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(54) **Device for controlling an unevenness of a sliver in a spinning machine**

Vorrichtung zur Vergleichmässigung eines Faserbandes bei einer Spinnmaschine

Dispositif pour régulariser la section d'un ruban de fibres sur une machine de filature

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- **PATENT ABSTRACTS OF JAPAN vol. 9, no. 45 (C-268) (1768) 26 February 1985 & JP-A-59 187 629 (HOWA KOGYO K.K.) 24 October 1984**

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Description

The present invention relates to a device for controlling an unevenness of a sliver in a drafting apparatus for a spinning machine, such as a drawing frame or a carding machine.

Known in the prior art is a device for controlling the unevenness of a sliver, in a drafting apparatus in a spinning machine, comprising a sensor for short-cycle unevenness arranged upstream from a set of back rollers, a sensor for long cycle unevenness arranged downstream from a set of front rollers, a servo unit for controlling the ratio of the rotational speeds of the back and front rollers to obtain a desired drafting ratio, a feed forward section connected to the short cycle unevenness sensor for generating a feed forward signal, a feed back section connected to the long cycle unevenness section for generating a feed back signal, and a section for combining the feed forward and feed back signals for generating an output signal directed to a servo unit. See Japanese Examined Patent Publication No. 44-23148.

The apparatus in the prior art is defective in that a drift easily occurs in the unevenness signal from a short cycle unevenness sensor constructed as an electrostatic sensor, thereby reducing the precision of the control of the unevenness of the sliver.

An object of the present invention is to provide a drafting device, for a spinning machine, capable of overcoming the drawbacks in the prior art.

According to the present invention, in order to attain this object, a device is provided for controlling an unevenness of a sliver in a drafting apparatus for a spinning machine, wherein a first sensor for detecting a short cycle unevenness of the sliver constructed as an electrostatic type detector is arranged upstream from a pair of back rollers of the drafting apparatus, while a second sensor for detecting a long cycle unevenness of the sliver is arranged downstream of a pair of front rollers, means are provided for combining signals from a feed forward channel from the first sensor as well as a feed back channel from the second sensor, to a signal for varying a relationship of rotational speeds of one of the pairs of the back and front rollers with respect to the other pair, thereby executing a feed forward control for a short cycle unevenness, on one hand, and a feed back control for a long cycle unevenness, on the other hand, in order to obtain a desired draft ratio, characterized in that a short cycle unevenness detecting unit including the first sensor as the electrostatic type detector is constructed so that its output characteristic is adjustable, an integrator is connected to the feed forward channel for obtaining an averaging signal of the short cycle unevenness detecting unit, and a correction feed back channel is provided for connecting the integrator with the short cycle unevenness detecting unit, thereby maintaining a desired output characteristic.

Now, an embodiment of the present invention will be explained with reference to attached drawings in which:

Fig. 1 is a diagrammatic view of an apparatus in a prior art.

Fig. 2 is a graph showing a relationship between unevenness in a sliver and the output signal level of a short cycle unevenness sensor.

Fig. 3 is a diagrammatic view of an apparatus according to the present invention.

Fig. 4 shows a circuit for outputting a short cycle unevenness signal with a correction feedback circuit.

The problem to be solved by the present invention will be further explained with reference to Figs. 1 and 2. In the prior art, a sensor for detecting a thickness of a sliver, in particular, a sensor for detecting short cycle unevenness in a sliver, which is a short-term sliver count variation, is usually constructed as an electrostatic type detector so that a small change in evenness can be detected. Such an electrostatic type detector is, for example, disclosed in the Japanese Examined Patent Publication No. 44-23148. This type of detector is explained with reference to Fig. 1. Namely, an electrostatic capacitor type detector (sensor for short-cycle unevenness) 10 is arranged upstream from back roller 5. The detector 10 is connected, via a high-pass filter 50, to a signal summation device 51, so that a sliver unevenness signal, as a feed-forward signal from the sensor 10, is applied thereto. An air micrometer 7, as a sensor for long cycle unevenness, is arranged downstream from a front roller 3.

A sliver unevenness signal, as a feedback signal from the sensor 7 is also applied to the signal summation device 51 to produce a combined pneumatic unevenness signal. The combined pneumatic unevenness signal obtained at the summation device 51 is transmitted to a pneumatic to hydraulic pressure transducer 52 so that a hydraulic pressure signal is obtained. The thus generated hydraulic pressure signal causes a hydraulic integrating device (a hydraulic cylinder) 53 to be operated, so that a cone belt 55 in a cone drum type transmission device 54 is moved. As a result, the rotational speed of the front roller 3 with respect to the back roller 5 is controlled, thereby removing the short cycle unevenness as well as the long cycle unevenness in the sliver. When drift, caused by temperature, occurs in the electrostatic capacitor-type detector, a low frequency component in the signal generated from the detector is removed by the high pass filter 50. As a result, only a high frequency component, i.e., a short cycle unevenness signal is transmitted to the signal summation device 51, thereby effectively reducing the high-frequency unevenness.

The electrostatic volume type detector 10 is, for example, combined with a short cycle detecting portion, such as a high frequency bridge circuit, wherein the output from the short cycle detecting portion becomes a sliver unevenness signal. However, the short cycle detecting portion issues, due to the fact that the output from the electrostatic volume type detector is influenced by

the temperature, a sliver unevenness signal in which a low frequency component is included, on one hand, and a displacement occurs in the center point of the operating range of the detecting portion, on the other hand. Namely, as shown in Fig. 2, in a relationship between the input (an unevenness in the sliver) and an output level, the operating point of the detecting portion is, in a linear portion of an output characteristic curve, displaced away from the center point P to a portion, which is, for example, shown by P1. As a result of such a displacement in the operating point, with respect to the same width R1 in the inlet signal, the width of the output level is compressed from the width r1 to r2, thereby preventing a precise detection from being executed. In order to obviate this problem, frequent adjustment is necessary so that the central point of the operating range is maintained so that it is not moved from the central portion of the linear portion of the output characteristic. However, the above-mentioned prior arts cannot provide any solution of this problem.

Now, an embodiment of the present invention, which can overcome the above-mentioned problem in the prior art, will be explained with reference to attached drawings. In Fig. 3, a reference numeral 2 denotes a drafting device in a spinning machine, such as a drawing frame 1. The drafting device 2 is constructed by spaced pairs of bottom and top front rollers 3 and 3', respectively and bottom and top back rollers 5 and 5'. The bottom front roller 3 is connected, via a transmission train 3-1, to a main motor 4, so that a fixed rotating movement from the main motor 4 is transmitted to the bottom front roller 3. The top front roller 3' rests on the bottom front roller 3, so that the top front roller 3' is rotated by the bottom front roller 3, while a sliver S is nipped between the rollers 3 and 3' while being fed therebetween. The bottom back roller 5 is connected, via a transmission train 5-1, to a servo motor 6, so that a variable rotating movement from the servo motor 6 is transmitted to the bottom back roller 5. The top back roller 5' rests on the bottom back roller 5, so that the top back roller 5' is rotated by the bottom back roller 5, while a sliver S is nipped between the rollers 5 and 5' while being fed therebetween.

Arranged downstream from the front rollers 3 and 3' is an air micrometer 7, which functions as a sensor for detecting long cycle unevenness in the sliver S. The air micrometer 7 may be formed as a funnel for collecting the sliver subjected to a drafting process at the drafting device 2, as is, for example, disclosed in Japanese Examined Patent Publication No. 60-12447. Namely, the air micrometer 7 constructed as a funnel is formed with a funnel body 7a which defines a downwardly converged longitudinal opening 7a for guiding therein the sliver S and a measuring opening 7c opened outwardly at its outer end and opened to the longitudinal opening 7b at its inner end. The measuring opening 7c is for measuring the pressure in the longitudinal opening 7b, when the sliver S moves through the longitudinal opening 7b, thereby measuring the degree of unevenness in the sliver S. The measuring hole 7c is provided with a pressure sensor (not shown) for obtaining an electrical signal indicative of the pressure at the measuring hole 7c. The pressure sensor is connected to a unit 8 for processing the long-cycle unevenness signal. The unit 8 includes a differential amplifier for producing a signal indicating the difference between the detected pressure value and a reference pressure value. The output of unit 8 is connected to a signal summation unit 9. Arranged upstream from the back rollers 5 and 5' is an electrostatic detector 10 as a sensor for detecting short cycle unevenness. The detector 10 is connected, via a feed forward channel 11, to a unit 12 for processing the signal from the detector 10. The unit 12 includes a memory for temporarily storing the short cycle unevenness data for a portion of a sliver, a delay timer for setting, in accordance with a spinning speed, a delay time for making the portion of the sliver corresponding to the detected data of the unevenness arrive at a draft changing point between the back rollers 5 and 5' and the front rollers 3 and 3', and a signal output means for allowing the stored difference signal to be issued to the signal summation unit 9 when the set delay time has elapsed.

The signal summation unit 9 is connected to a unit 13 for processing an output signal. Namely, the unit 13 includes a switching unit having an input connected to a detector 14 for detecting the rotational speed of the main motor 4, an input connected to the signal summation unit 9, and an output connected to a driver circuit 15 connected to the servo-motor 6. Thus, when sliver unevenness signal from the signal formation unit 9 does not occur, the output treatment unit 13 issues a rotating speed tuning signal to the motor driver 15 to obtain a rotating speed of the bottom back roller, in relation to the rotating speed of the bottom front roller 3, which makes the draft ratio equal to a reference value. Contrary to this, when a sliver unevenness signal from the signal formation unit 9 occurs, the output processing unit 13 functions issues a rotational speed correction signal to the motor drive 15 to correct the reference value of the draft ratio.

In Fig. 3, a reference numeral 20 denotes a short cycle unevenness output circuit in which the above-mentioned electrostatic volume type detector 10 is included as described later. As shown in Fig. 4, the short cycle unevenness output circuit 20 includes a high frequency bridge circuit 25, a rectifier circuit 26 connected to the bridge circuit 25 for transforming the alternating current output signal into a direct current, an amplifier 27 for amplify the output current from the rectifier circuit 26, a correction feedback channel 28 between the outlet of the amplifier 27 and the variable capacitor 23, and an output amplifier 29 for passing an output short circuit unevenness signal. The high frequency bridge circuit 25 is constructed by, in addition to the electrostatic volume type detector 10, a variable impedance 21, a fixed impedance 22 and a variable capacitor 23. The impedance

21 and 22, and the capacitors 10 and 23, are connected in series. These series circuits are connected in parallel to provide input points 25-1 and 25-2, which are connected to an alternating current source 24. Outlet points 25-3 and 25-4 are formed between the impedance 21 and 23, and between the capacitors 10 and 23, respectively. The output points 25-3 and 25-4 are connected to inputs of the rectifier circuit 26. The feed back channel 28 includes an integrator 30 for integrating the feedback signal from the amplifier 27, a switch 32 for controlling transmission of the feedback signal, and a summation unit 28-1 for obtaining a summation of the signal from the integrator 30 and voltage source 31.

In the high frequency bridge circuit 25, the variable impedance 21 is for adjusting the zero point of an output signal from the bridge circuit 25. The adjustment of the zero point, i.e., balancing the bridge circuit 25 by the variable impedance 21 is such that a zero output is obtained when no sliver passes the electrostatic type detector 10, a constant voltage from the electric power source 31 is applied to the summation unit 28-1, the variable capacitor 23 has the same capacity as the electrostatic type detector 10, and the switch 32 in the feedback channel 28 is opened to prevent the feedback signal from being transmitted to the adder 28-1. Furthermore, an adjustment of the sensitivity in reference to the thickness of the sliver by a variable resistor (not shown) in the amplifier is such that the output voltage is equal to a predetermined value when a sliver of a predetermined thickness passes through the electrostatic type detector 10, and the switch 32 is opened.

The integrator 30 of the correction feedback circuit 28 is for executing an integrating operation on an output signal from the amplifier 27. As mentioned above, the output signal from the amplifier 27 originates from the electrostatic type detector 10, and is, after passing through the high frequency bridge circuit 25, rectified by the rectifying circuit 26 and amplified by the amplifier 27. Thus, the output signal from the amplifier 27 indicates the unevenness of the sliver, which is a sum of the long cycle unevenness and the short cycle unevenness in the sliver. However, the output signal from the amplifier 27 also includes a low frequency component caused by the detector 10 itself due to a temperature drift. Thus, the output signal from the integrator is an average value of the unevenness in the sliver. This average sliver unevenness signal from the integrator 30, and a constant voltage from the electric voltage source 31, and supplied to the variable capacitor element 23 in order to vary the capacitance thereof correspondingly. Such a control of the capacitance, in accordance with the average unevenness of the sliver, allows the output of the high frequency bridge circuit 25 to be balanced, so that the operating point thereof is always at the center P of the linear portion of the output characteristic curve in Fig. 2. In order to obtain this operation of the integrator 30, the value of the time constant of the integrator 30 is set such that the long cycle unevenness as well as the low frequency component are deleted, while the short cycle unevenness is passed.

According to the present invention, as described above, an adjustment of the variable impedance 21 is done to obtain a zero balance of the bridge circuit 25 to make the output value of the amplifier 29 to be zero when no sliver passes through the electrostatic type detector 10 and the switch 32 is made OFF to cancel the feedback operation. Then, a sliver of a predetermined thickness is passed through the electrostatic volume type detector 10, while the variable resistor in the amplifier 29 is adjusted in such a manner that the output of the amplifier 29 is equal to the predetermined value. Then, the switch 32 is made ON, while the spinning operation is commenced, so that the correction feedback channel 28 is brought into an operation. Namely, the integrator 30 issues a signal which indicates an average sliver unevenness signal from the high frequency bridge circuit 25. This signal is supplied to the variable capacitor 23 to vary the value of its capacitance. As a result, a feedback signal, which corresponds to an average value of the detected sliver unevenness, is supplied to the high frequency bridge circuit 25. When the operating point of the bridge circuit 25 moves away from the center point P in the liner part of the output characteristic of the bridge circuit 25 due to effect of a temperature drift in the electrostatic volume type detector 10, such a feed back operation causes the operating point to return back to the zero point (P in Fig. 2). Furthermore, because of a large value of the time constant of the integrator 30 with respect to the length of the short cycle unevenness, the low frequency component caused by the temperature drift as well as a long cycle unevenness are removed from a sliver unevenness signal from the high frequency bridge circuit 25, which allows the short cycle unevenness component in the sliver unevenness signal from the amplifier 29 to be transmitted to the short cycle unevenness processing unit 12 without being influenced by the temperature. After a predetermined time has elapsed, the short cycle unevenness treatment section 12 issues, to the signal summation unit 9, a signal which indicates the deviation, with respect to a reference value, of the short cycle unevenness, so that the short cycle deviation signal is combined with the long cycle deviation signal from the long cycle unevenness processing section 8 connected to the air micrometer 7. The thus obtained combined unevenness signal from the signal summation unit 9 is introduced into the output signal processing unit 13, where a corrected rotational speed signal is calculated with respect to the reference draft ratio. The corrected signal is issued to the motor driver 15, so that a speed of the servo motor 6 is varied to correct the unevenness of the sliver. In short, control of a short cycle unevenness is executed using a feed forward control principle, on one hand, and a control of a long cycle unevenness is executed using a feed back control principle, on the other hand. When no unevenness exists in the sliver, no signal is issued by the signal

summation unit 9, so that the servo motor 6 controls the rotational speed of the back roller 5 in such a manner that a predetermined draft ratio is obtained with respect to the rotational speed of the front roller 3.

In the above embodiment, a high frequency bridge circuit is employed as a short cycle unevenness detector. However, another type of detector, such as a frequency modulation type, may also be employed.

While the present invention is described with reference to the attached drawings, many modifications and changes can be made by those skilled in this art without departing from the scope of the present invention.

Claims

1. A device for controlling an unevenness of a sliver in a drafting apparatus for a spinning machine, wherein a first sensor for detecting a short cycle unevenness of the sliver constructed as an electrostatic type detector (10) is arranged upstream from a pair of back rollers (5,5') of the drafting apparatus, while a second sensor (7) for detecting a long cycle unevenness of the sliver is arranged downstream of a pair of front rollers (3,3'), means (9) are provided for combining signals from a feed forward channel from the first sensor as well as a feed back channel (11) from the second sensor, to a signal for varying a relationship of rotational speeds of one of the pairs of the back and front rollers with respect to the other pair, thereby executing a feed forward control for a short cycle unevenness, on one hand, and a feed back control for a long cycle unevenness, on the other hand, in order to obtain a desired draft ratio, characterized in that a short cycle unevenness detecting unit (20) including the first sensor as the electrostatic type detector (10) is constructed so that its output characteristic is adjustable, an integrator (30) is connected to the feed forward channel for obtaining an averaging signal of the short cycle unevenness detecting unit, and a correction feed back channel (28) is provided for connecting the integrator with the short cycle unevenness detecting unit, thereby maintaining a desired output characteristic.

2. A drafting apparatus according to claim 1, wherein said short cycle unevenness detecting unit comprises a variable capacitor (23) as well as impedance elements (21,22), which construct, together with said first sensor as the electrostatic type detector (10), a high frequency bridge circuit (25), said variable capacitor being in connection with the integrating means so that the output characteristic of the high frequency bridge circuit is controlled in accordance with the average unevenness of the sliver.

3. A drafting apparatus according to claim 2, wherein one of the impedance elements (21) is a variable type, and wherein the drafting apparatus further comprises a switch (32) arranged in the correction feed back channel (28) at a position between the integrator (30) and the bridge circuit (25), the switch being usually in closed position but opened in order to allow the zero point of the bridge circuit to be adjusted by the variable impedance element, without passing the sliver.

4. A drafting apparatus according to claim 2, wherein it further includes an amplifier (29), for amplifying the signal from the bridge circuit (25), with a means for controlling an amplifying ratio, and wherein the drafting apparatus further comprises a switch (32) arranged in the feed back channel (28) at a position between the integrator and the bridge circuit, the switch being usually in closed position but being opened in order to allow control of the output to a predetermined level by adjusting the amplifying ratio when a sliver of a reference thickness is passed.

Patentansprüche

1. Überwachungsvorrichtung für die Ungleichmässigkeit eines Faserbandes in einer Zugausrüstung für eine Spinnereimaschine, worin ein als Detektor (10) des elektrostatischen Typs aufgebauter erster Fühler zur Erkennung einer hochfrequenten Faserband-Ungleichmässigkeit aufwärts von einem Paar von Hinterwalzen (5, 5') der Zugausrüstung angeordnet ist, während ein zweiter Fühler (7) zur Erkennung einer niederfrequenten Faserband-Ungleichmässigkeit abwärts von einem Paar von Vorderwalzen (3, 3') angeordnet ist, und worin ferner Mittel (9) vorgesehen sind, um die Signale von einem Vorkopplungskanal des ersten Fühlers und einem Rückkopplungskanal (11) des zweiten Fühlers zu einem Signal zu verknüpfen, mit dem die Beziehung zwischen der Umlaufgeschwindigkeit eines der beiden Paare von Walzen, der Hinter- oder der Vorderwalzen, zur Umlaufgeschwindigkeit des anderen Paares verändert werden kann, wodurch einerseits eine Vorkopplungsüberwachung für die hochfrequente Ungleichmässigkeit und andererseits eine Rückkopplungsüberwachung für die niederfrequente Ungleichmässigkeit ausgeübt wird, so dass ein gewünschtes Zugverhältnis erreicht wird, dadurch gekennzeichnet, dass eine Einheit (20) zur Erkennung der hochfrequenten Ungleichmässigkeit, die den ersten Fühler als einen Detektor (10) des elektrostatischen Typs einschliesst, so aufgebaut ist, dass seine Ausgangskennlinie verstellbar ist; dass an den Vorkopplungskanal ein Integrator (30) angeschlossen ist, um ein Mittelwertssignal der Einheit zur Erkennung der hochfrequenten Ungleichmässigkeit zu erhalten; und dass ein Rück-

kopplungskorrekturkanal (28) vorgesehen ist, über den der Integrator mit der Einheit zur Erkennung der hochfrequenten Ungleichmässigkeit verbunden wird, damit so eine gewünschte Ausgangskennlinie bewahrt wird.

2. Zugausrüstung gemäss Anspruch 1, worin die benannte Einheit zur Erkennung hochfrequenter Ungleichmässigkeit einen veränderlichen Kondensator (23) und Impedanzelemente (21, 22) umfasst, die zusammen mit dem benannten ersten Fühler vom Typ des elektrostatischen Detektors (10) eine Hochfrequenz-Brückenschaltung (25) ergeben, wobei der benannte veränderliche Kondensator mit integrierenden Organen in Verbindung steht, so dass die Kennlinie für das Ausgangssignal der Hochfrequenz-Brückenschaltung in übereinstimmung mit der durchschnittlichen Faserband-Ungleichmässigkeit gesteuert wird.

3. Zugausrüstung gemäss Anspruch 2, worin eines der Impedanzelemente (21) ein veränderlicher Typ ist und worin die Zugausrüstung ferner einen Schalter (32) umfasst, der im Rückkopplungskorrekturkanal (28) zwischen dem Integrator (30) und der Brükkenschaltung (25) angeordnet ist, gewöhnlich geschlossen ist, aber geöffnet wird, damit der Nullpunkt der Brückenschaltung mit dem veränderlichen Impedanzelement abgestimmt werden kann, ohne dass das Faserband hindurchläuft.

4. Zugausrüstung gemäss Anspruch 2, wo die Zugausrüstung weiterhin einen Verstärker (29) einschliesst, um das Signal von der Brückenschaltung (25) zu verstärken, wobei Mittel vorhanden sind, um das Verstärkungsverhältnis zu steuern, und wo die Zugausrüstung ferner einen im Rückkopplungskanal (28) zwischen dem Integrator und der Brückenschaltung angeordneten Schalter umfasst, der gewöhnlich geschlossen ist, aber geöffnet wird, damit das Ausgangssignal auf eine vorbestimmte Höhe eingeregelt werden kann, indem das Verstärkungsverhältnis angepasst wird, während ein Faserband einer Bezugsdicke hindurchläuft.

Revendications

1. Dispositif pour contrôler une irrégularité d'un ruban dans un appareil d'étirage pour une machine à filer, dans lequel un premier détecteur pour détecter une irrégularité de période courte de la mèche conçu comme un détecteur (10) de type électrostatique est disposé en amont d'une paire de cylindres postérieurs (5,5') de l'appareil d'étirage, tandis qu'un second détecteur (7) pour détecter une irrégularité de période longue du ruban est disposé en aval d'une paire de cylindres avant (3,3'),des moyens (9) sont agencés pour combiner des signaux d'un canal avant d'alimentation du premier détecteur ainsi que d'un canal arrière d'alimentation (11) du second détecteur, en un signal pour varier un rapport des vitesses de rotation de l'une des paires de cylindres postérieurs et avants par rapport à l'autre paire, de manière à exécuter une commande de l'alimentation avant pour une irrégularité de période courte, d'une part, et une commande de l'alimentation arrière pour une irrégularité de période longue, d'autre part, afin d'obtenir un rapport d'étirage désiré, caractérisé en ce qu'un élément (20) de détection d'irrégularités de période courte comprenant le premier détecteur comme détecteur (10) de type électrostatique est conçu de manière que sa caractéristique de sortie est ajustage, un intégrateur (30) est connecté au canal d'alimentation avant pour obtenir un signal moyen de l'élément de détection des irrégularités de période courte, et un canal de correction d'alimentation arrière (28) est ménagé pour connecter l'intégrateur avec l'élément de détection des irrégularités de période courte, de manière à maintenir une caractéristique de sortie désirée.

2. Appareil d'étirage selon la revendication 1, dans lequel ledit élément de détection des irrégularités de période courte comporte un condensateur variable (23) ainsi que des éléments d'impédance (21,22), lesquels forment, avec ledit premier détecteur en tant que détecteur (10) de type électrostatique, un circuit en pont (25) à haute fréquence, ledit condensateur variable étant connecté aux moyens d'intégration de sorte que la caractéristique de sortie du circuit en pont à haute fréquence est commandé en fonction de l'irrégularité moyenne du ruban.

3. Appareil d'étirage selon la revendication 2, dans lequel un des éléments d'impédance (21) est de type variable, et dans lequel l'appareil d'étirage comporte de plus un interrupteur (32) disposé dans le canal de correction d'alimentation arrière (28) dans une position entre l'intégrateur (30) et le circuit en pont (25), l'interrupteur étant habituellement en position fermée mais ouvert afin de permettre d'ajuster le point zéro du circuit en pont par l'élément à impédance variable, sans faire passer le ruban.

4. Appareil d'étirage selon la revendication 2, qui comporte en plus un amplificateur (29) pour amplifier le signal du circuit en pont (25), avec un moyen pour commander un rapport d'amplification, et dans lequel l'appareil d'étirage comporte de plus un interrupteur (32) disposé dans le canal d'alimentation arrière (28) dans une position entre l'intégrateur et le circuit en pont, l'interrupteur étant habituellement en position fermée, mais ouverte afin de permettre de commander la sortie à un niveau prédéterminé en réglant le rapport d'amplification lorsqu'un ruban

d'une épaisseur de référence est passé.

Fig.1

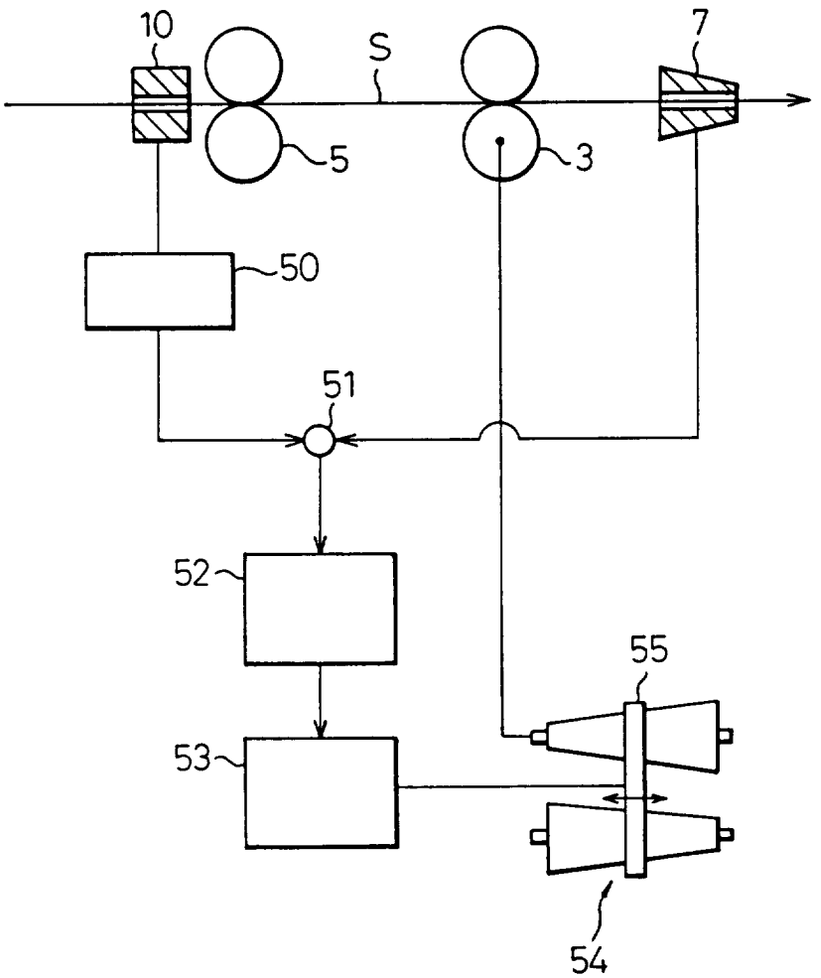


Fig.2

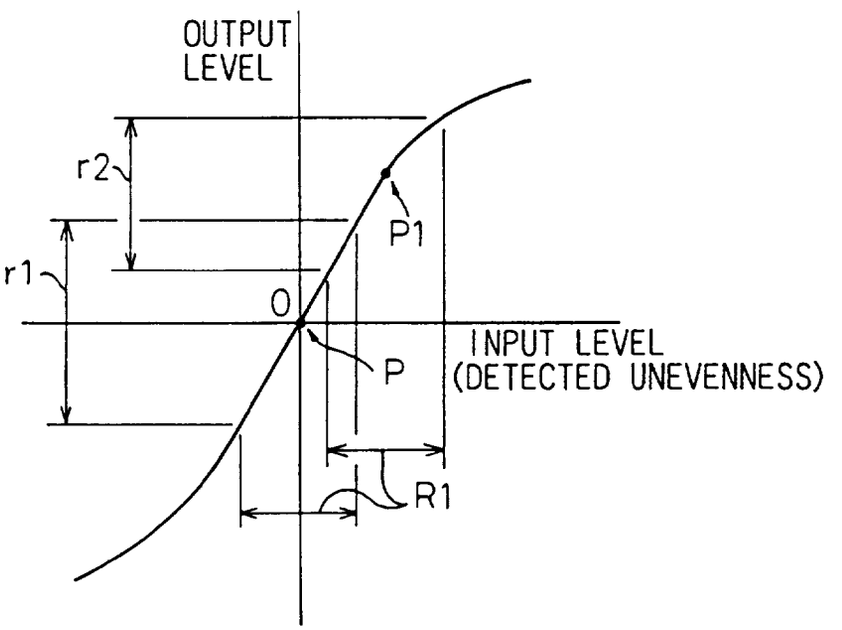


Fig.3

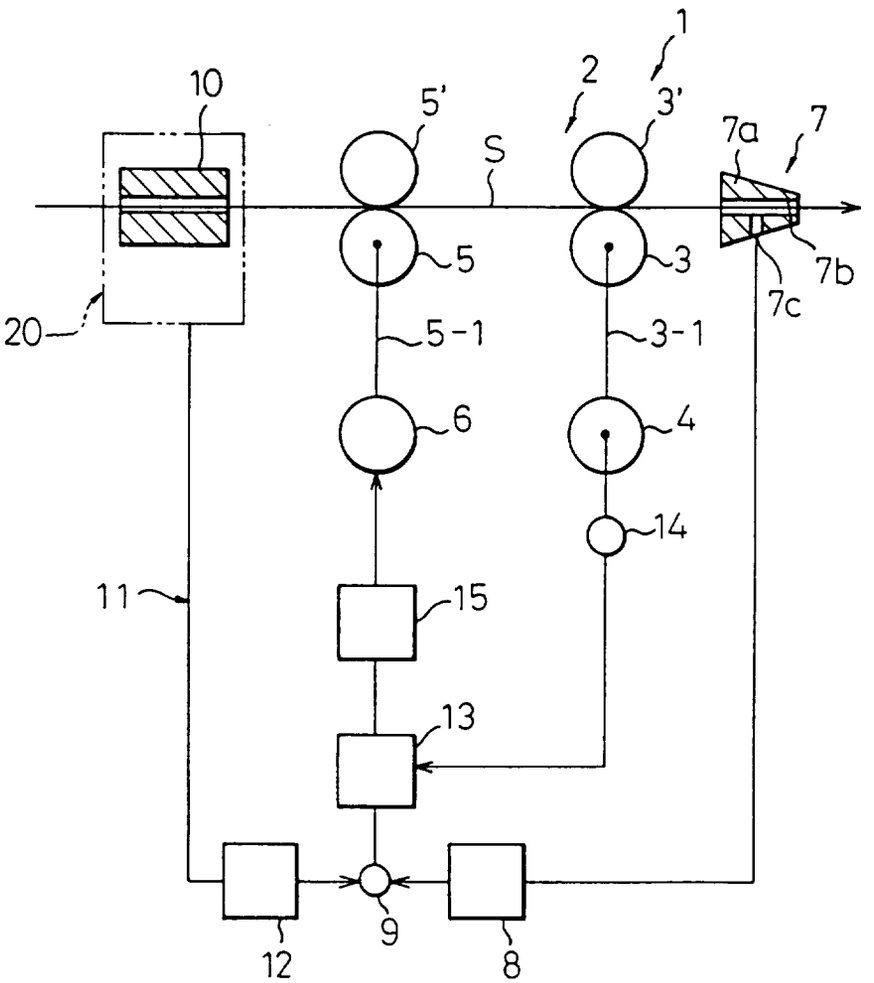


Fig.4

