in the corresponding area.

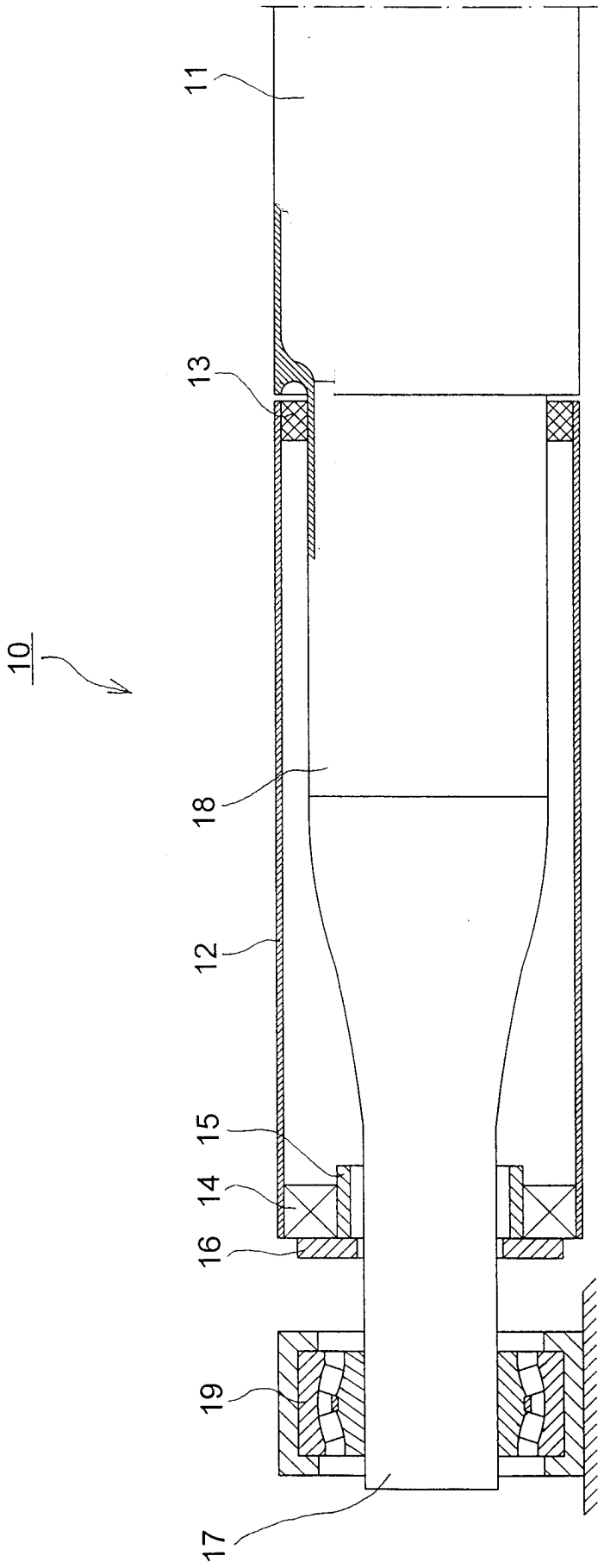


FIG. 1

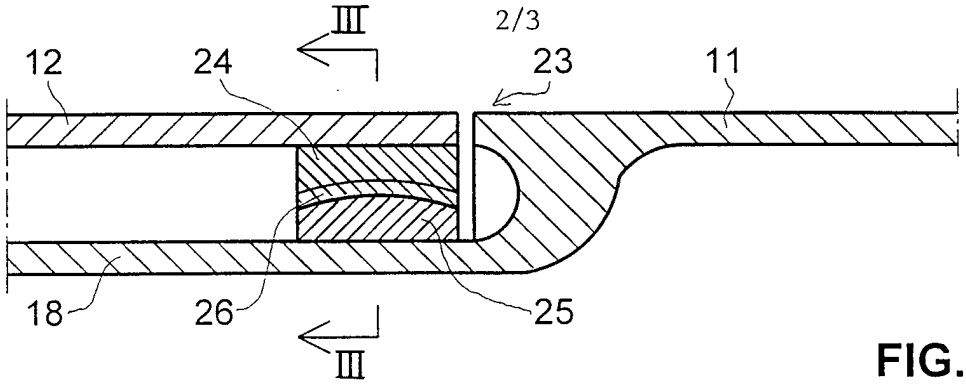


FIG. 2

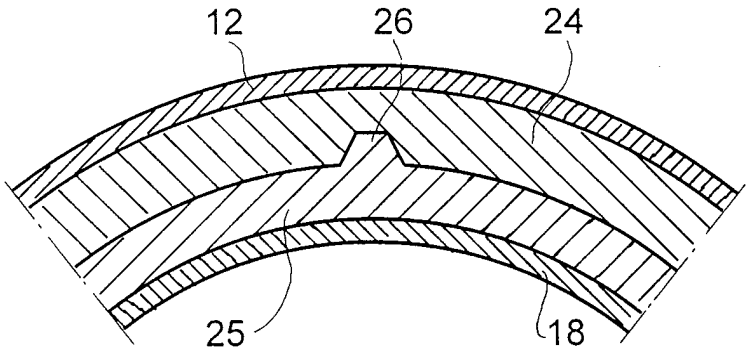


FIG. 3

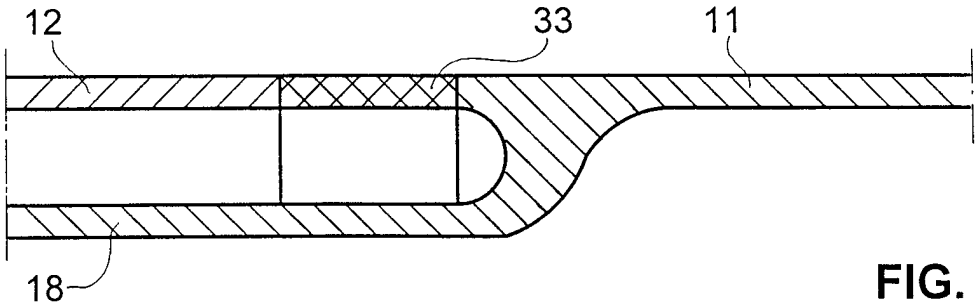


FIG. 4

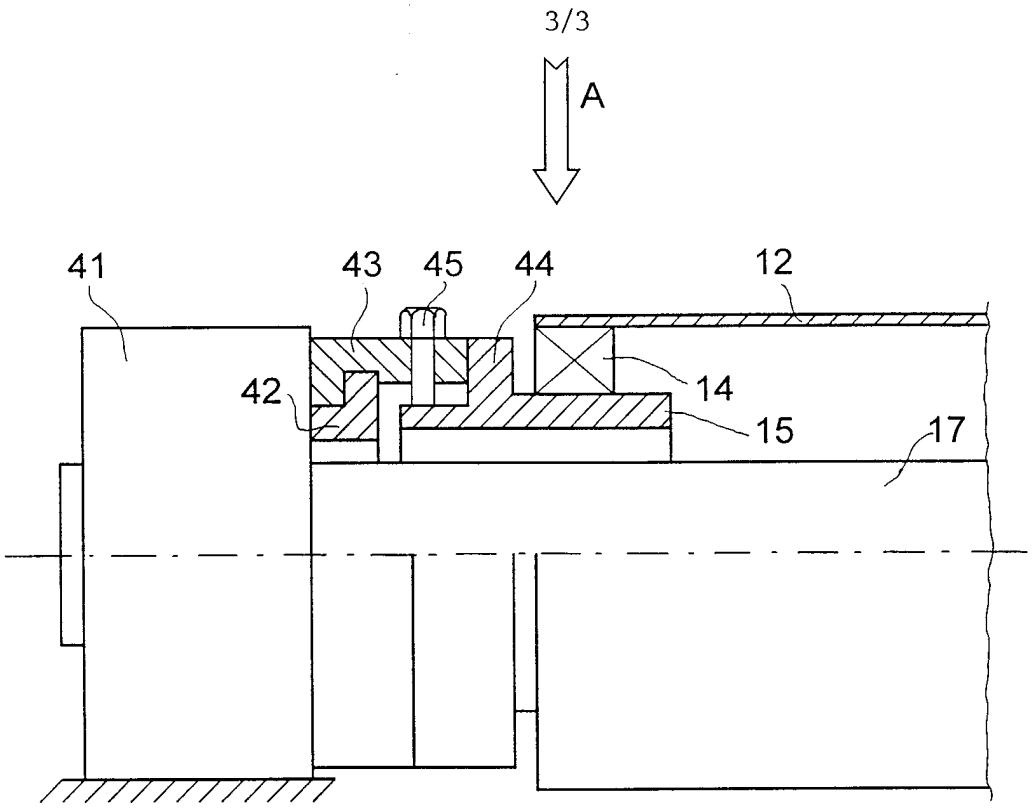


FIG. 5

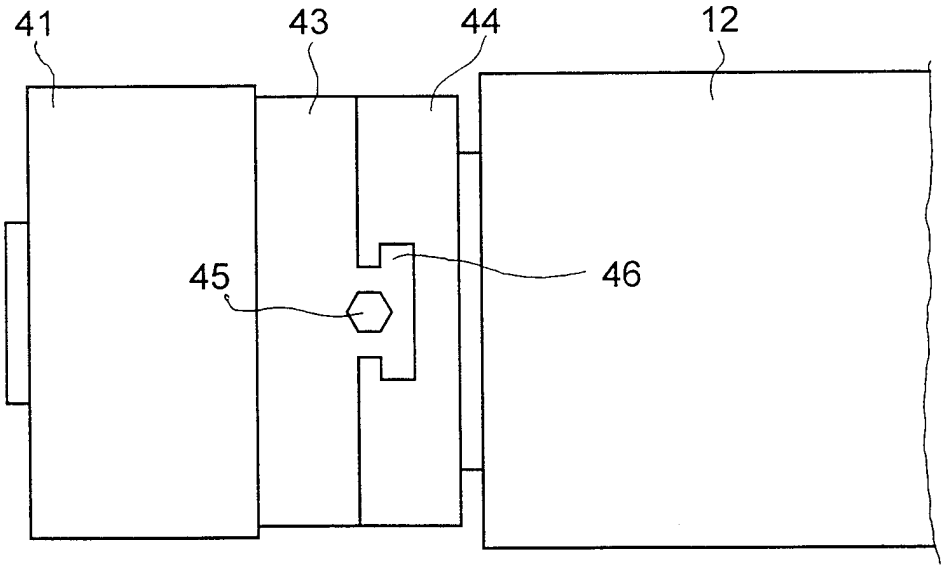


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 98/00078

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B65H 27/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B65H, D06C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3001682 A (M.J. CARROLL ET AL), 26 Sept 1961 (26.09.61) --	1-10
A	DE 2110079 A1 (H. WITTLER & CO.), 14 Sept 1972 (14.09.72) --	1-10
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A	EP 0225988 A1 (M.A.N. ROLAND DRUCKMASCHINEN AKTIENGESELLSCHAFT), 24 June 1987 (24.06.87) -- --------	1-10

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17 April 1998	15.05.1998
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Stina Sjögren Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

Information on patent family members

02/04/98

International application No.
PCT/FI 98/00078

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