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

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Description

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 ofen loosing 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 deterctors 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.

Another device for transporting a continuous recording web such as paper from a paper storage to a printing machine is known from DE-A-2.500.396.

A compensation loop of web is formed between said paper storage and said printing machine the lenght of which is controlled by a presence detector means which controls in turn driving means of the paper web.

Said detector means essentially consist of a photoelectric cell comprising a light source and a light receving element disposed opposite one to the other.

In this way the receiving element can receive the light from the light source only when the lower end of the compensation loop is above a prefixed position corresponding to the path of the ray of light from said source and the receving element.

When the lower end of the compensation loop is below said prefixed position the ray of light is interrupted.

In the first of said position driving means of the paper web are activated while in the second one driving means are stopped.

The device forming the object of the above mentioned patent has the remarkable disadvantage consisting in the fact that it operates on the principle of a beam which can be interrupted or not by the lower end of the compensation loop. The interruption on the restoration of said beam take place suddenly causing accordingly the immediate stopping or restarting of the driving means. This type of operation is extremely dangerous for the paper web which frequently is irremediably damaged.

A further disadvantage derive from the necessity to immediately stop the feeding of the printing machine for the restoration of the regular initial conditions whith evident idle times and increasing costs.

DE-A-2.912.656 discloses and depicts in the enclosed figure a device feeding either a continuous paper web (14) or discrete paper sheets (24) to a printer provided with opto-electronic detectors (7 and 8) to detect either the presence of whatever kind of paper at a location arranged downstream a moving roller (1) (Transportrolle 1) by means of the detector (7) or a discrete paper sheet (24) by means of the detector (8) arranged upstream the the moving roller (1), both detectors (7 and 8) being of reflective kind essentially consisting of a lamp and a photodetector, side-by-side contained in a housing, the photodetector receiving the light generated by the lamp and reflected by either the paper web (14) or the paper sheet (24). In such a publication the opto-electronic detectors (7 and 8)

can detect by reflexion either the presence or the absence of the paper in their useful ranges, through the simple "on-off" principle, but cannot evaluate and do not have any means to evaluate the intensity of the reflected light and, as a consequence, the reciprocal distances between paper and detectors, a matter of main importance in the present invention, because that evaluation of the reciprocal distance between paper and detector is indispensable in determining the features of the compensation loop provided by the device.

Briefly stated, a web compensation loop device according to the present invention for a paper web supplied from a paper supply means, including a storage and supply unit for the paper, to a laser printing machine having a variable printing speed for compensation for intermittent operation of the laser printing machine as a result of the variable printing speed thereof, comprises:

web means for supporting and moving said web positioned between said paper storage and supply unit and said printing machine for supporting one end of said web, and said printing machine including means supporting the other end of said web, said web means including means to mave the paper in a direction from said paper supply means to said laser printing machine and for supporting said web therebetween, and said web forming a compensation loop as it leaves said web means and enters into said printing machine, said printing machine having an intermittent rate of feed thereto, said moving means including roller means for driving the web to enter said printing machine with said compensation loop,

and is characterized by:

variable speed operative motor means carried by said means for driving said roller means in response to the intermittent operation of said printing machine;

a single detector means proximate to said web for transmitting rays thereto and responsive to reflection of the rays therefrom for detecting the presence of a pretermined length of said compensation loop and coupled with said variable operative motor means for controlling the speed thereof to provide a feed of the paper web in accordance with the intermittent operation of said printing machine and,

an electronic circuit for said presence detector means, said electronic circuit having a narrow hysteresis loop, the output of which sharply changes in a clear cut and definite way and without uncertainty from a high state to a low state, respectively, corresponding to the absence or the presence of said loop,

wherein said electronic circuit consists of a voltage comparator for comparing the output of a photodetector of said detector means with a voltage, prefixed by a voltage regulator means for influencing the sensitivity of said electronic circuit, said voltage comparator means setting said electronic circuit thereby to change its state at a prefixed distance between said presence detector means and the loop 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 of said driving roller and a gradual deceleration to a complete stop of said motor, said voltage comparator is followed by a ramp generator circuit 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 such as not to spoil said web.

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 photodector 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 longitudainl 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 a 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 photodector 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 38 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 throguh 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 downwarndly 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 drive 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 photo detector 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 initiaties 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 whould never be dawn 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 limitating 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. Web compensation loop device for a paper web (38) supplied from a paper supply means, including a storage and supply unit for the paper, to a laser printing machine having a variable printing speed for compensation for intermittent operation of the laser printing machine as a result of the variable printing speed thereof, comprising:

web means for supporting and moving said web (38) positioned between said paper storage and supply unit and said printing machine for supporting one end of said web (38), and said printing machine including means supporting the other end of said web (38), said web means including means to move the paper in a direction from said paper supply means to said laser printing machine and for supporting said web therebetween, and said web forming a compensation loop (40) as it leaves said web means and enters into said printing machine, said printing machine having an intermittent rate of feed thereto, said moving means including roller means (30) for driving the web (38) to enter said printing machine with said compensation loop (40), characterized by:

variable speed operative motor means carried

by said means (32) for driving said roller means (30) in response to the intermittent operation of said printing machine;
a single detector means (48) proximate to said web (38) for transmitting rays thereto and responsive to reflection of the rays therefrom for detecting the presence of a pretermined length of said compensation loop (40) and coupled with said variable operative motor means (32) for controlling the speed thereof to provide a feed of the paper web (38) in accordance with the intermittent operation of said printing machine and,
an electronic circuit (60) for said presence detector means, said electronic circuit (60) having a narrow hysteresis loop, the output of which sharply changes in a clear cut and definite way and without uncertainty from a high state to a low state, respectively, corresponding to the absence or the presence of said loop (40),
wherein said electronic circuit (60) consists of a voltage comparator (68) for comparing the output of a photodetector (52,62) of said detector means (48) with a voltage, prefixed by a voltage regulator means (potentiometer 74) for influencing the sensitivity of said electronic circuit (60), said voltage comparator means (68) setting said electronic circuit (60) thereby to change its state at a prefixed distance between said presence detector means (48) and the loop (40) giving place to a predetermined reflected light intensity.

2. Compensation loop device according to claim 1, characterized in 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).

Patentansprüche

1. Vorrichtung zum Erzeugen einer Ausgleichsschleife in einer Papierbahn (38), die von einer aus Papiervorrat und Zuführeinheit bestehenden Papierzuführvorrichtung zu einer mit unterschiedlicher Druckgeschwindigkeit arbeitenden Laser-Druckmaschine zugeführt wird, zum Ausgleich des periodischen Betriebes dieser Laser-Druckmaschine aufgrund deren unterschiedlicher Druckgeschwindigkeit mit
einer zwischen der Vorrats- und Zuführeinheit und der Druckmaschine angeordneten Bahnvorrichtung zum Lagern und Vorbewegen der Bahn (38), mit deren Hilfe ein Ende der Bahn (38) gelagert werden kann,
einer an der Druckmaschine angeordneten Vorrichtung zum Aufnehmen des anderen Endes der Bahn (38),
wobei die Bahnvorrichtung Einrichtungen zum Vorbewegen der Papierbahn in der Richtung von der Papierzuführeinheit zur Laser-Druckmaschine und zum Abstützen dazwischen umfaßt,
wobei ferner die Bahn dann eine Ausgleichsschleife (40) bildet, wenn sie die Bahnvorrichtung verläßt und in die Druckmaschine eintritt, die ihrerseits mit einer periodisch schwankenden Zuführgeschwindigkeit arbeitet, und
wobei schließlich die Vorschubvorrichtung Rollen (30) aufweist, mit deren Hilfe die Bahn (38) über die Ausgleichsschleife (40) in die Druckmaschine gelangt,
gekennzeichnet durch
einen mit veränderbarer Drehzahl betreibbaren Motor (32), der zum Antrieb der Rollen (30) entsprechend des periodisch schwankenden Betriebs der Druckmaschine an der Rollentragvorrichtung angebracht ist,
ein einzelnes, nahe an der Bahn (38) angebrachtes Meßgerät (48) zum Aussenden von Strahlen auf die Bahn und zum Aufnehmen von der Bahn reflektierter Strahlen zum Feststellen des Vorhandenseins einer bestimmten Länge der Ausgleichsschleife (40), wobei das Meßgerät mit dem mit veränderbarer Drehzahl betreibbaren Motor (32) zum Steuern von dessen Drehzahl verbunden ist, um die Papierbahn (38) entsprechend dem periodisch schwankenden Betrieb der Druckmaschine zu fördern und
einen der Meßvorrichtung zugeordneten, elektronischen Schaltkreis (60) mit einer engen Hysterese-Schleife, deren Ausgangssignal sich mit einem klaren Schnitt, bestimmt und ohne Ungenauigkeit entsprechend dem Vorhandensein oder dem Fehlen der Schleife (40) von einem hohen zu einem niedrigen Zustand verändert und der aus einem Spannungsvergleichswiderstand (68) zum Vergleichen des Ausgangssignals eines Fotodetektors (52, 62) des Meßgeräts (48) mit einer durch eine Spannungsregulierungsvorrichtung (Potentiometer 74) festgelegten Spannung zum Beeinflussen der Empfindlichkeit des elektronischen Schaltkreises (60) besteht, wobei der Spannungsvergleichswiderstand (68) den elektronischen Schaltkreis (60) dazu bringt, seinen Zustand

bei einem festgelegten Abstand zwischen dem Meßgerät (48) und der Schleife (40) und damit bei einer vorbestimmten Intensität des reflektierten Lichts zu ändern.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß zur fortschreitenden Beschleunigung bis zur höchsmöglichen Drehzahl des Motors (32) zum Antrieb der Rollen (30) und zur fortschreitenden Verzögerung bis zum vollständigen Stopp des Motors (32) dem Spannungsvergleichswiderstand (68) eine Kippgenerator-Schaltung (76) nachgeschaltet ist, mit deren Hilfe die Drehzahl des Motors zu festgelegten Zeiten von Null bis zum Höchstwert und zurück auf Null gebracht werden kann, so daß Beschhleunigungen und Verzögerungen des Motors (32) ermittelt werden, ohne daß die Bahn (38) beschädigt würde.

Revendications

1. Dispositif de formation de boucle de compensation de bande pour une bande de papier (38) fournie par une moyen d'amenée de papier, comprenant un ensemble de stockage et d'amenée pour le papier, vers une machine d'impression laser ayant une vitesse d'impression variable pour compenser un fonctionnement intermittent de la machine d'impression laser, suite à sa vitesse d'impression variable, comprenant : un moyen de bande pour supporter et déplacer ladite bande (38) disposée entre ledit ensemble de stockage et d'amenée de papier et ladite machine d'impression pour supporter une extrémité de ladite bande (38), ledit moyen de bande comprenant un moyen supportant l'autre extrémité de ladite bande (38), ledit moyen de bande comportant un moyen pour déplacer le papier dans une direction allant dudit moyen d'amenée de papier à ladite machine d'impression laser pour supporter ladite bande entre ces derniers, et ledit bande formant une boucle de compensation (40) lorsqu'elle quitte ledit moyen de bande et entre dans ladite machine d'impression, ladite machine d'impression ayant une vitesse d'amenée intermittente de ce papier, ledit moyen de déplacement comprenant un moyen formant rouleau (30) pour entraîner la bande (38) afin d'entrer dans ladite machine d'impression avec ladite boucle de compensation (40), caractérisé par :
un moyen formant moteur fonctionnant à une vitesse variable, supporté par ledit moyen (32) pour entraîner ledit moyen formant rouleau (30) en réponse au fonctionnement intermittent de ladite machine d'impression;
un moyen de détection (48) unique situé à proximité de ladite bande (38) pour transmettre des rayons à cette dernière et réagissant à la réflexion des rayons depuis cette dernière, pour détecter la présence d'une longueur prédéterminée de ladite boucle de compensation (40) et couplé audit moyen formant moteur (32) fonctionnant à une vitesse variable, pour commander sa vitesse afin de fournir une amenée de la bande de papier (38) selon le fonctionnement intermittent de ladite machine d'impression, et
un circuit électronique (60) pour ledit moyen de détection de présence, ledit circuit électronique (60) ayant une boucle d'hystérésis étroite, dont le signal de sortie varie brutalement en une coupe nette et de manière définie, et sans incertitude, depuis un état élevé à un état bas, respectivement, correspondant à l'absence ou à la présence de ladite boucle (40),
dans lequel ledit circuit électronique (60) consiste en un comparateur de tension (68) pour comparer le signal de sortie d'un photocapteur (52, 62) dudit moyen de détection (48) à une tension, prédéterminée par un moyen de régulation de tension (potentiomètre 74), pour influencer la sensibilité dudit circuit électronique (60), ledit moyen de comparaison de tension (68) réglant ledit circuit électronique (60) de manière à modifier son état à une distance préétablie entre ledit moyen de détection de présence (48) et la boucle (40), donnant lieu à une intensité de lumière réfléchie prédéterminée.

2. Dispositif de formation de boucle de compensation selon la revendication 1, caractérisé en ce qu'en vue d'obtenir une accélération graduelle jusqu'à la vitesse maximale du moteur (32) dudit rouleau d'entraînement (30) et une décélération graduelle jusqu'à un arrêt complet dudit moteur (32), ledit comparateur de tension (68) est suivi par un circuit générateur de rampe (76), par lequel la vitesse dudit moteur est réglée, en la faisant varier de la valeur zéro à une valeur maximale et de nouveau de la valeur maximale à la valeur zéro, selon des temporisations préétablies permettant des accélérations et des décélérations du moteur (32) telles, qu'elles ne provoquent pas d'endommagement de la bande (38).

Tav I

Fig.1

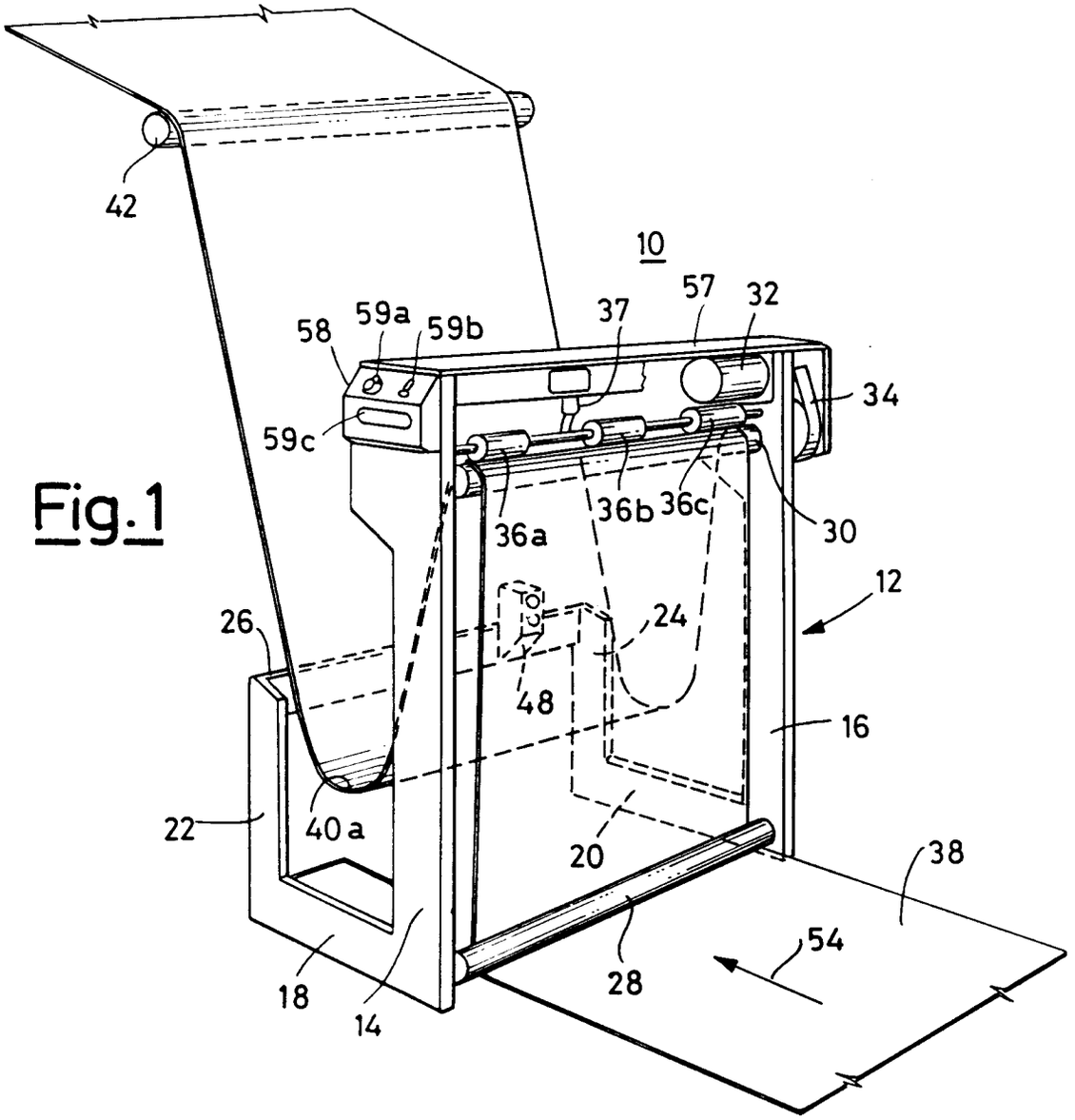
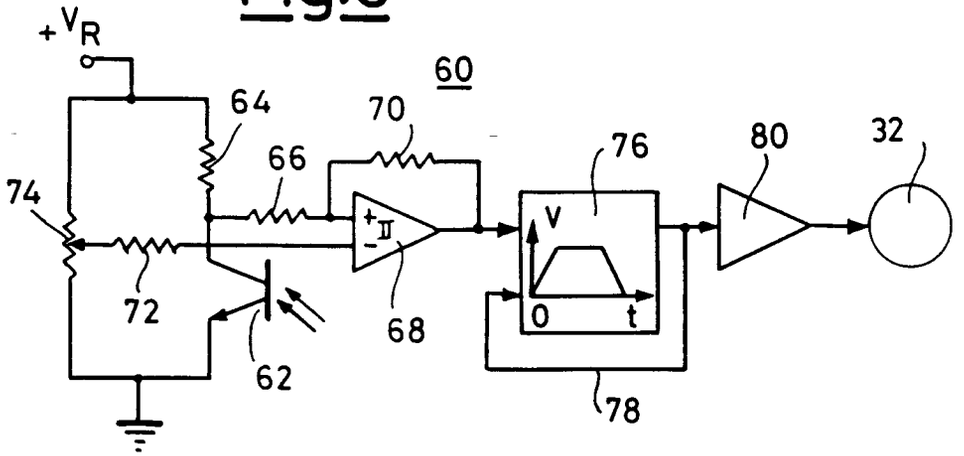


Fig.3



Tav. II

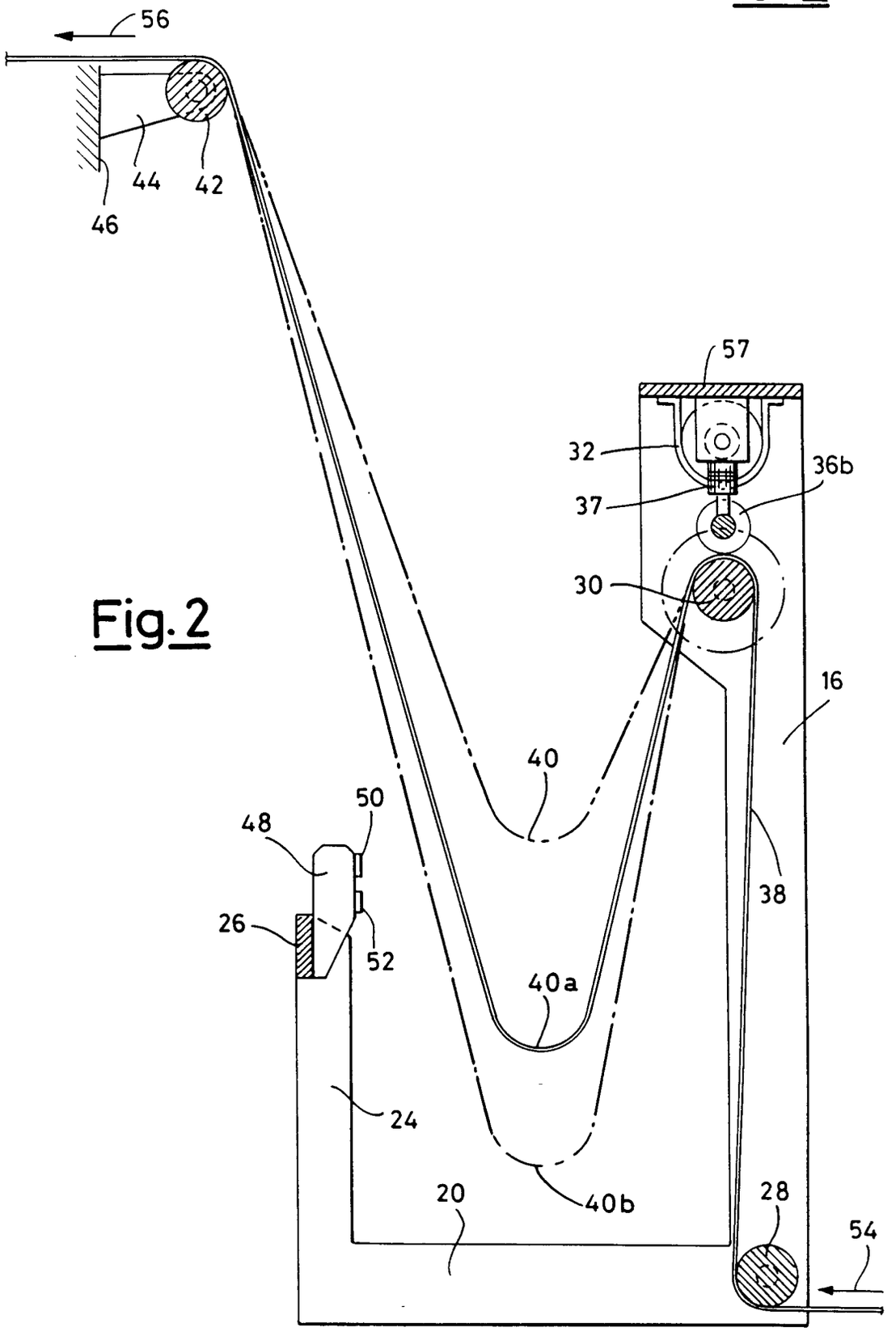


Fig. 2