

[54] **SMALL SIZED ELECTRONIC  
DUPLICATOR**

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[52] U.S. Cl. ....355/3, 355/8, 355/75  
[51] Int. Cl. ....G03g 15/00  
[58] Field of Search .....355/8, 3, 81, 82, 84, 25, 75

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*Attorney*—Watson, Cole, Grindle & Watson

[57] **ABSTRACT**

A cover body hinged to the housing of an electronic duplicator is rotatable between a first and second position so that in the first position a plurality of driven rollers within the cover body are aligned and in contact with a like plurality of driving rollers along an original document carrier path so that thin originals can be transported thereby and in the second position the driven rollers are located on the same level as the driving rollers and form an extension thereof so that thick originals can be transported along the carrier path.

**3 Claims, 5 Drawing Figures**

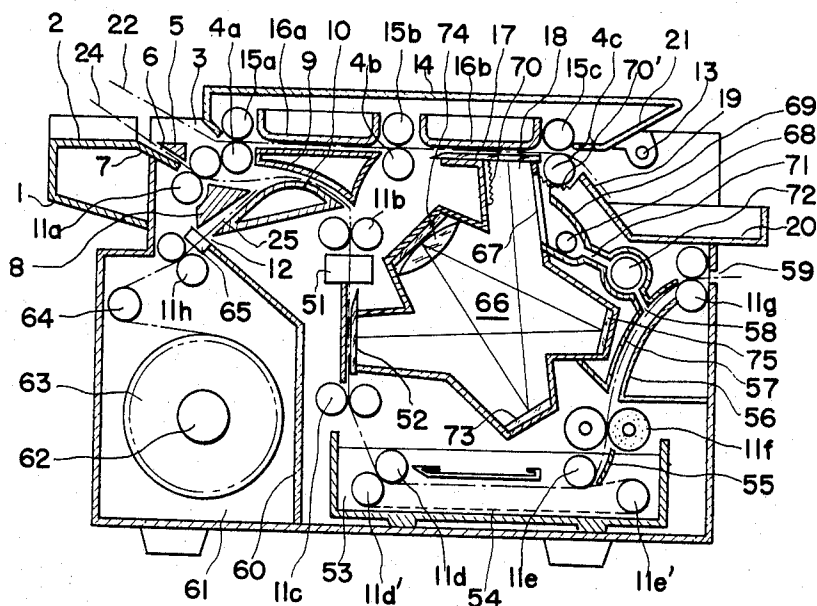


FIG. 1

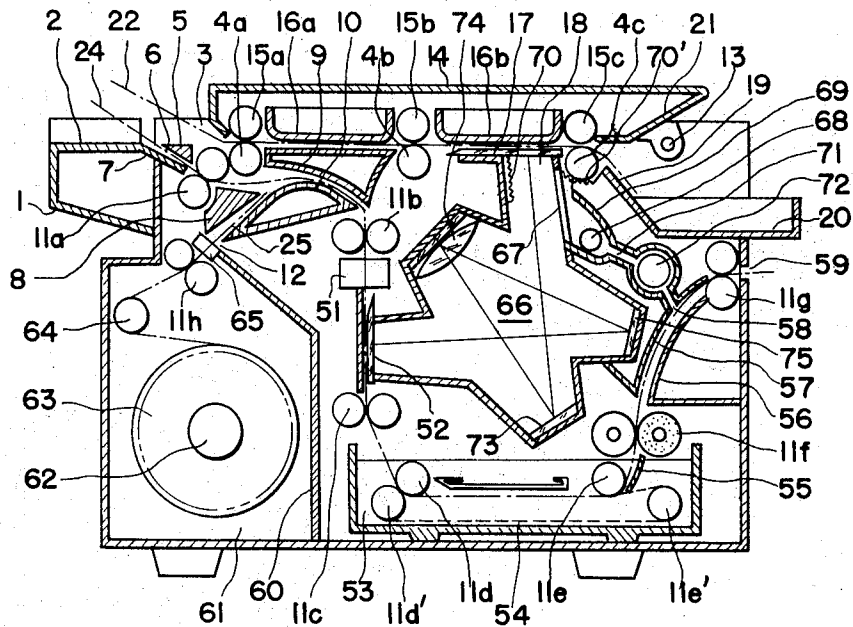
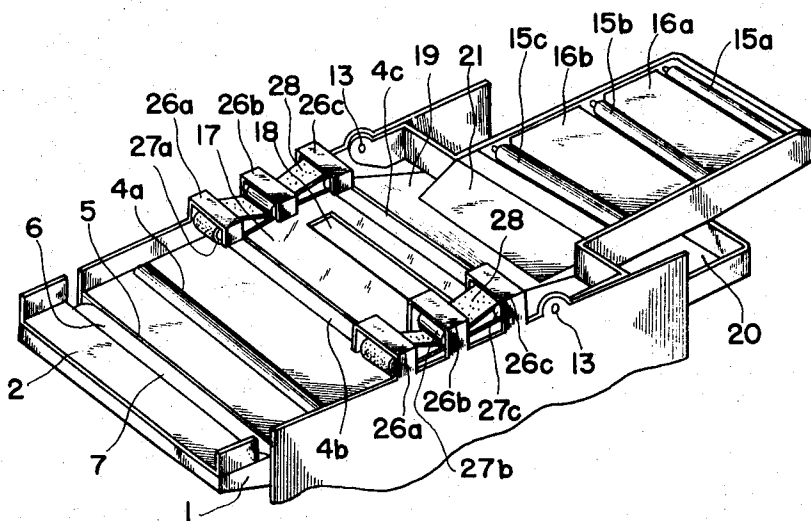


FIG. 2



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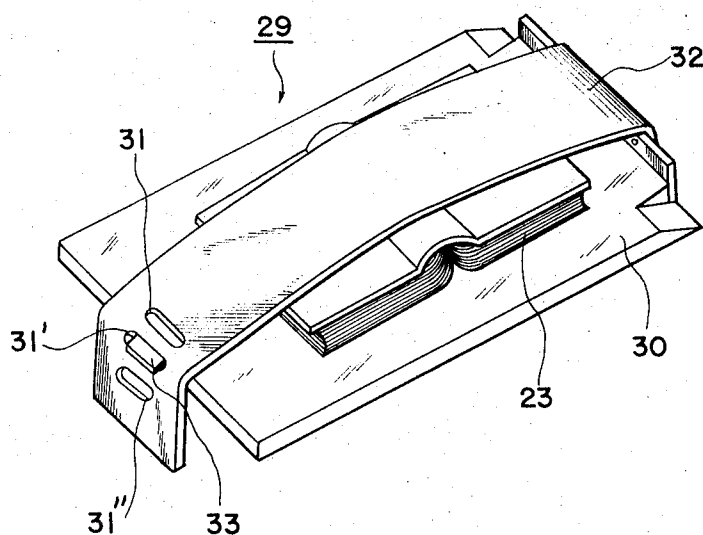
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FIG. 4

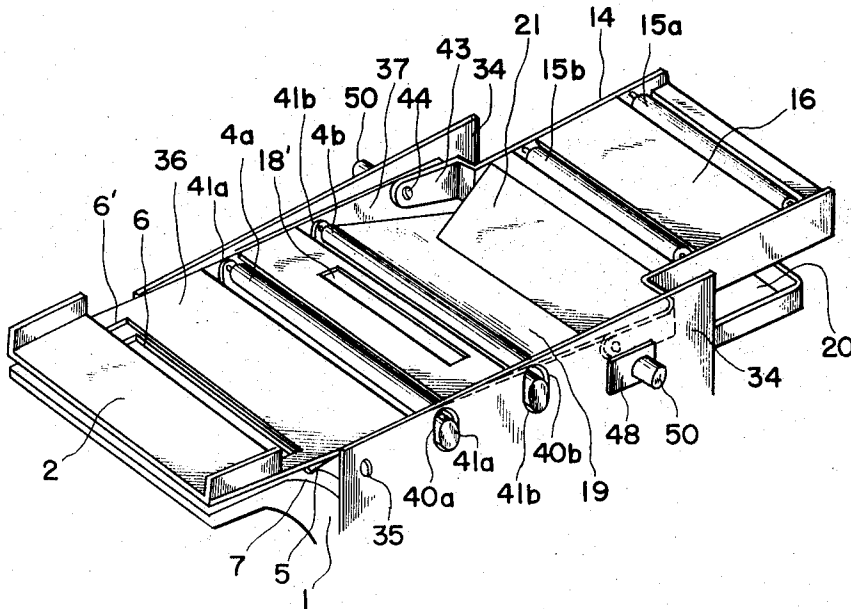
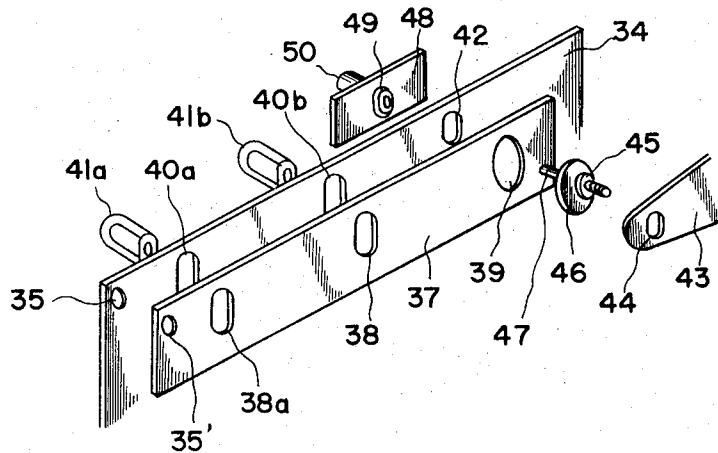


FIG. 5



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## SMALL SIZED ELECTRONIC DUPLICATOR

## BACKGROUND OF THE INVENTION

In a flow pattern duplicator, the duplication is effected while transporting the original and a photosensitive paper synchronously and thin originals are transported one by one along a carrier path from the charging port to the originals discharge base which is curved. However, when thick originals are duplicated, the carrier path must be linear because such thick originals are incapable of being bent to follow a curved exposure path.

While especially in the case of a thin original it is advantageous that the copy discharge base is in a lower position as compared with the duplication of a thick original in order that the exposed originals are stacked on the copy discharge base by gravity, in the case of a thick original it is necessary to provide a duplicated thick original receiving base provided with rollers for making a linear original exposure carrier path. In addition, while it is necessary to provide a press plate for holding the thin original flat relative to the exposure slit, in the case of a thick original it is necessary to provide a means for removing the press plate to contact the thick original with the exposure slit.

In a large duplicator, it is relatively easy to modify the structure or to attach additional parts to accommodate different thicknesses of originals, however, in a small-sized duplicator it is necessary to provide a simplified structure for handling both thin and thick originals.

## SUMMARY OF THE INVENTION

The present invention relates to a small sized electronic duplicator which enables a thin original to be transported linearly along an exposure carrier path and which is easily modified to accept thick originals, by rotating the cover body.

The primary object of the present invention is to provide a small electronic duplicator capable of duplicating both thin and thick originals.

A feature of the present invention is that a thin, original discharge base is provided on a lower level than the original exposure carrier path with the copy charging port. The original exposure carrier path being provided with a charging port thereon, and a cover body provided with an original exposure slit is connected by a pin to the rear end portion of the original exposure carrier path, and by rotating the cover body 180° it is spread out on the thin original discharge base so as to form a duplicated thick copy receiving base on the same level as the original exposure carrier path.

Another feature of the present invention is that a plurality of driving rollers are provided on the copy exposure carrier path, and to the cover body there are connected by pins driven rollers in contact directly or indirectly through the original with the driving rollers. The driven rollers being on the same level as the driving rollers on the original exposure carrier path to serve as a roller for a thick original receiving base when the cover body is rotated. A further feature of the present invention is that an original exposure carrier path in a substantially horizontal position can be inclined to allow the original exposure carrier to slope at a very small angle in the carrying direction when the cover body is rotated.

An additional feature of the present invention is that on both external sides of the cover body there is provided a carrier belt for pressing elastically a thick original against an exposure slit.

Additional objects and advantages of the present invention will be understood from the embodiment described hereinafter with the aid of the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side section of embodiment in accordance with the present invention.

FIG. 2 is a partial perspective view of an original exposure carrier path for handling a thick original in the embodiment shown in FIG. 1.

FIG. 3 is a perspective view of a carrier for a thick original.

FIG. 4 is a perspective view of an original exposure carrier path for a thick original in another embodiment in accordance with the present invention.

FIG. 5 is an exploded perspective view showing the means for inclining the original exposure carrier path in the embodiment shown in FIG. 4.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. 1, on the top of duplicator case body 1 there are arranged in a line at right angles with the direction of the carrier path, charging face 2 for a thin original 22 and several driving rollers 4a, 4b, and 4c connected by respective pins to the upper side edge of case body 1 so as to extend the drum face a little from charging face 2.

Near charging port 3 there is formed protrusion 5 for separating copy 22 and photosensitive paper 24 to deliver them separately to a respective carrier path. The photosensitive paper separated by said separation protrusion 5 is led downward so as to meet the copy exposure carrier path nearly at right angles by means of photosensitive paper charging port 6, guide faces 7, 8, 9 and 10, and photosensitive paper delivery rollers 11a, and into developing station 53 through delivery rollers 11b, passing electric charge device 51 composed of a corona discharge device, photosensitive paper slit 52, and delivery roller 11c, and then the photosensitive paper is carried by delivery rollers 11d, 11d' and 11e, provided in developing station 53, and carrying belt 54 provided between rollers 11d' and 11e', and carried out from developing station 53 to the outside of the case body through guide face 55, rollers 11f and 11f', port 58 opening on guide face 57, and transported by delivery rollers 11g to discharge port 59.

To spindle 62 in small chamber 61 isolated by portion plate 60 from said duplication devices mentioned above there is connected winding drum 63 for holding a roll of photosensitive paper, and photosensitive paper 25 is delivered from winding drum 63 into roll photosensitive paper charging port 12 by turning roller 64, delivery rollers 11h, cutting tool 65, and guided into the space between guide faces 9 and 10.

Meanwhile, to the rear upper end edge of case body 1 cover body 14 is hinged rotatably by spindle 13. When the upper surface of case body 1 is covered by cover body 14 as shown in FIG. 1, driven rollers 15a, 15b and 15c connected rotatably respectively by a pin to the inside of cover body 14 are adapted to come into contact respectively with copy driving rollers 4a, 4b and 4c to carry thin original 22.

And, on cover body 14 press plates 16a and 16b are elastically mounted respectively between driven rollers 15a, 15b and 15c so as to press thin original 22 flatly against the upper surface of case body 1. Transparent stiffening plate 17 faces press plate 16b, and below the stiffening plate is original exposure slit 18 and duplication optical system 66.

On the drum side near copy exposure slit 18 is opening 67 and lighting reflector 69 provided with light source 68 faces opening 67 so as to light originals 22, 23 passing through slit 18 by way of stiffening plate 17. Reference numerals 70, 70' denote respectively a diffuse reflector which reflects light rays for irradiating the outside of slit 18 and the inside of said slit 18.

At the vertex of lighting reflector 69 air suction port 71 is opened to send air to air outlet 58 provided on photosensitive guide face 57 by means of fan 72 so as to cool light source 68 and dry the photosensitive paper.

In duplication optical system 66, first reflector 73 is provided facing original exposure slit 18 to reflect light rays of the copy to mirror lens 74, and in order that light rays from mirror lens 74 are reflected to form an image on photosensitive exposure slit 52 through second reflector 75, the duplication optical system is formed so that the optical path thereof is three times as long as the optical axis.

In the rear of final driving roller 4c on the upper surface of case body 1 there is formed thin original discharge base 20 provided with guide face 19 inclined downwardly from the original exposure carrier face.

On cover body 14 thick original guide bending face 21 is formed beyond final driven roller 15c, and when cover body 14 is opened by rotating it 180° using spindle 13 as a pivot as shown in FIG. 2, guide bending face 21 is located on slope guide face 19 to lead the end of exposed thick original 23 to driven roller 15c.

On the upper side edge of case body 1 there are formed three pairs of bent housings 26a, 26b, 26c formed into an inverted channel shape and housing 26a is formed adjacent second driving roller 4b, housing 26b is formed right in front of the front edge of exposure slit 18, and housing 26c is formed right above third driving roller 4c. Housings 26a, 26c and short-spindle rollers 27a, 27c are connected respectively by a pin in parallel with driving rollers 4b, 4c, and carrier belts 28 are provided over short-spindle rollers 27a, 27c. Short-spindle rollers 27b one connected respectively by a pin to housing 26b to press belts 28 respectively on the center thereof from the upper side to hold the belts respectively under tension, and by means of the back faces of belts 28 and driving rollers 4a, 4b, 4c, thick original carrier 29 is carried as described hereinafter.

FIG. 3 illustrates carrier 29, wherein right and left sides of the front edge of flat glass plate 30 for supporting thick original 23 thereon are formed into a wedge like shape, and a wide elastic band 32 is provided on the central portion of the front edge of glass plate 30 and on the other end of band 32 there are slots 31, 31', 31'' hooked by hooked restrainer 33 formed in the rear of glass plate 30. Thereby a thick original, for example, a book or the like placed on glass plate 30 to be duplicated is pressed into flat contact with glass plate 30 by means of band 32, and both side edges of carrier 29 are interposed between driving rollers 4b, 4c and carrier belts 28 so that transported 29 may be carried.

Since the present invention is formed as described above, thin original 22 is duplicated by covering case body 1 as shown in FIG. 1 and then charging it and photosensitive paper 24 from charging face 2, both the original and the photosensitive paper are separated by protrusion 5, and thin original 22 is delivered between copy driving roller 4a and driven roller 15a. Photosensitive paper 24 is delivered from photosensitive paper charging port 6 to photosensitive paper delivery roller 11a, and then both papers are delivered synchronously through their respective carrier paths. And, when the front edge of thin original 22 delivered while being flattened by press plates 16a, 16b arrives at exposure slit 18 it is lit by lighting device 69, and the picture thereof is charged passing through charge device 51 to form successive individual images on the photosensitive paper carried through photosensitive paper exposure slit 52 by means of image forming optical system 66.

Thin originals 22 after exposure are led to slope guide face 19 after passing through copy driving roller 4c and driven roller 15c thereof and piled up one by one on thin original discharging base 20.

Whereas, the exposed photosensitive paper 24 is developed at developing station 53, dried and blasted with hot air from air outlet 58, and discharged from photosensitive paper discharge port 59.

Next, when duplicating a thick original 23, by rotating cover body 14, 180° using spindle 13 as a pivot, the cover body is opened rearward.

When thick original 23 is a single cardboard, carrier 29 is not always necessary, and in the same way as with a thin original, upon charging thick copy 23 and photosensitive 24 charging face 2, protrusion 5 delivers photosensitive paper 24 from charging port 6 to photosensitive paper delivery rollers 11a, and thick original 23 is placed on driving roller 4a to be carried to driving roller 4b and while being carried by driving rollers 4a and 4b, upon coming to exposure slit 18 duplication is started. The duplicated portion is further carried rearward by driving roller 4c, and the front edge thereof is led by guide face 21 to be carried to driven roller 15c and further transferred to driven rollers 15c, 15b, 15a and then stopped.

That is, driven rollers 15c, 15b, 15a connected respectively by a pin to cover body 14 serve in this case as the receiving base for a thick duplicated 23 original.

In the case of a thick original such as a book, in order to make use of carrier 29, original 23 is put on glass plate 30 of carrier 29 and fastened over the back thereof by band 32 so as to press original 23 into flat contact with glass plate 30 by restraining band 32 hooked by hooked restrainer 33 on any one of slots 31, 31', 31''. When such carrier 29 as equipped as described above is delivered together with photosensitive paper 24 from charging face 2 in the same way as described above and the front edge of carrier 29 carried by driving roller 4a comes to driving roller 4b, both side edges of carrier 29 are interposed between driving roller 4b and carrier belt 28 and while being carried rearward exposure is effected. The carrier 29 is then transported to driven rollers 15c, 15b, 15a and stopped.

In the present invention, as described above, when duplicating a thick original 23, either the thick original 23 or carrier 29 is not bent at all and is yet carried on the same level as with a thin original so that a smooth exposure can be effected.

Besides, when the carrier is used, provided the depth of glass plate 30 is  $d$  and the refractive index thereof is  $n$ , the optical path length is elongated by  $d/n$  however, this is very little elongation so that the carrier remains within the depth of focus of the duplication optical system.

In the embodiment shown in FIGS. 4 and 5, there are two original driving rollers and corresponding driven rollers connected by pins to the cover body. And by inclining the original carrier path relative to the case body the load applied to the driving roller especially in the case of duplication of a weighty and thick book and the like is reduced. Further, the variation of the optical path length due to the glass plate of the carrier is compensated.

In FIG. 4, on the upper face of case body 1 carrier base 36 is provided and connected rotatably by a pin to case body 1 by means of hole 35' provided on the upper portion in front of both side plate 37 and hole 35 is provided on side plate 34 of case body 1. And, on carrier base 36 there are opened 6' facing charging port 6 for photosensitive paper 24 separated by protrusion 6, and slit opening 18' facing the exposure slit on case body 1. In the front and rear of slit opening 18' original driving rollers 4a, 4b are connected rotatably respectively by a pin to side plate 37. That is, as shown in FIG. 5 on side plate 37 oval shaped bearing holes 38a, 38b are provided so as to fit bearings 41a, 41b of the same shape for driving rollers 4a, 4b therein, and on the side edge of case body 1 there are provided long slots 40a, 40b for guiding oval shaped bearings 41a, 41b.

And, near the rear end of side plate 37 circular hole 39 is provided, and on the side plate 34 of the case body across from circular hole 39 oval shaped hole 42 is provided to fit bearing 49 of the same shape as oval shaped hole 42 therein. Siffening plate 48 is in contact with side plate 34 of the case body.

Spindle 47 mounted rotatably in the circular hole of bearing 49 is fixed eccentrically with disk 46 fitted in circular hole 39 provided on side plate 37, and in addition in the extension direction of spindle 47 oval shaped protrusion 45 is formed.

On cover body 14 arm 43 is provided and near the end of arm 43 is hole 44 of the same shape as oval shaped protrusion 45 which fits therein.

Since the present invention is formed as described above, when cover body 14 is in the state shown in FIG. 1 in order to duplicate a thin original 22, carrier base 36 is located horizontally on the upper face of case body 1.

To duplicate a thick original, cover body 14 is rotated 180° and arm 43 rotates oval shaped protrusion 45 of spindle 47, so that spindle 47 is rotated together with eccentric disk 46 to push down circular hole 39 to move side plate 37 downward in accordance with the eccentricity of disk 46 and accordingly side plate 37 rotates clockwise using spindle hole 35' as a pivot. With this motion the spindles of driving rollers 4a, 4b also come down together to slope downward in the delivery direction as shown in FIG. 4.

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Therefore, carrier 29 and the thick original thereon are carried by their weight due to the slope of the copy carrier path and the driving force of the driving rollers, so that the load applied to the driving roller is reduced and the carrier belt is not used. Additionally the increase of the optical path length due to the thickness of the glass plate of the carrier 29 can be compensated.

I claim:

1. An original document transporting device for an electronic duplicator having separate carrier paths for the original and duplicate comprising;

a plurality of driving rollers mounted on the duplicator housing and driven in synchronism by a prime mover;

a sloping guide face connected to said duplicator housing beyond the endmost driving rollers,

a means for receiving and stacking original documents discharged from said guide face and mounted on said housing at a lower level than said driving rollers,

a cover body hinged to said housing to be rotatable between a first and second position, and

a plurality of driven rollers parallelly mounted on said cover

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body driven by said driving rollers with said cover body in said first position, said driven rollers are located on the same level as said driving rollers and form an extension thereof with said cover body in said second position.

2. A transporting device as in claim 1 further comprising paired driving elements mounted on respective sides of said cover body and including spindle driving elements having a width substantially less than that of the original carrier path, said paired elements engaging said original document to transport it along said carrier path, said driven rollers are aligned directly above said driving rollers with said cover body in said first position.

3. A transporting device as in claim 1 further comprising a shaft rotatably mounted in said housing for supporting said cover body, said driven rollers are journaled within said cover body and contact said driving rollers with said cover body in said first position, and means mounted to said shaft and said housing for leveling said cover body in said first position and for inclining said cover body in said section position.

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**UNITED STATES PATENT OFFICE**  
**CERTIFICATE OF CORRECTION**

PATENT NO. : 3,659,937  
DATED : May 2, 1972  
INVENTOR(S) : Yamanoi

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

**[30] Foreign Application Priority Data**

April 29, 1969 Japan Utility Model 44-39226

May 8, 1969 Japan Application 44-35445

**Signed and Sealed this**

*Twenty-eighth Day of March 1978*

**[SEAL]**

*Attest:*

**RUTH C. MASON**  
*Attesting Officer*

**LUTRELLE F. PARKER**  
*Acting Commissioner of Patents and Trademarks*

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