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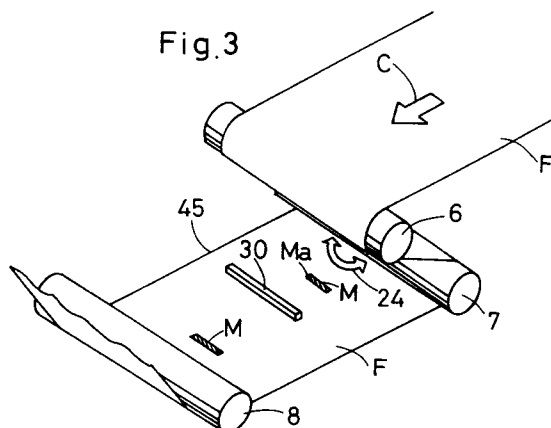
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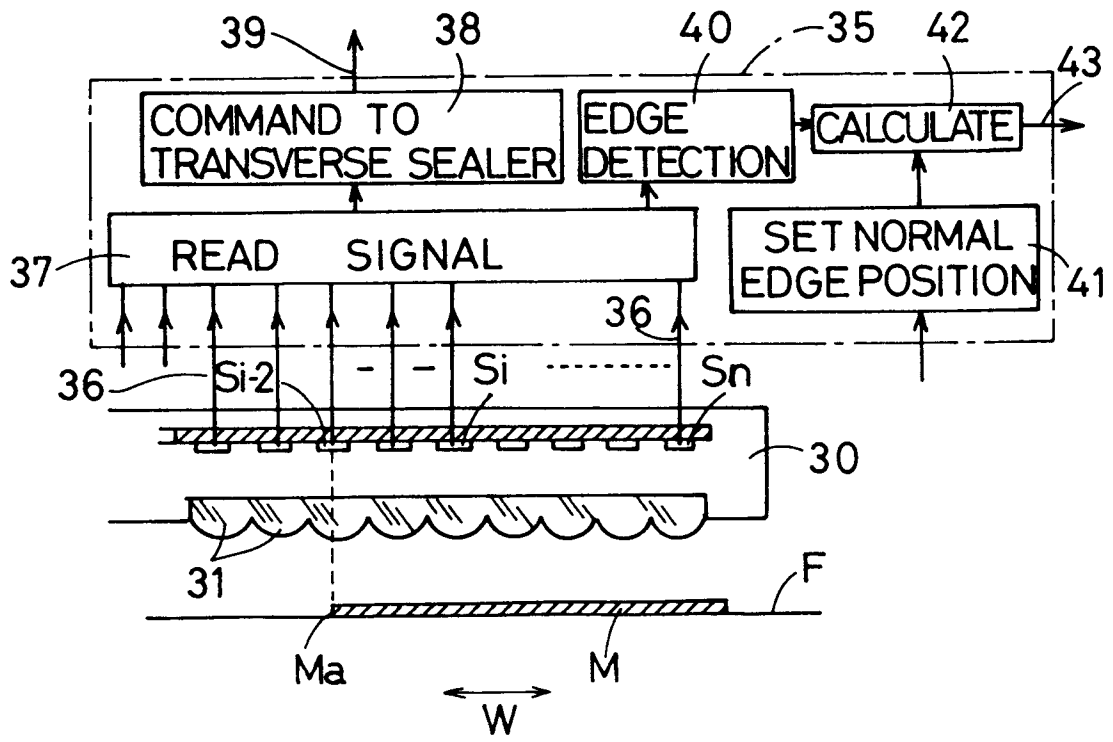
**APPARATUS FOR DETECTING POSITION OF ARTICLE TO BE FED.**

An apparatus for detecting a position in a widthwise direction (W) perpendicularly intersecting a direction of feeding (C) of an article such as a packaging film (F), which is provided with a light receiving means (30) for detecting an edge (Ma) in the widthwise direction (W) of a cut mark (M) attached to an edge (45) of the film or the film (F). On this light receiving means (30), a plurality of light receiving elements (S1 ... Sn) are arranged in a row in the widthwise direction (W), the row of the light receiving elements (S1 ... Sn) are arranged to extend across the edge (45, Ma). Because light receiving elements (S1 ... Sn) such as solid image sensing devices are arranged at a small pitch, a detecting accuracy can be improved.



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Fig.4



## Background of the Invention

This invention relates to an apparatus for detecting the position of an object, such as a resin film or paper, being transported as a supply material. More particularly, this invention relates to an apparatus for detecting the edge position of such an object or the edge position of marks on such an object.

Consider, for example, a combination bag maker and packaging machine adapted to make a bag of a resin material while filling it with articles. Such a machine is generally adapted to bend an elongated resin film into a cylindrical form by means of a former while continuously transporting it and, after its mutually overlapping side edges are longitudinally sealed together, to seal it in a transverse direction.

For making bags by an apparatus of this type, use is often made of a double-layered polyethylene film F as shown in Fig. 15(a) with the frontal layer subjected in particular to a stretching process to add lustre to it such that ink can stick better and it will have a generally improved external appearance. From the point view of sealing, however, the backside layer not undergoing the stretching process can be sealed much more easily. Thus, when the side edges of such a film are longitudinally sealed together, it is necessary to join the backside layers together as shown in Fig. 15(b). For this reason, if the film F shifts sideways in a transverse direction W while it is being transported longitudinally, such a shift becomes most conspicuous where the side edges G are overlapped together, adversely affecting the commercial value of the bags.

In order to eliminate such shifts in the transverse direction W, it has been known to provide an edge detector along the transportation path of the film such that the shift can be corrected according to its output. In fact, detectors as shown in Fig. 16 have been in use with two photo-couplers 93 and 94 disposed across a side edge of the film F. If the inside photo-coupler 93 detects the film F but the outside photo-coupler 94 does not, the condition is adjudged normal. If both photo-couplers 93 and 94 detect the film F or if neither of them detects it, the condition is considered abnormal with the film F shifted sideways, and the shift is corrected accordingly.

It has also been known to use a detector of a nozzle flapper type provided, as shown in Fig. 17, with a plurality of nozzle flappers for passing air therethrough instead of the photo-couplers 93 and 94. The presence or absence of the film F is determined by pressure values detected by pressure gauges 97 and 98 disposed on the side of the air inlets.

These detectors of photo-coupler or nozzle flapper types are disadvantageous in that their position must be adjusted every time a film of a different size is to be used. This problem can be obviated by arranging a large number of detectors, but detectors of photo-coupler or nozzle flapper types cannot be made compact because they require a pair of components, one for emitting light or air and the other for receiving it. In other words, it is not possible to provide a large number of such detectors at a small pitch. As a result, the accuracy of detection cannot be improved in this manner.

It is therefore an object of the present invention to eliminate the problems of prior art detectors and to provide an apparatus for accurately detecting an object such as the edge of a film without the necessity of adjustment whenever there is a change in the size of the object being transported.

## Summary of the Invention

In order to achieve the above and other objects, a position detector according to the present invention for an object being transported comprises a light-receiving means extended perpendicularly to the direction of transportation of the object for detecting a side edge of this object. This light-receiving means has a plurality of light-receiving elements in this perpendicular direction such that the array of these light-receiving elements will extend across the edge of the object to be detected.

Since the plurality of light-emitting elements constituting the light-receiving means of the present invention are arranged not only transversely to the direction of motion of the target object but also over the edge of the object being transported, the position of the light-receiving means does not have to be adjusted even if the transverse dimension of the object being transported is changed. The light-receiving means serving as detector is positioned according to the object being transported and there is no need for any light-emitting means. Thus, a large number of light-receiving elements can be provided at a small pitch and hence the position of a target object can be detected with high accuracy.

What is intended to be detected includes process marks provided on the object being transported or on its side for showing processing positions in the direction of motion, such as marks for showing transverse cut positions.

The light-receiving means may be composed of a base onto which are affixed a plurality of light-receiving elements each comprising a solid image pickup element.

If an optical means for focusing light onto the light-receiving elements is provided on the incident side of the light-receiving means, there is the ad-

vantage of reliably activating the light-receiving elements even if available ambient light is very weak.

If necessary, a light-emitting means may be disposed opposite to the light-receiving means across the object being transported.

Examples of the object being transported include elongated films and paper materials, as well as thin steel materials.

If the object being transported is an elongated film intended to be made into bags, it is preferable to dispose such a light-receiving means between guide rollers for correcting the film tracking and the former for making the film into the shape of a bag.

According to a preferred embodiment of the present invention, a light-emitting means is provided corresponding to the light-receiving elements. The light-emitting means has a plurality of light-emitting elements arranged in the same transverse direction such that the array of these light-emitting elements extends across a side edge of the object being transported and the beams of light emitted from the array of light-emitting elements are substantially entirely reflected by the object being transported and made incident onto the light-receiving means. By thus making use of total reflection of light, it is possible to accurately detect the side edge even if the object being transported is a transparent film.

According to a variation of the above based on total reflection, another pair of light-emitting and light-receiving means is provided opposite to each other across the object being transported. The light-emitting means of the second pair has its light-emitting elements aligned transversely and over the edge of the object being transported and the light-receiving elements of the second pair are also aligned opposite to these light-emitting elements, transversely and over the edge of the object being transported. Thus, the light-emitting and light-receiving means of the second pair together form a detector of light-transmissive type, capable of detecting the edge of an opaque object. In other words, since detectors of both transmissive and reflective types are provided, they can be used selectively, depending on the transparency of the object being transported, such that the edge of objects of all kinds can be accurately determined.

#### Brief Description of the Drawings

Fig. 1 is a diagonal view of a mechanism for transporting a package-making material for a bag-maker-packaging machine incorporating a detector according to a first embodiment of the invention for detecting an object being transported.

Fig. 2 is a side view of a portion of the transporting mechanism of Fig. 1.

Fig. 3 is a diagonal view of the same portion of

the transporting mechanism.

Fig. 4 is a front view of the detector of the first embodiment.

Fig. 5 is a front view of a detector according to a second embodiment of the present invention.

Fig. 6 is a front view of a detector according to a third embodiment of the present invention.

Fig. 7 is a diagonal view of a detector according to a fourth embodiment of the present invention.

Fig. 8 is a side view of the detector according to the fourth embodiment of the present invention.

Fig. 9 is a sectional view taken along the line IX-IX of Fig. 7.

Fig. 10 is a system diagram for the signal processing circuit of the fourth embodiment of the present invention.

Fig. 11 shows the waveforms of the signals in the signal processing circuit of Fig. 10.

Fig. 12 is a side view of a detector according to a fifth embodiment of the present invention.

Fig. 13 is a plan view of a detector according to a sixth embodiment of the present invention.

Fig. 14 is a side view of a detector according to a seventh embodiment of the present invention.

Fig. 15(a) is a sectional view of a film and Fig. 15(b) is a sectional side view of a bag formed by bending the film.

Fig. 16 is a sectional view of a prior art detector.

Fig. 17 is a sectional view of another prior art detector.

#### Detailed Description of the Preferred Embodiments

In what follows, embodiments of the present invention will be described with reference to the drawings.

To start, an outline will be given of a mechanism for transporting a package-making material for a bag-making-packaging machine in which the present invention can be utilized. With reference to Fig. 1, a double-layered polyethylene film F serving as package-making material is pulled out of a film roll R around which the elongated film is wound. The film F is passed around first and second guide rolls 1 and 2 and introduced to a diagonally oriented guide rod RD whereby its direction of motion is changed by a right angle. As will be described more in detail below, this diagonally oriented guide rod RD has the so-called tracking function for correcting the film position in the transverse direction W perpendicular to the direction of film transportation C.

The film F is transported horizontally from the guide rod RD. After third and fourth guide rolls 3 and 4 cause it to move upward, the film F is made to travel horizontally again by a fifth guide roll 5.

After the film F moves along a zigzag path around sixth and seventh guide rolls 6 and 7, it is sent to a former 9 by an eighth roll 8. The sixth and seventh guide rolls 6 and 7 also have a tracking function for correcting the film position in the transverse direction W.

After the film F is bent into the shaped of a cylinder by the former 9, its mutually overlapped side edges G are longitudinally sealed together by means of a longitudinal sealer 10. Thereafter, a transverse sealer 11 seals the bag in transverse direction and cuts the film.

Fig. 2 shows the details of the film-supporting mechanism by the sixth through eighth guide rolls 6 - 8.

As shown in Fig. 2, a rotary plate 18 is provided above a base 16 so as to be rotatable around a support shaft 17. If an ultrasonic motor 20 affixed onto the rotary plate 18 is activated in response to an output signal from a detection sensor to be described below, its pinion 21 engages with a planar arcuate sector gear 22 and causes the rotary plate 18 to rotate.

A support table 13 is affixed to the rotary plate 18, and the sixth guide roll 6 for tracking correction is attached to the tip of an arm 14 which is axially supported by this support table 13 so as to be able to assume either a raised position or a laid down position. The arm 14 generally assumes the laid down position, keeping the sixth guide roll 6 on the downstream side of the seventh guide roll 7 so as to force the film F to follow a zigzag path and to thereby cooperate with the seventh guide roll 7 to control the transverse deviation of the film F.

The seventh guide roll 7, which is the other of the guide rolls for tracking correction, is supported on the rotary plate 18 through another arm 19. As the rotary plate 18 is rotated, therefore, both the sixth and seventh guide rolls 6 and 7 rotate within a horizontal plane in the direction of arrow 24 shown in Fig. 1, thereby correcting transverse deviation of the film F and delivering the film F to the former 9 through the eighth guide roll 8 further on its downstream side.

In Fig. 2, numeral 15 indicates a load cell adapted to detect the tension inside the film F on the basis of the load on the arm 14.

A detection sensor 30 comprising a light-receiving means is disposed along the supply path of the film F between the seventh guide roll 7 for tracking correction and the former 9.

With reference next to Fig. 3, cut marks M (a kind of process marks) are printed on the front surface of the film F, indicating the positions where the film F is to be transversely sealed and cut.

The sensor 30 is for the purpose of detecting the cut marks M serving as targets for the detection and outputting a signal for controlling the tim-

ing of operation of the transverse sealer 11 and the tracking correction of the film F in the transverse direction W. For this purpose, the sensor 30 is elongated like a rod and extends in the transverse direction W. As shown in Fig. 4, a lens array with a plurality of lenses 31 is provided on a plane facing the film F, longitudinally extending in the transverse direction W with respect to the film F. A plurality of independently corresponding light-receiving elements  $S_1 - S_n$  are on the back surface of the lens array at the positions of the foci of the lenses 31.

As shown in Fig. 4, furthermore, the sensor 20 is disposed such that the array of the light-receiving elements  $S_i$  crosses side edges Ma of the cut marks M on the film F.

When one of the cut marks M, printed on the film F with a specified length, passes directly under the detection sensor 30, it is detected as a change in the amount of incident light by the light-receiving elements  $S_{i,2} \dots S_n$  immediately thereabove. Detection signals 36 are transmitted to a central processing unit (CPU) 35, and the transverse deviation of the film F is detected in terms of the shift  $\delta$  between the detector element  $S_{i,2}$  which detected the edge Ma of the cut mark M and the element  $S_i$  which is expected to detect the edge Ma if the film F is being transported normally.

With the sensor 30 thus structured, if the film F with cut marks M of a specified length printed thereon passes thereunder, those of the light-receiving elements immediately above the cut mark M experience a change in the amount of incident light. Since all of the light-receiving elements  $S_1 \dots S_n$  are adapted to receive external light through the lens array 31, the sensor 30 can function accurately even if the external light is weak.

When the detection signals 36 from the light-receiving elements  $S_1 \dots S_n$  are received by the CPU 35 through its signal reading means 37, it is understood that a cut mark M has been detected, and a command 39 is outputted, simultaneously or after a specified length of time, from a command transmitting means 38 to a driving circuit (not shown) for the transverse sealer 11, causing the cylindrically formed film F to be transversely sealed and separated into individual bags.

With reference still to Fig. 4, the CPU 35, through its edge detecting means 40, identifies the particular light-receiving element  $S_{i,2}$  which detected the edge Ma of the cut mark M. The identity of another particular light-receiving element  $S_i$ , which is expected to detect the edge Ma when the film F is traveling normally, is inputted through an external means to a normal edge setting means 41. The shift  $\delta$  between these two light-receiving elements  $S_i$  and  $S_{i,2}$  is calculated by a calculating means 42, and a correction command signal 43 comprising a pulse signal indicative of the shift  $\delta$  is outputted

from the calculating means 42 to an ultrasonic motor driving circuit (not shown). This causes the ultrasonic motor 20 of Fig. 2 to rotate in an appropriate direction so as to rotate the rotary plate 18 through the sector gear 22 engaging with the pinion 21. The sixth and seventh guide rolls 6 and 7 are thereby rotated to the right or left by an appropriate amount (in the direction of the arrow 24 shown in Fig. 3) such that the film F is returned onto its normal path of travel.

In summary, since the detection sensor 30 is disposed such that the array of the light-receiving elements  $S_1 \dots S_n$  is oriented in the transverse direction W of the film F and over the edge Ma of the cut marks M thereon, the edge Ma can be reliably detected even if a film F with a different transverse dimension is transported or the detection sensor 30 is misplaced by a small distance in the transverse direction W. As a result, the tracking correction of the film F in the transverse direction W can be controlled without undue troubles.

Since there is no need for any light-emitting means, furthermore, the sensor 30 can contain a plurality of light-receiving elements  $S_1 \dots S_n$  at a small pitch. Thus, the edge Ma of the cut marks M can be accurately detected. Since solid image pickup elements are small, the aforementioned pitch can be made extremely small if they are used in the light-receiving elements  $S_1 \dots S_n$ . Since the sensor 30 is situated between the tracking correction guide roll 7 and the former 9, furthermore, transverse deviations of the film F within the former 9 can be reliably prevented.

Since the sensor 30, according to this embodiment of the invention, can also detect the position of the cut mark M in the direction of travel C of the film F, its detection signals 36 can be used to control the transverse sealing and cutting operations of the transverse sealer 11. In other words, there is no need to provide two separate sensors for the detection of sealing positions and transverse deviation, and the structure of the apparatus can be simplified.

In situations where available external light is extremely weak, use may be made of a light-emitting means 43 such as LED opposite to the sensor 30 across the film F, that is, below the film F, according to a second embodiment of the invention as shown in Fig. 5.

In the case of an opaque or printed film F having no cut marks, the detection sensor 30 is positioned over a side edge 45 of the film F according to a third embodiment of the invention as shown in Fig. 6. Since the transverse position of the edge 45 can thus be detected, detection signals can be used for accurate tracking correction of the film F in the transverse direction W.

Fig. 7 shows a fourth embodiment of the inven-

tion provided with an edge sensor 50 appropriate for the detection of a side edge 45 of a transparent film F. This edge sensor 50 is disposed along the travel path of the film F between the diagonal rod RD and the fourth guide roll 4, as shown in Fig. 1. As the edge sensor 50 detects the position of the edge 45 of the film F, its detection signal activates a tracking correction motor 46, causing the diagonal rod RD to move to a parallel position indicated by broken lines in Fig. 1 and to thereby correct the deviation of the film F in the transverse direction W.

As shown in Fig. 7, this edge sensor 50 is comprised of light-emitting and light-receiving elements combined as a photo-interrupter of a total reflection type.

Explained more in detail, the edge sensor 50 has a casing 51 extending in the transverse direction W near the lower surface of a side edge 45 of the film F. The casing 51 is provided with an elongated slit extending in the transverse direction W opposite to the lower surface of the film F. An LED array 53 serving as light-emitting means is disposed at one corner inside the casing 51 and directed towards this slit 52. Correspondingly, a one-dimensional CCD image sensor 55 serving as light-receiving means is disposed at the opposite corner inside the casing 51 and is also directed towards the slit 52. The LED array 53 is composed of a large number of LEDs serving as light-emitting elements aligned transversely on a base plate 56. Similarly, the one-dimensional CCD image sensor 55 is composed of a large number of solid image pickup elements aligned in the transverse direction W on another base plate 57.

The principle of the positioning of the LED array 53 and the one-dimensional CCD image sensor 55 is explained next with reference to Fig. 8. When light from the light-emitting elements is made incident on the surface of the film F, it normally travels through the film F at a certain angle of refraction. If the angle between the beam axis of the light and the surface of the film F is made smaller than a certain critical angle  $\theta$ , however, there is no longer any transmission through the film F and the light is totally reflected, the reflected beam travelling substantially symmetrically to the incident beam with respect to the axis Y normal to the surface of the film F at an angle of  $\theta_1$  which is nearly equal to  $\theta$ .

The apparatus according to the fourth embodiment of the invention is so structured that the substantially totally reflected light from the light-emitting elements will be received by the light-receiving elements. Thus, the LED array 53 is disposed on one side of the casing 51 such that the angle of the beam axis therefrom will cause substantially total reflection on the surface of the

film F. The one-dimensional CCD image sensor 55 is likewise disposed symmetrically with respect to the normal axis Y so as to render the angle  $\theta_1$  equal to  $\theta$ . As shown in Fig. 9, the edge sensor 50 is disposed such that light-receiving elements  $S_1, \dots, S_i$ , for example, are inside 59 of the edge 45 of the film F.

Of the many light-receiving elements  $S_1 \dots S_i \dots S_n$  comprising solid image pickup elements arranged in the one-dimensional CCD image sensor 55, therefore, only those  $S_1 \dots S_i$  inside the edge 45 receive reflected light from the film surface, becoming excited to a higher level. Since the remaining light-receiving elements  $S_{i+1} \dots S_n$  will continue to stay in low level, a detection signal 61 from the one-dimensional CCD image sensor 55 is processed by a signal processing circuit 62 which concludes that the edge 45 of the film F should be somewhere between the  $i^{\text{th}}$  and the  $(i+1)^{\text{st}}$  of the many light-receiving elements.

With reference to Fig. 10 which shows the details of the signal processing circuit 62, when a start pulse 65 and a clock pulse 66 are inputted to the one-dimensional CCD image sensor 55, detection pulse 67 begins to be sequentially outputted from this sensor 55, using the start pulse 65 as its starting point. The signal processing circuit 62 includes a low pass filter 68 for receiving the detection pulse 67, a converter 69 for converting the output from the low pass filter 68 into a rectangular wave signal, and an AND circuit 70.

Fig. 11(a) shows a shaped pulse 72 obtained by shaping the waveform of the detection pulse 67 from the film F by means of the low pass filter 68. If this shaped pulse 72 is passed through the converter 69 containing a Schmidt circuit, a rectangular wave signal 75 with a falling section 76 is obtained from a direct current waveform 73 and a threshold level 74 as shown in Fig. 11(b). This falling section 76 indicates a position between the  $i^{\text{th}}$  and  $(i+1)^{\text{st}}$  light-receiving elements  $S_i$  and  $S_{i+1}$ , that is, the position of the edge 45 of the film F shown in Fig. 9.

If the rectangular wave signal 75 from the converter 69 and the clock pulse 66 are inputted to the AND circuit 70 as shown in Fig. 10, pulses 77 shown in Fig. 11(d), indicative of the number of the light-receiving elements  $S_{i+1} \dots S_n$  situated outside the edge 45, are outputted from the AND circuit 70. The position of the edge 45 can be ascertained by counting the number of these pulses 77 by a counter 78 shown in Fig. 10. If the count number corresponding to the edge position when the film F is being transported normally is preliminarily inputted from outside and stored in a normal counter setting means 79 and the difference between the stored number and a detected count number is calculated by a calculator 80, a correction com-

mand signal 81 corresponding to this difference may be outputted to thereby cause the tracking correction motor 46 to rotate either positively or negatively, moving the guide rod RD parallel to its original position and returning the film F to its normal position.

When a film with a different width is installed, the transversely elongated one-dimensional CCD image sensor 55 of Fig. 7 similarly detects the position of the edge 45 from the light received from the LED array 53, correcting the film position accordingly.

By means of the fourth embodiment of the present invention described above with reference to Figs. 7 - 11, the edge position of not only an opaque or printed film but also a transparent film can be accurately determined by making use of the total reflection of light.

Fig. 12 shows a fifth embodiment of the present invention characterized in that the edge sensor 50A includes a piece of ground glass 84 on the optical axes of the LED array 53 so as to diffuse the sharp light beams from the array 53. A slitted plate 86 is also provided in front of the one-dimensional CCD image sensor 55 such that the reflected light from the surface of the film F can be made incident while cutting off the diffracted external light. In Fig. 12, numeral 87 indicates a screening plate disposed between the LED array 53 and the one-dimensional CCD image sensor 55.

In the case of a one-dimensional CCD image sensor 55 using a single crystalline Si substrate which cannot easily be made too long, a lens array 88 may be inserted according to a sixth embodiment of the invention as shown in Fig. 13 on the incident side of the one-dimensional CCD image sensor 55 inside the edge sensor 50B such that the totally reflected light can be convergently refracted and focused on a smaller image sensor 55.

Fig. 14 shows an edge sensor 50C according to a seventh embodiment of the invention, characterized in that it is provided not only with a sensor of a total reflection type shown in Fig. 12 but also with another sensor of a light-transmissive type comprising another one-dimensional CCD image sensor 90 disposed inside the casing 51 and another LED array 91 opposite thereto across the film F. The additional one-dimensional CCD image sensor 90 for receiving transmitted light is shielded by screening plates 87A so as not to receive light from the LED array 53 for total reflection.

The added one-dimensional CCD image sensor 90 and LED array 91 for light transmission are structure similarly to those for total reflection (55 and 53), respectively with a large number of solid image pickup elements and LEDs arranged in the transverse direction W of the film F and over the edge 45 of the film F.

With an apparatus thus structured, the sensor of the total reflection type (53 and 55) is used with a transparent film F and the sensor of transmissive type (90 and 91) is used with an opaque or printed film F such that an edge can be detected accurately for films of all types. 5

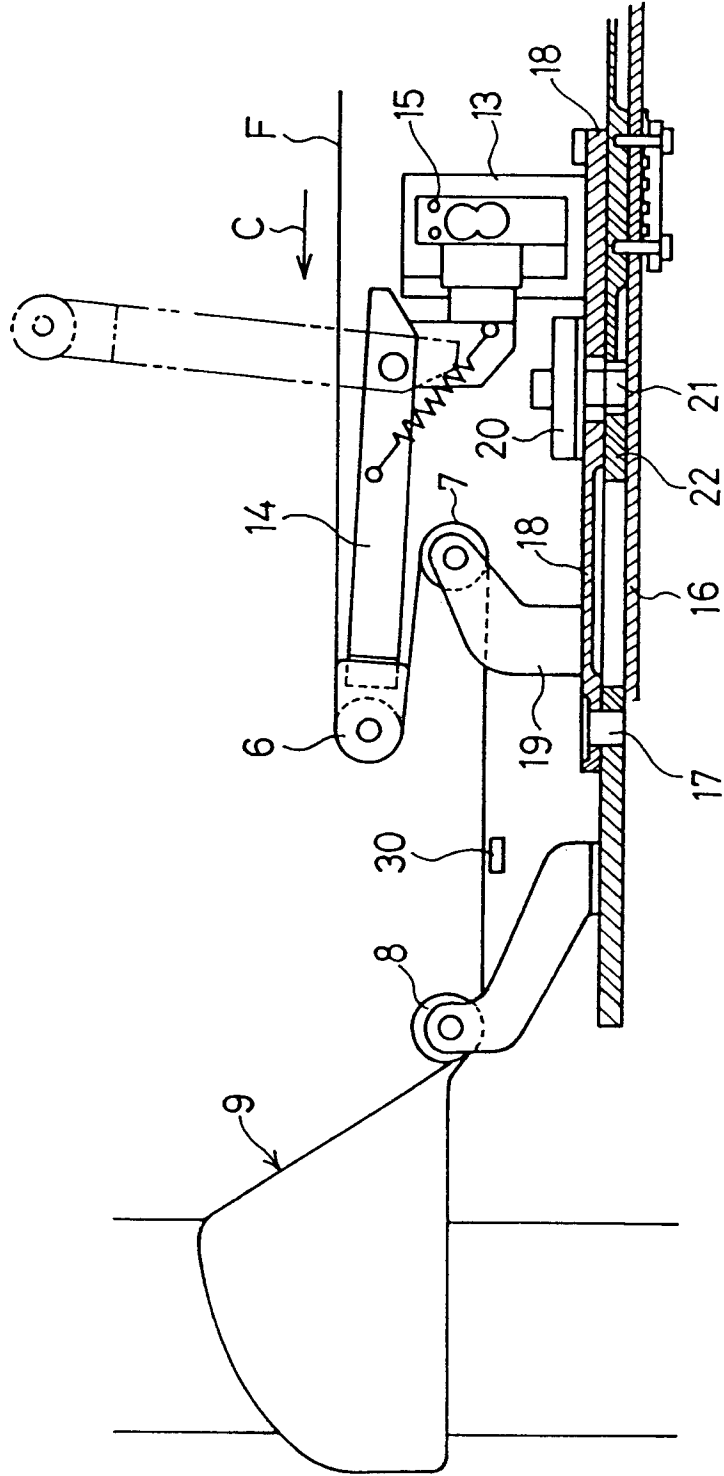
The present invention can be used for the detection of the transverse position of not only elongated films but also elongated paper material or long, thin steel material which is being transported longitudinally. 10

### Claims

1. An apparatus for detecting the position of an object being transported, comprising light-receiving means for detecting a side edge of a target part to be detected on said object, said light-receiving means being extended in a transverse direction which is perpendicular to the path of said object being transported, said light-receiving means having a plurality of light-receiving elements aligned in said transverse direction, and an array of said light-receiving elements is so disposed as to cross said side edge of said target part. 15 20 25
2. The apparatus of claim 1 wherein said target part comprises a process mark on said object being transported for indicating process positions in the direction of transportation of said object. 30
3. The apparatus of claim 1 wherein said target part is a side edge of said object being transported. 35
4. The apparatus of a claim 1 wherein said light-receiving means comprises a base plate and a plurality of light-receiving elements affixed to said base, said light-receiving elements each comprising a solid image pickup element. 40
5. The apparatus of claim 1 further comprising optical means on the incident side of said light-receiving means for focusing light on said light-receiving elements. 45
6. The apparatus of claim 1 further comprising light-emitting means opposite said light-receiving means across said object being transported. 50
7. The apparatus of claim 1 wherein said object being transported is an elongated film. 55
8. The apparatus of claim 1 wherein said object being transported is an elongated film for making bags, said path being provided with tracking correction guide rolls for correcting the transverse position of said film and a former on the downstream side thereof for forming bags from said film, said light-receiving means being situated along said path between said tracking correction guide rolls and said former.
9. The apparatus of claim 3 further comprising light-emitting means corresponding to said light-receiving elements, said light-emitting means comprising a plurality of light-emitting elements aligned along said transverse direction, the array of said light-emitting elements crossing over said side edge, said light-emitting means being so disposed that light emitted from said light-emitting means is essentially totally reflected by said object and made incident on said light-receiving means.
10. The apparatus of claim 9 further comprising another light-emitting means and another light-receiving means mutually opposite to each other across said object being transported, said another light-emitting means comprising a plurality of light-emitting elements aligned along said transverse direction, the array of said light-emitting elements crossing over said side edge, said light-receiving means aligned in said transverse direction and facing opposite said light-emitting elements, the array of said light-receiving elements crossing said side edge of said object being transported.



Fig. 2



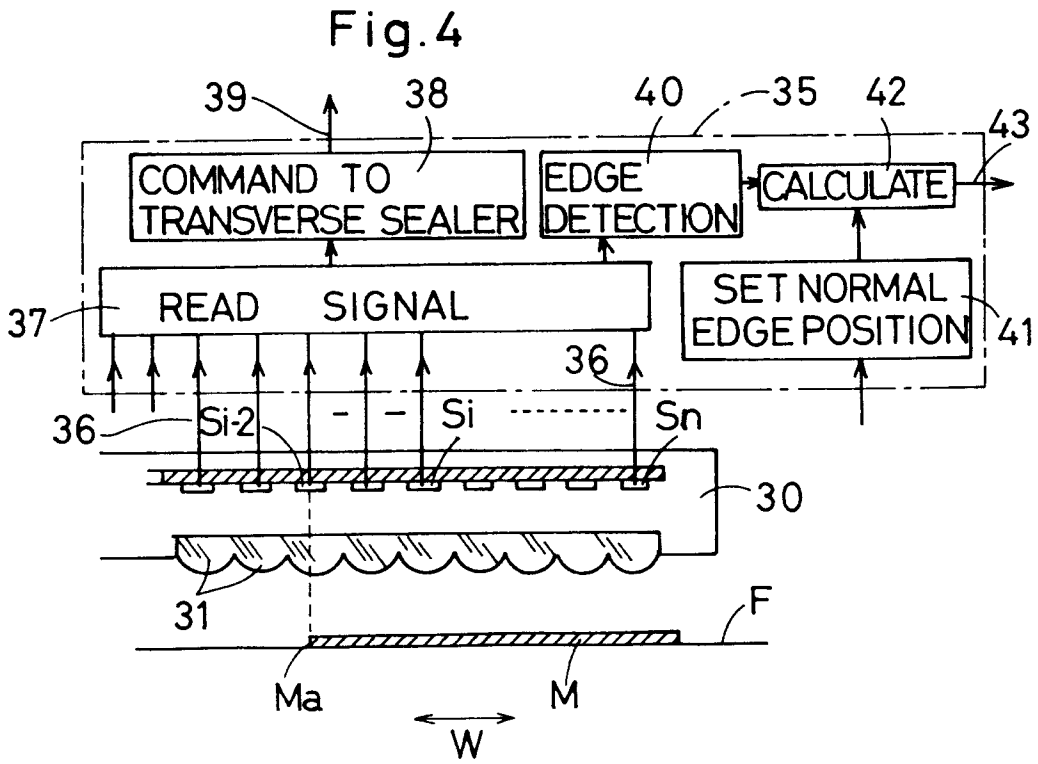
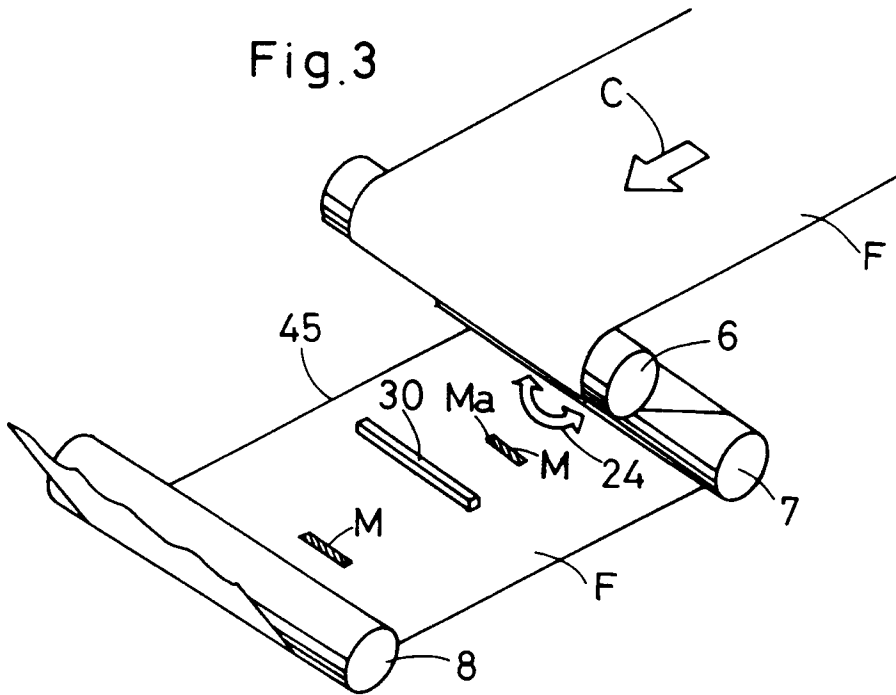


Fig. 5

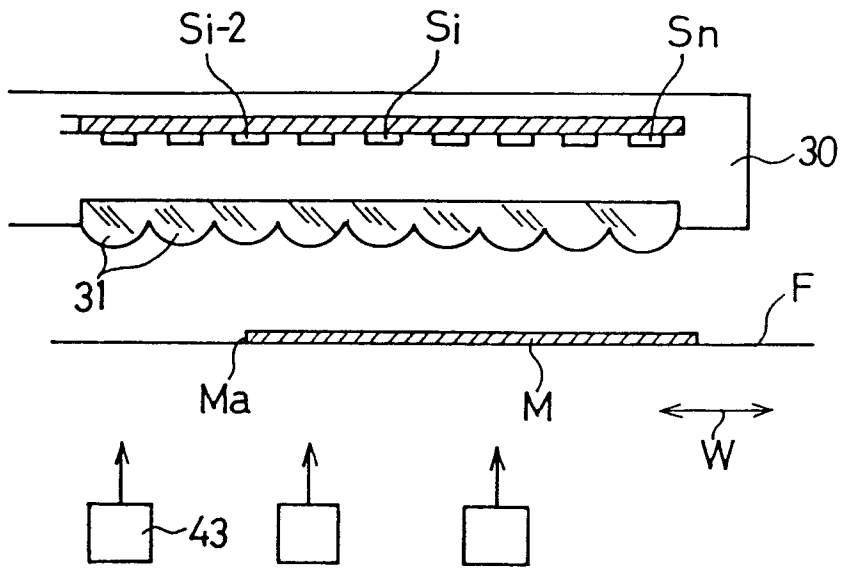


Fig. 6

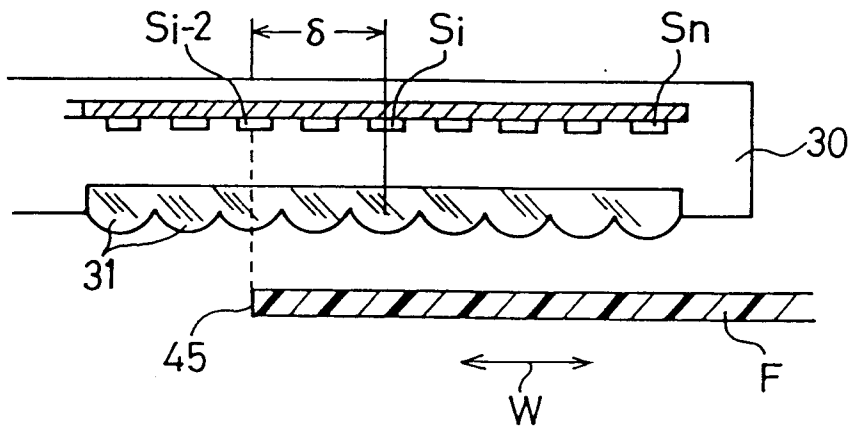


Fig. 7

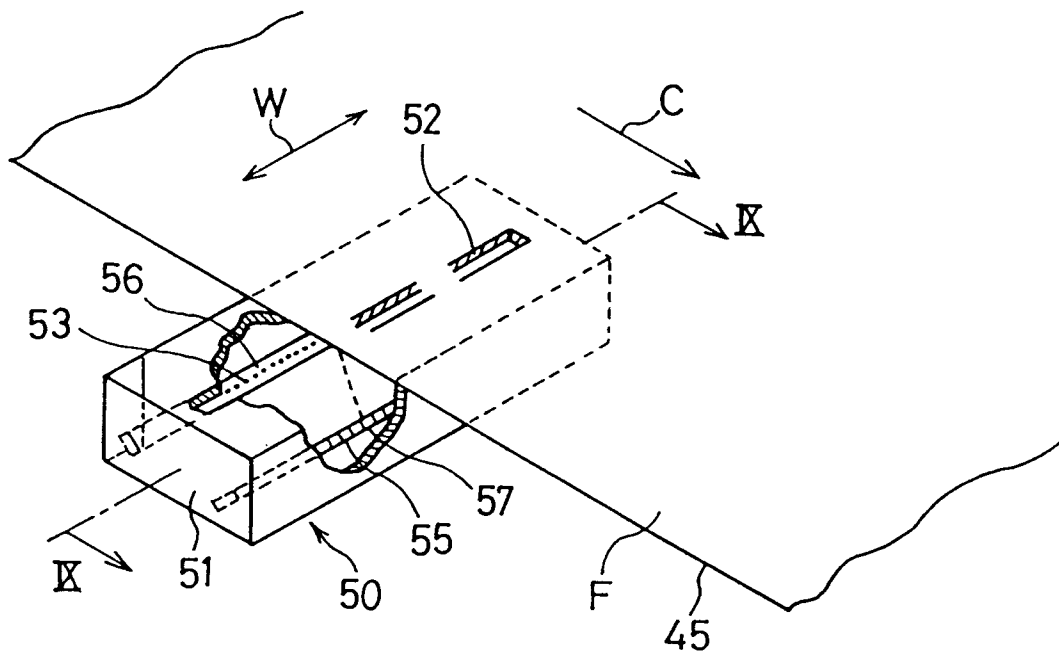


Fig. 8

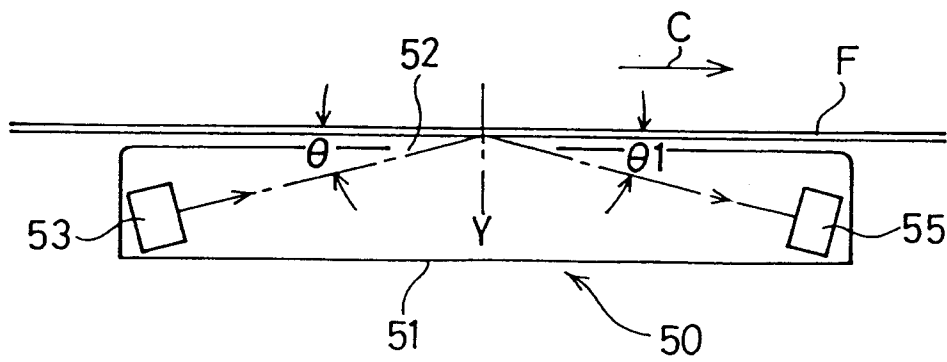


Fig.9

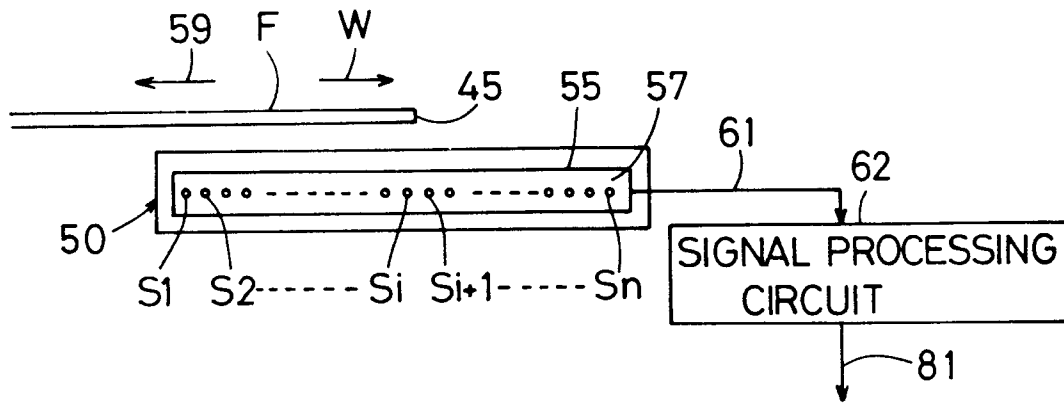


Fig.10

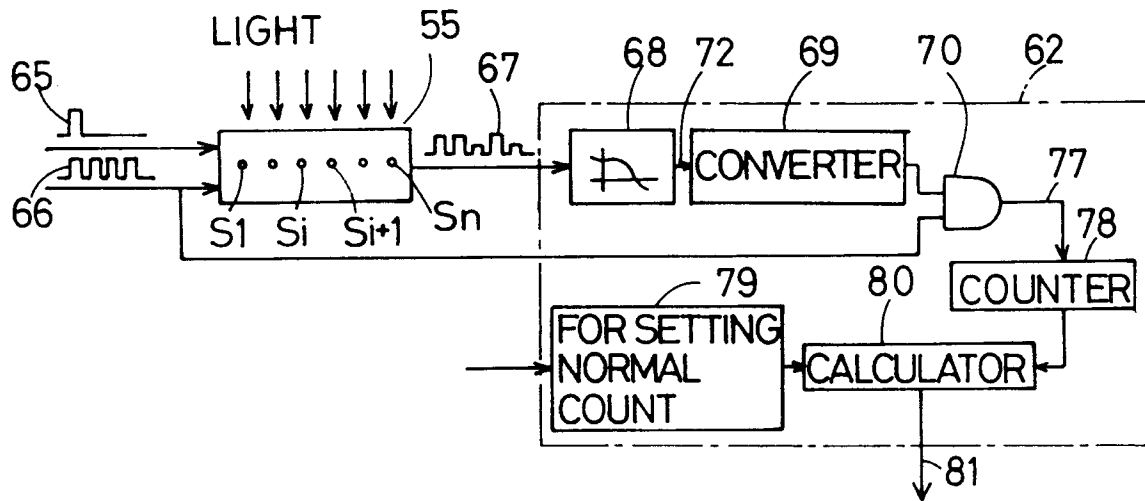


Fig. 11 (a)

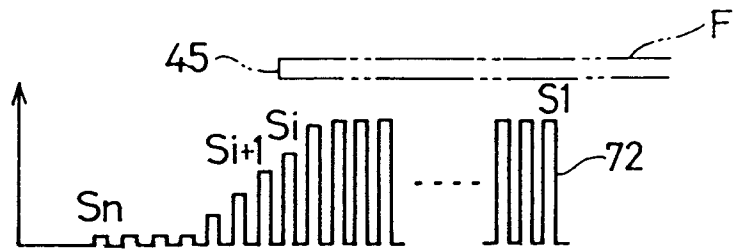


Fig. 11 (b)

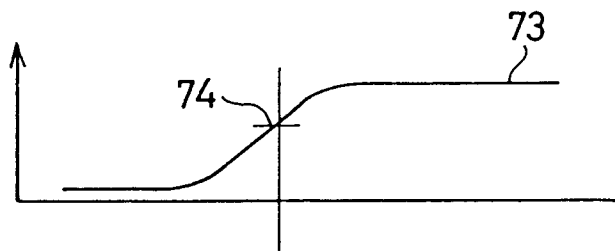


Fig. 11 (c)

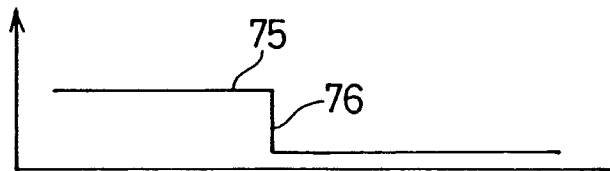


Fig. 11 (d)

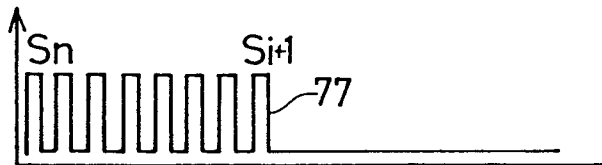


Fig. 12

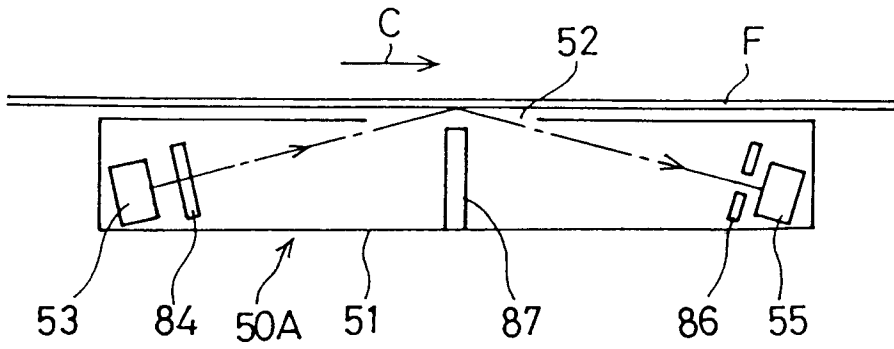


Fig. 13

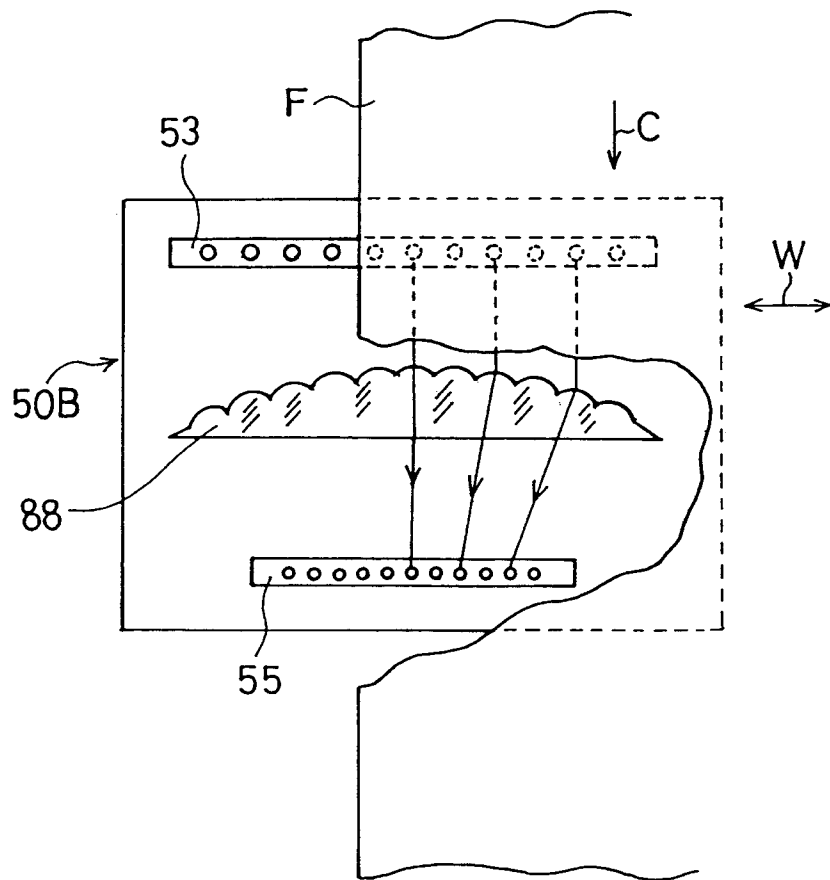


Fig. 14

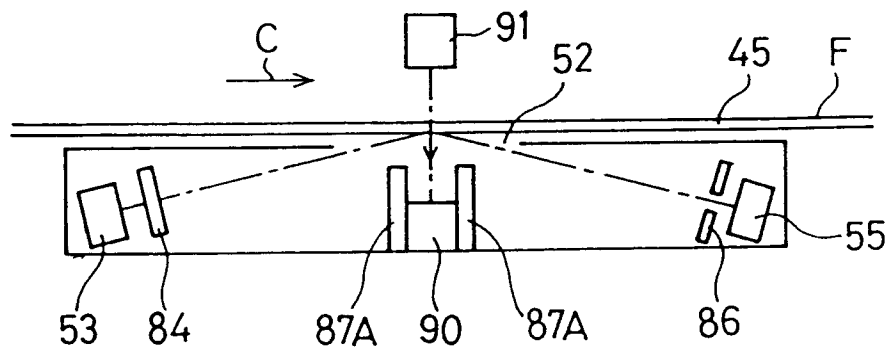


Fig. 15 (a)

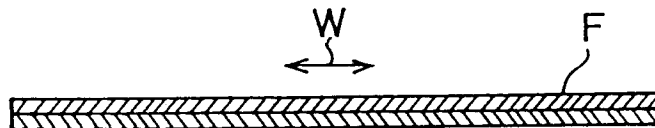


Fig. 15 (b)

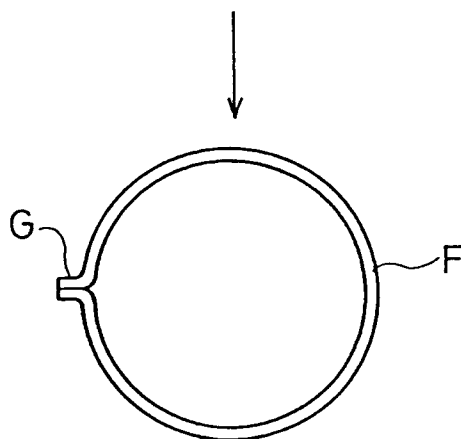


Fig. 16

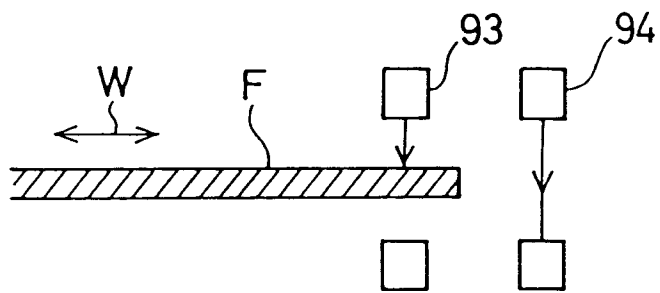
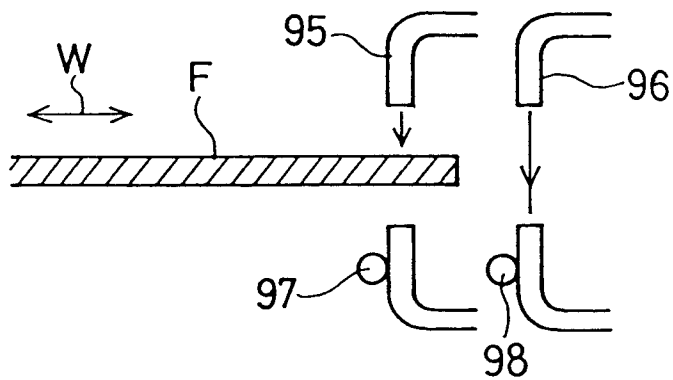


Fig. 17



# INTERNATIONAL SEARCH REPORT

International Application No PCT/JP91/01763

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup>				
According to International Patent Classification (IPC) or to both National Classification and IPC				
Int. Cl <sup>5</sup> B65B41/18, B65H23/032, G01B11/00				
<b>II. FIELDS SEARCHED</b>				
Minimum Documentation Searched <sup>7</sup>				
Classification System	Classification Symbols			
IPC	B65B9/00-9/22, 11/02-11/46, 41/12-41/18, B65H23/038, 26/00, G01B11/00, 11/04			
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>				
Jitsuyo Shinan Koho	1926 - 1991			
Kokai Jitsuyo Shinan Koho	1971 - 1991			
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b>				
Category <sup>9</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>		
X	JP, U, 61-112206 (Microfilm)	1, 3, 6, 7,		
Y	(Dainippon Printing Co., Ltd.), July 16, 1986 (16. 07. 86), Line 20, page 5 to line 20, page 6 (Family: none)	2, 4, 5, 8-10		
Y	JP, A, 3-25303 (Toppan Printing Co., Ltd.), February 4, 1991 (04. 02. 91), Line 18, lower left column, page 2 to line 13, upper right column, page 3 (Family: none)	2, 8		
Y	JP, A, 57-34401 (TDK Corp.), February 24, 1982 (24. 02. 82), Line 9, upper right column to line 8, lower left column, page 3 (Family: none)	4, 5		
Y	JP, A, 2-88910 (Kawasaki Steel Corp.), March 29, 1990 (29. 03. 90), Line 18, lower right column, page 2 to line 19, upper left column, page 3	8-10		
<p><sup>10</sup> Special categories of cited documents:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="width: 50%; border: none;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p> </td> </tr> </table>			<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p>
<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p>			
<b>IV. CERTIFICATION</b>				
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report			
April 15, 1992 (15. 04. 92)	May 12, 1992 (12. 05. 92)			
International Searching Authority	Signature of Authorized Officer			
Japanese Patent Office				

## FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

(Family: none)

Y JP, A, 58-149207 (Omori Kikai Kogyo K.K.), 8-10  
 September 5, 1983 (05. 09. 83),  
 Line 16, upper left column to  
 line 9, lower right column, page 3  
 (Family: none)

V.  OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE <sup>1</sup>

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1.  Claim numbers . . . because they relate to subject matter not required to be searched by this Authority, namely:
2.  Claim numbers . . . because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3.  Claim numbers . . . because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI.  OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING <sup>2</sup>

This International Searching Authority found multiple inventions in this international application as follows:

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:
3.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:
4.  As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

- The additional search fees were accompanied by applicant's protest.
- No protest accompanied the payment of additional search fees.