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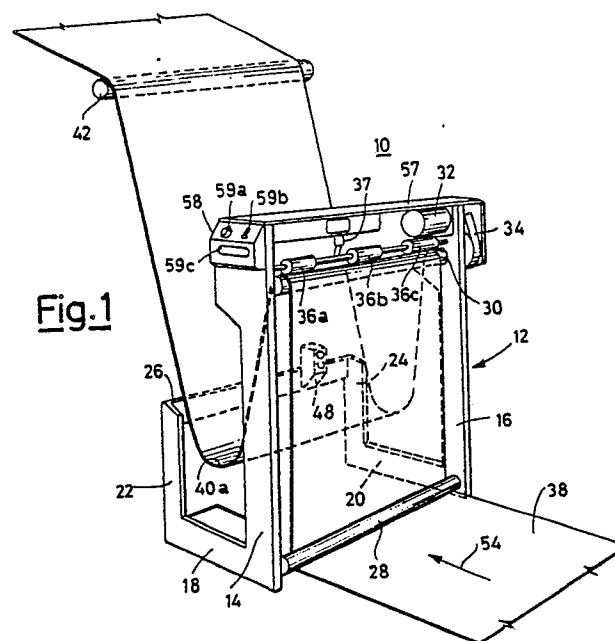
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54 **Compensation loop device for a web and operation.**

57 Compensation loop device put between a web (38) supply and the input of said web in a paper using machine such as a high speed printer, for example a laser printer, including a frame provided with sliding feeding rollers (28 and 30), the latter roller (30) is driven by an electrical motor (32) that accelerates or decelerates said web (38) coming into said machine according to becoming shorter or longer said loop (40).



The present invention is referred to a device generating a compensation loop on a web that is sent to graphic machines, such as printers.

In the graphic industry there is often the problem of providing a continuous web for printing paper coming from supply means, such as a reel or a box containing said web in a folded configuration to a printer, wherein said printer may work in an intermittent way, while said web, even though does not have to arrive in a continuous manner and at a constant rate to the printer, however its running cannot be suddenly started or stopped because it could be torn or piled up in an excessive quantity at the printer input, where sliding problems might arise.

Therefore an object of the present invention is that of providing a device generating a loop in a web feeding a graphic machine, for compensating the intermittent operating of said graphic machine, meaning that sometimes said web is not required and sometimes there is a strong necessity thereof.

Another object is that of providing signal means capable of detecting the formation of a loop in a web at the input of said graphic machine.

Another object is to stop the web letting in to said graphic machine when a loop formed in said device exceeds a first prefixed length and to start it again when said loop is shorter than a second prefixed length (that is its length is too short).

A further object is to cause said stopping or said starting of the movement of said web to take place in a gradual way to prevent the paper from being spoiled.

A known method to signal an excessive shortening or lengthening of said loop is to employ very sensible microswitches respectively connected both to a tray whereon the loop bottom can lay and to a short rod that can be lifted from the loop when the loop is shortening too much, said microswitches operating a motor controlling the entrance of the web to said graphic machine.

This method has the disadvantage of requiring very sensible microswitches and consequently of being readily disturbed by vibrations typical of this kind of machine. Moreover very weak microswitches can fail very often losing their operation and therefore the control of the web loop with consequences that can be easily understood.

Another method uses proximity detectors such as capacity detectors by which the capacity variation of an electrode as caused by the presence of an insulating material such as a web is sensed. These kind of detectors have a good strength and are relatively insensible to vibrations, but they have the drawback of requiring frequent adjustments when the web composition changes or the environmental conditions changes the moisture content of said web.

Shortly, the device of the present invention consists of a frame (12) put between a storage or supply for paper to be printed and a graphic machine, such as a printer, said frame being provided with at least one roller (30) driving a web (38) that comes into the graphic machine after having formed a compensation loop (40), said roller (30) being driven by motor means (32) the turning on of which depends on the detection of a prefixed length of said loop (40) by a web presence detector.

Particularly, said frame (12) includes two rollers, one (28) of which is idle and is used to take said web (38) around another driving roller (30) in turn driven by said motor (32) and helped in driving said web by counter-rollers (36a-36c) which press said web against said roller.

According to a preferred embodiment of the present invention, the loop (40) of the web (38) is supported upstream by said driving roller (30) and downstream by another driving roller (42) that is part of the graphic machine receiving the web (38).

According to another preferred embodiment, said web presence detector is composed by a lamp (50) and photodetector (52) assembly by which the presence of the loop (40) of the web (38) in its proximity through the light reflected by said web (38).

According to said last mentioned preferred embodiment, the photodetector (52), which detects the presence of the loop (40) of the web (38), has a digital output, indicating the absence or the presence of said loop (40) without considering the small variations of said reflected light. Moreover, said photodetector (52) is equipped with an electronic circuit (60) having a narrow hysteresis loop the output of which changes in the as much as possible clear cut way and without uncertainty from a high state to a low state respectively corresponding to the absence or presence of said web (40).

Particularly, said electronic circuit (60) includes a voltage comparator (68) comparing the output of said photodetector (52) with a voltage prefixed by voltage regulator means (74) setting said electronic circuit (60) to change its state at a prefixed distance between the photodetector (52) and the loop (40) of said web giving place to a predetermined reflected light intensity.

In addition, in order to obtain a gradual acceleration up to a maximum speed of the motor (32) of said driving roller (30) and a gradual deceleration to a complete stop of said motor (32), said voltage comparator (68) is followed by a ramp generator circuit (76) by which the speed of said motor is adjusted varying it from a zero to a maximum value and back from the maximum value to zero in prefixed times permitting accelerations and decelerations of the motor (32) such as not to

spoil said web (38).

The features and the advantages of the present invention will be better appreciated from the following description of an embodiment referred to the enclosed drawings, wherein:

figure 1 is a partial perspective view of the compensation device according to the present invention,

figure 2 is a side cutaway projection view of the device shown in figure 1;

figures 3 shows a simplified electronic circuit connecting a loop presence photodetector with an electric motor for advancing a web.

Referring to the figures and particularly to figures 1 and 2, it can be seen a compensation loop device 10 according to the present invention as including a frame 12 formed by two first vertical struts 14 and 16, two longitudinal members 18 and 20 attached to the base of said struts 14 and 16, two shorter vertical struts 22 and 24 and a cross member 26 connecting said struts at their top. The two first vertical struts 14 and 16 support, in the lower part, a first idle roller 28 and in the upper part, a second roller 30 driven by an electric motor 32 by suitable means such as a belt 34. Supporting counter-rollers 36a, 36b, 36c, keep pressed, by means of a device 37, a web 38 against a second roller 30 after it has passed around the idle roller 28, said web 28 coming from a paper storage, such as a reel or a box (not shown).

The web 38 after coming down from the roller 30 forms a loop 40 which during the operation can take positions 40a and 40b and then comes up to another roller 42 fixed by brackets, such as a bracket 44 to the body (48) of a graphic machine.

The right shape of the loop 40 is detected by a proximity detector consisting of a lamp or light emitting means 50 and of a photodetector 52, sensing a light ray emitted by the lamp 50 and reflected or diffused by the loop 40 of the web 38 that is running in the direction of the arrows 54 and 56.

The upper ends of the struts 14 and 16 are joined by a bridge 57, supporting the motor 32 and the device 37 by which the counterrollers 36a, 36b, 36c are placed against the roller 30 and one of the struts has a housing 58 for controlling circuits for the web 38 provided with knobs and displays 59a, 59b and 59c.

An electronic circuit for detecting the loop 40, as shown in figure 3, includes a phototransistor 62 connected by a load resistor 64 to a continuous input voltage $+V_R$ and by a coupling resistor 66 to a not inverting input of a voltage comparator circuit 68 that through a feedback resistor 70, whose value can be determined by a person skilled in the art, has a narrow hysteresis loop to promote a clear cut and definite change of its input state. The

inverting input of the voltage comparator 68 is connected through a coupling resistor 72 to a potentiometer 74 whose adjustment influences the sensibility of the circuit 60 and therefore the distance between the loop and the proximity detector 48 causing the state change at the output of the comparator 68.

The output of the comparator 68 is connected to an input of a ramp generator 76 that upon receiving at said input a stepped signal both upwardly and downwardly transforms the said signal at the output in a ramp signal extending the duration of said variation. The ramp signal is taken to a second input by a feedback connection 78 to give linearity thereto and it is applied to an input of a driving amplifier 80 the purpose of which is to supply to an electric motor, such as the motor 32, having a speed proportional to an applied voltage.

The operation of the present invention is as follows: a web 38 to be printed, drawn from a supply is passed around the rollers 28 and 30 of the frame 12 and then, after having formed a loop 40, comes to a roller 42 of the graphic machine.

The motor 32 rotates at its maximum speed driving the roller 30 and thus the web 38, the loop of which takes the positions 40, 40a, 40b. While the loop goes from the position 40 to the position 40b, the light reflected from the emitter 50 to the photodetector 52 changes from an intensity almost zero to an increasing intensity, making the phototransistor of figure 3 more and more conductive until its collector voltage gets down to a value at which it commutates the output of the voltage comparator 68 from its high value to the low one. At that point the ramp detector 76 initiates a descending ramp at its output causing the motor 32 to gradually decelerate until it stops. Once the motor 32, is stopped the roller 42 keep on drawing the web 48 in such a way that its loop goes from the position 40b to the position 40 where the lacking of light impinging onto the photodetector 52 restores a high voltage at the output of the voltage generator 68 and a gradual return of high voltage according to a rising ramp at the output of the ramp generator 76. This in turn causes the motor to gradually accelerate again which in turn causes the web 38 to form again the loop passing from the position 40 to the position 40b and the operating cycle of the motor 32 is repeated.

If for any reason the graphic machine stops, the web 38 would never be drawn by the roller 42 and the loop would quickly extend below the position 40b causing the motor 32 to stop according to the characteristics of the ramp of the generator 76 thus ensuring the same web to stop gently.

In the same way, the raising of the loop above the position 40 would cause the motor 32 to operate according to the characteristics of the ramp

ensuring the restarting of the web 38 without being torn.

The hereinabove described embodiment is a preferred and not limiting form of the present invention and it is obvious that changes and substitutions with functionally equivalent elements for one or more components of the described device will lead to embodiments to be considered all within the scope of the invention.

For example the ramp circuit 36 could be substituted for by stepping function generator or by a microprocessor providing a series of numerical data that is able to provide gradual acceleration and deceleration controls for the motor 32.

Claims

1. Compensation loop device for a web consisting of a frame (12) put between a storage or supply for paper to be printed and a graphic machine, such as printer characterized by that said frame (12) is provided with at least one roller driving a web coming into a graphic machine after having formed a compensation loop (40), said roller (30) being driven by motor means (32) the turning on of which on the detection of a predetermined length of said loop (40) by a presence detector (48) of said web (38).

2. Compensation loop device, according to claim 1, characterized by that said frame (12) comprises two rollers, one (28) of which is an idle roller serving to take said web (38) around another driving roller (30) in turn driven by said motor (32) and helped in this driving action by counter-rollers (36a-36c) which press said web against said roller.

3. Compensation loop device, according to claim 2, characterized by the loop (40) of the web (38) is supported upstream by said driving roller (30) and downstream by another driving roller (42) that is part of the graphic machine receiving the web (38).

4. Compensation web device, according to claim 2, characterized by that said presence detector consists of a lamp (50) and a photodetector (52) assembly by which the presence in its proximity of the loop (40) of the web (38) is detected through the light reflected by the web itself (38).

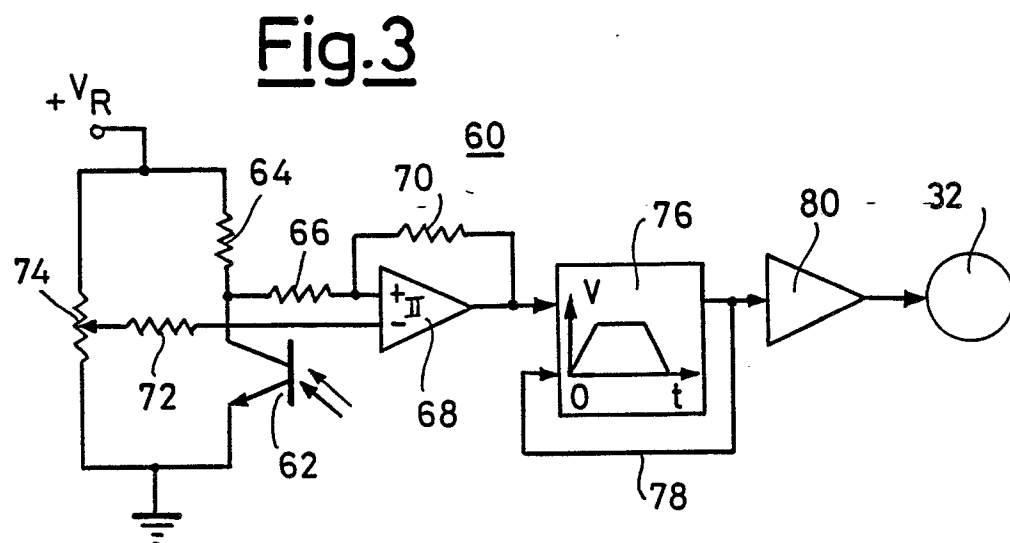
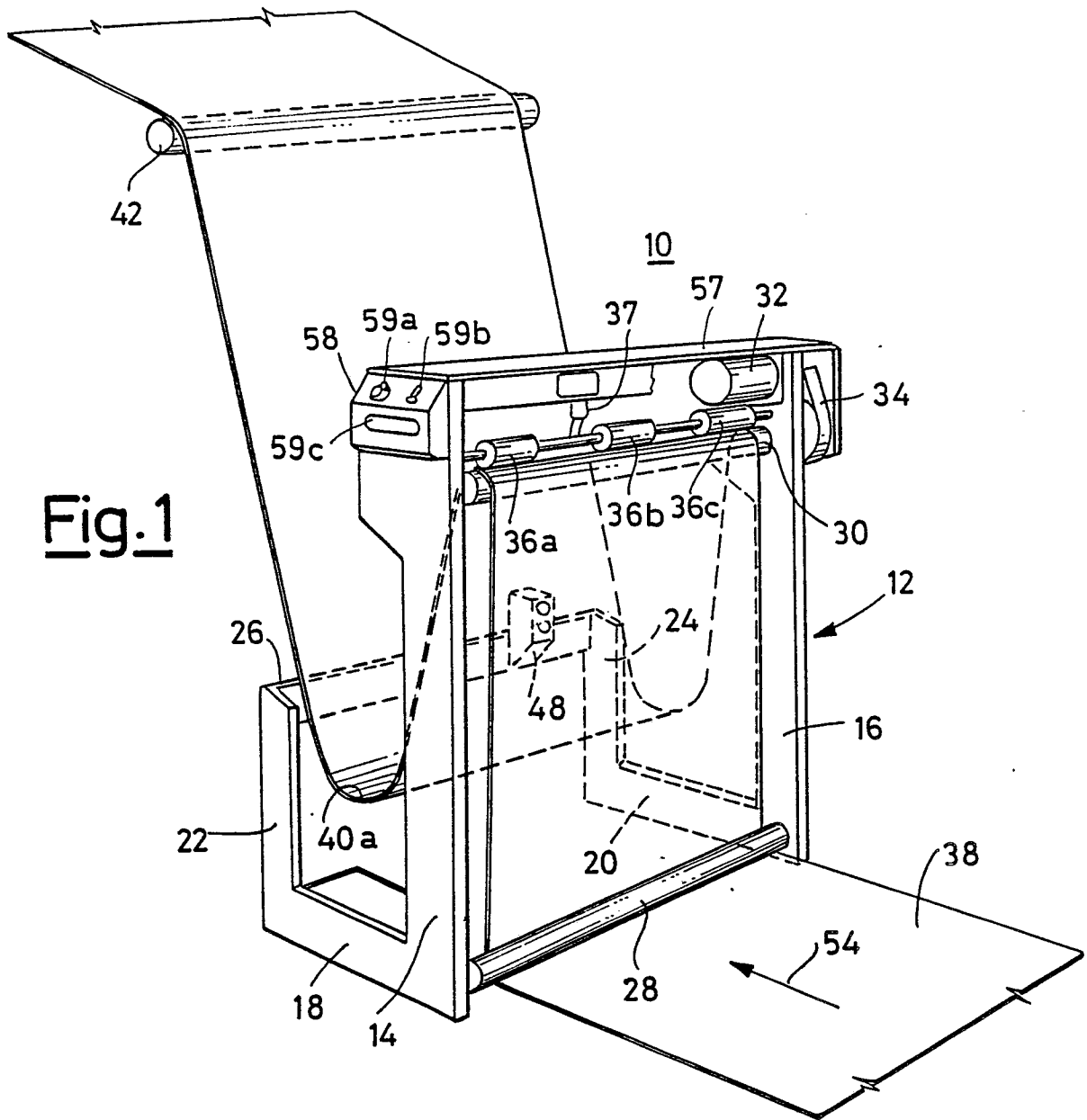
5. Compensation loop device, according to claim 4, characterized by that the photodetector (52) sensing the presence of the loop (40) of the web (40), has a digital output, detecting the absence or presence of said loop (40) without considering small variations of said reflected light.

6. Compensation loop device, according to claim 5, characterized by that said photodetector (52) is equipped with an electronic circuit (60) having a narrow hysteresis loop, the output of

which changes in the as much as possible clear cut way and without uncertainty from a high state to a low state respectively, corresponding to the absence or the presence of said loop (40).

7. Compensation loop device, according to claim 6, characterized by that said electronic circuit (60) consists of a voltage comparator (68) comparing the output of said photodetector (52) with a voltage, prefixed by comparator means (74), setting said electronic circuit (60) to change its state at a prefixed distance between the photodetector (52) and the loop (40) of said paper web giving place to a predetermined reflected light intensity.

8. Compensation loop device, according to claims from 5 to 7, characterized by that in order to obtain a gradual acceleration up to the maximum speed of the motor (32) of said driving roller (30) and a gradual deceleration to a complete stop of said motor (32), said voltage comparator (68) is followed by a ramp generator circuit (76) by which the speed of said motor is adjusted, varying it from zero to a maximum value and back from the maximum value to zero in prefixed times permitting accelerations and decelerations of the motor (32) such as not to spoil the web (38).



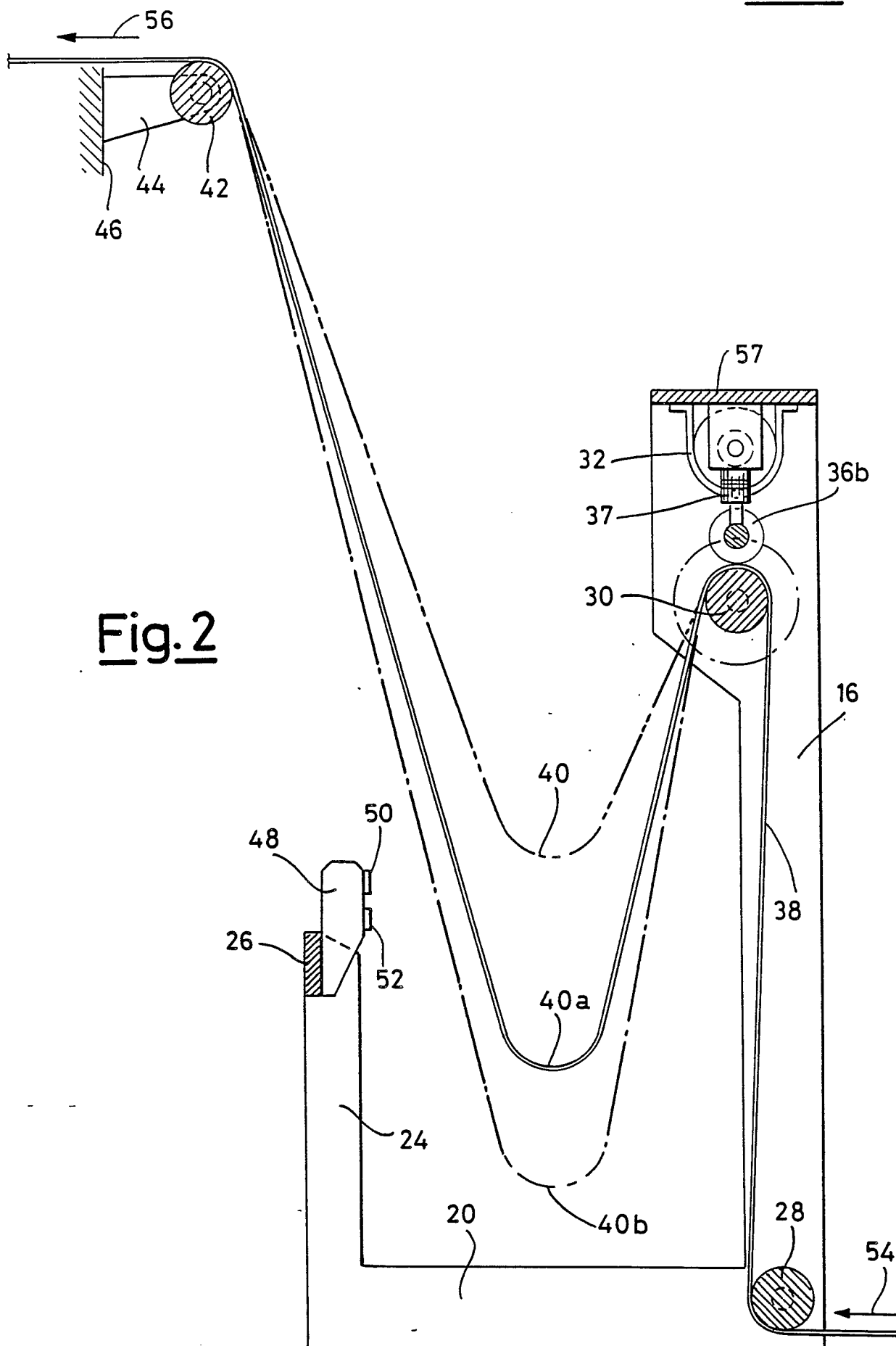


Fig.2