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(54) Device for cooling and stacking a sheet of rubber.

(57) A modularly combined rubber sheet cooling device, which, after the mixing process, takes the warm plastic rubber mass in an almost continuous wide band from the mixing roller, leads it through a fluid bath which is provided with an anti-sticking means, then, by means of a forced air cooling, delivers a dried, cooled and no longer sticky band of rubber and which, by means of a forward and backward movement of the conveyor belt (1) and detainers, delivers an upright stack of rubber or delivers, optionally, cut-to-size, dried, cooled, no longer sticky rubber plates in upright stacks, the cutting device (11) and the stacking device being preferably mechanically separated from each other.

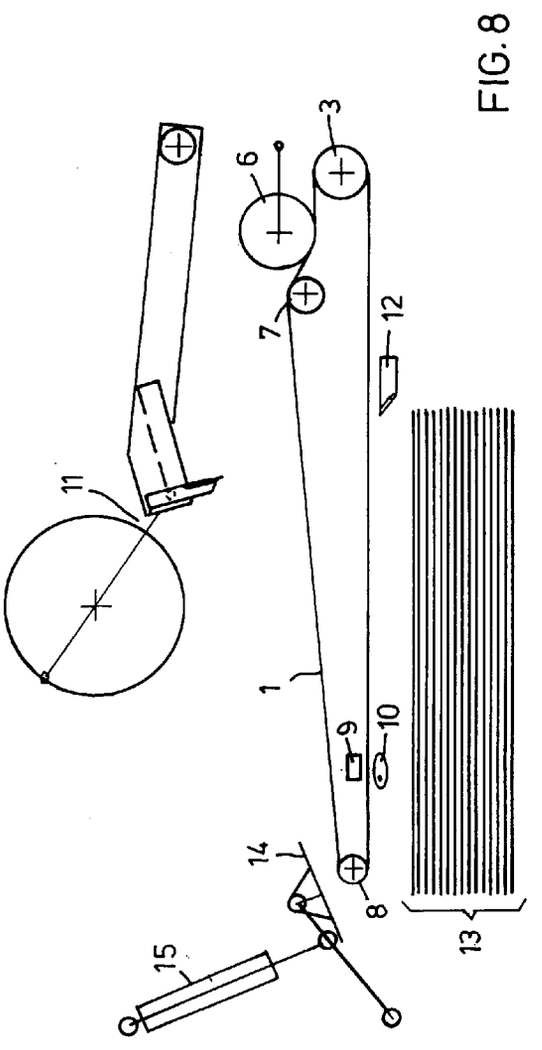

FIG. 8

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The invention relates to a device for cooling and stacking a sheet of rubber, comprising a stacking device for stacking the sheet of rubber.

Such a device is frequently found in the rubber processing industry. At the end of the mixing process which takes place in often large mixers in which rubber polymers, filling materials and ten or so different chemicals are kneaded and mixed, just mixed or newly-made rubber mixtures are formed in such a device into a rubber sheet with the help of high-speed rotors, the mixtures leaving the mixer under high pressure and high temperatures as an unmanageable, formless, hot, plastic rubber mass.

For a long time now the formless mass has been formed by rolling the latter by means of a rolling device, as a result of which a wide band is formed, characterized by a standard width, thickness and temperature and which is still very sticky. The device which is also known under the name of "batch-off" device is also used for reducing the high delivery temperature of 120° to 150° to a manageable temperature of 25 to 40° and for applying an anti-sticking means to the surface of the rolled rubber sheet.

At the end of the cooling path where the rubber sheet reaches a much lower temperature of 25 to 40° and is no longer sticky, the rubber sheet can be delivered by means of a stacking device to stacking frames or lifting platforms, the rubber sheet on the stack having one initial end and one far end suitable for further processing on calenders, spraying machine and other devices.

In the rubber processing industry which is directed towards making so-called technical rubber articles, the continuous band of rubber, which is supplied by the rubber sheet cooling device is cut into easily handled rubber plates in order to simplify further processing by a separate cutting device for the rubber sheet. Not only are two installations necessary for delivering continuous bands of rubber as well as rubber plates, which is uneconomical, but cutting the continuous sheet requires extra time.

It is, among others, an object of the present invention to manufacture in an economical way continuous bands of rubber as well as rubber plates by means of a device for cooling and stacking a rubber sheet .

For this purpose a device of the type named in the introduction is characterized in that the device is provided with a cutting device for the rubber sheet.

By integrating a stacking device as well as a cutting device into one device for cooling and stacking a rubber sheet, there is the possibility of delivering optionally either a continuous rubber sheet or, by means of switching on the automatic cutting device, of obtaining plates cut to length, which are then, or at the same time as the cutting movement, stacked up by the same stacking device on lifting platforms.

In a preferred embodiment the stacking and cutting devices are driven separately, as a result of which it is possible to remove the more maintenance prone cutting device for upkeep, overhaul or replacement, while the rest of the machine can continue to participate in the production process for stacking rubber in a continuous band. Besides, by doing this it is among other things possible to modularly construct the machine, the latter being of advantage when transporting, constructing and maintenancing the device.

Other embodiments and advantages of a device according to the invention follow from the description below which illustrates some embodiments of the invention on the basis of the drawing.

Figure 1 schematically shows a known rubber sheet cooling device with stacking device.

Figure 2 and 3 schematically show an embodiment of a rubber sheet cooling device according to the invention with a stacking as well as a cutting device.

Figures 4 to 7 schematically show the steps of stacking a continuous rubber sheet in the one operating method of a rubber sheet cooling device according to the invention.

Figures 8 to 10 schematically show the steps of cutting and at the same time stacking the rubber plates in the other operating method of a rubber sheet cooling device according to the invention.

A known rubber sheet cooling device 20 is schematically shown in figure 1. In this device 20 just mixed or newly-made rubber mixtures 21 are formed into a rubber sheet 26, by means of a rolling device 22. In this way a wide continuous band of rubber characterized by a standard width, thickness and temperature is made, the band of rubber being sticky. Reduction of the high delivery temperature of approximately 120 to 150°C to a manageable temperature of 25 to 40°C and application of anti-stick means to the surface of the rolled rubber sheet, takes place by means of a cooling device 23. Then the cooled rubber sheet 26 is dried by a drying device 24, after which the rubber sheet is delivered to stacking frames or lifting platforms 27 by means of a stacking device 25, the rubber sheet 26 on the sheet having an initial 28 and a far end, which can be arranged optionally, suitable for further processing. In figure 2 and figure 3 a part 25' of a rubber sheet cooling device according to the invention is schematically shown, in which both the stacking and the cutting function can be carried out. In these figures there is a sheet of cooled, plastic but no longer sticky rubber (not shown) on top of a conveyor belt 1, which comes from the cooling portion. The conveyor belt 1 has a frame, that includes, among others, support rollers 3 and 8. The conveyor belt and frame in their entirety can be moved backward and forward between a position as drawn with full lines and a position shown by broken lines. This movement can, for example, be caused by coupling the conveyor belt with its frame to a drive belt 2. By driving drive belt 2 the whole of support frame of the conveyor belt, the conveyor belt 1 itself and its sup-

port rollers 3 and 8 can be moved. Drive belt 2 is driven by a motor 5, for example a servo direct-current motor or three-phase motor with regulation or a hydro-motor, the support of the drive belt 2 also being realized by roller 4. Among all the many alternatives for realizing this backward/forward movement, by the very choice of this drive belt 2 for moving the whole of conveyor belt and its frame backward and forward it is possible to accurately control this backward/forward movement, as a result of which an exact stacking of the rubber sheet is made possible.

On top of the rubber sheet there is a pressure roller 6, which, in combination with smaller roller 7 sees to it, that the rubber sheet keeps good contact with the conveyor belt 1 below. As a consequence the layers of rubber sheet stacked on top of one another show no unevenness. Neither roller 6 nor 7 are movable by the drive belt 2. The point of reversal of conveyor belt 1 which is formed by roller 8, is movable over a fixed path which is formed between the point of departure of the conveyor belt, indicated by roller 8 and the ultimate position of conveyor belt 1, indicated by roller 8'. This path is controlled by drive belt 2 with its motor 5. During the forward movement of the conveyor belt 1 from its departure position to its ultimate position the rubber sheet can be taken along, because the lowest portion of the conveyor belt 1 is clamped by clamping means 9 and 10 and because the support rollers 3 and 8 are blocked in one direction of rotation, owing to which the conveyor belt 1 will unwind itself to the front during the forward stroke and will consequently take the rubber sheet along with it. On the backward stroke the clamping of the clamping means 9 and 10 is discontinued. There are other possibilities of laying aside the rubber sheet during the forward movement of the conveyor belt 1 to its ultimate position, such as for example driving the conveyor belt itself.

The cutting device is shown schematically in figures 2 and 3 by a hingeable cutting knife 11 and a fixed cutting knife 12. Depending on the operating method of the rubber sheet cooling device, these cutting knives can be placed up to both sides of the rubber sheet, as is shown in figure 2, in which situation the rubber sheet cooling device can deliver rubber plates cut to size, or can be movable to beyond the range of movement of the conveyor belt, as is shown in figure 3, in which situation the rubber sheet cooling device is used to stack a continuous rubber sheet. Moving the cutting device can take place in a variety of ways, for example with the help of hinges. However, it is also possible to keep knives 11 and 12 always positioned on both sides of the conveyor belt, in the course of which during the operating method for the delivery of a continuous rubber sheet, the cutting device which is formed by the knives 11 and 12, is inoperable.

When the conveyor belt with the rubber sheet on it has reached the ultimate position, as is shown by the broken lines, the rubber sheet is clamped to the conveyor belt by a clamping means. This situation is shown in figure 4, in which the clamping device is formed by a clamping surface 14 which is driven in a hinging way by a pressure cylinder 15. The clamping means 14, 15 presses on the rubber sheet at the moment the conveyor belt 1 is moving towards its starting position. The clamping means 14, 15 then flattens the fold in the rubber sheet.

Although there is little or no friction between the rubber sheet and the conveyor belt 1, by applying an anti-sticking means in the cooling water, the clamping means 14, 15 aims at preventing the rubber sheet from also being pulled back during backward movement and has, moreover, the task of flattening the fold.

Before reaching the starting position a roller 17, which is driven by an air cylinder attached to a swivel arm, comes down in order to tighten (figures 5 and 6) and retain the rubber sheet, which is held on one side by the clamping means 14, 15, until a clamping means 16 (fig. 7) takes over the rubber sheet and presses it on the stack after stretching by the roller 17. Clamping means 16 keeps the rubber sheet in place at the next forward movement to the ultimate position of the conveyor belt. It will be clear that before the conveyor belt is moved towards its ultimate position, roller 17 is again moved by hinging action to its position as drawn in figure 5, and before the conveyor belt reaches its ultimate position, clamping device 14, 15 is positioned at a distance from the rubber sheet.

In clamping device 14, 15 and/or 16 there is a mechanism which is not shown, for controlling the height of the growing stack 13 and this height can be adjusted such that in production stacks of rubber are delivered which are uniform in height. Known embodiments employ mechanisms which make use of photocells for controlling the height of stack 13. As these sorts of mechanisms are placed in the generally very warm, dirty, steamy department where the mixing process takes place, these photocells often do not function consistently due to rapid pollution. A mechanical control system in clamping means 14 and 15 is given preference as this is less susceptible to defects.

Figures 8, 9 and 10 show how the combined action between the backward and forward moving conveyor belt 1 cutting device 11, 12 and clamping device 14 is before laying aside, cutting through and stacking up exactly cut, cooled and no longer sticky rubber plates. The backward and forward movement of the conveyor belt 1 between its starting position and its ultimate position takes place in the same way as described above.

In figure 8 the situation in which the conveyor belt 1 has reached its ultimate position is shown, and in this position the rubber sheet on the conveyor belt 1

is clamped by means of clamping means 14, 15. After this the conveyor belt 1 is moved to its starting position, as is shown in figure 9, after which cutting the rubber plate to size takes place. In order to realize this cutting, knife 11 of the cutting device moves to knife 12, by way of, for example, a hinging movement, whereupon the knife 11 is placed at a distance from knife 12. As soon as the cutting action is completed, the conveyor belt moves to its ultimate position, in the course of which the rubber sheet is taken along because the lower portion of the conveyor belt 1 is clamped by clamping means 9 and 10. In this way on the forward movement of the conveyor belt to its ultimate position, no rubber sheet is put onto the stack and when the conveyor belt has reached its ultimate position, as shown in figure 8, the clamping by the clamping means 9 and 10 is discontinued and taken over by clamping means 14, 15. Thus a uniform positioning of the rubber plates is realized.

In addition, there are other ways of preventing the rubber sheet from being laid aside during the forward movement of the conveyor belt, for example by a suitable drive of the conveyor belt itself. In this operating mode roller 17 and clamping means 16 are not essential.

(For convenience sake the drawing of conveyor belt 2 is not shown in all figures.)

Claims

1. Device for cooling and stacking a sheet of rubber, comprising a stacking device for stacking the sheet of rubber, **characterized in that** the device is provided with a cutting device for cutting the rubber sheet.

2. Device according to claim 1, **characterized in that** the stacking device contains a conveyor belt with frame for the rubber sheet, the conveyor belt with frame being movable backwards and forwards.

3. Device according to claim 2, **characterized in that** the conveyor belt is movable with regard to the frame by means of clamping means (9, 10) and rollers which are locked in one direction of rotation.

4. Device according to claim 2 or 3, **characterized in that** the stacking device contains a clamping device for clamping the rubber sheet onto the conveyor belt at the end of the forward movement of the conveyor belt.

5. Device according to claim 4, **characterized in that** the clamping device contains a mechanical control system for the stacking height of the rubber sheet.

6. Device according to claim 2, 3, 4 or 5, **characterized in that** the stacking device contains a roller disposed on a swivelling arm for tightening and holding the rubber sheet during the backward movement of the conveyor belt.

7. Device according to any one of the preceding claims 2 to 6, **characterized in that** the stacking device contains a further clamping device for clamping the rubber sheet during the forward movement of the conveyor belt.

8. Device according to any one of the claims 2 to 6 **characterized in that** the cutting device is formed by a hingeable and a fixed knife.

9. Device according to claim 8, **characterized in that** the stacking and the cutting devices can each be driven separately.

10. Device according to claim 9, **characterized in that** the hingeable knife forms a detachable unit with its drive.

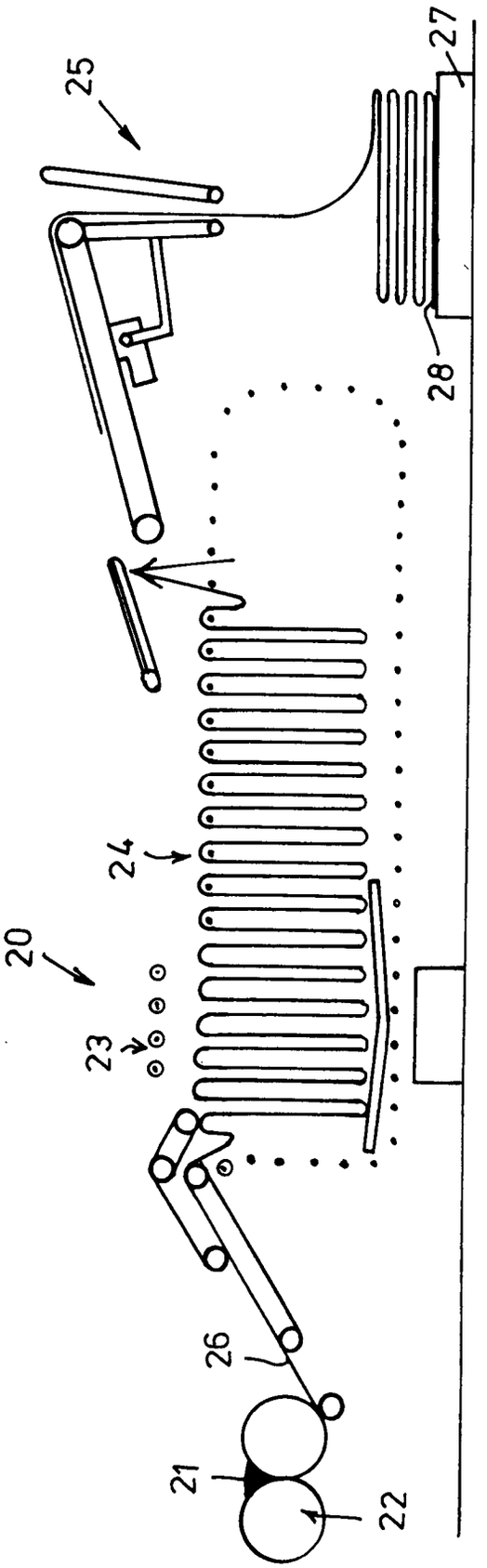

FIG.1

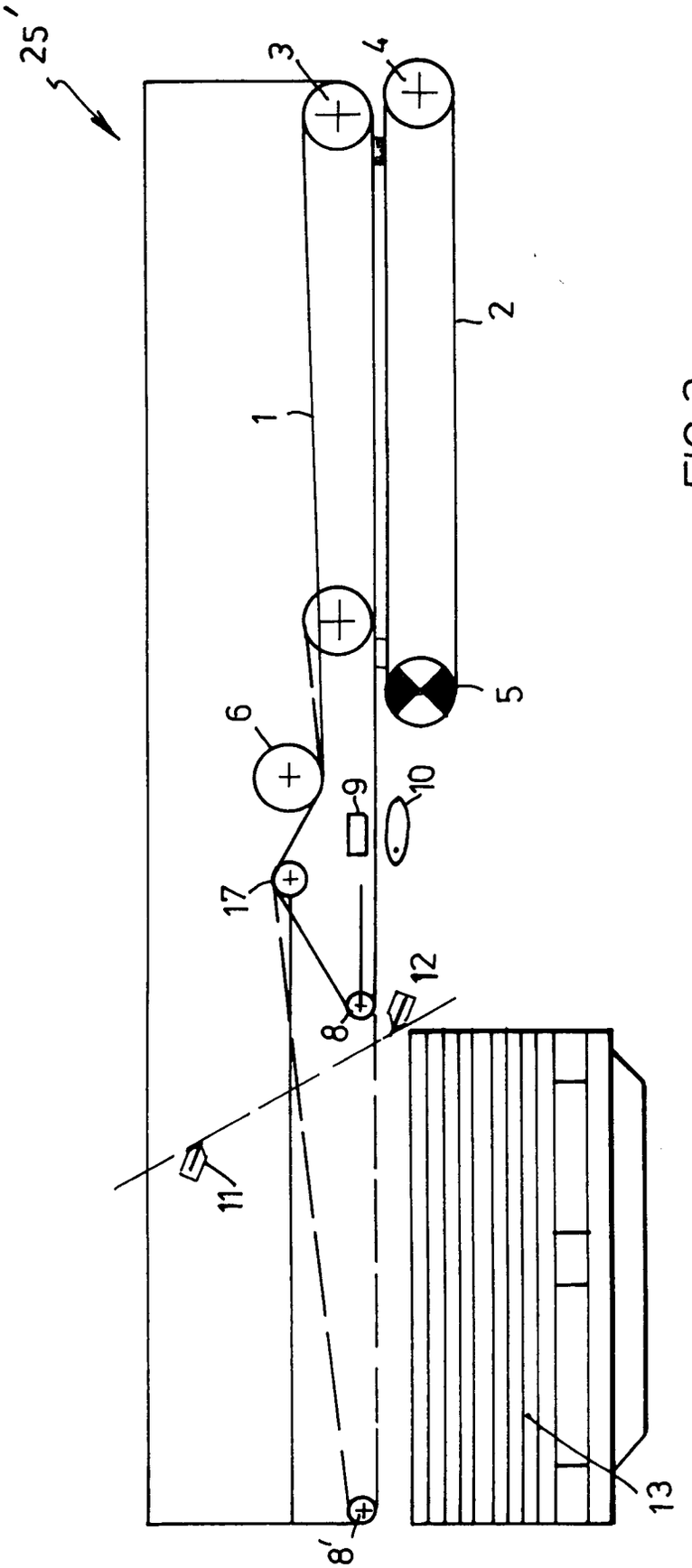

FIG.2

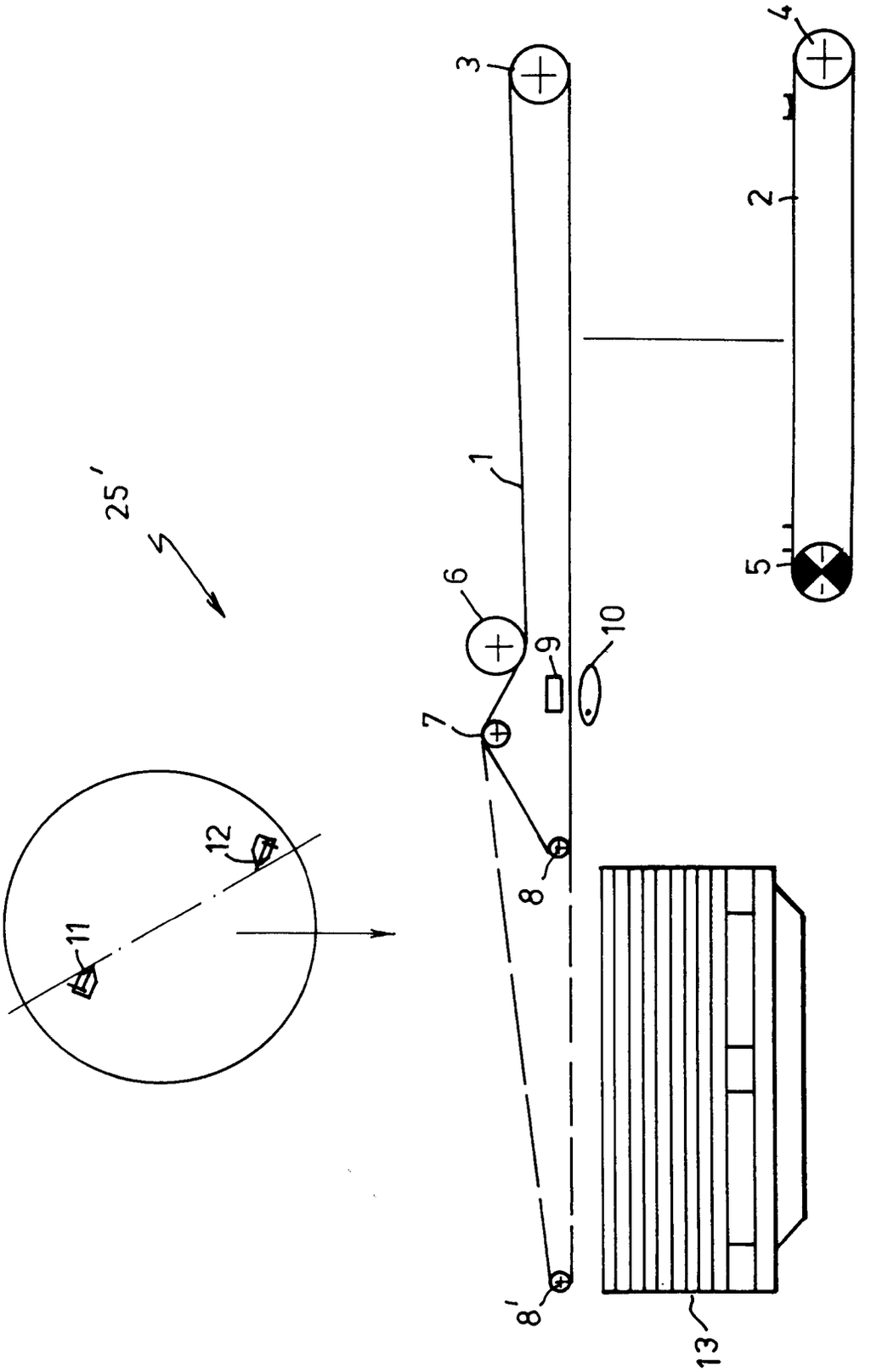

FIG.3

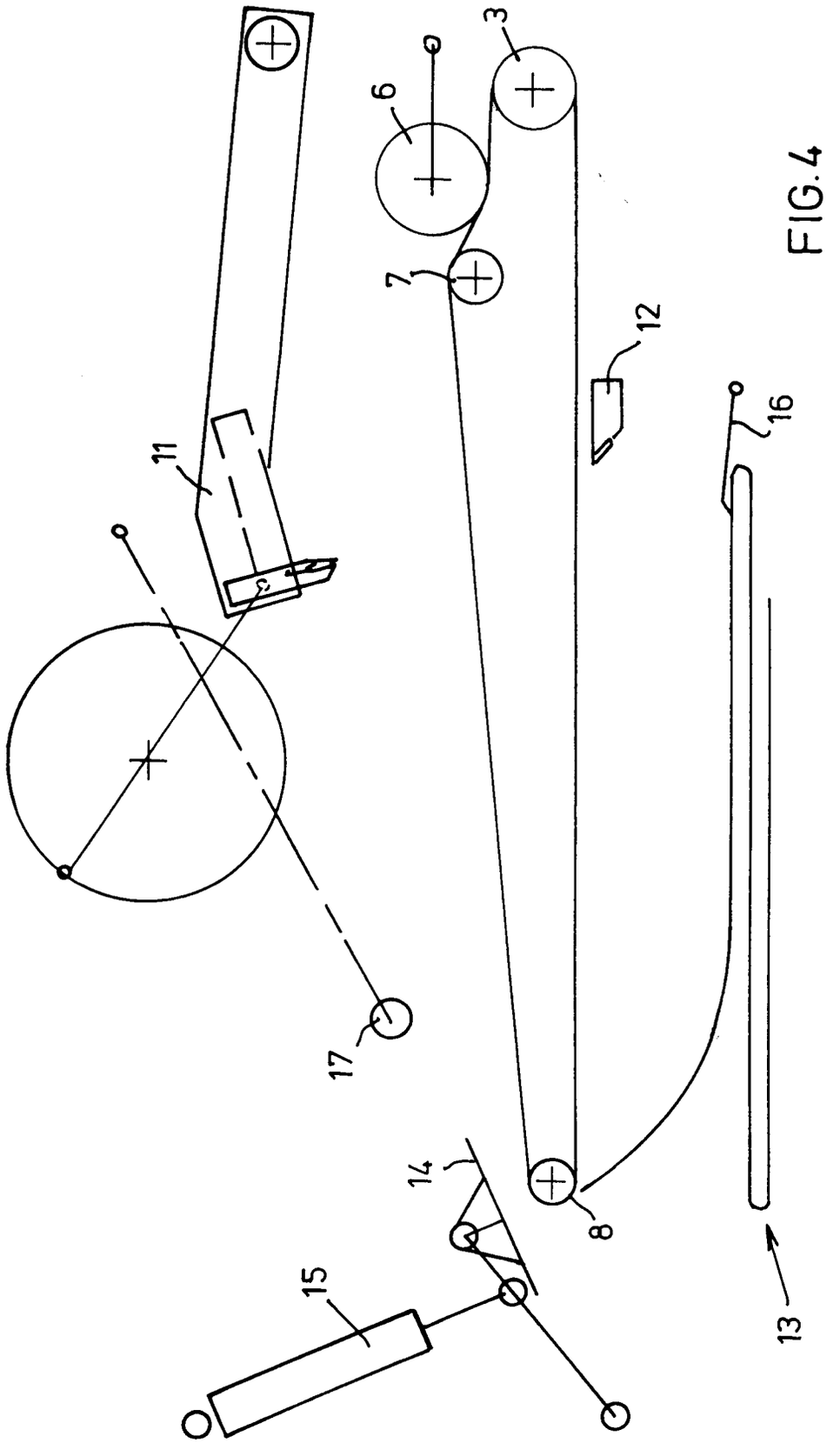

FIG.4

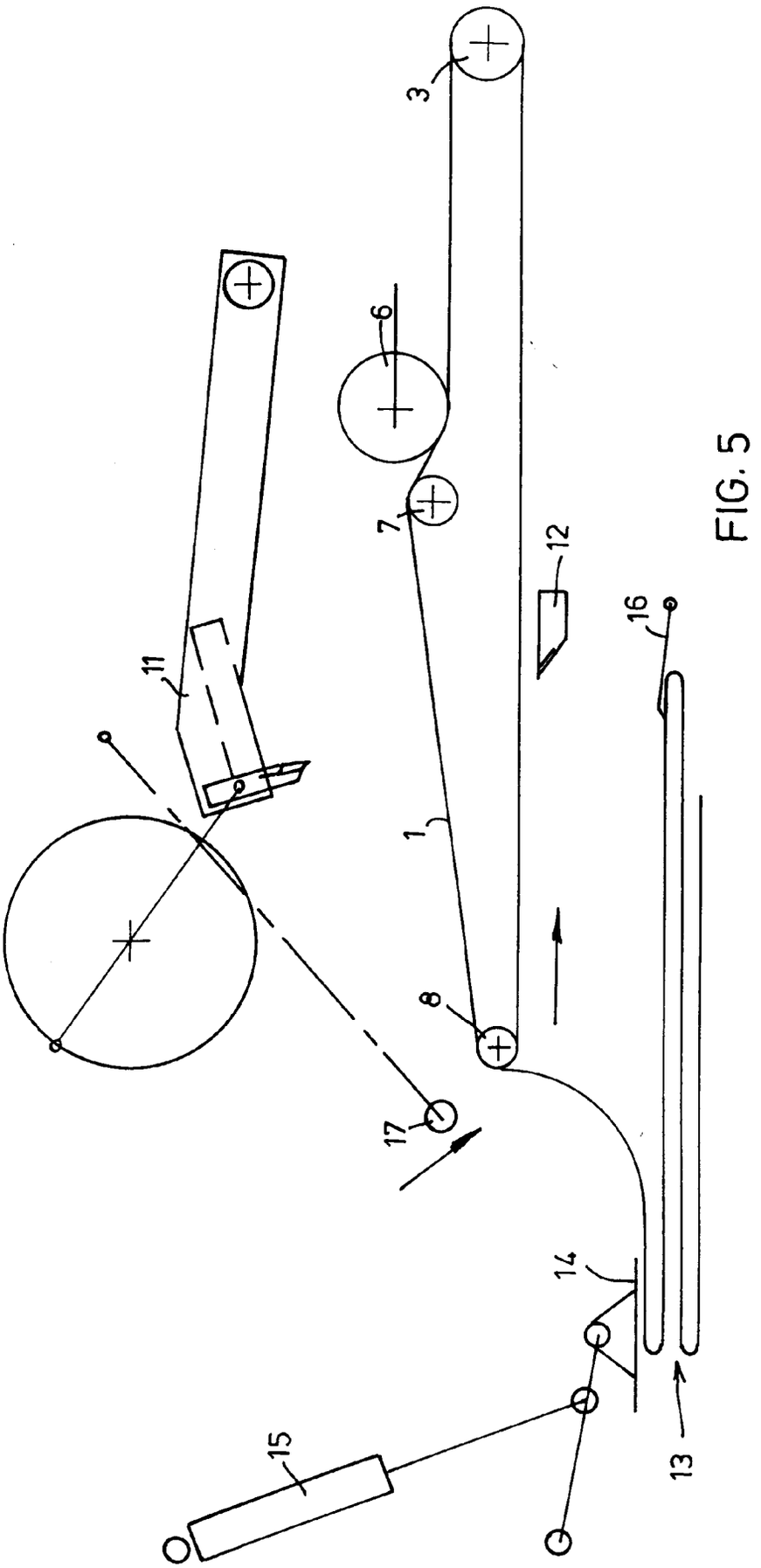

FIG. 5

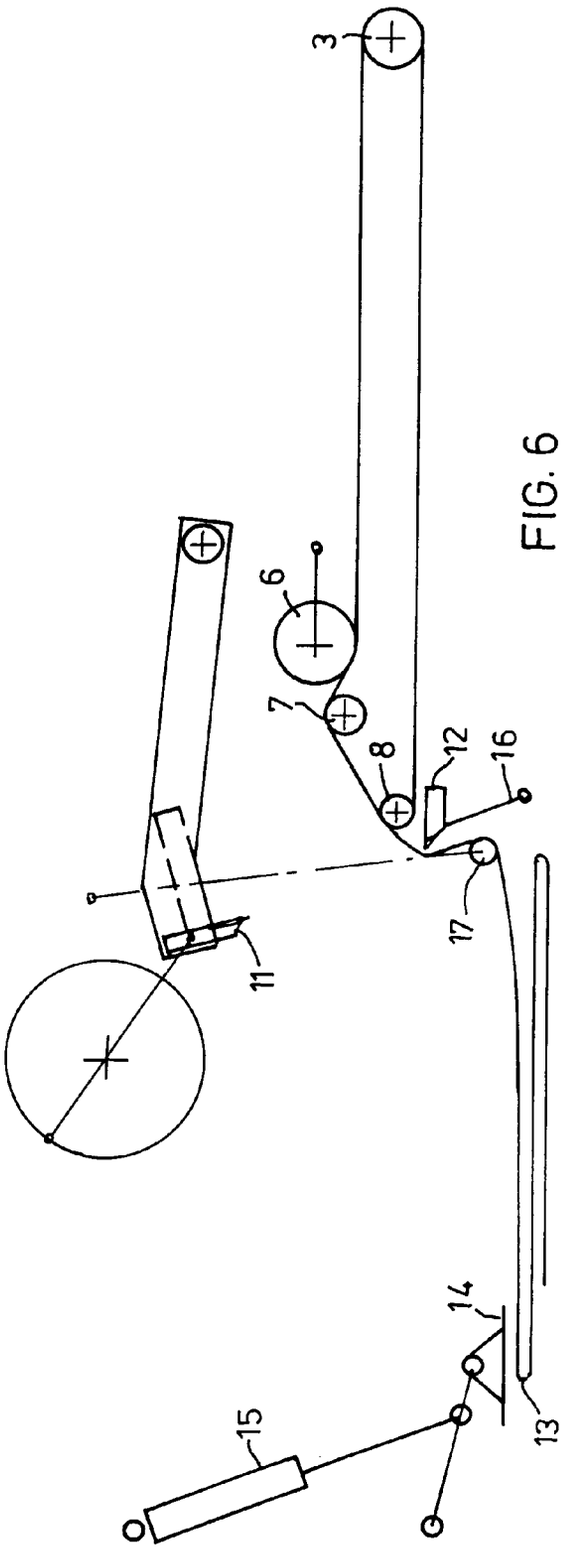

FIG. 6

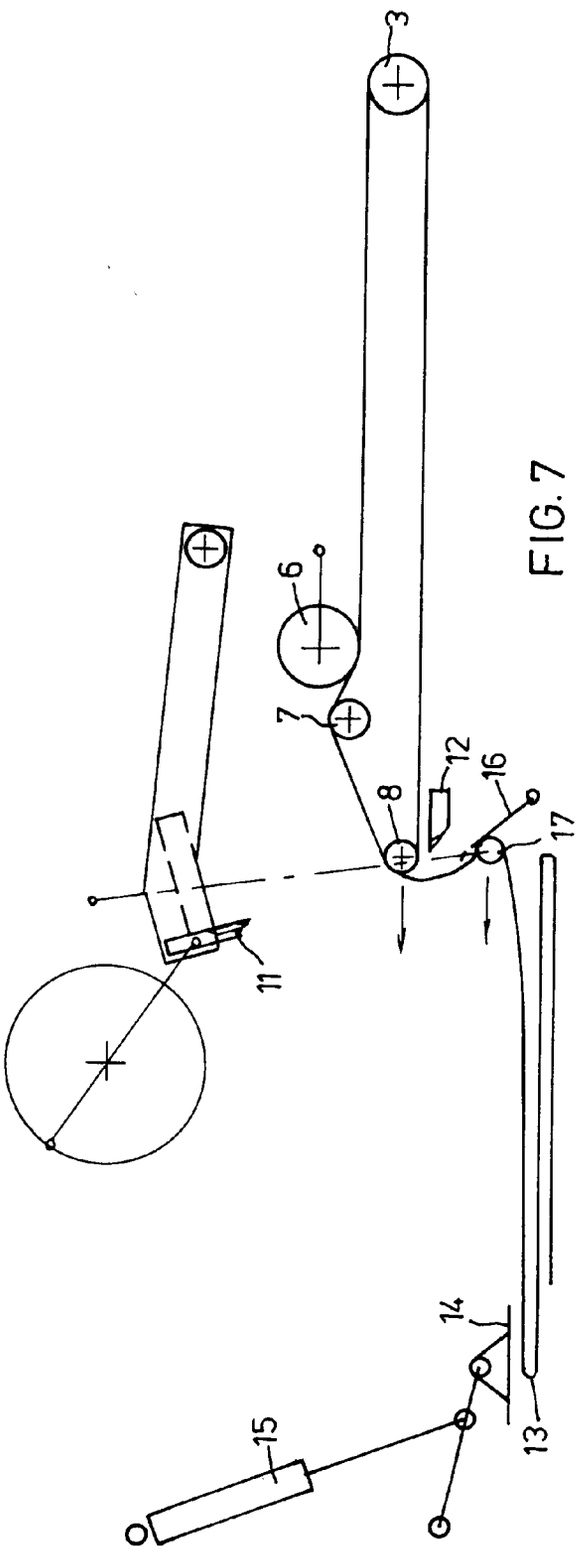

FIG. 7

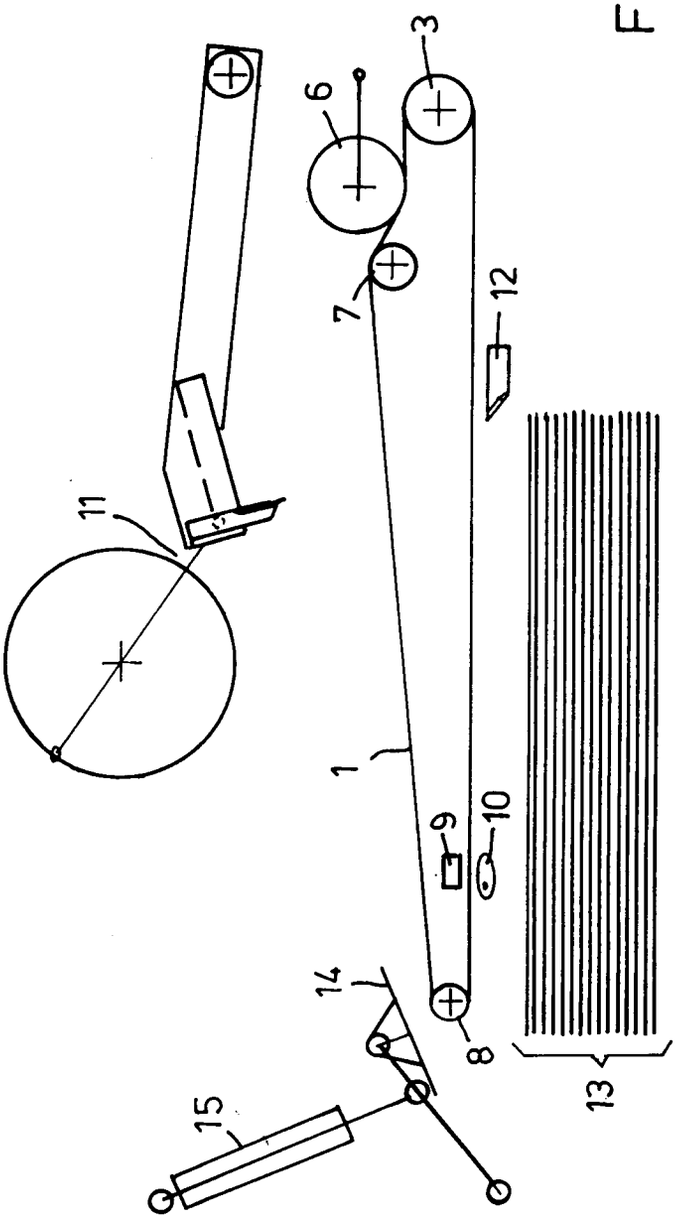

FIG.8

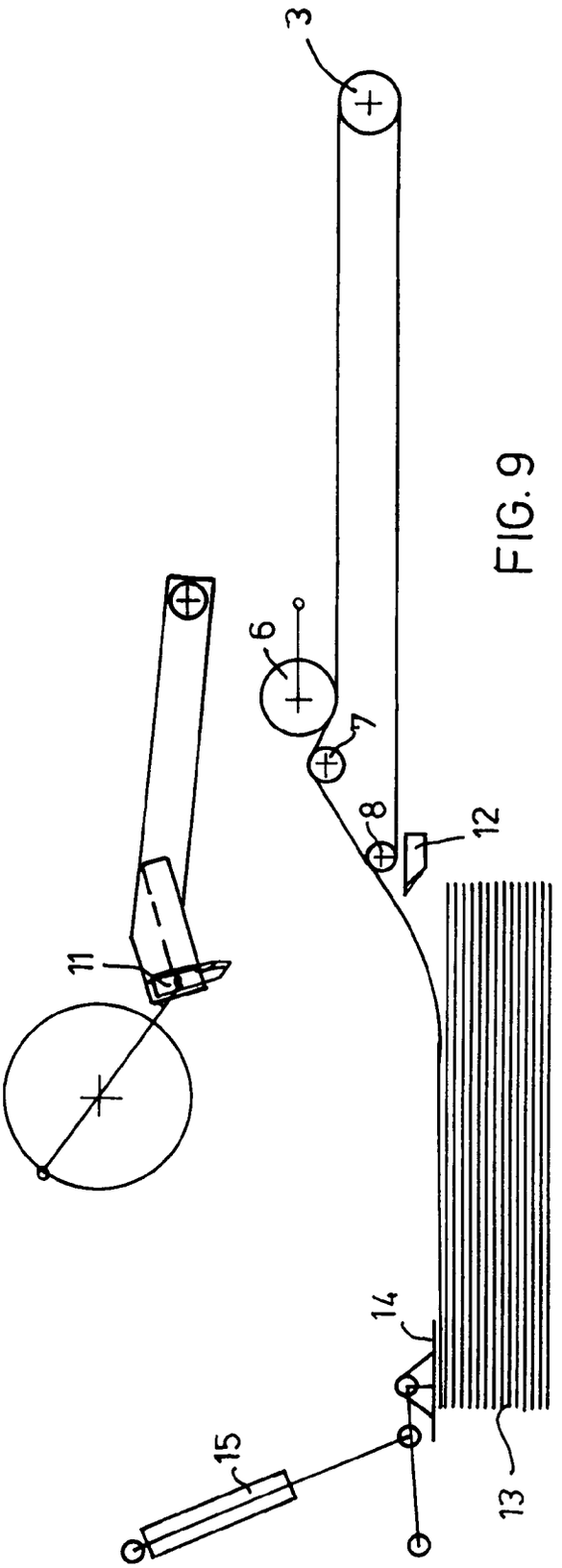

FIG. 9

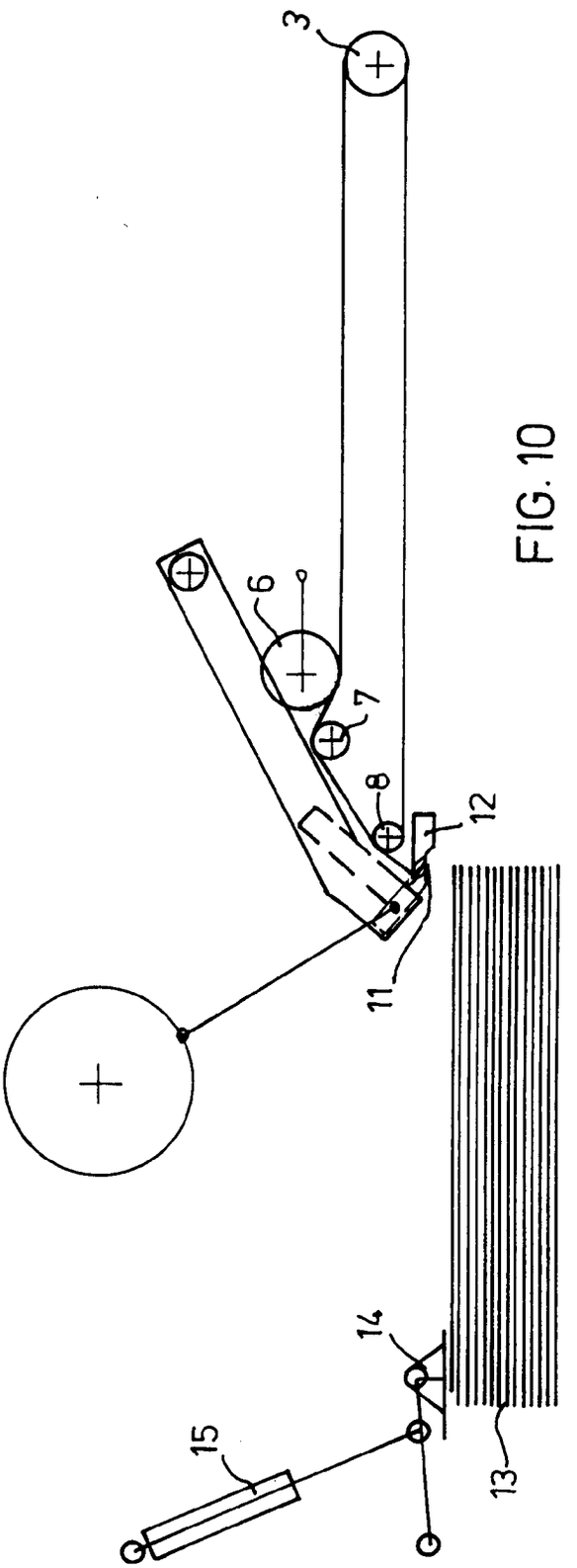

FIG. 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 20 2302

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.6)
X Y	WO-A-90 12749 (EAGLE-PICHER INDUSTRIES) * the whole document *	1,2 3-7	B65H45/101 B65H29/36
Y	US-A-3 495 819 (CURTIS & MARBLE) * the whole document *	4,5,7	
Y	EP-A-0 049 224 (GADDA LUIGI & C.) * page 2, line 25 - page 6, line 11; figures 1-3 *	3,6	
A	DE-A-23 41 235 (GEBR. BORGHART)		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	1 December 1994	Loncke, J

CATEGORY OF CITED DOCUMENTS

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