

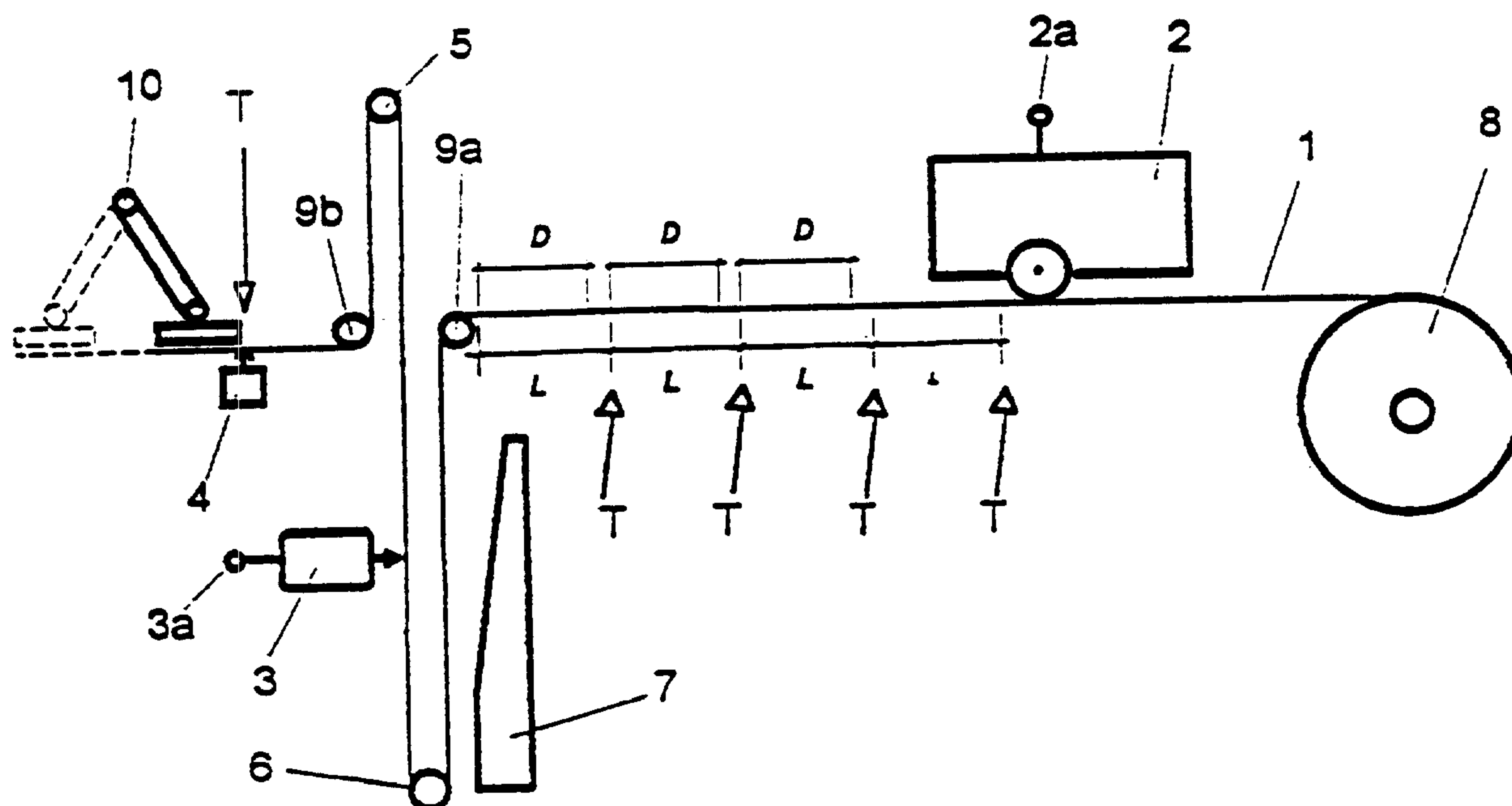
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(54) Title: DEVICE FOR POSITIONALLY EXACT PRINTING OF CONTINUOUS SHEETING



A device for printing unmarked continuous sheeting (1) with images of a first predetermined length (D) has a printer (2) which prints continuously and has an input (2a) which initiates a positionally exact printing process. After printing a cutting device (4) is used to cut up the sheeting (1) into segments of a second predetermined length (L) and the printed images must be produced on the sheeting (1) exactly positioned in relation to the separation points (T) between the segments. Furthermore, there is a sensor (3) which at its output (3a) gives a signal whenever the point corresponding to the start of a segment for printing corresponds to a predetermined multiple of the second predetermined length (L), the output (3a) of the sensor (3) being connected to the input (2a) of the printer (2).



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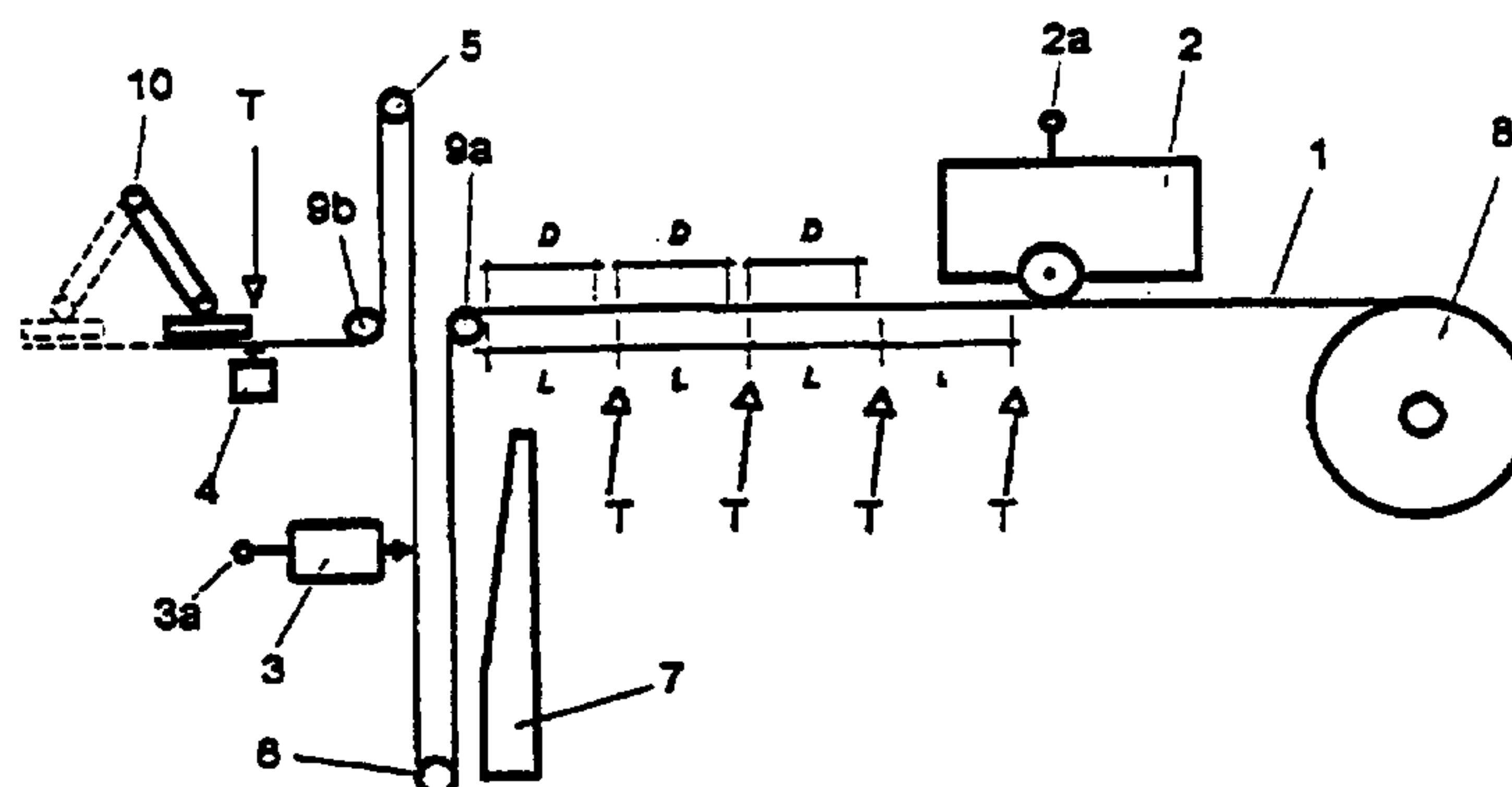
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(57) Abstract

A device for printing unmarked continuous sheeting (1) with images of a first predetermined length (D) has a printer (2) which prints continuously and has an input (2a) which initiates a positionally exact printing process. After printing a cutting device (4) is used to cut up the sheeting (1) into segments of a second predetermined length (L) and the printed images must be produced on the sheeting (1) exactly positioned in relation to the separation points (T) between the segments. Furthermore, there is a sensor (3) which at its output (3a) gives a signal whenever the point corresponding to the start of a segment for printing corresponds to a predetermined multiple of the second predetermined length (L), the output (3a) of the sensor (3) being connected to the input (2a) of the printer (2).

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DEVICE FOR POSITIONALLY EXACT PRINTING OF CONTINUOUS SHEETING

The invention concerns a device for the printing of printed images of a first predetermined length on an unmarked, continuous sheeting, whereby after the printing the sheeting is divided up into segments of a second predetermined length by means of a cutting device and the printed images are necessarily applied to the sheeting in a positionally exact manner with respect to the cut point between the segments.

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A printing device of this type finds application in the pharmaceutical industry, for example. Here it is a matter of providing so-called blister packages, in which tablets, for example, are contained, with a printed image in a positionally exact manner.

The tablets are normally enclosed by a deepdrawn sheeting consisting of plastic or paper, which deepdrawn sheeting is sealed up by a cover sheeting. Located on the cover sheeting is a printed image, usually containing information about the tablets, for example data concerning when the tablets are to be taken. It is therefore crucial that this information is applied to the cover sheeting in accordance with the position of the tablets.

Due to the large quantity of blister packages needed, pre-printed cover sheetings of a very great length are used. The sheetings are usually located on rolls.

Although with the printing techniques known today a very great precision can be achieved, nevertheless the positionally exact joining of the cover sheeting to the deepdrawn sheeting represents a great problem, since existing deviations can accumulate. Thus, in the course of time the position of the printed image would deviate considerably from the required position.

In order to join the cover sheeting to the deepdrawn sheeting in a positionally exact manner, the printed image is laid out on the pre-printed sheeting somewhat smaller than would actually be necessary. The difference in length thereby present is equalized by means of a so-called stretching. The cover sheeting is pulled to the required length by a special device. By deliberately producing a deviation of the length of the printed image in a

certain direction and individually equalizing this deviation again, one indeed avoids an accumulation of production tolerances; however, such a process is very expensive.

To be sure, there is known a printing device for printing labels that are situated on a continuous carrier, with which device the printing process is triggered by a sensor that detects the initial edge of a label. Since the printing process is triggered in each case by a label situated on the carrier, the position of the printed image is dependent on the position of the label on the sheet. Thus, in the application of such a printing device to the printing of blister packages the same problem would arise as with the pre-printed films.

3a

Known from DE 195 00 169 A1 is a printing system for double-sided printing of continuous paper, in which system an intermediate buffer arrangement is arranged between a first and a second printer for absorbing the difference in paper-feed speed between the first and second printers. A detector component detects the amount of retention in the intermediate buffer arrangement. A printer controller stops the printing and the feed through the first printer when the amount of retention exceeds a first value. The printer controller restarts the printing and the paper feed through the first printer when the amount of retention falls below a second value. The printing and the paper feed then take place until the amount of retention again exceeds the first value.

In addition, known from DE 34 20 304 A1 is a device that shows several self-contained printing units, which are able to carry out different printing processes. Furthermore, the device shows one or several independent units for finishing, which are able to carry out different finishing treatments such as perforations or cuttings. Beyond that, the device shows arrangements for the selective control of each of these independent units, which arrangements control the independent units in such a manner that the printing and/or the finishing are adapted to the operation performed by the high-speed printer. The arrangements for selective control show sensors that recognize markings applied to the carrier to be printed upon, which markings are carried out by the high-speed printer.

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3b

It is the task of the invention to specify a printing device of the type mentioned at the beginning, by means of which device a printed image can be applied to a sheeting, whereby the accumulation of an error is to be precluded.

The accomplishing of this task is a result of the features of the characterizing section of claim 1. Advantageous further developments of the invention result from the dependent claims.

According to the invention, provision is made for a printer that has an input for triggering a positionally exact printing process, as well as a sensor that delivers a signal at its output whenever the length of the sheeting between the cutting device and the point corresponding to the beginning of a segment to be printed equals a predetermined multiple of the second predetermined length, the output of the sensor being connected to the input of the printer.

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What is achieved hereby is that beginning of a sheeting segment to be printed upon is continually determined anew. By means of the constantly new determination of the beginning of a section to be printed upon, an error possibly present cannot accumulate. Consequently, even relatively large deviations are generally not harmful, since the deviation present in one segment has no influence on the beginning of the next segment to be printed upon. Likewise, a slippage of the sheeting has no effect.

If the predetermined multiple of the second predetermined length corresponds, for example, to ten times the length of a segment to be printed upon, and if the length of the sheeting between the cutting device and the location on the sheeting where the printer would place the beginning of the printed image with an input signal present is less than ten times the second predetermined length, then the sensor delivers no signal, i.e. a printing process is not begun. Now if further sheeting is transported through the printer so that the length between the cutting device and the printer becomes greater, then the point is just reached where the length of the sheeting between the cutting device and the location where the printer would place its printed image with a signal present equals ten times the second predetermined length. At that moment the sensor delivers an output signal to the printer. That is to say, the printer begins its printing process at precisely the location on the sheeting that corresponds to the beginning of a segment to be printed upon.

In an especially advantageous manner, an electrophotographic printer is used as the printer, for example a laser or LED printer. However, an equally advantageous arrangement involves the use of an ion-transfer printer or a thermo-transfer printer or the like.

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Decisive for the selection of the printer is that the printer can carry out its printing process in a positionally exact manner and the positioning can be controlled by an input signal.

In a particular implementation form of the invention, which is especially advantageous when printed segments are removed from the device in a discontinuous manner, provision is made for the sensor to be an optical sensor that detects the position of a compensation roller, which is movably arranged in such a manner that the position of the compensation roller depends on the length of the sheeting between the cutting device and the printer. By this means a very great precision is achieved.

If sheeting is removed from the printing device at a rate that corresponds to a multiple of the rate at which the sheeting passes through the printer, then the length of the sheeting between the cutting device and the printer becomes shorter. The reduction of the length of the sheeting lasts as long as sheeting is removed from the printing device at an increased rate. If the removal stops, i.e. if temporarily no sheeting is removed from the printing device, the process is reversed. Through a continuous printing process the length of the sheeting between the cutting device and the printer increases.

The compensation roller is provided for in order to equalize the changing length of the sheeting between the cutting device and the printer. The compensation roller is located in a loop of the sheeting, which loop is produced by a turning of the sheeting around the compensation roller. If the length of the sheeting decreases, the compensation roller is moved in the direction of the opening of the loop. If the length of the sheeting increases, the compensation roller moves away from the opening of the loop, whereby the path of the sheeting around the compensation roller is lengthened.

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If the sensor is arranged at the location on the device where the compensation roller is located, then when the path along which the sheeting extends between the cutting device and the point corresponding the beginning of a segment to be printed upon is equivalent to, for example, ten times the second predetermined length, the sensor delivers a signal to the printer. By this means a printed image is produced at the desired location on the sheeting.

The precision can be further augmented by having the change in length of the sheeting located between the cutting device and the printer be detected by means of, for example, a cable slung around the compensation roller, which cable is fixed at its end facing the cutting device and is movably attached at its end facing the printer. In an appropriate manner the cable follows the same course as the sheeting. Since the cable is immovably attached at one end, the position of the cable end arranged so as to be movable is dependent on the position of the compensation roller. Thus the same change in length is found at the movable end of the cable as occurs in the sheeting located between the cutting device and the printer. Since the movable cable end covers double the distance that the compensation roller covers, a sensor arranged at the movable end of the cable would have twice the resolution of a sensor arranged at the compensation roller, which has an advantageous effect on the precision.

For adjustment of the position of the compensation roller, provision is made for an offset roller, which is arranged in such a manner that the length of the sheeting between the cutting device and the printer can thereby be changed. This is of advantage when the size of the printed image or of the segment to be printed upon changes, since in that case the length of the sheeting between the cutting point and the

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printer must be altered. In order to leave the position of the compensation roller unchanged despite the changed length between the cutting device and the printer, the offset roller is shifted far enough that the length of the sheeting located between the cutting device and the printer once again corresponds to a predetermined multiple of the second, now changed, predetermined length when the compensation roller is located opposite the sensor. By this means one avoids the necessity of changing the position of the printer whenever the segment length changes.

A further advantageous configuration of the invention provides for a device by means of which the printer speed is controlled. When application is made of a compensation roller, a proximity sensor has proved to be of particular advantage, which proximity sensor delivers an appropriate signal depending on the distance of the compensation roller from a ramp of the sensor. Since the compensation roller is constantly in motion during the described discontinuous removal of sheeting from the printing device, preferably an average value of the sensor output signal, which owing to the ramp of the proximity sensor is likewise constantly changing, is formed. The offset roller is adjusted so that the point around which the compensation roller oscillates is located approximately in the middle of the ramp with the usual segment length and removal rate. In addition, the control is appropriately designed in such a manner that the magnitude of the sensor signal is limited both above and below. In this way the speed of the printer is likewise subject to a maximum and a minimum.

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If the removal rate or the length of the printed segments increases, more sheeting is removed from the printing device per unit time than before. Since the printer at first continues to print at a constant speed, the length of the sheeting between the cutting device and the printer decreases. In this way the point around which the compensation roller oscillates moves upward, whereby the speed of the printer increases. When the printer speed has adapted to the new segment length and/or removal rate, the compensation roller oscillates around a point that is now located in the upper region of the ramp of the proximity sensor. That is to say, through the changed oscillation midpoint the proximity sensor delivers an average-value signal on the basis of which the printer prints with an increased speed. The same process takes place in the reversed situation, when the segment length shortens and/or the removal rate decreases. In that case the compensation roller oscillates around a point on the proximity sensor that is located in the lower region of the ramp.

Since through the changed oscillation midpoint the vertices of the oscillation movement of the compensation roller also change, the position of the sensor must likewise be changed. The sensor must be shifted sufficiently far that it once again delivers an output signal when the length of the sheeting located between the cutting device and the printer again corresponds to a multiple of the second, if need be, changed, predetermined length of a printed segment.

Further details, features, and advantages of the present invention emerge from the following description of a particular implementation example, reference being made to the drawing.

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The single figure shows a schematic arrangement of a printing device according to the invention.

In a printing device according to the invention a sheeting 1 to be printed upon, which is unwound from a roll 8, is lead through a printer 2. After the printer 2 the sheeting 1 is diverted around a first diverting roller 9a. After the first diverting roller 9a the sheeting winds around a compensation roller 6 as well as an offset roller 5 in an S-shaped manner. The compensation roller 6 as well as the offset roller 5 are located in each case at the bottom of loops formed by the course of the sheeting 1. After the offset roller 5 the sheeting 1 is diverted around a second diverting roller 9b. After the second diverting roller 9b there is a removal device 10, which removes the sheeting 1 from the printing device in a discontinuous manner. With the removal device 10 it is a matter of a conventional device that repeatedly picks up a part of the sheeting 1 and extracts it from the printing device through a shuttling motion.

Arranged ahead of the removal device 10 is a cutting device 4. The cutting device 4 can be designed so that it cuts up the sheeting 1. In any case, the beginning of a region to be printed upon is determined by the cutting device 4. The start of the printed image produced by the printer 2 is dependent on the beginning of the region.

The compensation roller 6 and the offset roller 5 are arranged such that they can be moved towards and away from each other. While the offset roller 5 is lockable, the compensation roller 6 is freely movable.

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Arranged adjacent to the compensation roller 6 is a proximity sensor 7 formed in the shape of a ramp. The proximity sensor 7 is designed or arranged in such a manner that the distance from the compensation roller 6 to the proximity sensor 7 constantly varies over an active region in the course of the movement of the compensation roller 6. Outside the active region the distance from the compensation roller 6 to the proximity sensor 7 is constant.

A sensor 3 is arranged approximately at the height of the lower third of the active region of the proximity sensor 7. The sensor 3 is formed as a photoelectric beam and has an output 3a. A signal appears at the output 3a of the sensor 3 whenever the compensation roller 6 is located in a certain position in front of the sensor 3. The position is appropriately located in the lower third of the active region of the proximity sensor 7 with printed images of medium length and a medium removal rate. Such an adjustment can be made through the offset roller 5. The output 3a of the sensor 3 is connected to the input 2a of the printer 2. If the length of the segment containing the printed image changes, then the sensor 3 must be shifted so that it is suited to the changed length of the sheeting located between the cutting device 4 and the printer 2.

During the time in which the removal device 10 is situated in a resting position for the picking up of a segment of the sheeting 1, no sheeting 1 is removed from the printing device. With a continuous passing of sheeting 1 through the printer 2, the length of the sheeting 1 that is located between cutting device 4 and the printer 2 increases. Consequently, the compensation roller 6 moves downward. The compensation roller 6 sinks until sheeting 1 is removed from the printing device by the removal device 10. The representation in the figure corresponds approximately to the point in time at which the removal device

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10 begins to remove sheeting 1 from the printing device.

Through the removal process sheeting 1 is removed from the printing device at a speed that corresponds to a multiple of the speed at which the sheeting 1 passes through the printer 2. Since more sheeting 1 is removed from the printing device than is transported through the printer 2, the length of the sheeting 1 between the cutting device 4 and the printer 2 becomes shorter. Owing to the shortening of the length the compensation roller 6 is moved upward.

At the moment when the compensation roller 6 is in the position in which the sensor 3 delivers a signal through its output 3a to the input 2a of the printer 2, the length of the sheeting 1 between the cutting device 4 and the position corresponding to beginning of a segment to be printed upon equals, for example, ten times the length of a segment to be printed upon. Since precisely at that moment the printer 2 receives a signal to print, the printed image is placed exactly at the beginning of a segment to be printed upon. It goes without saying that, depending on the printer type, if consideration must be given to a stretch that corresponds to, for example, the portion of the circumference of a printer imaging roller between the locations of the imprinting onto the image roller and the printing from the roller onto the sheeting 1, this portion must be taken into consideration through an appropriate offset compensation.

The offset roller 5 is arranged in such a manner that the oscillation movement of the compensation roller 6, which is due to the discontinuous removal of sheeting 1 from the printing device, takes place near the middle of the active region of the proximity sensor 7 when the length of segment receiving the printed image and the removal rate are medium.

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If the first predetermined length D of the printed image increases, and therewith the second predetermined length L of the segment to be printed upon, then the portion of the sheeting 1 that is located between the cutting device 4 and the printer 2 must likewise increase, since the length of this portion must always correspond to a predetermined multiple, for example ten times, of the second predetermined length L . The compensation roller 6 would hereby pass out of the region of the proximity sensor 7. The offset roller 5 must therefore be shifted upward far enough that the oscillation motion of the compensation roller 6, which is made greater by a larger segment to be printed upon, once again takes place around a point in the middle of the active region.

Since the sensor 3 must deliver a signal at its output 3a whenever the length of the sheeting 1 located between the cutting device 4 and the printer 2 equals, for example, ten times the second predetermined length L , the sensor 3 is appropriately arranged so as to be movable. It can thus be adjusted to the variable path of the compensation roller 6.

Although the present invention has been described on the basis of a printing device from which the sheeting 1 is removed in a discontinuous manner, it can nevertheless also find application with a continuous removal of sheeting 1 from a printing device. Since with a continuous removal of sheeting 1 from a printing device the compensation roller 6 can be dispensed with, if necessary, a different structure of the printing device would result. However, the presence of a sensor 3 is essential, which sensor delivers a signal at its output whenever the length of the sheeting 1 located between the cutting device 4 and the printer 2 corresponds to a multiple of the second predetermined length of the segment to be printed upon.

CLAIMS:

1. An apparatus for accurately imprinting, onto a continuous unmarked foil, print images of a predetermined first length D, wherein said foil is divided, after the imprinting, into sections of a predetermined second length L, on which said print images are accurately positioned, said apparatus comprising: a printer including an input for receiving a signal to initiate printing of said printer, a foil section removal and cutting device disposed in spaced relationship from said printer and receiving said foil which has been imprinted by said printer for cutting said foil into said sections L, a foil guide structure for transferring said foil from said printer to said foil section removal device along a predetermined foil path and including guide rollers and a compensating roller around which said foil extends to form a loop, said compensating roller being movably supported so as to accommodate slack in said foil during periods in which said foil section removal device is inoperative, a sensor arranged adjacent said foil loop for detecting the position of said compensating roller which depends on the length of the foil between the cutting device and the printer, said sensor having an output connected to the input of said printer for supplying a printing signal to said printer when said compensating roller passes said sensor at which point the length of said foil between said cutting device and the point of the foil corresponding to the beginning of a section to be imprinted is a predetermined whole number multiple of the second length L of said sections to initiate printing of said printer accurately within a section of said foil.

2. An imprinting apparatus according to claim 1, wherein said printer is a continuously printing electrophotographic printer.

3. An imprinting apparatus according to claim 1,

wherein an offset roller is disposed along the path of said foil such that said foil loop is formed between one of said guide rollers, said compensating roller and said offset roller, said offset roller being movably supported for controlling the length of said foil between said cutting device and said printer.

4. An imprinting apparatus according to claim 1, wherein means are provided for controlling the printer speed depending on the mean position of said compensation roller.

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