

METHOD FOR WINDING AN ELONGATED NARROW FILM AT
HIGH SPEED

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates to a method for winding an elongated narrow film at high speed on a winding axle or on a support tube mounted thereon, and more particularly to a method for winding an elongated narrow film at high speed into a large-diameter roll without causing any misalignment in winding.

DESCRIPTION OF RELATED ART

A film is used as a liner member for preventing adjacent turns of a roll of a strip of metal, for example such as copper, copper alloys, SUS (including those plated with tin) and like metals from being damaged by abrasion when the strip is wound into the roll.

Fig. 4 shows a conventional cutting system 50 for a metallic strip. The cutting system 50 for the metallic strip is for slitting, under tension, the strip of metal such as copper, copper alloys, SUS (including those plated with tin) and like metals at high speed to traverse-wind the thus slitted strip, i.e., to wind the slitted strip in the same manner as that of the line wound on a spool of a reel.

In general, the system 50 comprises: an unwinding roll 52 of a metallic strip 51 with a predetermined width; a slitter 54 for cutting or slitting, under tension, the metallic strip 51 thus unwound from the unwinding roll 52 into a plurality of narrow metallic bands 53; and, a plurality of winding rolls 56 with no brake mechanism for traverse-winding the metallic bands 53.

Disposed just behind the unwinding roll 52 is a film-breakage/slipping-out detector 58, which detects any of breakage and slipping-out motion, i.e., excessive weaving motion of an elongated narrow film F to issue a detection signal 61 for immediately stopping the metallic strip 51 before the film F reaches the slit 54.

As for the film F disposed on the metallic strip 51, such detection signal 61 is issued from the detector 58 to a control panel 60. Upon receipt of the detection signal 61, the control panel 60 issues a stop signal 62 to each of the unwinding roll 52 and the slit 54 to bring the thus detected portion of the film F to a sudden stop just before the film F reaches the slit 54.

A plurality of the metallic bands 53 thus slitted by the slit 54 are deflected to their corresponding winding rolls 56 and traverse-wound at the positions of from Nos. 1 to 5.

As described above, since the metallic strip 51 is wound on the unwinding roll 52 in a condition in which the strip 51 is lined with the film F serving as a liner member, it is necessary to wind the film F when the metallic strip 51 is unwound and supplied to the slit 54. Fig. 5 shows a detail view of the unwinding roll 52. As shown in Fig. 5, the film F is wound on a paper core 57 at the same linear speed as that of the metallic strip 51. The paper core 57 is fixedly mounted on a winding axle 55, which is disposed in the vicinity of the unwinding roll 52.

In the prior art, the winding operation of the film F onto the paper core 57 is carried out depending on the width of the film F and its winding speed as follows. Namely, when the width of the film F exceeds 250 mm, it is possible to wind, without any trouble, the film F on the paper core 57 mounted on the winding

axle 55 provided with a torque motor from the unwinding roll 52 directly. When the torque motor is used, it suffices to set a winding tension in the film F. In this case, it is possible to wind the film F at a speed of more than 100 m/min. in fine condition. When the width of the film F is in a range of from 250 to 200 mm, it is necessary to dispose a guide bar between the paper core 57 and the unwinding roll 52. The film F is restricted in motion widthwise, and wound on the paper core 57 in such restricted condition. Although the torque motor needs only the setting of the winding tension, it is difficult for the torque motor to wind the film F in fine condition when the winding speed of the film F exceeds 100 m/min. In case that the width of the film F is less than or equal to 200 mm, it is further necessary to use a dancer roller for keeping a tension of the film F constant. Though the film F is restricted in motion widthwise and wound on the paper core 57 in such restricted condition, in order to wind the film F in fine condition, it is necessary to wind the film F at a speed of less than or equal to 100 m/min.

SUMMARY OF THE INVENTION

As described above, in the conventional method for winding the elongated narrow film F, when the film F, for example such as one with a width of less than or equal to 200 mm is wound at a winding speed of more than or equal to 100 m/min., air is involved in a roll FR of the film F thus wound, so that an air layer 68 is formed between adjacent turns of the film F in the roll FR. Consequently, the apparent frictional force (or, friction coefficient) between adjacent turns of the film F in the roll FR considerably decreases in its winding operation, which results in a lateral slide of the film F. Such lateral slide of the film F eventually causes the

film F to slip out of the roll FR and enter the production line together with the metallic strip 51. This is a problem inherent in the conventional method. Further, in the conventional method, since the winding tension of the film F is not clear, the paper core 57 often crashes under the winding pressure of the film F, which makes it impossible to wind the film F into a fine roll FR, and also impossible to prevent the thus slipped-out film F from entering the production line together with the metallic strip 51.

Due to the reasons mentioned above, in the conventional method for winding the elongated narrow film F, the winding speed of the film F is limited to 100 m/min. at maximum. Due to this limitation, in the conventional cutting system 50 of the metallic strip 51, the line speed of the strip 51 is also limited to 100 m/min. at maximum. Further, since the film F readily slips out of the roll FR widthwise, it is difficult to wind the film F into a large-diameter roll FR having a diameter of ore than or equal to 200 mm, which requires a significant number of paper-core changes to increase set-up time, and, therefore impairs the system 50 in productivity.

In the production line using the conventional system 50, it is necessary for an operator thereof to be in constant attendance upon the roll FR of the film F in order to keep the production line normal.

In view of the above problems inherent in the prior art, it is an object of the present invention to provide a method for winding an elongated narrow film at high speed into a large-diameter roll without suffering from any misalignment in winding.

According to a first aspect of the present invention, the above object of the present invention is accomplished by providing:

In a method for winding an elongated narrow film at high speed on a winding axle or on a support tube mounted thereon, the improvement which comprises:

reducing in width the elongated narrow film by compressing the elongated narrow film widthwise by a pair of guide means spaced apart from each other widthwise by a distance smaller than the width of said elongated narrow film which are located in a position immediately before the elongated narrow film is wound on the winding axle; and

winding the elongated narrow film on the winding axle in such compressed condition.

In the method of the present invention, since the elongated narrow film is compressed widthwise by the guide means, when the film is wound on the winding axle or on the support tube mounted thereon, the film has been already compressed, and, therefore wrinkled. A part of such wrinkled portion of the film is then brought into contact with a lower turn of the film of the same roll to prevent a continuous air layer from being formed therebetween, which prevents an apparent friction force (i.e., friction coefficient) developed between adjacent turns of the film in the roll from decreasing, and, therefore prevents the film from sliding out of the roll widthwise when wound thereon.

According to a second aspect of the present invention, the above object of the present invention is accomplished by providing:

The method for winding the elongated narrow film at high speed, as set forth in the first aspect of the present invention, wherein:

the pair of guide means are movable widthwise relative to each other in a widthwise direction of said elongated narrow film, which enables a distance between the pair of guide means to be adjusted in accordance with a width of the elongated narrow film, so that the film assumes a favorable wrinkled or curved shape when it is wound on the winding axle or on the support tube mounted thereon.

According to a third aspect of the present invention, the above object of the present invention is accomplished by providing:

The method for winding the elongated narrow film at high speed, as set forth in the first or the second aspect of the present invention, wherein:

the elongated narrow film is wound in a condition in which the elongated narrow film has its opposite edges lifted upward so that its central area assumes a concave shape in cross section.

This prevents an air layer from being continuously formed widthwise between adjacent turns of the film, so that the film is prevented from sliding widthwise on the roll, whereby a lower or inner turn of the film of the roll may firmly hold an outer or upper turn of the film of the same roll. Consequently, even when the film is wound into a large-diameter roll, such roll thus formed has substantially no misalignment in width in winding.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an enlarged perspective view of an essential part of the unwinding roll for carrying out the method of the present invention for winding the elongated narrow film at high speed.

Fig. 2 is a pair of compression guide members fixedly mounted on the support axle, wherein (a) is a front view thereof, and (b) is a right side view of the same.

Fig. 3 is a cross-sectional view of a part of the elongated narrow film, which is wound on the paper core in a condition in which the film has its opposite edges lifted upward and its central area curved downward in cross section.

Fig. 4 is a schematic diagram of the conventional system for cutting the metallic strip.

Fig. 5 is a detail view of an area proximate to the unwinding roll shown in Fig. 4.

Fig. 6 is a cross-sectional view of a part of the elongated narrow film, which is wound on the conventional winding axle.

THE BEST MODE FOR EMBODYING THE INVENTION

Hereinbelow, a method of the present invention for winding an elongated narrow film at high speed will be described in detail with reference to its preferred embodiments shown in the accompanying drawings.

Fig. 1 is an enlarged perspective view of an essential part of an unwinding roll unit for carrying out the method of the present invention for winding the elongated narrow film at high speed.

The unwinding roll unit 10 shown in the drawings is constructed of: an unwinding roll axle 12; a plurality of guide bars 14, 16; a support axle 18 for supporting a pair of compression guide members 24, 24; and, a winding axle 20 on which a paper

tube or core 22 is mounted. At least one of the compression guide members 24, 24 is movable relative to the other, which makes it possible to adjust a distance between these compression guide members 24, 24.

As shown in Fig. 2 in detail, each of the compression guide members 24, 24 is constructed of: a sleeve-like portion 24a slidably mounted on a support axle 18; and, a disc-like flange 24b integrally joined to the sleeve-like portion 24a by welding.

As shown in Fig. 2(b), the center of the flange 24b is eccentric to that of the sleeve-like portion 24a to provide a large radially-outward protrusion, which extends downward as viewed in Figs. 2(a) and 2(b) and has its inner surface brought into press-contact with the edge of the elongated narrow film F, whereby the film F is compressed and guided by the flange 24b. If necessary, a distance between the pair of the compression guide members 24, 24 may be adjusted by slightly loosening bolts 25. After such adjustment is made, the bolts 25 are fastened again so that a desired distance is set between the compression guide members 24, 24. Due to the above construction, it is possible for the compression guide members 24, 24 to set an optimum distance therebetween as to the elongated narrow film F, which may vary in width. Preferably, the distance between the compression guide members 24, 24 is in a range of from 0.5 to 0.8 W, where W is the width of the elongated narrow film F.

As described above, in a position immediately before the elongated narrow film F is wound on the winding axle 20 or on the paper core 22 mounted thereon, the film F is compressed widthwise by the pair of the compression guide members 24, 24 which are spaced apart from each other by a distance smaller

than the width of the film F. Then, the thus compressed film F is wound on the winding axle 20 or on the paper core 22 mounted thereon. Consequently, the thus wound film F is wrinkled, and a part thereof is brought into contact with the lower turn of the film F in the same roll FR thereof. Due to such contact, an air layer is prevented from being continuously formed widthwise between adjacent turns of the film F, whereby the film F is prevented from sliding widthwise.

Referring to Fig. 1, the metallic strip 11 and the elongated narrow film F are wound together into a roll R which is rotatably mounted on the unwinding axle 12. Under such circumstances, when the metallic strip 11 is unwound and supplied to the slit 54 (shown in Fig. 4), the elongated narrow film F serving as the liner member is also unwound by the same length as that of the thus unwound metallic strip 11. Consequently, it is necessary to wind the thus unwound film F on the winding axle 20. In the beginning of such winding operation, the winding axle 20 is rotatably driven at high speed. However, as the film F is wound on the winding axle 20, the winding speed of the axle 20 is gradually slowed down. In order to keep constant the tension of the film F to be supplied to the roll FR thereof, a dancer roller 16 may be provided, which may move vertically in an elongated vertical hole 26 provided in the unwinding roll unit 10, as shown in Fig. 1.

Further, as shown in Fig. 2(a), when a curved portion 24c is formed inside each of the flanges 24b, the elongated narrow film F assumes an arc shape in cross section, which facilitates winding of the elongated narrow film F on the winding axle 20 or on the paper core 22. As described above, when the elongated narrow

film F is wound in a condition in which the film F has its opposite edges lifted upward and its central area formed into a concave portion in cross section, the air layer extending widthwise between adjacent turns of the film F of the roll FR is prevented from being formed, which prevents the film F from sliding widthwise in the roll FR of the film F. Further, in the roll FR of the film F, since the lower or inner turn of the film F of the roll FR firmly holds the upper or outer turn of the film F in the same roll FR, there is substantially no misalignment in width in the roll FR of the film F even when the film F is wound into a large-diameter roll FR. As a result, even when the line speed of the cutting system 50 reaches 200 m/min., there is no fear that the film F slips out of the roll FR, which enables the roll FR to have its outer diameter reach 350 mm, whereas the largest possible outer diameter of the conventional roll FR of the film F is only 150 mm. Such large-diameter roll FR realized in the present invention reduces set-up time for changing the paper cores 22. Further, in the method of the present invention, the operator is released from the crushing burdens of constant monitoring of the roll FR of the film F. Due to these facts, the cutting system 50 according to the method of the present invention is remarkably improved in productivity.

Incidentally, in the preferred embodiments of the present invention shown in the drawings, it is possible, by setting the winding tension of the film F at 0.002 Kg/mm (per unit width), to prevent the paper core 22 from crashing and also possible to prevent the film F from breaking.

In the method of the present invention for winding the elongated narrow film F at high speed, in a position immediately

before the film is wound on the winding axle, the film is compressed widthwise by the pair of the guide means (i.e., compression guide members 24) spaced apart from each other by a distance smaller than the width of the film, and is wound in such compressed condition. Consequently, when the film is wound on the winding axle or on the paper core mounted thereon, the film has been already wrinkled, so that a part of the thus wrinkled film of the roll is brought into contact with the inner turn of the film of the same roll, which prevents a continuous air layer from being formed widthwise between adjacent turns of the film in the same roll, whereby the apparent friction force or friction coefficient between the adjacent turns of the film in the roll FR is prevented from decreasing. Consequently, it is possible to prevent each turn of the film from sliding widthwise in the roll FR. This is the advantage inherent in the method of the present invention.

Due to the above advantage, the number of line stoppages due to troubles occurring in the film winding section is remarkably reduced, which lessens the operator's monitoring burdens in the winding operation of the roll of the film. As a result, it is possible for the system carrying out the method of the present invention to have its operation rate 50 percent, whereas that in the conventional system is no more than 30 percent.



What is claimed is:

1. In a method for winding an elongated narrow film at high speed on a winding axle or on a support tube mounted thereon, the improvement which comprises:

reducing in width said elongated narrow film by compressing said elongated narrow film widthwise by a pair of guide means spaced apart from each other widthwise by a distance smaller than the width of said elongated narrow film which are located in a position immediately before said elongated narrow film is wound on said winding axle; and

winding said elongated narrow film on said winding axle in such compressed condition.

2. The method for winding the elongated narrow film at high speed, as set forth in claim 1, wherein:

said pair of guide means are movable relative to each other in a widthwise direction of said elongated narrow film, which enables the distance between said pair of guide means to be adjusted in accordance with a width of said elongated narrow film.

3. The method for winding the elongated narrow film at high speed, as set forth in claim 1 or 2, wherein:

said elongated narrow film is wound in a condition in which said elongated narrow film has its opposite edges lifted upward so that its central area assumes a concave shape in cross section.

METHOD FOR WINDING AN ELONGATED NARROW FILM AT
HIGH SPEED

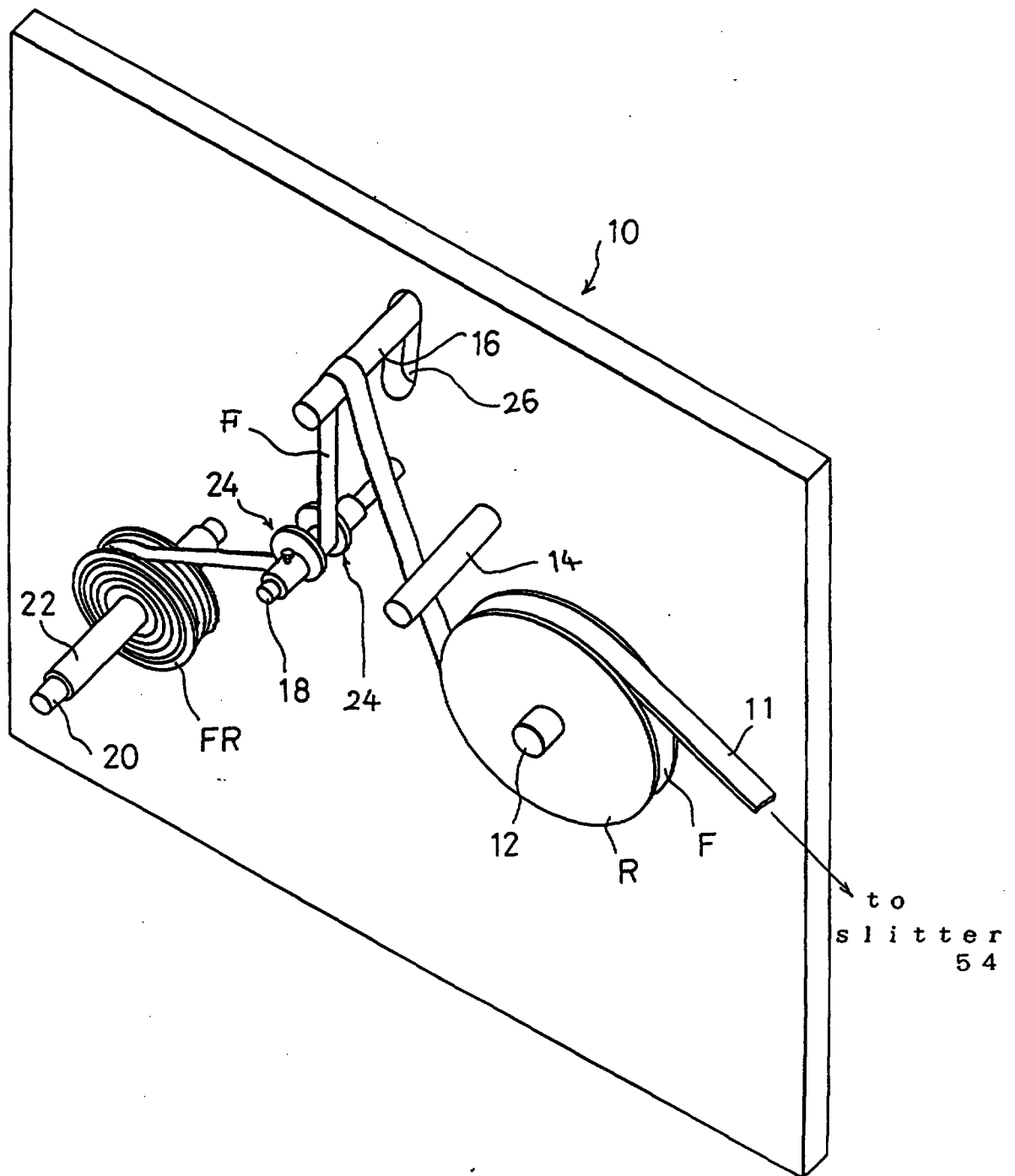
ABSTRACT

In a method for winding an elongated narrow film F at high speed on a winding axle 20 or on a support tube 22 fixed thereto, the invention is characterized in that: in a position immediately before the film F is wound on the winding axle 20, the film F is compressed widthwise by a pair of guide means 24, 24 spaced apart from each other widthwise by a distance smaller than the width of the film F, and is then wound in such compressed condition.

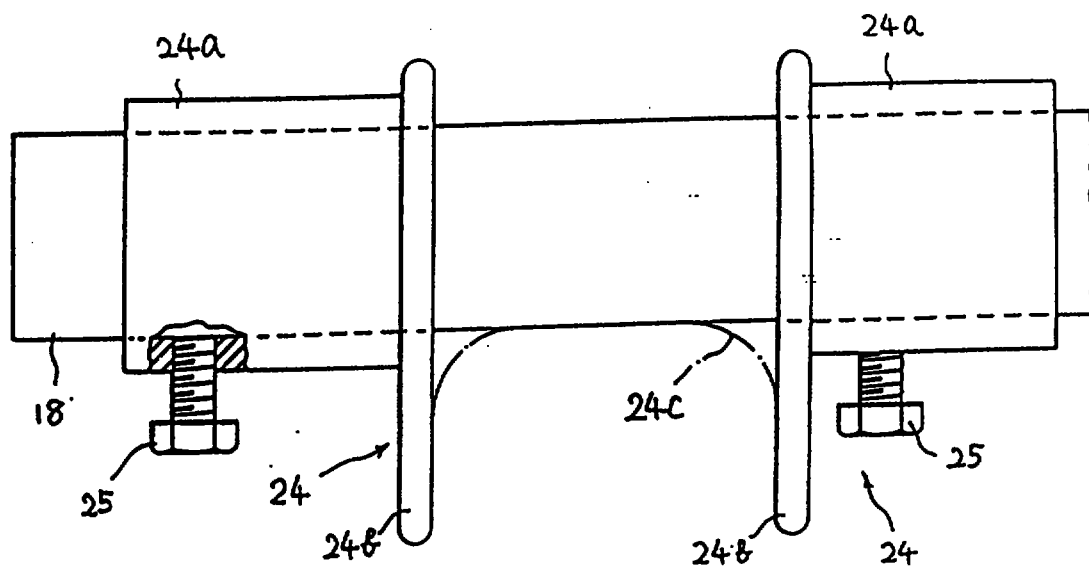
Since the film F is compressed widthwise by the guide means 24, 24, the film F has been already wrinkled when wound on the winding axle 20 or on the support tube 22 fixed thereto, and, therefore has a part of its wrinkled portion brought into contact with a lower turn of the film F in the same roll FR. This prevents a continuous air layer from being formed widthwise between adjacent turns of the film F, so that the apparent frictional force (or, friction coefficient) between the adjacent turns of the film F in the roll FR is prevented from decreasing, which prevents the film F from sliding widthwise in the roll FR.

(Drawing to be published): Fig. 1

F i g . 1



(a)



(b)

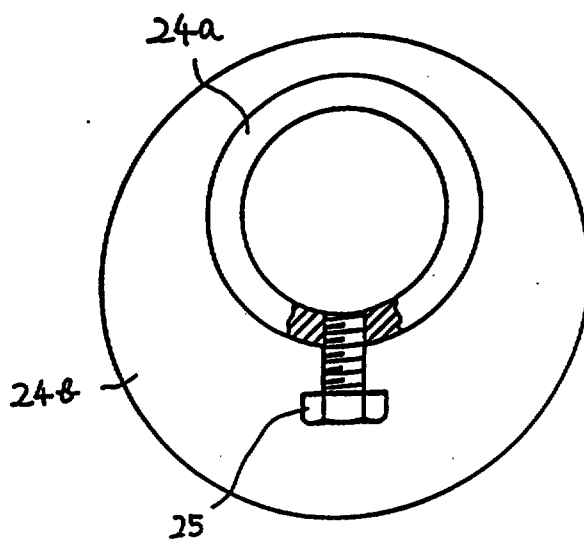


Fig. 3

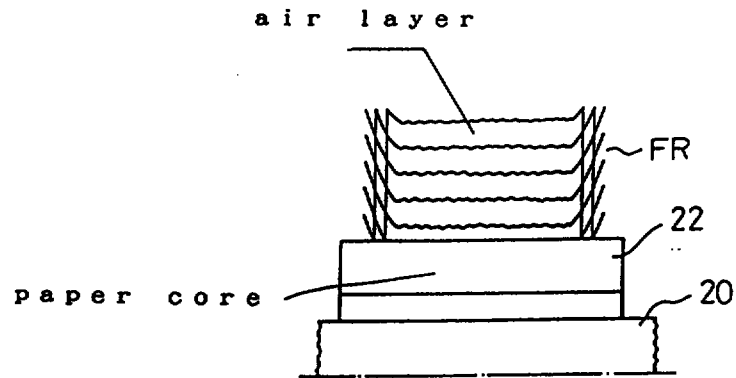


Fig. 4

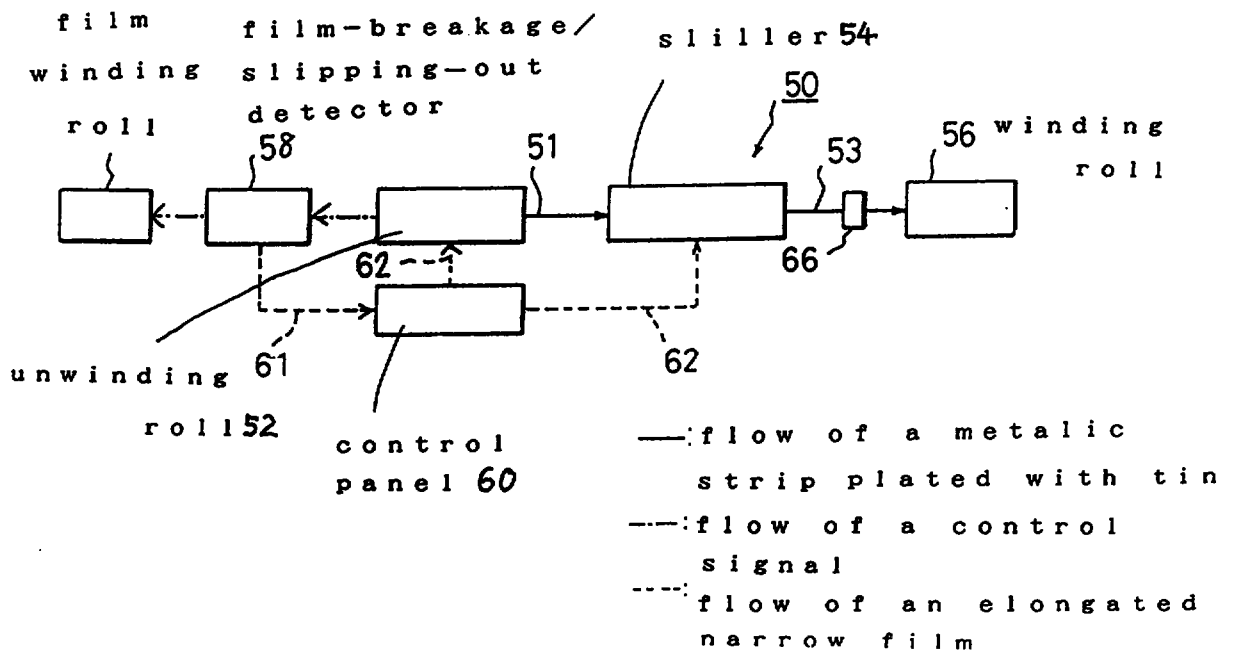


Fig. 5

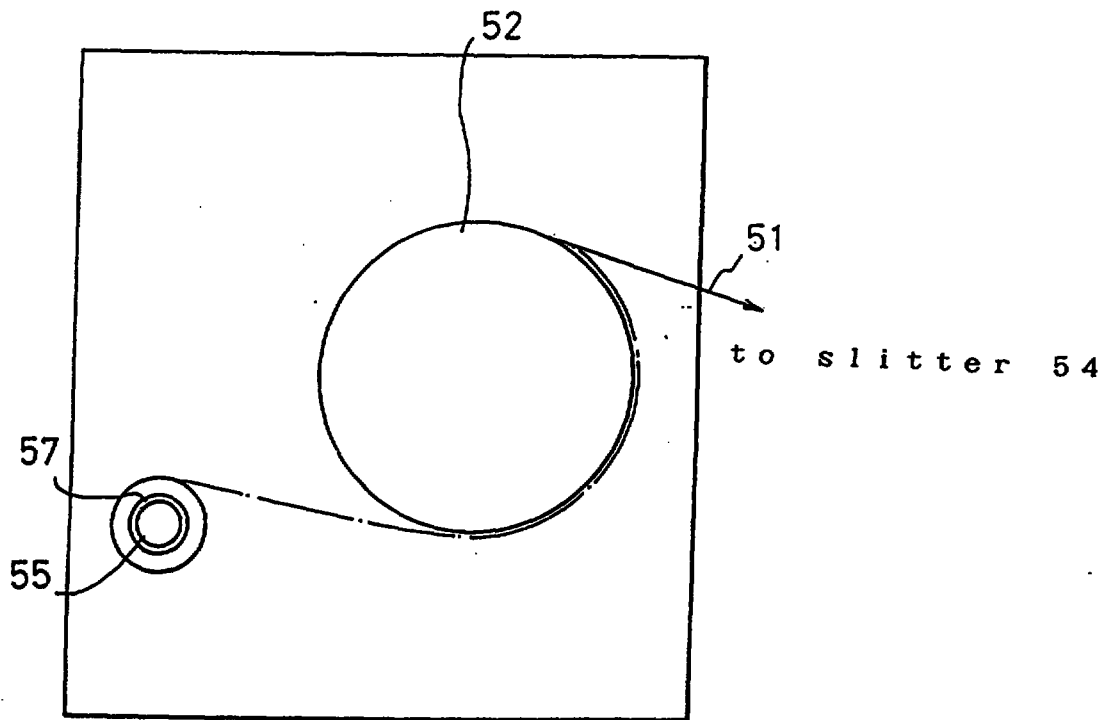


Fig. 6

