(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 077 570**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 82109656.7

(51) Int. Cl.³: B 65 H 17/20

(22) Date of filing: 19.10.82

(30) Priority: 20.10.81 JP 166435/81

(43) Date of publication of application:
27.04.83 Bulletin 83/17

(84) Designated Contracting States:
DE FR GB IT

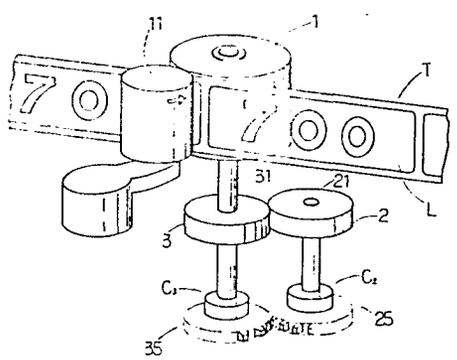
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(54) Pattern-bearing tape feeding apparatus.

(57) The invention relates to an apparatus for feeding a tape (T) bearing a plurality of patterns and corresponding check marks printed thereon. A small-diameter drum (3) is fixedly mounted on a first shaft (31) and a large diameter drum (2) is fixedly mounted on a second shaft (21) and in contact with said small-diameter drum (3), said large-diameter drum (2) having a slightly longer circumference than said small-diameter drum (3). Furthermore, a feed drum (1) is mounted on said first shaft (31) for feeding the tape (T), and photoelectric means (R) are associated with the path of tape feed for detecting for each pattern the position of a corresponding check mark (M) on the tape with respect to a pretermined reference. Drive means (35) selectively transmit driving force to either of said first and second shafts (21, 31) in accordance with the detected position of the check mark (M).



EP 0 077 570 A1

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TITLE OF THE INVENTION

Pattern-Bearing Tape Feeding Apparatus

BACKGROUND OF THE INVENTION

This invention relates to an apparatus for feeding a tape bearing a plurality of patterns printed thereon to a secondary processing machine operating at a constant speed, for example, a cutter. A piece of tape having one pattern is used as a label.

Apparatus for taking up a tape from its roll at a constant speed or by a constant length per unit time for the purpose of printing or cutting are well known and relatively easy to fabricate. The most simple example is a constantly rotating drum.

However, when a tape bearing a plurality of repetitive patterns printed thereon is fed to a constantly operating secondary machine, for example, a cutter or secondary printing machine, constant speed take-up is unacceptable. If a tape is fed at a constant speed to a constantly operating cutter, the tape will be cut into pieces of an equal length. However, in the case of a tape bearing repetitive patterns printed thereon, all the patterns are not precisely equal in length. Referring to Fig. 6, a series of patterns L (to be used as labels, for example) are printed on a tape. One pattern or label has a length l_1 and another pattern has a length l_2. The lengths l_1 and l_2

are often slightly different as long as the patterns are remote from each other. Such a difference in length among printed patterns results from a number of factors including accumulation of errors in the position of patterns printed on the tape, accumulation of expansion and/or shrinkage of the tape during printing process, expansion of the tape due to high tension at a high speed feeding, influence of humidity during feeding, influence of humidity and aging during storage of tape rolls, taking-up slipage, resistance by the unwinding roll and the like. If the tape is constantly cut by feeding it at a constant speed or by an equal length per unit time, then the cutting position will gradually deviate from the desired position between adjoining printed patterns.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide an improved apparatus capable of feeding a tape bearing a plurality of label patterns printed thereon accurately one by one pattern and at a high speed to a constantly operating machine such as a cutter.

It is another object of the present invention to provide an improved apparatus of the above-mentioned type and capable of feeding a variety of tapes having different lengths or widths of patterns printed thereon with the minimum exchange of parts.

According to the present invention, there is provided

an apparatus for feeding a tape bearing a plurality of label patterns and corresponding check marks printed thereon, which comprises a small-diameter drum fixedly mounted on a first shaft, and a large-diameter drum fixedly mounted on a second shaft and in contact with the small-diameter drum. The large-diameter drum has a slightly longer circumference than the small-diameter drum. A feed drum is mounted on the first shaft for feeding the tape, and preferably, an auxiliary drum is in contact with the feed drum to frictionally feed the tape therebetween. Photoelectric means is associated with the path of tape feed for detecting for each pattern the position of a corresponding check mark on the tape with respect to a predetermined reference, and selective transmission means including unidirectional and electromagnetic clutches is provided for selectively transmitting a driving force to either of the first and second shafts in accordance with the detected position of the check mark. In a preferred embodiment, a first drive gear adapted to rotate at a constant speed is mounted on the first shaft via the unidirectional clutch, and a second drive gear in mesh with the first drive gear is mounted on the second shaft via the electromagnetic clutch which is electrically connected to the output of the photoelectric means. The electromagnetic clutch associated with the large-diameter drum is energized or de-energized in accordance with the detected position of a

check mark with respect to the reference at the time when the photoelectric means is actuated.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will be more fully understood from the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a perspective illustration of the tape feeding apparatus according to the present invention;

Fig. 2 is an elevational view of the tape feeding apparatus of Fig. 1, members being partially cut away to show the arrangement of drums and gears;

Fig. 3 is a cross-sectional view of a unidirectional clutch mounted on a first shaft;

Figs. 4 and 5 illustrate a photoelectric device and a check mark on the tape, the check marks being at different positions in Figs. 4 and 5; and

Fig. 6 is an illustration of a tape having repetitive patterns printed thereon.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Fig. 1, the tape feeding apparatus according to the present invention includes a feed drum 1 mounted on a first shaft 31. The feed drum 1 is in tangential contact with a free-rotating auxiliary drum 11 for frictionally transporting a tape T therebetween as the drums rotate. The

feed drum 1 has a circumference slightly shorter than the expected minimum length or standard length of patterns L printed on the tape T which is subject to expansion and/or shrinkage. The feed drum 1 is replaceable. A different tape, that is, a tape having a different length of patterns may be fed by means of this tape feeding apparatus simply by replacing the feed drum 1 by a new feed drum having a corresponding circumference. Accordingly, the feed drum 1 is required to be removably mounted on the shaft 31 such that it is replaceable, but restricted against free rotation with respect to the shaft when mounted.

A provision is made for regulating feed speed, including two drums in mutual contact, that is, a large-diameter drum 2 and a small-diameter drum 3. The large- and small-diameter drums 2 and 3 are slightly different in circumference More specifically, when the small-diameter drum 3 has a circumference of 100 cm, the large-diameter drum 2 has a circumference of 100.2 cm. The large-diameter drum 2 is fixedly mounted on a second shaft 21 and the small-diameter drum 3 is fixedly mounted on the first shaft 31. Both the drums 2 and 3 are secured to the respective shafts by any suitable locking means, for example, a key as shown in Fig. 2. Drive gears 25 and 35 having the same diameter and the same number of teeth are mounted for free rotation on the shafts 21 and 31, respectively. As best shown in Fig. 2, the drive gear 35

is in mesh with the second drive gear 25 and with another gear (partially shown) which is constantly driven by a motor (not shown). The drive gears 25 and 35 are rotating at a constant speed.

The drive shaft 21 having the large-diameter drum 2 secured is provided with an electromagnetic clutch C_2. The electromagnetic clutch for the selective transmission of driving force may be of a well-known mechanism. In a typical arrangement shown in Fig. 2, the shaft 21 is extended through the drive gear 25 via a bearing 22 so that the shaft 21 is free of the constantly rotating drive gear 25. Above the gear 25, a movable disc 23 is mounted on the drive shaft 21 such that the disc 23 is movable in the axial direction, but restricted in the circumferential or rotational direction with respect to the shaft 21. Located above the axially movable disc 23 is an electromagnet 24 which is adapted to receive an electrical signal from a photoelectric device to be described later. Upon receipt of an electrical signal, the electromagnet 24 is energized to urge the disc 23 in frictional contact with the drive gear 25 so that the rotational force of the drive gear 25 is transmitted to the shaft 21 via the disc 23. In the absence of such an electrical signal, or normally, the rotational force of the drive gear 25 is not transmitted to the shaft 21.

On the side of the small-diameter drum 3, a unidirectional

cluch C_3 is associated with the first drive gear 35. The unidirectional clutch C_3 may also be of a well-known mechanism. In a typical arrangement shown in Figs. 2 and 3, the drive gear 35 is mounted for free rotation on the drive shaft 31 and has an annular rim 33 on its upper surface. A toothed disc 32 is secured to the shaft 31, and received within the annular rim 33 of the gear 35. More particularly, each tooth of the disc 32 is oriented in one direction. Steel balls 34 are placed between the channels defined by the teeth of the disc 32 and the annular rim 33, and preferably, biased in one direction toward the apex of the teeth by a spring. With this arrangement, the rotational force of the drive gear 35 is transmitted to the annular rim 33 and hence, to the shaft 31 via the balls 34, whereas the shaft 31 is allowed to rotate at a higher speed than the drive gear 35 in the same rotating direction.

The tape T has check marks M which have been printed in black on the back surface or at any suitable position at the same time as lable patterns. The distance between two succesive check marks M is equal to the length of a corresponding pattern printed on the tape T.

A photoelectric device R having light-emitting and light-sensing sections built therein is located in conjunction with the path of tape feed. This device R develops an electric signal when a light beam emitted from the light-

emitting section impinges against a reflective portion of the tape surface (the surface portion other than black marks M) and the light-sensing section receives the reflected beam. This type of photoelectric device is commercially available. It will be understood that other types of photoelectric device may equally be employed.

An electric circuit (not shown) connecting a power supply to the photoelectric device is designed such that the device is actuated accurately once per revolution of the drive gears 25 and 35. For such a purpose, a timing switch may be inserted between the power supply and the photoelectric device. The timing switch may comprise a disc having a radial slit cut therein and a pair of photoelectric tubes disposed on opposite sides of the disc. The disc rotates at the same revolution per minute as the drive gears 25 and 35. Then the timing switch is closed to actuate the photoelectric device R each time when the drive gears 25 and 35 rotate once.

The operation of the thus constructed apparatus is described below.

Tape setting

The tape T having label patterns printed thereon is unwound from its roll and extended between the feed drum 1 and the auxiliary drum 11. The leading edge of the tape is further guided to the subsequent processing station, for

example, a cutter or a secondary printing machine. At this point, the position of the tape T (or the position of a label pattern or check mark) and the closing time of the timing switch (or the position of the disc slit) are adjusted such that the photoelectric device R emits a light beam to a check mark when the mark passes the reference position in alignment with the photoelectric device.

Normal Feed

As described above, the feed drum 1 is secured to the shaft 31 having the small-diameter drum 3 secured thereto, and the drive gear 35 is in driving engagement with the shaft 31 via the unidirectional clutch C_3. The drive gear 35 is constantly rotated by means of a motor via a suitable gear train. Then, in the normal condition, the feed drum 1 continues rotating with the drive gear 35.

In this normal condition, the electromagnetic clutch C_2 is off. The axially movable disc 23 is spaced apart from the drive gear 25 so that the drive gear 25 rotates independent of the shfat 21. In the normal condition, the transmission system of the gear 25, shaft 21 and large-diameter drum 2 is regarded absent.

Since the feed drum 1 is selected to have a circumference slightly shorter than the standard length of a pattern, a revolution of the feed drum 1 will feed the tape T by a length slightly shorter than the standard length of a pattern.

The photoelectric device R is actuated once per revolution of the feed drum 1. Then, with respect to the timing of light emission, the arrival of check marks M at the reference position is sucessively delayed little by little. However, the photoelectric device does not develop an electric signal as long as the emitted light beam impinges on the check mark M and hence, the light beam is not reflected (see Fig. 5).

Tape underfeed

Tape feeding at a slightly lower speed is continued as described above. Successive check marks are gradually delayed in reaching the reference position in alignment with the photoelectric device, and eventually a check mark will not reach the reference position at the time when the photoelectric device R emits a light beam. The emitted beam impinges on the tape off the check mark (as shown in Fig. 4.). Then the photoelectric device R develops an electric signal which is supplied to the electromagnetic clutch C_2 associated with the large-diameter drum 2. The disc 23 is brought in frictional contact with the drive gear 25 so that the shaft 21 is driven by the drive gear 25.

Since the unidirectional clutch C_3 allows the shaft 21 associated with the small-diameter drum 2 to rotate at a higher speed than the drive gear 35, the tape feeding speed defined by the feed drum 1 is dependent on the peripheral

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speed of the large-diameter drum 2. The tape feeding speed is increased to some extent. In this condition, the transmission system including the gear 35, shaft 31 and small-diameter drum 3 is regarded absent.

Tape overfeed

The tape feeding speed is increased after the delay has been detected (light beam reflected at the tape surface other than a check mark has been sensed). Thereafter, the light beam again impinges against a check mark M, and no reflection occurs and no electric signal is developed by the photoelectric device.

The electromagnetic clutch C_2 is de-energized, rendering the large-diameter drum 2 independent of the shaft 21. The tape feeding speed is decreased again. Thereafter, the above-described procedure is repeated.

As understood from the foregoing, the feed drum is selectively driven via either the small-diameter drum or the large-diameter drum transmission system.

A variety of tapes having different lengths of patterns or different spacings between the adjoining check marks can be fed by the apparatus of the present invention simply by replacing the feed drum by a new feed drum having a circumference matched with the length of a particular pattern. Although a number of parts must be exchanged in the previous tape feeding apparatus of the inventor when a different type

of tape is to be fed, the apparatus of the present invention is versatile in that it can handle a variety of tapes simply by replacing the feed drum.

WHAT IS CLAIMED IS:

1. An apparatus for feeding a tape bearing a plurality of patterns and corresponding check marks printed thereon, comprising

a small-diameter drum fixedly mounted on a first shaft,

a large-diameter drum fixedly mounted on a second shaft and being in contact with said small-diameter drum, said large-diameter drum having a slightly longer circumference than said small-diameter drum,

a feed drum mounted on said first shaft for feeding the tape,

photoelectric means associated with the path of tape feed for detecting for each pattern the position of a corresponding check mark on the tape with respect to a predetermined reference, and

means for selectively transmitting driving force to either of said first and second shafts in accordance with the detected position of the check mark.

2. A tape feeding apparatus according to claim 1 wherein said selective transmission means includes

unidirectional clutch means associated with the first shaft for transmitting the driving force to the first shaft, and

electromagnetic clutch means associated with the

second shaft for transmitting the driving force to the second shaft, said electromagnetic clutch means being electrically connected to the output of said photoelectric means.

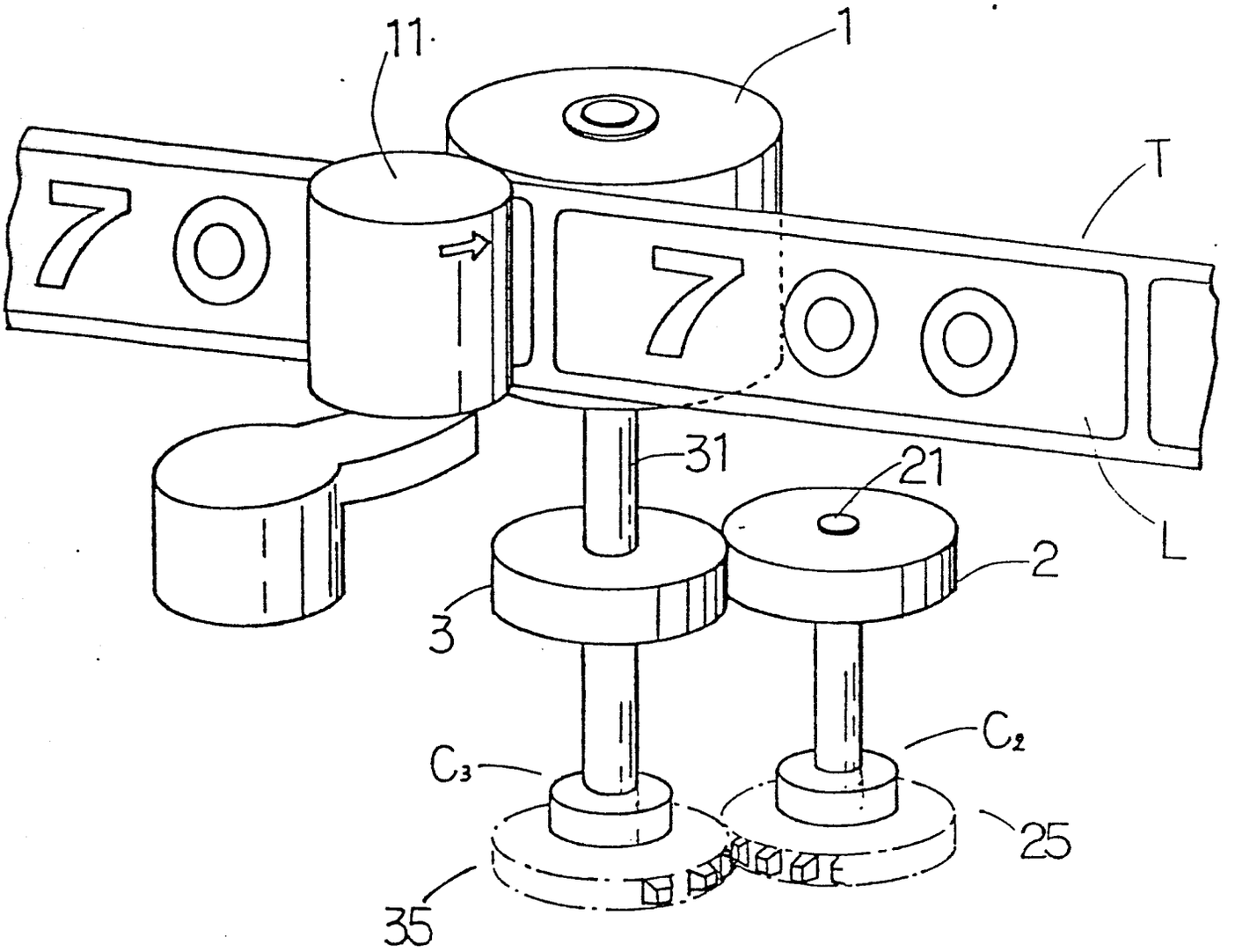
3. A tape feeding apparatus according to claim 2 wherein a first drive gear adapted to rotate at a constant speed is mounted on the first shaft via said unidirectional clutch means and a second drive gear in mesh with the first drive gear is mounted on the second shaft via said electromagnetic clutch means.

4. A tape feeding apparatus according to claim 1 which further comprises an auxiliary drum in contact with said feed drum for frictionally feeding the tape therebetween.

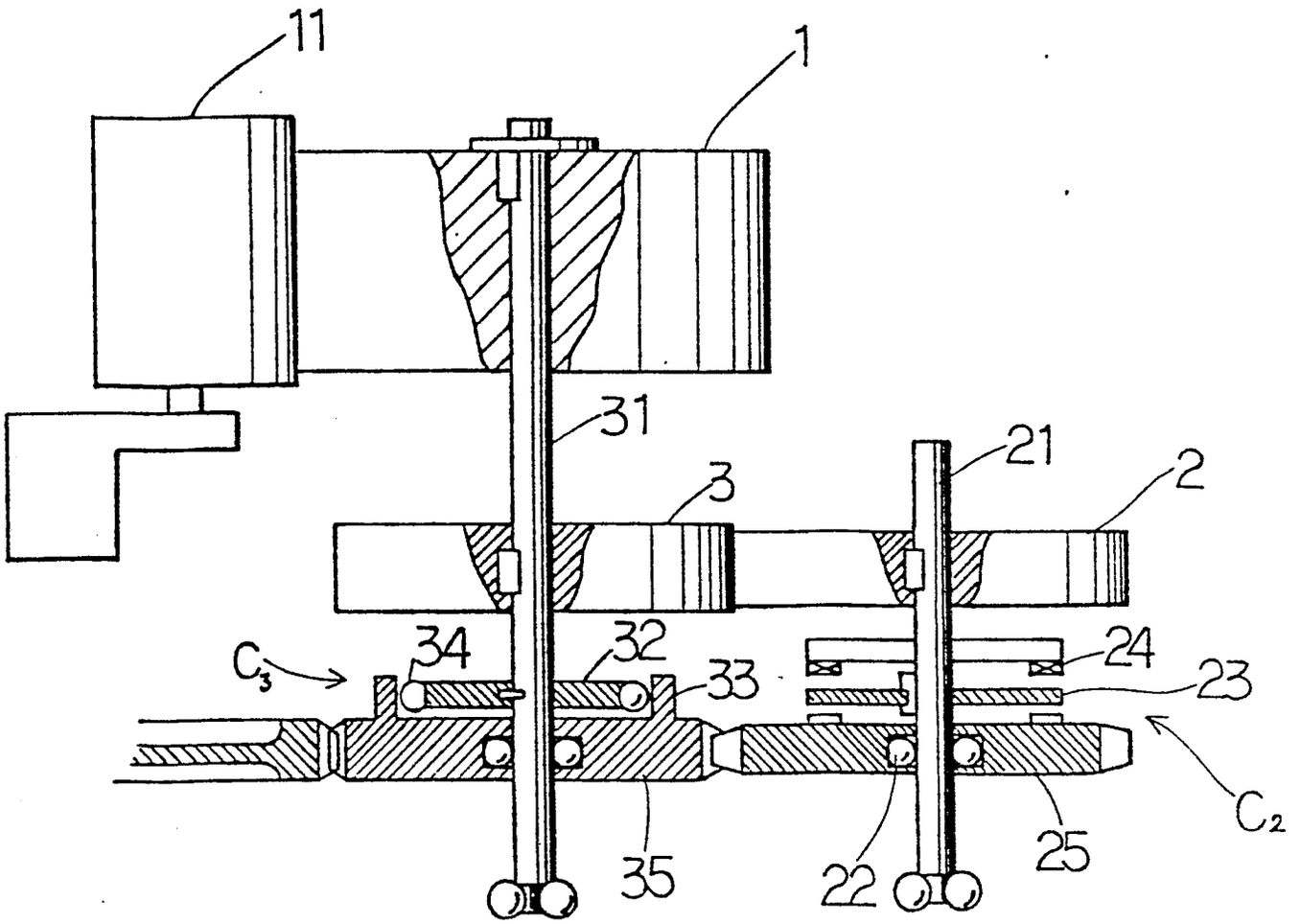
5. A tape feeding apparatus according to claim 1 wherein said feed drum is replaceable and has a circumference slightly shorter than the standard length of printed patterns.

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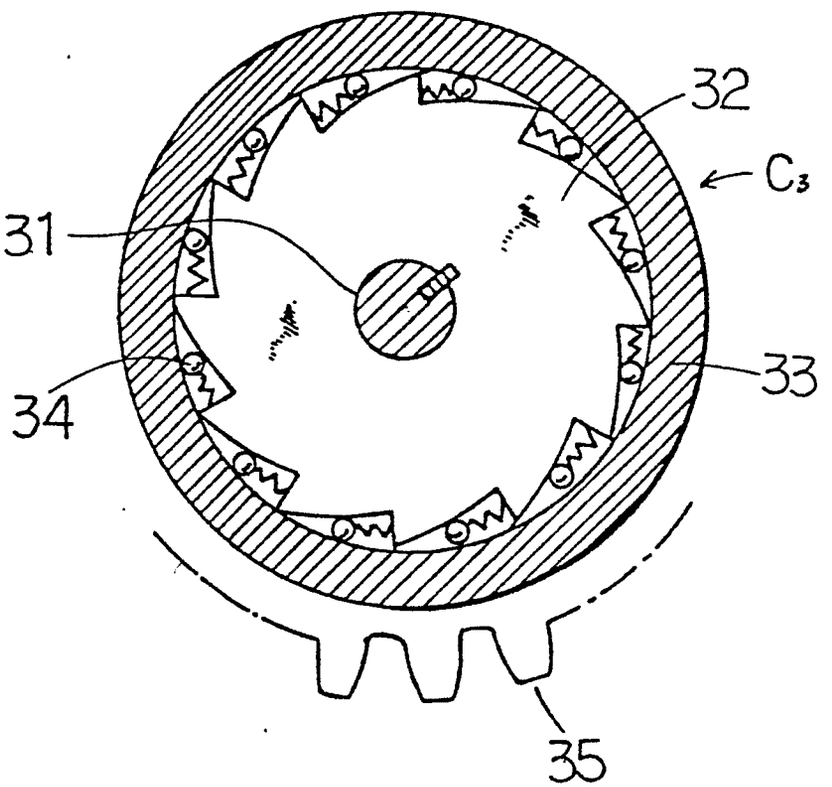
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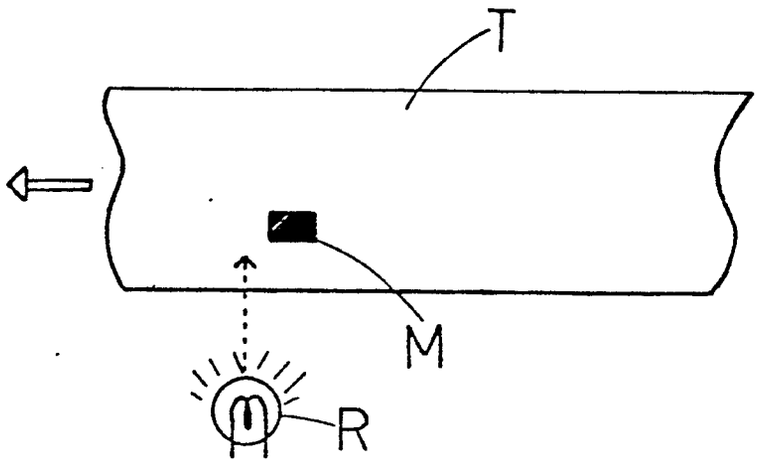
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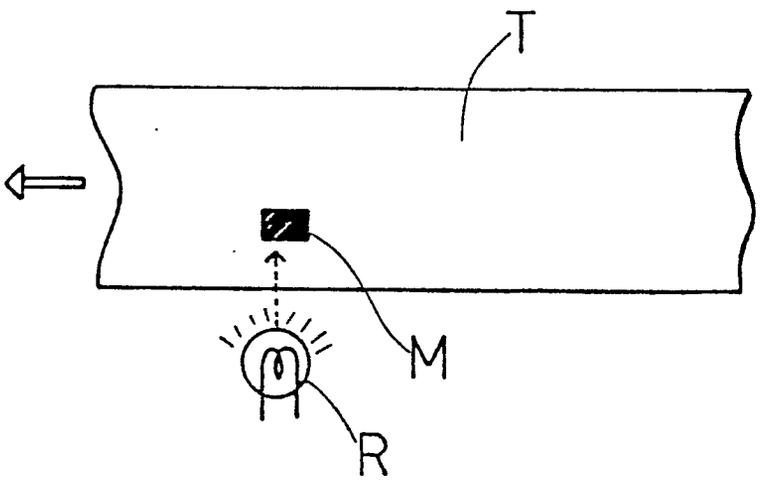
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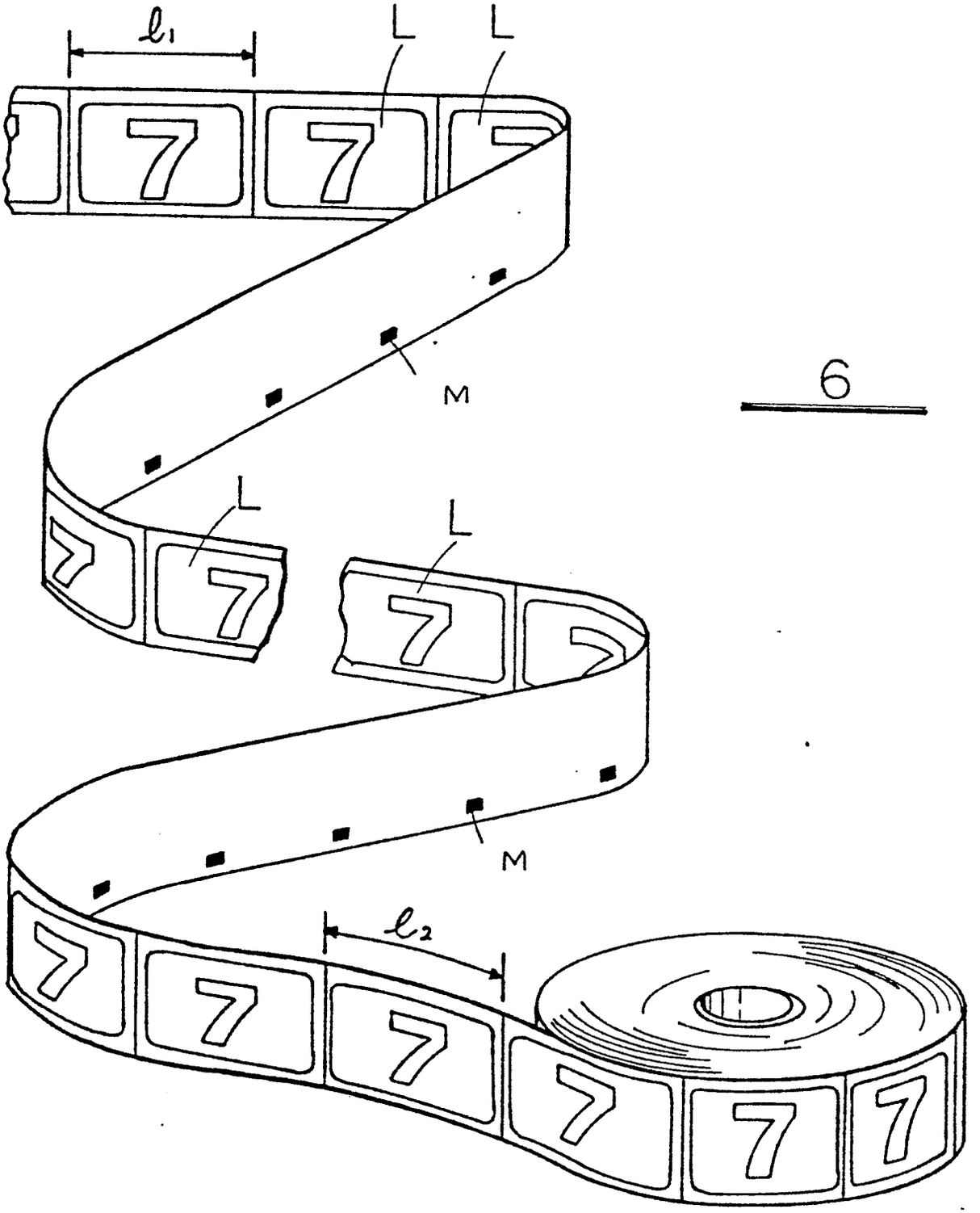


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European Patent Office

EUROPEAN SEARCH REPORT

0077570
Application number

EP 82 10 9656.7

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
A	DE - B2 - 2 439 180 (BRAUN)	
A	DE - A - 2 149 754 (CIBA-GEIGY)	
A	DE - A - 1 774 206 (HONEYWELL)	
A	CH - A5 - 568 924 (MENDE)	
A	US - A - 3 877 627 (BOASE et al.)	

CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)

B 65 H 17/20

TECHNICAL FIELDS SEARCHED (Int.Cl. ³)

B 65 H 17/00
B 65 H 23/00
B 65 H 25/10

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
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E: earlier patent document, but published on, or after the filing date
D: document cited in the application
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&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	06-12-1982	KLITSCH

EPO Form 1503.1 06.78