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DE GB IT(71) Applicant: JAPAN TOBACCO INC.
2-1 Toranomom 2-chome Minato-ku
Tokyo 105(JP)(72) Inventor: Sakano, Makoto
41-2-104, Ooyamahigashi-cho, Itabashi-ku
Tokyo(JP)(74) Representative: Popp, Eugen, Dr. et al
MEISSNER, BOLTE & PARTNER
Widenmayerstrasse 48 Postfach 86 06 24
D-8000 München 86(DE)

(54) Device for detecting leading end and remaining amount of strip-like material unrolled from roll.

(57) A device for detecting the leading end and the remaining amount of a strip-like material A unrolled from a roll (R) is disclosed. This device includes a swing arm (5). A roller carrier (7) is pivotally mounted on the distal end portion of the swing arm (5). Two contact rollers (8) and a sensor (9) are arranged on the roller carrier (7). The contact rollers (8) of the roller carrier are brought into rolling contact with the

peripheral surface of the roll. When the strip-like material is unrolled from the roll and the diameter of the roll is changed, the swing arm (5) swings so that the roller carrier (7) follows the change in diameter. Therefore, the sensor (9) is always adjacent to the peripheral surface of the roll (R), and can reliably detect an object to be detected (C) of the strip-like material (A) of the roll.

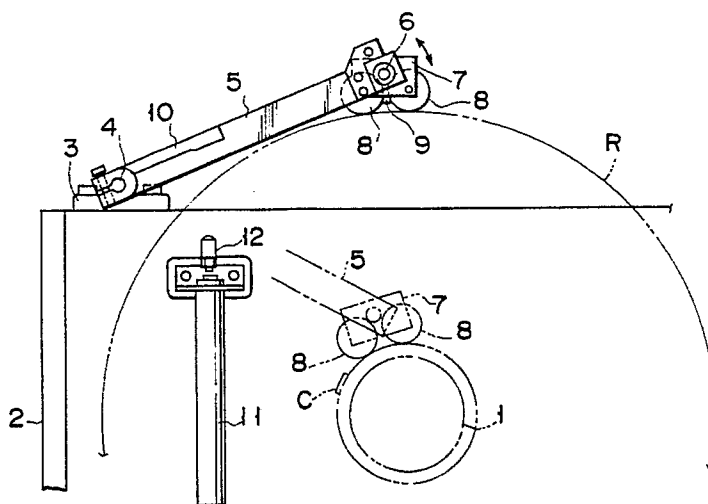


FIG. 3

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The present invention relates to a device, used in an apparatus for unrolling a strip-like material from a roll formed by winding strip-like wrapping paper for wrapping cigarettes, for detecting the leading end and the remaining amount of the strip-like material.

Conventionally, a wrapping material of, e.g., cigarettes has a strip-like shape, and the strip-like wrapping material is wound in a roll. In a cigarette wrapping apparatus, the roll is loaded, and a strip-like material is unrolled from the roll and is fed to a cigarette wrapping process.

Since the cigarette wrapping apparatus is continuously operated at high speed, when a wrapping material of the roll is used up, the roll must be switched to a new roll without interrupting supply of the wrapping material. For this reason, in the conventional apparatus, a plurality of rolls are loaded, and when a wrapping material of one roll is used up, the leading end of a new wrapping material unrolled from a new roll is joined to the trailing end of the unrolled wrapping material to supply the wrapping material without interruption.

In the conventional apparatus, switching of rolls can be automatically performed. In order to automatically perform the switching operation, objects to be detected such as aluminum tapes are adhered to given positions separated by a predetermined distance from the leading and trailing end portions of a wrapping material wound in a roll, and these aluminum tapes are detected by a non-contact type detector, thereby detecting that the unrolled wrapping material runs short, and detecting the leading end portion of a wrapping material of a new roll.

Since the diameter of the roll is gradually decreased as the wrapping material is unrolled, a distance from the detector to the object to be detected such as an aluminum tape is changed. Therefore, it is difficult to accurately and reliably detect the aluminum tape or the like, and an erroneous operation easily occurs.

It is an object of the present invention to provide a detection device which can accurately and reliably detect an object to be detected provided to a strip-like material wound in a roll.

The object of the present invention can be attained by the following arrangement. That is, the detection device of the present invention comprises a swing arm. One end portion of the swing arm is pivotally supported on a main body of the device. The swing arm swings so that its other end portion approaches/separates from the peripheral surface of a roll. A roller carrier is pivotally attached to the other end portion of the swing arm through a support pin. Two contact rollers are rotatably mounted on the roller carrier. The roller carrier is provided with a sensor for detecting an object to be

detected provided to the strip-like material in a non-contact manner.

In this detection device, the contact rollers of the roller carrier are in rolling contact with the peripheral surface of the roll, so that the roller carrier is kept adjacent to the peripheral surface of the roll. As the strip-like material is unrolled and the diameter of the roll is reduced, the swing arm is pivoted and the roller carrier is guided to be always adjacent to the peripheral surface of the roll. Therefore, the sensor mounted on the roller carrier is held to be always adjacent to the peripheral surface of the roll, and the object to be detected can be accurately and reliably detected.

According to a preferred embodiment, the contact rollers are arranged to be separated by the equal distance from the support pin, and the sensor is arranged on a plane including the axis of the support pin and the central axis of the roll. Therefore, even if the diameter of this roll is changed, this sensor is always located at a very accurate position with respect to the peripheral surface of the roll, and the object to be detected can be very accurately and reliably detected.

This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view of a roll;

Fig. 2 is a partial sectional view of a roll;

Fig. 3 is a side view of a detection device of the present invention; and

Fig. 4 is a plan view of the detection device shown in Fig. 3.

A detection device according to an embodiment of the present invention will be described below with reference to the drawings.

Fig. 1 shows a roll R formed by winding a wrapping material A as a strip-like material. An adhesive tape B as an object to be detected indicating the leading end is adhered to the leading end portion of the wrapping material A of the roll R. The adhesive tape B comprises, e.g., an aluminum tape, and is adhered to the central portion of the wrapping material A to close a hole b formed in the leading end portion of the wrapping material A, as shown in Fig. 2. Therefore, the adhesive tape B is utilized not only to indicate the leading end of the wrapping material A of the roll R but also as a fixing tape for fixing the leading end of the wrapping material A.

An end indication tape C comprising an aluminum tape as an object to be detected is adhered to the central portion of the trailing end portion of the wrapping material A of the roll R in the same manner as the adhesive tape B. The end indication tape C is schematically shown in Fig. 3.

The roll R is loaded on a loading shaft 1 shown

in Figs. 3 and 4. The loading shaft 1 is rotatably mounted on a base frame 2, and is rotated by a driving mechanism (not shown).

A pivot shaft 4 is mounted on the upper portion of the base frame 2 through a bearing base 3, and is located outside the roll R to extend parallel to the loading shaft 1.

One end of the pivot shaft 4 projecting toward the roll R extends to overlap the peripheral surface of the roll R in the vertical direction, and a swing arm 5 is mounted on this end. More specifically, the swing arm 5 is swingable in a direction to approach/separate from the outer peripheral surface of the roll R.

A roller carrier 7 is pivotally mounted on the distal end portion of the swing arm 5 through a support pin 6 parallel to the axis of the roll R. A pair of contact rollers 8 which can be in rolling contact with the peripheral surface of the roll R are rotatably mounted on the roller carrier 7. These contact rollers 8 are located to be separated by equal intervals in the circumferential direction of the roll R.

A non-contact type sensor, e.g., a photosensor 9 is attached to the roller carrier 7 to be located above the central portion of the peripheral surface of the roll R and in a plane including the axes of both the support pin 6 and the roll R. When the pair of contact rollers 8 are brought into rolling contact with the outer peripheral surface of the roll R, the photosensor 9 opposes the outer peripheral surface of the roll R to be separated therefrom by a predetermined distance. When the adhesive tape B and the end indication tape C of the roll R pass below the photosensor 9, the photosensor 9 detects the adhesive tape B and the end indication tape C to output detection signals.

The other end of the pivot shaft 4 projects from the base frame 2 on a side opposite to the roll R, and a release arm 10 for the swing arm 5 is mounted on this end. As can be seen from Figs. 3 and 4, the release arm 10 extends parallel to the swing arm 5 in the same direction. A release cylinder 11 comprising an air cylinder stands upright on the base frame 2 through a bracket to be located below the release arm 10. A pusher 12 which can be engaged with the release arm 10 is mounted on the distal end of a piston rod of the release cylinder 11.

According to the above-mentioned detection device, when the roll R is loaded on the loading shaft 1, the piston rod of the release cylinder 11 is expanded, and the release lever (or arm) 10 is pivoted upward to a predetermined position together with the swing lever (or arm) 5. Thus, the swing lever 5 will not disturb loading of the roll R. After the roll R is loaded on the loading shaft 1 in this state, the piston rod of the release cylinder 11

is contracted, as shown in Fig. 3. Thus, the swing arm 5 is pivoted downward by its weight, and the pair of contact rollers 8 of the roller carrier 7 are brought into rolling contact with the outer peripheral surface of the roll R.

Thereafter, when the roll R is rotated at least once so that the leading end of the wrapping material A of the roll R becomes the rear end in a rotating direction, the adhesive tape B of the roll R passes below the photosensor 9 of the roller carrier 7. At this time, the photosensor 9 detects the adhesive tape B and outputs a detection signal, thereby detecting the leading end of the wrapping material A of the roll R. At this time, the rotation of the roll R is temporarily stopped.

After the leading end of the wrapping material A is detected in this manner, the roll R is rotated in the reverse direction in turn. More specifically, the roll R is rotated so that the leading end of the wrapping material A becomes the front end. Thus, the leading end of the wrapping material A is clamped by a wrapping material unrolling device (not shown) arranged below the roll R, and then, the adhesive tape B is peeled. More specifically, the wrapping material unrolling device comprises a chuck which can approach/separate from the outer peripheral surface of the roll R. The leading end of the wrapping material A is inserted in and clamped by the chuck upon rotation of the roll R. Thereafter, the adhesive tape B is peeled upon downward movement of the chuck, and the leading end of the roll R becomes a free end. In this manner, the unrolling operation of the wrapping material A is allowed.

Thereafter, since the wrapping material A is unrolled from the roll R upon rotation of the roll R, the diameter of the roll R is gradually decreased as the unrolling operation progresses. As indicated by an imaginary line in Fig. 3, as the diameter of the roll R is reduced, the swing arm 5 is gradually pivoted downward. In addition, since the roller carrier 7 itself can be pivoted about the support pin 6, the contact rollers 8 of the roller carrier 7 are in rolling contact with the outer peripheral surface of the roll R. More specifically, the photosensor 9 of the roller carrier 7 can always be held in a given position with respect to the outer peripheral surface of the roll R regardless of the diameter of the roll R.

When the remaining amount of the wrapping material A in the roll R reaches a predetermined amount or less, the end indication tape C at the trailing end portion of the wrapping material A passes immediately below the photosensor 9 of the roller carrier 7. Thus, the photosensor 9 detects the end indication tape C with the same precision as in detection of the adhesive tape B, and can output a detection signal.

Thereafter, the trailing end portion of the wrapping material A is cut at a predetermined position, and is joined to the leading end of a wrapping material similarly unrolled from another roll (not shown), thus switching rolls from which wrapping materials are to be unrolled.

As described above, according to the detection device of the present invention, since the roller carrier comprising the pair of contact rollers is pivotally mounted on the swing arm through the support pin, the non-contact type sensor can always maintain a predetermined positional relationship with respect to the outer peripheral surface of a roll, i.e., an object to be detected regardless of the diameter of a roll. Therefore, even when objects to be detected are located at any diameter positions of the roll, they can be reliably detected by the sensor.

eral surface of the roll (R) by weights of said swing arm (5) and said roller carrier (7).

Claims

1. A device for, when a strip-like material is unrolled from a roll formed by winding the strip-like material, detecting a leading end and a remaining amount of the unrolled strip-like material, objects to be detected which respectively indicate the leading end and the remaining amount being provided to the strip-like material, and said device detecting these objects to be detected, characterized by comprising:

a swing arm (5), one end portion of which is pivotally supported on a base frame (2), and which is pivoted so that the other end portion thereof approaches/separates from a peripheral surface of the roll (R);

a roller carrier (7) which is supported on the other end portion of said swing arm (5) to be pivotal about a support pin (5), said support pin (6) being arranged to be parallel to a central axis of the roll (R);

two contact rollers (8) which are rotatably mounted on said roller carrier (7); and

a sensor (9), mounted on said roller carrier (7), for detecting an object to be detected provided to the strip-like material (A) wound in the roll (R) in a noncontact manner.

2. A device according to claim 1, characterized in that said two contact rollers (8) are arranged at positions where distances between said support pin (6) and said contact rollers (8) are equal to each other, and said sensor (9) is arranged in a plane including an axis of said support pin (6) and the central axis of the roll (R).

3. A device according to claim 1, characterized in that said swing arm (5) is arranged above the roll, and said contact rollers (8) of said roller carrier (7) are brought into rolling contact with the periph-

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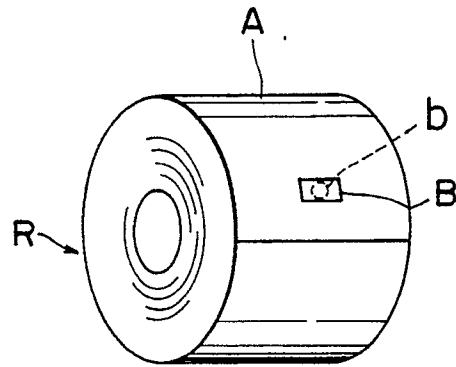


FIG. 1

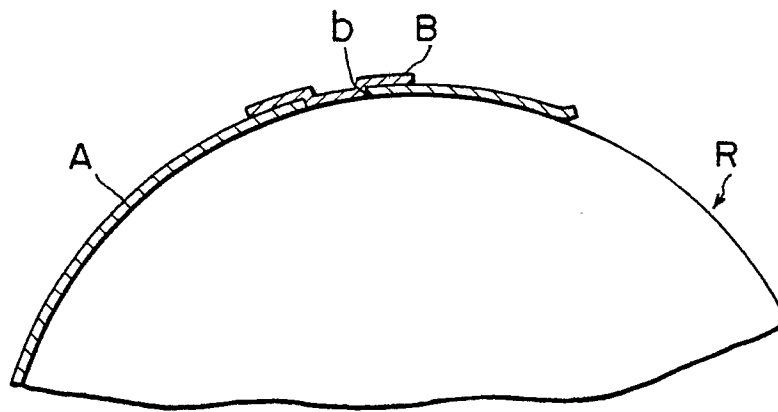


FIG. 2

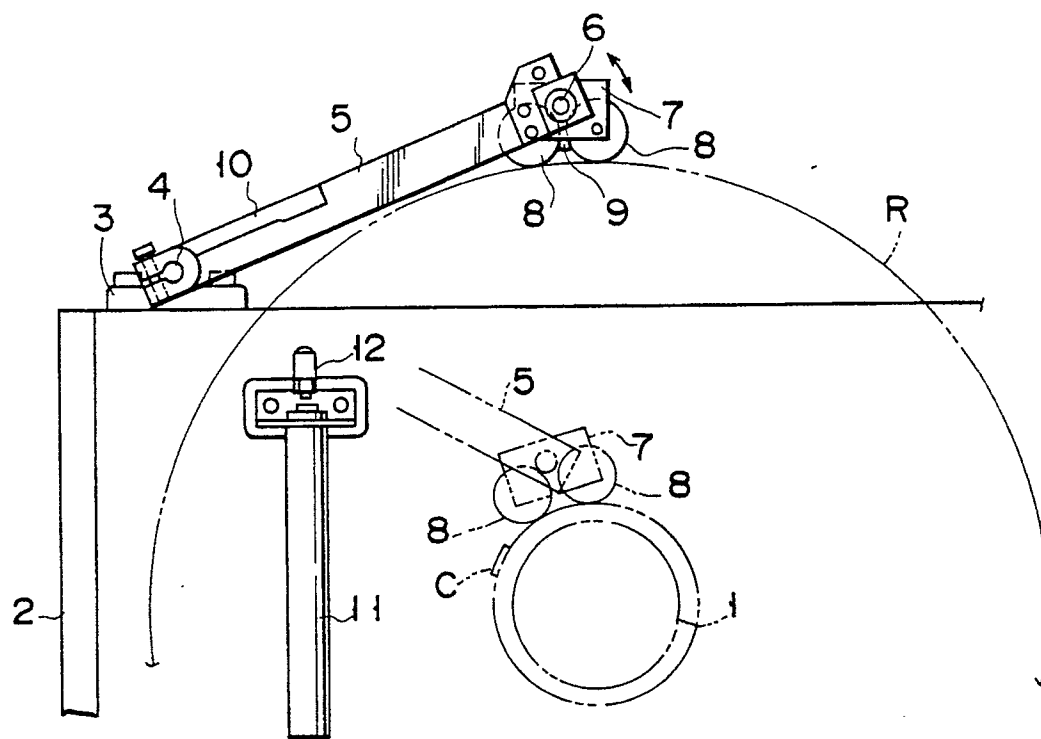


FIG. 3

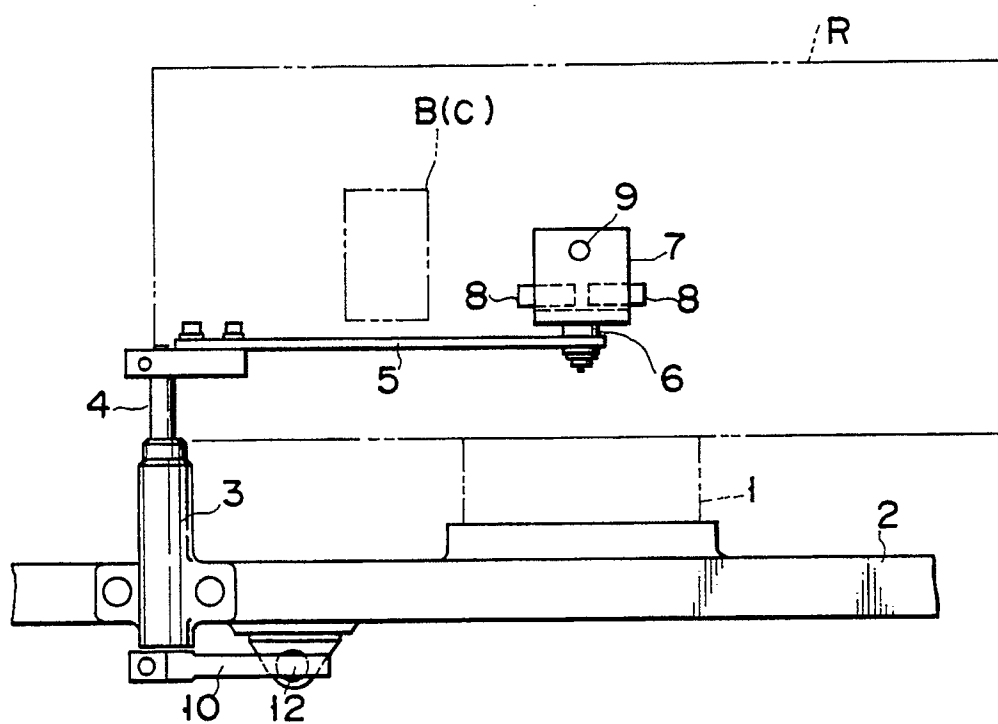


FIG. 4