



(11) **EP 1 678 059 B9**

(12) **CORRECTED EUROPEAN PATENT SPECIFICATION**

Note: Bibliography reflects the latest situation

(15) Correction information:

Corrected version no 1 (W1 B1)

Corrections, see

Claims DE

Claims EN

Claims FR

(51) Int Cl.:

B65G 23/12 (2006.01) **B65G 23/38** (2006.01)

A01K 1/01 (2006.01)

(86) International application number:

PCT/SE2004/001478

(48) Corrigendum issued on:

24.10.2007 Bulletin 2007/43

(87) International publication number:

WO 2005/037690 (28.04.2005 Gazette 2005/17)

(45) Date of publication and mention
of the grant of the patent:

30.05.2007 Bulletin 2007/22

(21) Application number: **04775552.5**

(22) Date of filing: **14.10.2004**

(54) **FRICTION DRIVE DEVICE FOR A CONVEYOR AND METHOD FOR DRIVING**

REIBANTRIEBSVORRICHTUNG FÜR EINE FÖRDEREINRICHTUNG UND ANTRIEBSVERFAHREN

DISPOSITIF D'ENTRAÎNEMENT A FRICTION POUR UN CONVOYEUR ET PROCÉDE
D'ENTRAÎNEMENT

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PL PT RO SE SI SK TR**

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(30) Priority: **16.10.2003 SE 0302734**

(43) Date of publication of application:

12.07.2006 Bulletin 2006/28

(56) References cited:

WO-A1-02/071836

SE-B- 436 019

US-A- 1 946 452

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- **DATABASE WPI Week 199613, Derwent Publications Ltd., London, GB; Class Q35, AN 1996-127549, XP002983291 & RU 2 038 996 C1 (VORON PACKAGING EQUIP RES PRODN ASSOC) 09 July 1995**

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Description

Field of the Invention

[0001] From a first aspect, the present invention relates to a drive device for intermittent driving of a conveyor that partly surrounds a drum rotatable around a centre axis, which drive device comprises drive member and motion transmission member.

[0002] From a second aspect, the invention relates to a method for driving such a conveyor.

Background of the Invention

[0003] Conveyors of the type in question are used in many different applications. One is in animal farming such as of, e.g., cattle and pigs. In such an application, it is previously known to form animal-farming spaces with movable floor, with the floor consisting of such a conveyor for the removal of the dung and/or feed of fodder. Consequently, in this application the conveyor has a considerable width and is driven slowly and intermittently. A conveyor in such an application is disclosed, e.g., in WO 02/071836.

[0004] In many cases, a conveyor running over a drum shows a tendency of being displaced laterally along the same. Occasionally, large forces are required in order to counteract this and hold the belt in place. It may be particularly difficult if the belt is wide and of steel, as usual in the application mentioned above. Measures in order to, in that way, retain the belt may become cost-demanding and cause friction loss and belt wear. Another possibility is to let the drum rotate in the opposite direction at regular intervals, a laterally retrograde motion of the belt being obtained. The disadvantage, though, is that the conveyor trails in a backward motion in the conveying direction.

[0005] In these circumstances, the object of the present invention is to provide a drive device for a conveyor of the kind in question and a method for driving it that brings about correction of the lateral position of the belt on the drum without the occurrence of the disadvantages pointed out above.

[0006] US-A-1 946 452 shows an intermittently driven belt conveyor in which both strikes of the reciprocating drive member are transferred to drive the belt drum in the same direction.

Summary of the Invention

[0007] In the first aspect of the invention, the object set up has been attained by the fact that a drive device of the kind defined and which comprises the features that the drive member is arranged to execute a reciprocating motion, that the motion transmission member, in the motion of the drive member in a first direction, is arranged to impart the drum a rotary motion in a first rotary direction and impart the conveyor a motion, characterized in that

- that the motion transmission member, in the motion of the drive member in a second direction, is arranged to impart the drum a rotary motion in a second rotary direction in such a way that the conveyor is at rest.

[0008] By the fact that the drum thereby is imparted a reciprocating rotary motion, a correction of possible lateral motion of the belt upon each returning rotary motion is brought about. Thanks to the belt during the returning motion of the drum being kept at rest, a unidirectional motion is maintained so that backward conveyance of goods is avoided. By the fact that the drive device thereby fulfils the double function of driving the belt in the intended conveying direction as well as providing correction against lateral motion, large cost savings in comparison with having separate drive device and correction device are attained.

[0009] According to a preferred embodiment of the invented drive device, the rotary motion of the drum is substantially equally large in both rotary directions. Thereby, optimum correction of the lateral displacement is attained.

[0010] According to an additional preferred embodiment, the drive member comprises a pressure-actuated bellows and a mechanical spring. Accordingly, the stated reciprocating motion of the drive member is attained in a very simple and expedient way. The same gets a minimum number of movable parts and becomes robust and insensitive to disturbances. For instance, the bellows may be made as a woven hose similar to a firehose, and a tension spring may be arranged parallel to the bellows. Of course, alternatively a compression spring may be used. Further, the bellows may by itself be formed with resilient properties, the need for an additional spring being eliminated.

[0011] According to an additional preferred embodiment, the motion transmission member comprises:

- an arm connected with the drive member,
- a pressure element connected with the arm,
- a neck arranged on at least one of the end surfaces of the drum, in which neck the arm is rotatably mounted, and
- a carrier member arranged on said end surface,
- in the motion of the drive member in said first direction, the arm being arranged to initially displace the pressure element to abutment against the conveyor and then by means of the abutting pressure element impart the conveyor said motion and simultaneously via the neck and the pressure element impart the drum a rotary motion in said first rotary direction,
- and in the motion of the drive member in said second direction, the arm being arranged to initially displace the pressure element from abutment against the conveyor as well as being brought to abutment against the carrier member and then via the carrier member and the neck impart the drum a rotary motion in said

second rotary direction.

[0012] Such a formed motion transmission member provides the stated motion pattern by means of very few movable parts and with uncomplicated co-operation thereof. This entails that the device becomes inexpensive to manufacture as well as in maintenance. The simplicity also entails great operational reliability even in heavily dirty surroundings, which frequently may be at hand.

[0013] According to an additional preferred embodiment, the carrier member and the connection of the drive member with the arm are located on one side of a plane through the centre axis of the drum, and the neck and the pressure element are located on the opposite side. Accordingly, an efficient transfer of force is attained by the use of leverage.

[0014] According to an additional preferred embodiment, the pressure element is rod-shaped and parallel to the drum and extends along the major part of the length of the drum. Thanks to such an extension in the longitudinal direction, the force becomes distributed over a large area so that concentrated loads are avoided and so that obliquely directed forces are avoided.

[0015] According to an additional advantageous embodiment, the drive member is controlled to alternate between inactive, relatively long periods, when it is idle, and active, relatively short periods when it executes some strokes. This makes the invention expedient to utilize in applications where conveyance of material is required only during certain short periods.

[0016] According to an additional preferred embodiment, the conveyor is a movable floor of an animal-farming unit. The present invention is primarily developed for use in such an application, and the advantages thereof are particularly valuable in this connection.

[0017] The above-mentioned preferred embodiments of the invented drive device are defined in the claims depending on claim 1.

[0018] In the second aspect of the invention, the object set up has been attained by the fact that a method of the kind defined comprises the special measures that the drive takes place while alternating between a first and a second stage, during the first stage the drum being imparted a motion in a first rotary direction while the conveyor being imparted a motion, characterized in that during the second stage the drum being imparted a motion in a second rotary direction while the conveyor being kept at rest.

[0019] According to preferred embodiments of the invented method, this is exercised by means of the invented drive device and particularly by means of anyone of the preferred embodiments of the same.

[0020] Accordingly, advantages of the corresponding types that have been accounted for above regarding the invented drive device are gained.

[0021] The invention is explained closer by the appended detailed description of preferred embodiment ex-

amples of the same, reference being made to the appended drawing figures.

Brief Description of the Figures

[0022]

Figure 1 is a perspective view of a drive device according to the invention in a first end position.
Figure 2 is a corresponding perspective view in a second end position.
Figure 3 is a side view of the drive device in the position shown in figure 1.
Figure 4 is a side view of the drive device in the position shown in figure 2.

[0023] In figure 1, the invented drive device arranged for driving a conveyor 1 is illustrated, which in this example consists of a movable floor in an animal-farming device. The conveyor 1, which may be of steel, runs between two parallel beams 2, and immediately under the conveyor 1 there is a (not shown) fixed supporting floor. In the longitudinal direction, the conveyor is bent 180° around a drum 3 at the drive end and is correspondingly bent 180° over a drum at the opposite (not shown) end of the equipment.

[0024] The drum 3 constitutes the drive drum of the conveyor, and the same drum is driven by means of the drive device so that the drum 3, during short periods, executes some reciprocating rotary motions and so that the conveyor, in that connection, moves intermittently in the direction of the arrow A.

[0025] The drive device comprises a unit at each end of the drum 3 and a rod that connects the same and runs parallel to the drum 3.

[0026] Each unit comprises a bellows 5 and a tension spring 6 and an arm 7 connected with these, which arm at the opposite end thereof is connected with the rod 4. The arm 7 is rotatably mounted on an axle journal 8 attached to the end surface of the drum 3. Further, on the end surface of the drum there is a carrier member 9 in the form of a protruding pin.

[0027] The figure shows the drive device in a first end position when the bellows 5 is fully expanded.

[0028] Figure 2 shows the drive device in the opposite end position, the bellows 6 being entirely compressed.

[0029] The mode of operation of the drive device is most clearly seen in figures 3 and 4.

[0030] In figure 3, the drive device is in the same end position as is shown in figure 1. The bellows 5 is arranged between a fixed strut 10 and a jointed connection device 11 at the arm 7. At the strut 10, the bellows is connected to an air pipe for the supply of compressed air. However, the same is not shown in the figure. The tension spring 6 is attached to the strut 10 with one end thereof and to the arm 7 with the other end thereof.

[0031] When the bellows 5 is decompressed, the spring 6 will pull the upper end towards the right in the

figure. This entails that the arm initially will be rotated clockwise around the axle journal 8. During this initial rotation, the rod 4, which in the figure abuts against the belt 1, will be released from the abutment against the belt. The initial rotation is stopped shortly afterwards by the fact that the arm 7 has been rotated to abutment against the carrier member 9. When the spring 6 then continues to pull the upper end of the arm 7 towards the right, the connection of the arm with the drum 3 via the axle journal 8 and the carrier member 9 entails that the drum is rotated clockwise. The friction between the drum 3 and the belt 1 is, in that connection, not sufficient in order to transmit motion to the belt 1, which consequently is at rest during this phase.

[0032] After completed compression of the bellows, the position shown in figure 4 is attained. When this is attained, the supply of compressed air to the bellows 5 is activated, which on that occasion, while overcoming the tensile force from the spring 6, pushes the upper end of the arm towards the left in the figure. In that connection, initially the arm 3 will execute a rotary motion around the axle journal 8 counter-clockwise and leaves abutment against the carrier member 9. Shortly afterwards, in that connection, the rod 4 has been rotated to abutment against the belt 1, continued rotation around the axle journal 8 being prevented. Continued displacement of the upper end of the arm 7 towards the left entails therefore that the arm 7 rotates the drum counter-clockwise via the axle journal 8 and the abutment of the rod 4 against the belt 1. In that connection, the rod 4 will be pressed by large force against the belt 1 so that the same is pressed between the rod 4 and the drum 3. When the drum 3 rotates in this phase, therefore also the belt will trail the motion in the conveying direction A. Eventually, the position shown in the figure is attained once again and the motion cycle is repeated.

[0033] Consequently, the result of some motion cycles becomes that the drum is rotated reciprocatingly some times while the conveyor moves unidirectionally and intermittently forward. The rotary motion is relatively limited, normally less than 30°. Therefore, the drum 3 does not need to be circular cylindrical but it is enough that it has a winding of about 210°, such as is the case with the drum shown in the figures.

[0034] The position of the centre axis 0 of the drum can be adjusted by means of a belt tension device 12.

[0035] As mentioned, the embodiment example shown in the figures relates to an application where the conveyor 1 consists of a movable floor of an animal-farming device. The same may be an individual box or a larger space for a plurality of animals. Here, the object of the conveyor 1 is to convey away dung and/or feed fodder, bedding and the like. Consequently, here the conveyance operation is limited and the speed of motion is small. This means that the device is inactive during the major part of the time. It may be suitable that periods of about 30 min inactivity alternate with periods of some or a few minutes when the device is active and executes a number of

strokes.

Claims

1. Drive device for intermittent driving of a conveyor (1) that partly surrounds a drum (3) rotatable around a centre axis (0), which drive device comprises drive member (5, 6) and motion transmission member (4, 7, 8, 9) wherein the drive member (5, 6) is arranged to execute a reciprocating motion, and the motion transmission member (4, 7, 8, 9), in the motion of the drive member (5, 6) in a first direction, is arranged to impart the drum (3) a rotary motion in a first rotary direction and impart the conveyor (1) a motion, **characterized in that** the motion transmission member (4, 7, 8, 9), in the motion of the drive member (5, 6) in a second direction, is arranged to impart the drum (3) a rotary motion in a second rotary direction in such a way that the conveyor (1) is at rest.
2. Drive device according to claim 1, **characterized in that** the rotary motion of the drum (3) is substantially equally large in both rotary directions.
3. Drive device according to claim 1 or 2, **characterized in that** the drive member (5, 6) comprises an air-operated bellows (5) and a mechanical spring (6).
4. Drive device according to any one of claims 1-3, **characterized in that** the motion transmission member (4, 7, 8, 9) comprises
 - an arm (7) connected with the drive member (5, 6),
 - a pressure element (4) connected with the arm (7),
 - a neck (8) arranged on at least one of the end surfaces of the drum (3), in which neck the arm (7) is rotatably mounted, and
 - a carrier member (9) arranged on said end surface,
 - in the motion of the drive member (5, 6) in said first direction, the arm (7) being arranged to initially displace the pressure element (8) to abutment against the conveyor (1) and then by means of the abutting pressure element (4) impart the conveyor (1) said motion and simultaneously via the neck (8) and the pressure element (4) impart the drum (3) a rotary motion in said first rotary direction,
 - and in the motion of the drive member (5, 6) in said second direction, the arm (3) being arranged to initially displace the pressure element (8) from abutment against (1) the conveyor as well as being brought to abutment against the carrier member (9) and then via the carrier member (9) and the neck (8) impart the drum (3) a

rotary motion in said second rotary direction

5. Drive device according to claim 4, **characterized in that** the carrier member (9) and the connection of the drive member (5, 6) with the arm are located on one side of a plane through the centre axis (0) of the drum, and that the neck (8) and the pressure element (4) are located on the opposite side of said plane. 5
6. Drive device according to claim 4 or 5, **characterized in that** the pressure element (4) is rod-shaped and parallel to the drum (3) and extends along the major part of the length of the drum (3). 10
7. Drive device according to any one of claims 1-6, **characterized in that** the drive member (5, 6) is controlled to alternate between inactive, relatively long periods, when it is idle, and active, relatively short periods when it executes some strokes. 15
8. Drive device according to any one of claim 4 or 5, **characterized in that** the conveyor (1) is a movable floor of an animal-farming unit. 20
9. Method for intermittent driving of a conveyor (1) that partly surrounds a drum (3) rotatable around a centre axis (0), wherein the drive takes place while alternating between a first and a second stage, during the first stage the drum (3) being imparted a motion in a first rotary direction while the conveyor being imparted a motion, **characterized in that** during the second stage the drum (3) being imparted a motion in a second rotary direction while the conveyor (1) being kept at rest. 25
10. Method according to claim 9, **characterized in that** the method is exercised by means of a drive device according to any one of claims 1-8. 30

Patentansprüche

1. Antriebsvorrichtung zum intermittierenden Antrieb eines Förderers (1), der teilweise eine Trommel (3) umgibt, die um eine Zentralachse (0) drehbar ist, wobei die Antriebsvorrichtung ein Antriebselement (5, 6) und ein eine Bewegung übertragendes Element (4, 7, 8, 9) aufweist, wobei das Antriebselement (5, 6) hin- und herbewegbar und das die Bewegung übertragende Element (4, 7, 8, 9) so angeordnet ist, dass es bei der Bewegung des Antriebselements (5, 6) in einer ersten Richtung der Trommel (3) eine Drehung in einer ersten Drehrichtung und dem Förderer (1) eine Bewegung erteilt, **dadurch gekennzeichnet, dass** das die Bewegung übertragende Element (4,7,8,9) bei der Bewegung des Antriebselements (5, 6) in einer zweiten Richtung der Trommel (3) eine Drehung in einer zweiten Drehrichtung so erteilt, 45

dass der Förderer (1) stillsteht.

2. Antriebsvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** die Drehung der Trommel (3) in beiden Drehrichtung im wesentlichen gleich groß ist.
3. Antriebsvorrichtung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Antriebselement (5, 6) einen luftbetätigten Balgen (5) und eine mechanische Feder (6) aufweist.
4. Antriebsvorrichtung nach einem der Ansprüche 1-3, **dadurch gekennzeichnet, dass** das die Bewegung Übertragende Element (4,7,8,9) aufweist: 50

einen Hebel (7), der mit dem Antriebselement (5, 6) verbunden ist;
ein Andruckelement (4), das mit den Arm (7) verbunden ist;
einen Hals (8), der auf mindestens einer der Stirnflächen der Trommel (3) angeordnet ist und der den Hebel (7) drehbar lagert; und
ein auf der Stirnfläche angeordnetes Trägerelement (9);

wobei bei der Bewegung des Antriebselements (5, 6) in der ersten Richtung der Hebel (7) das Andruckelement (8) anfänglich so auslenkt, dass es sich an den Förderer (1) anlegt und ihm die Bewegung erteilt und gleichzeitig über den Hals (8) und das Andruckelement (4) der Trommel (3) eine Drehung in der ersten Drehrichtung erteilt;
und bei der Bewegung des Antriebselements (5, 6) in der zweiten Richtung der Hebel (3) das Andruckelement (8) anfänglich aus der Anlage am Förderer (1) trennt und an das Trägerelement (9) anlegt und dann über letzteres und den Hals (8) der Trommel (3) eine Drehung in der zweiten Drehrichtung erteilt. 35

5. Antriebsvorrichtung nach Anspruch 4, **dadurch gekennzeichnet, dass** das Trägerelement (9) und die Verbindung des Antriebselements (5, 6) mit dem Hebel auf der einen Seite einer durch die Zentralachse (0) der Trommel verlaufenden Ebene und der Hals (8) und das Andruckelement (4) auf der anderen Seite dieser Ebene liegen. 40
6. Antriebsvorrichtung nach Anspruch 4 oder 5, **dadurch gekennzeichnet, dass** das Andruckelement (4) stangenförmig ist und parallel zur Trommel (3) über den größten Teil von deren Länge verläuft. 50
7. Antriebsvorrichtung nach einem der Ansprüche 1-6, **dadurch gekennzeichnet, dass** das Antriebselement (5, 6) zwischen verhältnismäßig langen Ruheintervallen, in denen es stillsteht, und verhältnismäßig kurzen Arbeitsintervallen abwechselnd steuer- 55

bar ist, in denen es einige Hübe ausführt.

8. Antriebsvorrichtung nach einem der Ansprüche 4 oder 5, **dadurch gekennzeichnet, dass** der Förderer (1) der verfahrbare Boden einer Tierhaltungsanlage ist. 5
9. Verfahren zum intermittierenden Antrieb eines Förderers (1), der teilweise um eine Trommel (3) gelegt ist, die um eine Zentralachse (0) drehbar ist, wobei der Antrieb im Wechsel zwischen einem ersten und einem zweiten Stadium erfolgt, wobei im ersten Stadium der Trommel (3) eine Bewegung in einer ersten Drehrichtung und dem Förderer eine Bewegung erteilt wird, **dadurch gekennzeichnet, dass** im zweiten Stadium der Trommel (3) eine Bewegung in einer zweiten Drehrichtung erteilt und der Förderer (1) im Stillstand gehalten wird. 10
10. Verfahren nach Anspruch 9, **dadurch gekennzeichnet, dass** das Verfahren mittels einer Antriebsvorrichtung nach einem der Ansprüche 1-8 ausgeführt wird. 15 20

Revendications

1. Un dispositif d'entraînement pour l'entraînement intermittent d'un convoyeur 25
 (1) qui entoure partiellement un tambour (3) pouvant tourner autour d'un axe central (0), lequel dispositif d'entraînement comporte un membre d'entraînement (5, 6) et un membre de transmission de mouvement (4, 7, 8, 9) dans lequel le membre d'entraînement (5, 6) est agencé pour effectuer un mouvement alternatif, et le membre de transmission de mouvement (4, 7, 8, 9), dans le mouvement du membre d'entraînement (5, 6) dans une première direction, est agencé pour impartir le tambour (3) d'un mouvement de rotation dans une première direction de rotation et pour impartir le convoyeur (1) d'un mouvement, **caractérisé en ce que** le membre de transmission de mouvement (4, 7, 8, 9), dans le mouvement du membre d'entraînement (5, 6) dans une deuxième direction, est agencé pour impartir le tambour (3) d'un mouvement de rotation dans une deuxième direction de rotation de façon à ce que le convoyeur (1) soit au repos. 30 35 40 45 50
2. Un dispositif d'entraînement selon la revendication 1, **caractérisé en ce que** le mouvement de rotation du tambour (3) est essentiellement aussi grand dans les deux directions. 55
3. Un dispositif d'entraînement selon la revendication 1 ou 2, **caractérisé en ce que** le membre d'entraî-

nement (5, 6) comporte un soufflet à air comprimé (5) et un ressort mécanique (6).

4. Un dispositif d'entraînement selon l'une quelconque des revendications 1-3, **caractérisé en ce que** le membre de transmission de mouvement (4, 7, 8, 9) comporte
 - un bras (7) relié au membre d'entraînement (5, 6),
 - un élément de pression (4) relié au bras (7),
 - un collet (8) agencé sur au moins une des surfaces d'extrémités du tambour (3), collet dans lequel, le bras (7) est monté rotativement, et
 - un membre transporteur (9) agencé sur ladite surface d'extrémité,
 - dans le mouvement du membre d'entraînement (5, 6) dans ladite première direction, le bras (7) étant agencé pour initialement déplacer l'élément de pression (8) en butée contre le convoyeur (1) et alors au moyen de l'élément de pression de butée (4) impartir le convoyeur (1) dudit mouvement et simultanément via le collet (8) et l'élément de pression (4), impartir le tambour (3) d'un mouvement de rotation dans ladite première direction de rotation,
 - et dans le mouvement du membre d'entraînement (5, 6) dans ladite deuxième direction, le bras (3) étant agencé pour initialement déplacer l'élément de pression (8) de sa butée contre (1) le convoyeur tout en étant amené en butée contre le membre transporteur (9) pour ensuite via le membre transporteur (9) et le collet (8) impartir le tambour (8) d'un mouvement de rotation dans ladite deuxième direction de rotation. 5
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5. Un dispositif d'entraînement selon la revendication 4, **caractérisé en ce que** le membre transporteur (9) et la connexion du membre d'entraînement (5, 6) avec le bras sont situés sur un côté d'un plan à travers l'axe central (0) du tambour, et **en ce que** le collet (8) et l'élément de pression (4) sont situés sur le côté opposé dudit plan.
6. Un dispositif d'entraînement selon la revendication 4 ou 5, **caractérisé en ce que** l'élément de pression (4) est en forme de tige et parallèle au tambour (3) puis s'étend le long de la majeure partie de la longueur du tambour (3).
7. Un dispositif d'entraînement selon l'une quelconque des revendications 1-6, **caractérisé en ce que** le membre d'entraînement (5, 6) est réglé pour alterner entre l'inactivité, pendant des périodes relativement longues, lorsqu'il est au repos, et l'activité pendant des périodes courtes lorsqu'il effectue quelques courses.

8. Un dispositif d'entraînement selon l'une quelconque des revendications 4 ou 5, **caractérisé en ce que** le convoyeur (1) est un plancher mobile dans un système d'élevage d'animaux.
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9. Un procédé pour l'entraînement intermittent d'un convoyeur (1) qui entoure partiellement un tambour (3) pouvant tourner autour d'un axe central (0) dans lequel l'entraînement s'effectue en alternant entre une première et une deuxième étape, pendant la première étape le tambour (3) étant imparti d'un mouvement dans une première direction de rotation tandis que le convoyeur est imparti d'un mouvement, **caractérisé en ce que** pendant la deuxième étape le tambour (3) étant imparti d'un mouvement dans une deuxième direction de rotation tandis que le convoyeur (1) est maintenu au repos.
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10. Un procédé selon la revendication 9, **caractérisé en ce que** le procédé est exercé au moyen d'un dispositif d'entraînement selon l'une quelconque des revendications 1-8.
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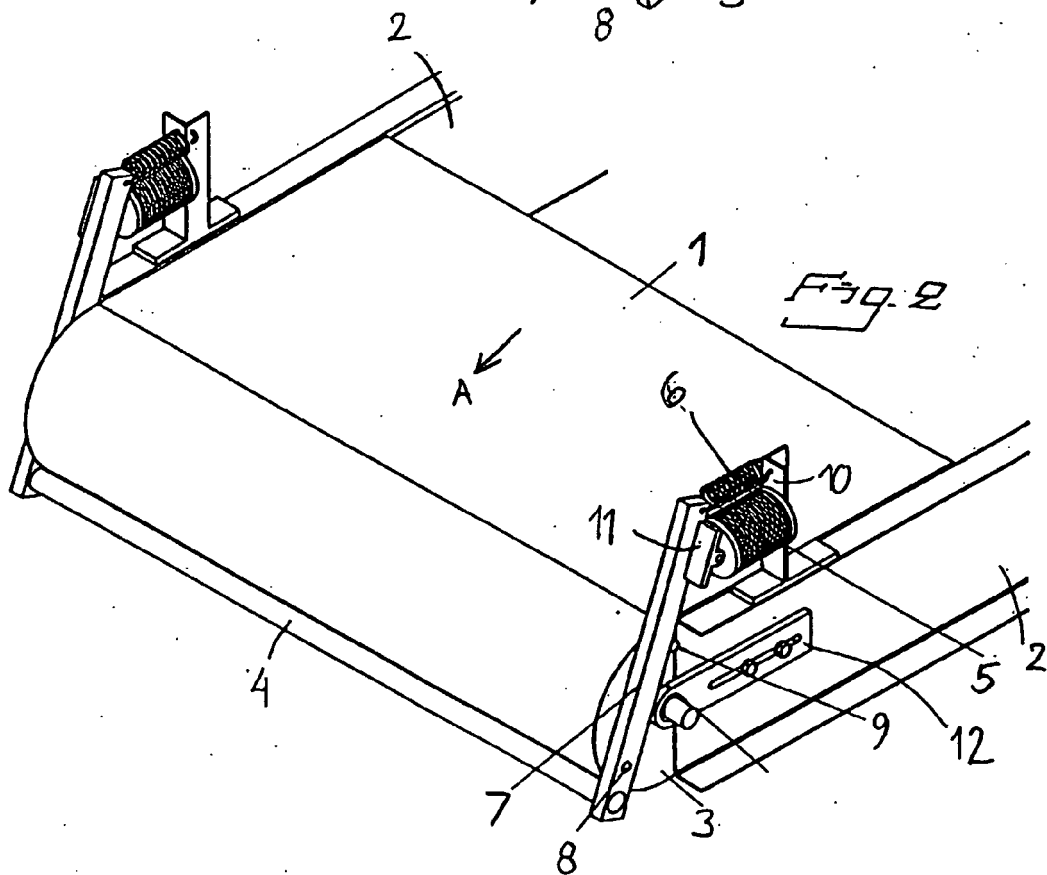
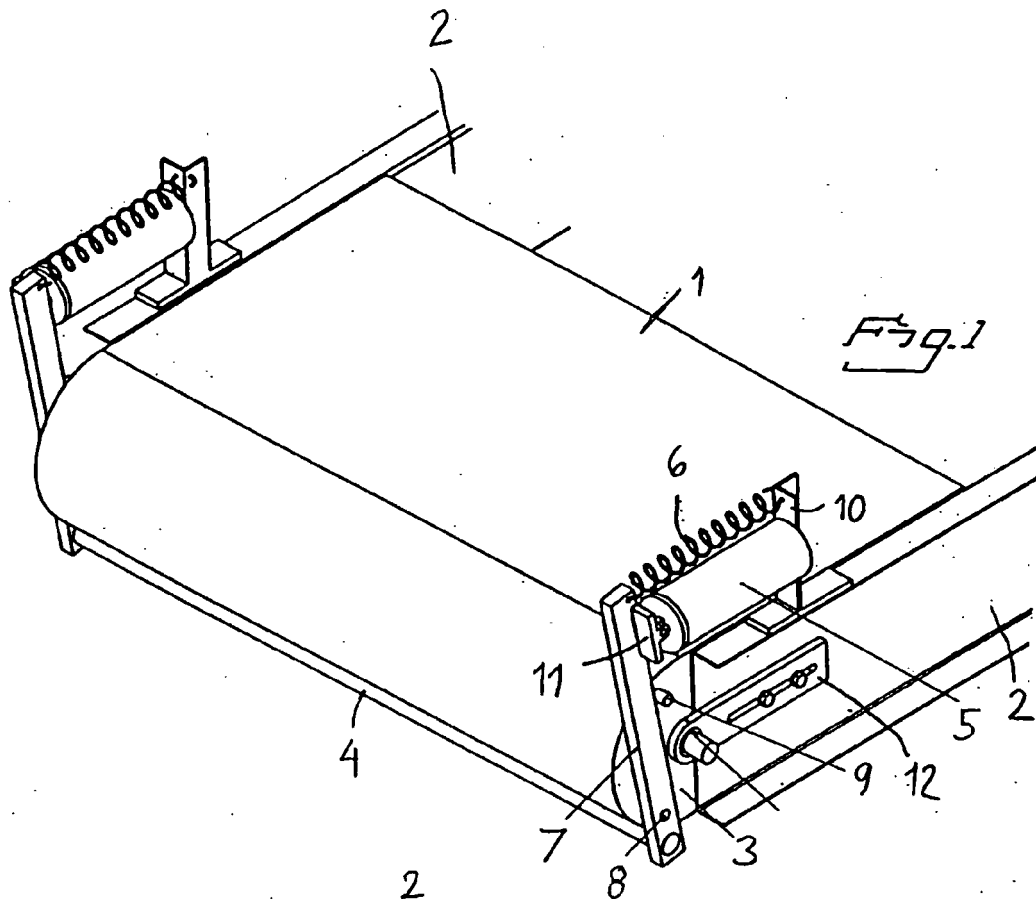
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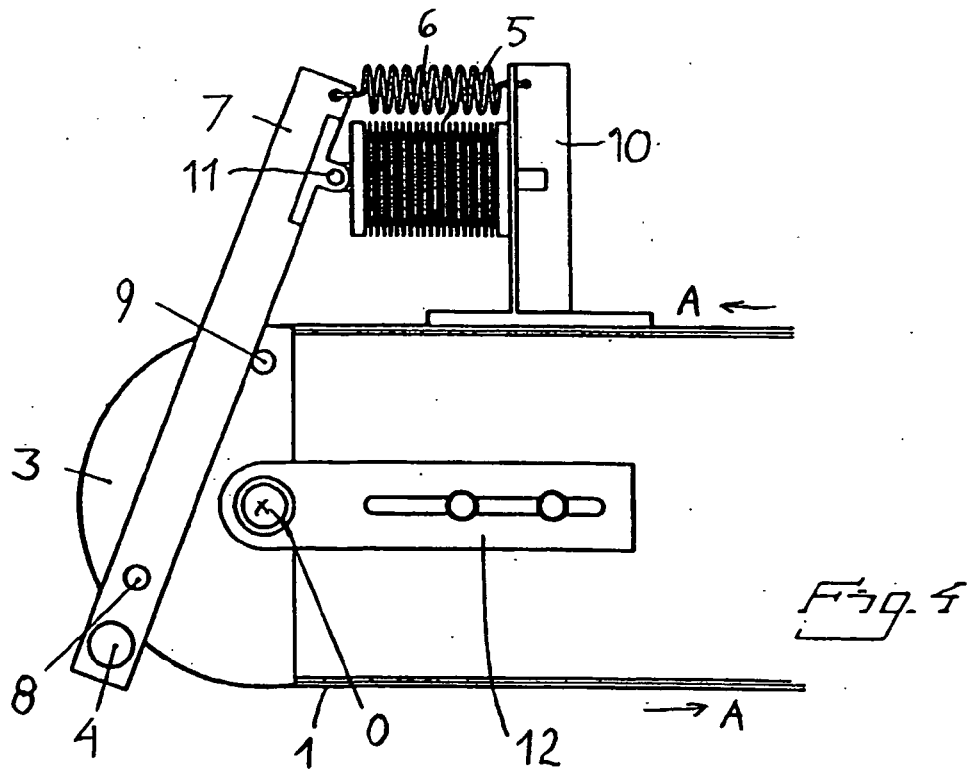
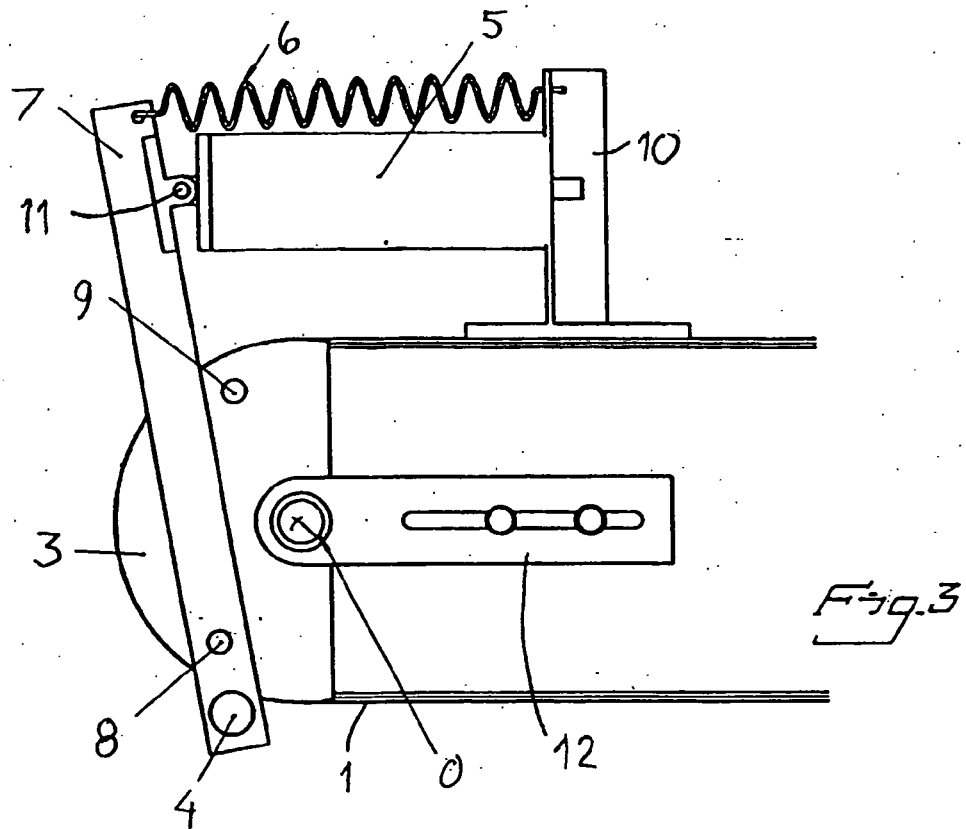
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REFERENCES CITED IN THE DESCRIPTION

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