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(71) Applicant: **KABUSHIKI KAISHA TOSHIBA**
72, Horikawa-cho Saiwai-ku
Kawasaki-shi Kanagawa-ken 210(JP)

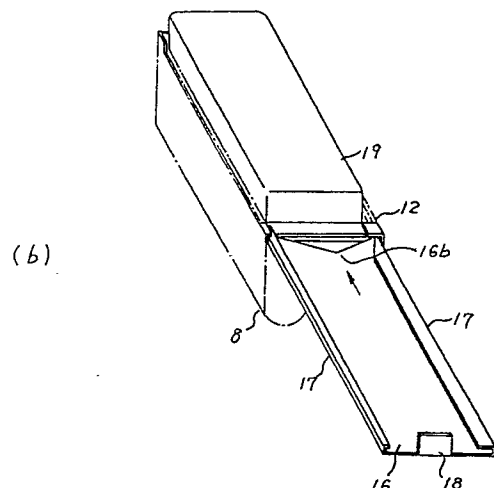
(72) Inventor: **Ishikawa, Takashi, c/o Intell.**
Property Div.
Toshiba Corporation, 1-1-1, Shibaura
Minato-ku, Tokyo(JP)

(74) Representative: **BATCHELLOR, KIRK & CO.**
2 Pear Tree Court Farringdon Road
London EC1R 0DS(GB)

(54) **Developing device.**

(57) A developing device for an electrophotographic recorder includes an open-topped container having a toner inlet port; a toner cartridge which can be detachably mounted on the container so that its toner discharge port is opposed to the toner inlet port and supplies toner through the ports to the container, and a toner cartridge cover which is connectible at one end to the container. The toner cartridge is slid from the container on to the cover so that any toner left in the cartridge does not leak out between the cartridge and the cover to soil the surrounding area.

FIG. 8



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This invention relates to a developing device provided in an electrophotographic recorder so that toner can be supplied to a photosensitive member.

Electrophotographic recorders, such as photocopiers, facsimile machines, laser printers and the like, have a rotatable photosensitive drum with a charger; exposure device; developing device; transfer device and fixing device. In operation of the recorder, the drum is caused to rotate, the exposure device exposes the charged surface of the rotating drum to form a latent image, the developing device develops the latent image on the surface of the drum with toner to form a toner image, the transfer device transfers the toner image from the surface of the drum to a sheet of paper and the fixing device fixes the toner image on the paper.

The developing device stores a quantity of toner and supplies it to the surface of the photosensitive drum. When the toner in the developing device is exhausted it has to be replaced and it is usual for the replacement toner to be supplied in a toner cartridge. A discharge port of the cartridge is covered with a removable sheet. To transfer the toner from the cartridge to the developing device, it is usual for the developing device to comprise an open-topped container having a pair of channel-shaped guides along the top of the container and for the cartridge to have outwardly extending flanges which are slideable in the channel-shaped guides. The toner cartridge is slid into position on the open-topped container so that the discharge port of the cartridge overlies the open top of the container which serves as the toner inlet port, and an externally projecting end of the removable sheet is pulled by the operator to separate the sheet from the cartridge. The toner stored in the toner cartridge is discharged from the opened discharge port into the container.

The toner cartridge, although it is considered to be empty, does, in fact, contain a small quantity of toner which fails to enter into the container and, unless care is taken when the empty toner cartridge is removed from the container, this remaining small quantity of the toner may fall out of the cartridge and soil the surrounding area. To prevent this quantity of toner from falling from the cartridge, it has been proposed to slide the cartridge from the open-topped container on to a toner cartridge cover which closes off the cartridge discharge port.

Referring now to Figures 11 to 14 of the accompanying drawings,

Figures 11a and 11b are a plan and an inverted plan of a conventional toner cartridge;

Figures 12a and 12b are a plan and a perspective view of a conventional toner cartridge cover;

Figure 13 shows diagrammatically a toner cartridge slid from an open-topped container of a

developing device to a toner cartridge cover; and

Figures 14a and 14b are diagrammatic end views of the toner cartridge and the toner cartridge cover.

Referring to Figure 13, the developing device includes an open-topped container 8 which stores toner and delivers it to the photosensitive drum. When the toner in the container is almost exhausted, the toner cartridge 19', which has previously been mounted on the open topped container 8, has to be removed and a new cartridge slid into position. To remove the almost empty cartridge 19', one end of the cartridge cover 16 is connected to the edge 15 of the container 8 and the toner cartridge is slid along the cartridge cover with the outwardly extending flanges of the toner cartridge in the guide channels 17 on the toner cartridge cover. When the front end of the cartridge abuts a stop 18 on the cartridge cover, the outer port 20 of the cartridge is covered by the base portion 16a of the cover, thereby preventing remaining toner in the cartridge from falling out to soil the electrophotographic recorder or the user.

However, the conventional apparatus has the following problems.

The cartridge cover is made from a slightly flexible material, such as vinyl chloride, and, because the cover flexes slightly, the edge 16' of the cover is sometimes caught on the edge of the discharge port 20 of the cartridge when the toner cartridge 19' is slid from the container 8 to the cover 16 and the base 16a of the cover is flexed inwardly towards the toner cartridge, as shown in Figure 14b.

As shown in Figures 12a and 12b, the edge 16Z of the conventional cartridge cover 16 is at right angles to the guides 17, i.e., at right angles to the direction of movement of the cartridge as it is moved from the container 8 to the cartridge cover.

Furthermore, as can be seen from Figures 11a and 11b, the edge 19z of the discharge port is at right angles to the direction of movement of the cartridge as it is moved from the container to the cartridge cover.

If the base portion 16a of the cartridge cover is flexed inwardly towards the cartridge, the edge 16z of the cartridge cover is caught on the edge 19Z of the discharge port and the base portion 16a of the cartridge 16 does not completely cover the discharge port 20, allowing surplus toner in the cartridge to leak out of the gap between the cartridge and the cover.

It is an object of the present invention to overcome the deficiencies of the prior art apparatus.

According to a first aspect of the invention, for use in a developing device of an electrophotographic recorder, there is a toner cartridge having a

toner discharge port through which toner in the cartridge can be discharged; and a toner cartridge cover slideably connectible with the toner cartridge, said cover having a base portion which covers the toner discharge port when the cartridge and the cover are connected together; characterised in that at least one of the edge of the base portion at one end of the cover and the edge of the toner discharge port at the adjacent end are so shaped as to prevent interference between them when the cartridge is slid from said one end on to the toner cartridge cover.

According to a second aspect of the invention, a developing device for an electrophotographic recorder comprises an open-topped container in which the open-top serves as a toner inlet port; a toner cartridge slideably connectible with the container to permit a toner discharge port in the cartridge to be in communication with the toner inlet port of the container; a toner cartridge cover to which the toner cartridge is slideably connectible and having a base portion which covers the toner discharge port when the cartridge and the cover are connected together, said cover being connectible at one end with the open-topped container to permit a toner cartridge to be slid from connection with the container to connection with the cover; characterised in that at least one of the edge of the base portion at said one end and the adjacent edge of the toner discharge part of the cartridge is so shaped as to prevent interference between them when the cartridge is slid on to the toner cartridge cover.

In order that the invention may be more readily understood, it will now be described, by way of example only, with reference to Figures 1 to 10 of the accompanying drawings, in which:-

Figure 1 is a sectional side view of a facsimile machine using a developing device;

Figure 2 is a perspective view of the container of the developing device;

Figures 3a, 4a and 5a are plan views of alternative cartridge covers;

Figures 3b, 4b and 5b are perspective views of the cartridge cover of Figures 3a, 4a and 5a;

Figures 6a and 6b are perspective views of a toner cartridge;

Figures 7a and 7b are perspective views of an alternative toner cartridge; and

Figures 8, 9 and 10 are perspective views showing the toner cover connected to the open-topped container of the developing device.

Referring to Figure 1, a stack of paper P is arranged in a cassette (1). The paper is displaced one sheet at a time by rollers 2, 4 from the stack and sent along a guide path to a photosensitive drum 6. In known manner, a required latent image is deposited on the peripheral surface of the drum

6 by way of means including exposure device 9. A developing device 8 supplies toner to the surface of the drum and the image is transferred to the paper P which is brought into contact with the drum. A fixing device 7 fixes the image which has been transferred to the paper P. The paper P, with the visible image on it, is carried on to a stacker tray 11.

The developing device 8 will now be described in more detail. For the purpose of this specification, the device 8 consists of an open-topped container having a removable and replaceable toner cartridge 19 secured to it to close off the open top. The container is of generally rectangular plan and has an open top 13. Along each of the longer sides of the open top there is a guide channel 12. The open top serves as a toner inlet port. An end wall 14 at one end of the container closes off the guide channels 12 at that end of the container.

As can be seen from Figures 3 to 5, the toner cartridge cover 16 has a flat base portion 16a. This portion is of generally rectangular form and channel-shaped guides 17 are located along opposite longitudinal sides of the base portion 16a. A release member 16c projects longitudinally of one guide 17 at one end of the cover and an upstanding stop 18 is provided at the opposite end of the cover. Conveniently, the base portion 16a, guides 17 and stop 18 are of integral construction and are of, for example, vinyl chloride sheet.

The edge of the base portion 16a which is opposite the stop 18 is shaped to overcome the difficulties of the prior art. The arrangement shown in Figures 3a and 3b has the edge 16b of the base portion cut inwardly towards the opposite end of the base portion so that it is of V-shape.

In the arrangement shown in Figures 4a and 4b, the edge 16d is inclined other than at right angles to the longitudinal length of the base portion 16a.

In the arrangement shown in Figures 5a and 5b, the edge 16e of the base portion is of concave form.

Referring to Figures 6 and 7, a toner cartridge 19 is shown having a toner discharge port 20 and a flange 21 around the discharge port. The discharge port is of generally rectangular form and the opposite ends of the port are shaped in some convenient manner. In Figure 6, the opposite ends 19b are straight but inclined to the longitudinal axis of the cartridge. In Figure 7, the ends 19c are of outwardly extending V-form. As an alternative, the ends could be of concave form. Toner is stored in the cartridge and the discharge port is covered with a removable sheet. The side flanges 21 permit the cartridge to be slid into the guides 12 on the container 8 and also into the channel-shaped guides 17 on the cartridge cover.

When a new toner cartridge is to be mounted on the container 8, the side flanges 21 of the cartridge are inserted into the guides 12 of the container 8 and the cartridge is slid relative to the container until it abuts the end wall 14. In this position, the discharge port on the cartridge is opposed to the inlet port on the container 8 with the removable sheet between them. When the sheet is removed by the user, the toner is discharged from the cartridge to the container.

Referring now to Figures 8 to 10, it will be described how the cartridge is removed from the container with the help of the cartridge cover.

The front edge 16b, 16d, 16e of the cartridge cover 16 is projected into the adjacent ends of the guides 12, as shown in Figure 8, so that the guides 17 on the cover form an extension to the guides 12. The cartridge 19 is slid along the top of the container 8 on to the base portion 16a of the cartridge cover along the guides 17 until the front flange of the toner cartridge abuts against the stop 18. In the position shown in Figure 10, the base portion 16a of the cartridge covers the lower discharge port 20 of the toner cartridge and the cartridge and the cover can be removed together from the container, thereby preventing toner falling from the cartridge.

If the cartridge cover 16 is distorted so that the base portion 16c projects in the direction towards the inside of the toner cartridge, the shaped edge 16b, 16d, 16e does not become caught against the edge of the toner discharge port 20 because the base portion has been cut away at the centre where the distortion would be a maximum. Alternatively, if a conventional cartridge cover is used and the ends of the discharge port of the cartridge are shaped so that, at the centre of the ends of the discharge port, the base portion of the cover does not engage the end wall of the discharge port, the cartridge can be slid from the container 8 on to the cover 16.

As described above, the edge of the base portion 16a of the cartridge cover may be shaped to avoid it abutting against the adjacent edge of the toner discharge port; alternatively, the edge of the toner discharge port can be shaped so that the adjacent edge of the cartridge cover does not abut against it, and, clearly, both the edge of the base portion and the edge of the cartridge may be shaped to prevent them abutting against each other when the cartridge is slid from the container on to the cartridge cover.

Claims

1. For use in a developing device of an electrophotographic recorder, the combination of a toner cartridge (16) having a toner discharge

port (20) through which toner in the cartridge can be discharged; and a toner cartridge cover (16) slideably connectible with the toner cartridge, said cover having a base portion (16a) which covers the toner discharge port when the cartridge and the cover are connected together; characterised in that at least one of the edge of the base portion (16a) at one end of the cover and the edge of the toner discharge port at the adjacent end are so shaped as to prevent interference between them when the cartridge is slid from said one end on to the toner cartridge cover.

2. A developing device for an electrophotographic recorder, said device serving to supply toner stored therein to a photosensitive member and comprising an open-topped container (8) in which the open-top serves as a toner inlet port (13); a toner cartridge (19') slideably connectible with the container to permit a toner discharge port (20) in the cartridge to be in communication with the toner inlet port of the container; a toner cartridge cover (16) to which the toner cartridge is slideably connectible and having a base portion (16a) which covers the toner discharge port when the cartridge and the cover (16) are connected together, said cover being connectible at one end with the open-topped container to permit a toner cartridge to be slid from connection with the container to connection with the cover; characterised in that at least one of the edge of the base portion (16a) at said one end and the adjacent edge of the toner discharge part (20) of the cartridge is so shaped as to prevent interference between them when the cartridge is slid on to the toner cartridge cover.
3. The combination of claim 1 or the developing device of claim 2, characterised in that the edge (16b, 16e) of the base portion at said end of the cover is concave.
4. The combination or device of claim 3, characterised in that said edge (16b) is V-shaped.
5. The combination or device of claim 3, characterised in that said edge (16e) is arcuate.
6. The combination of claim 1 or the developing device of claim 2, characterised in that the edge (16d) of the base portion of the cover is inclined other than at a right angle to the length of the cover.
7. The combination of claim 1 or the developing device of claim 2, characterised in that the

edge (19c) of the toner discharge port is V-shaped.

8. The combination of claim 1 or the developing device of claim 2, characterised in that the edge (19b) of the toner discharge port is inclined other than at a right angle to the length of the cartridge.

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FIG. 1

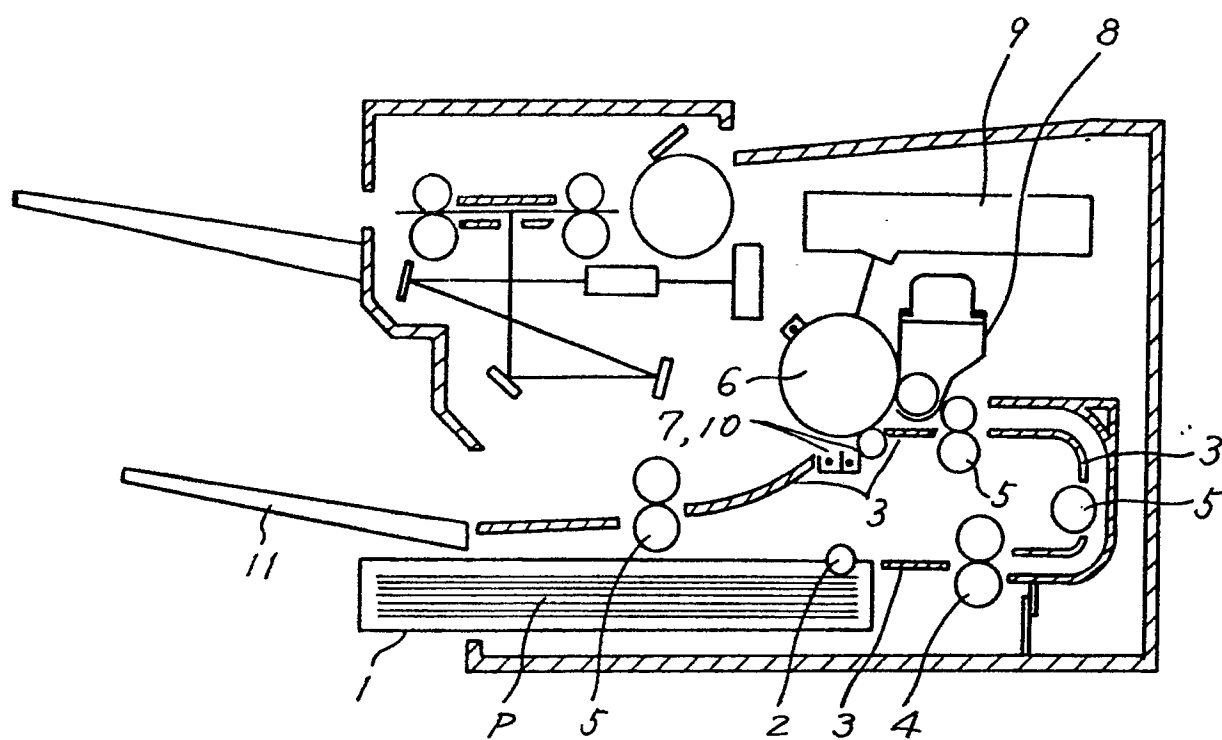


FIG. 2

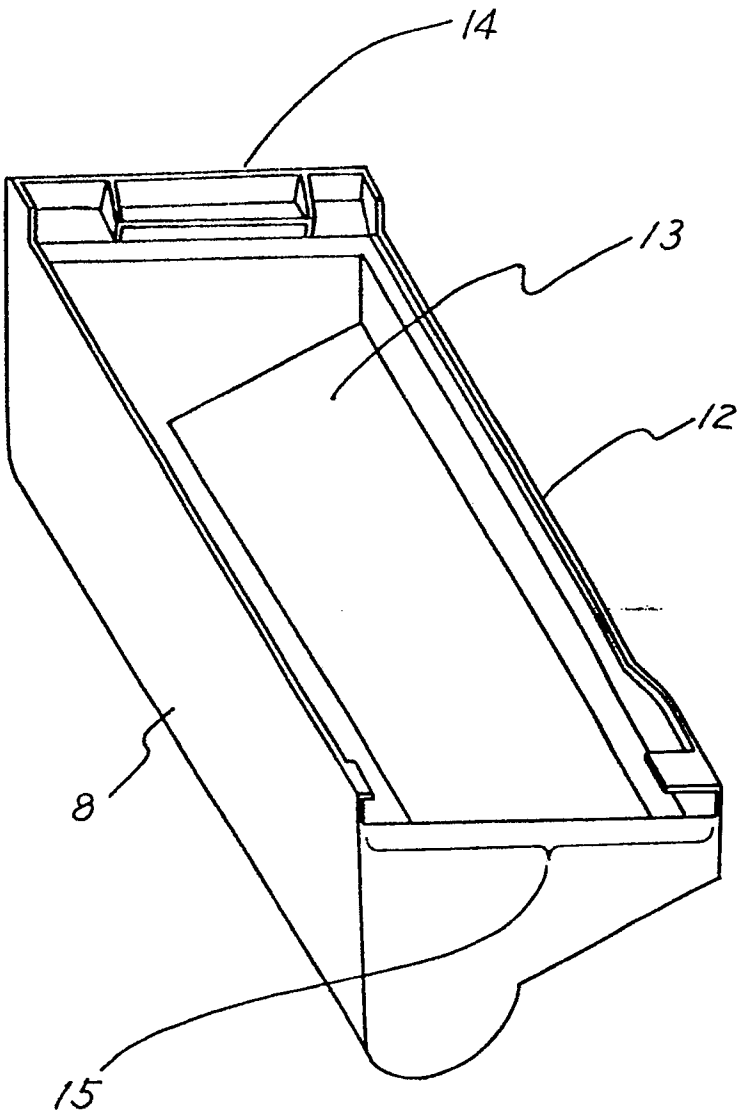


FIG. 3

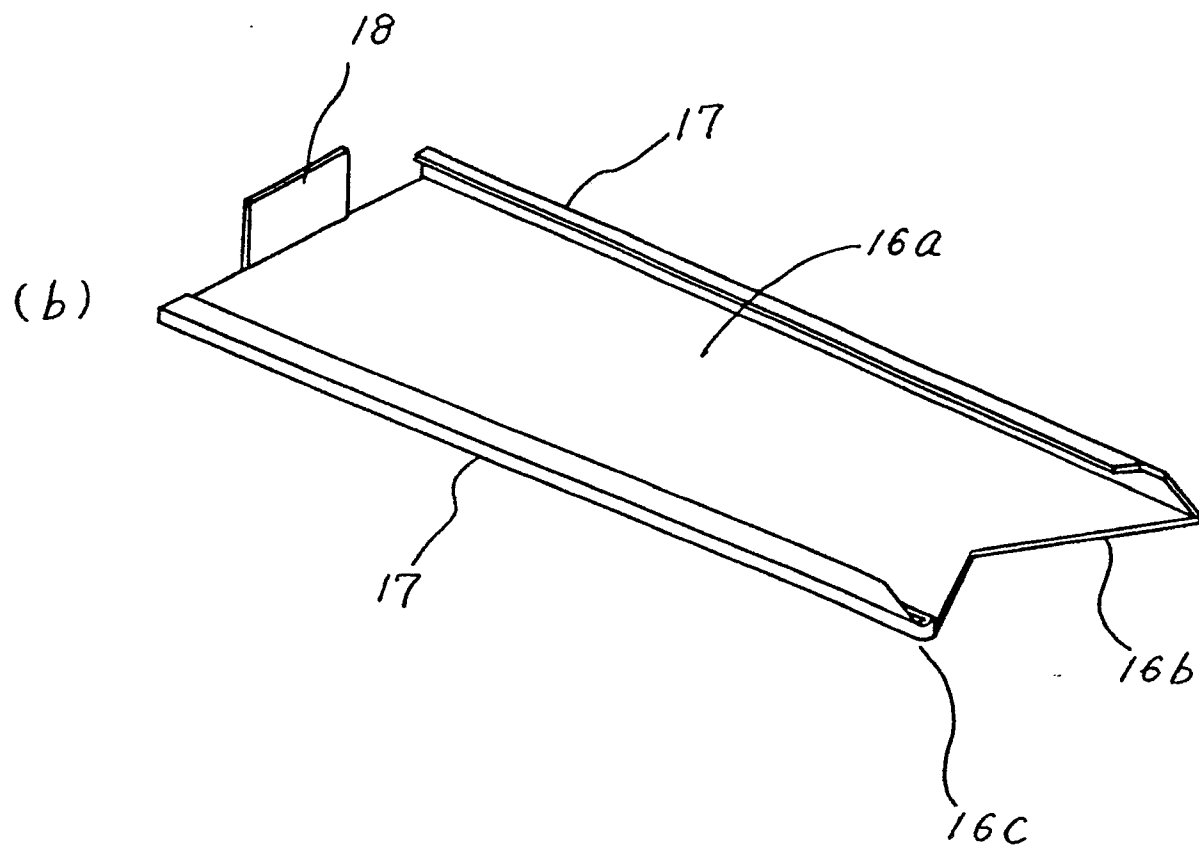
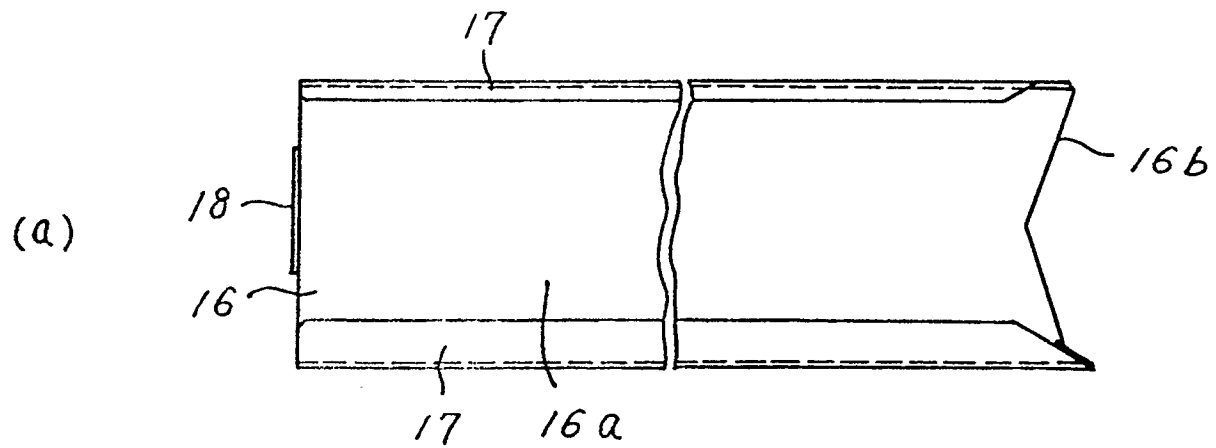


FIG. 4

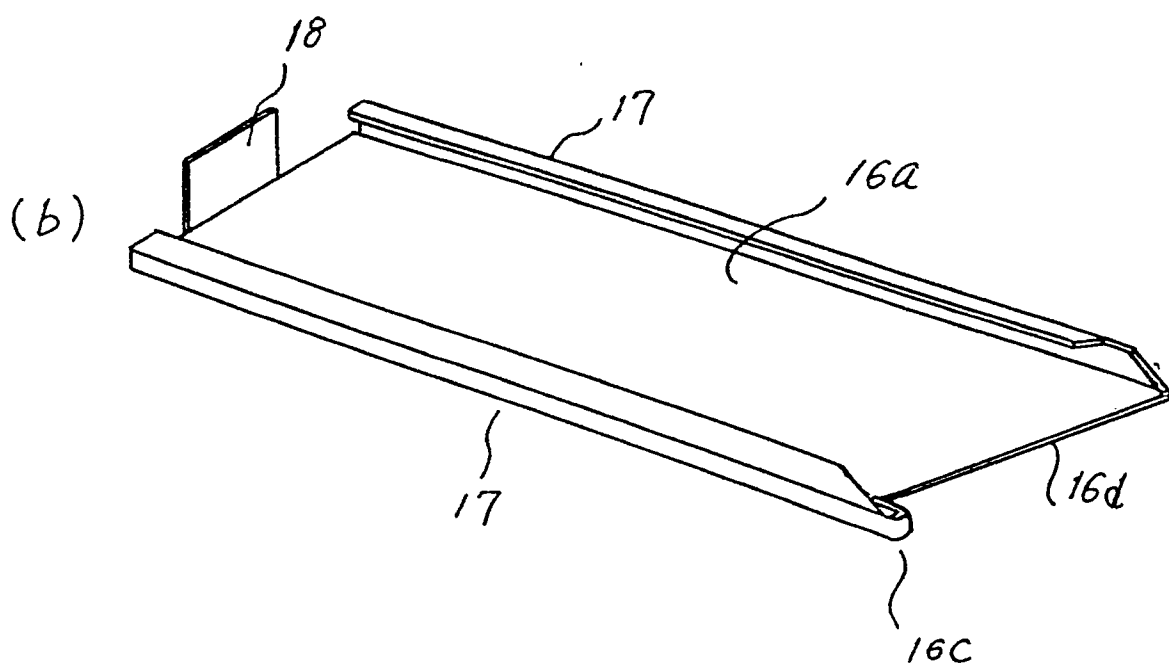
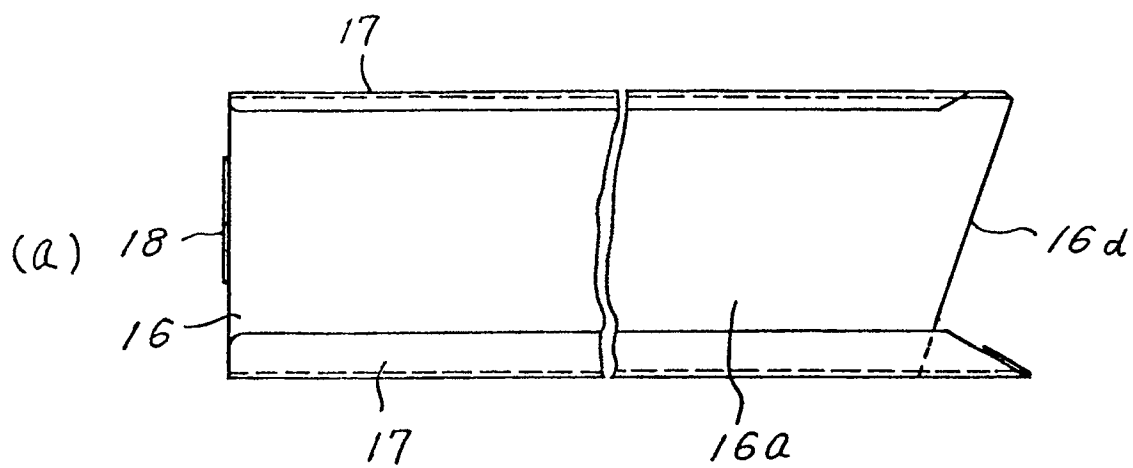


FIG. 5

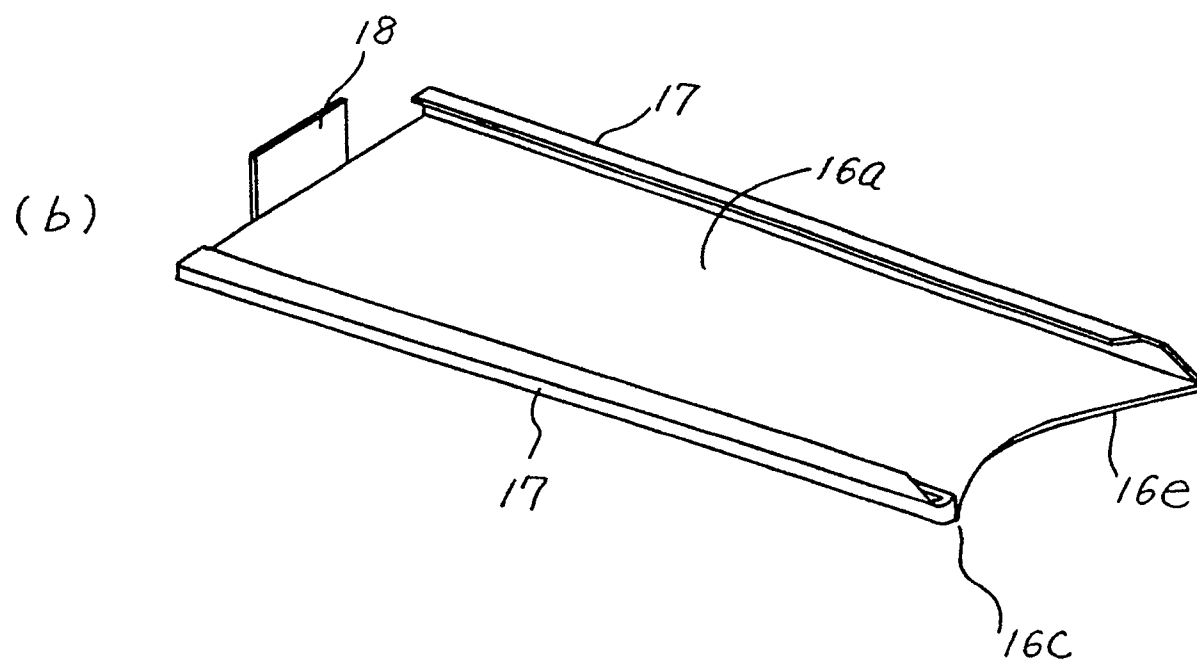
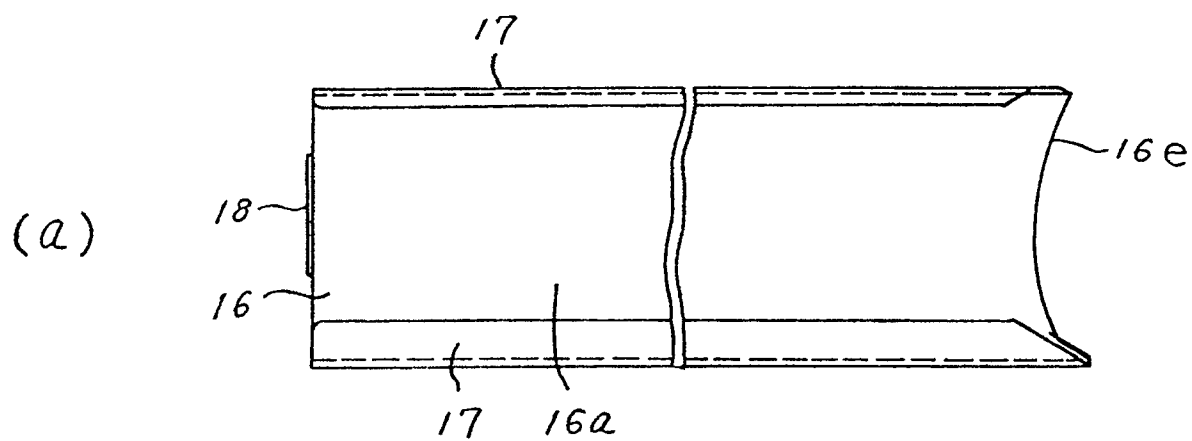


FIG. 6

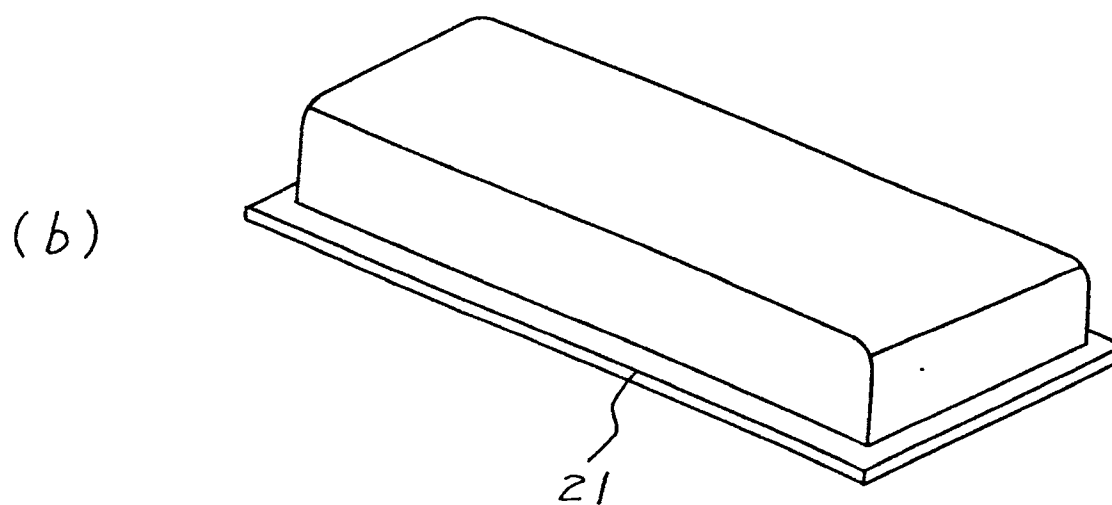
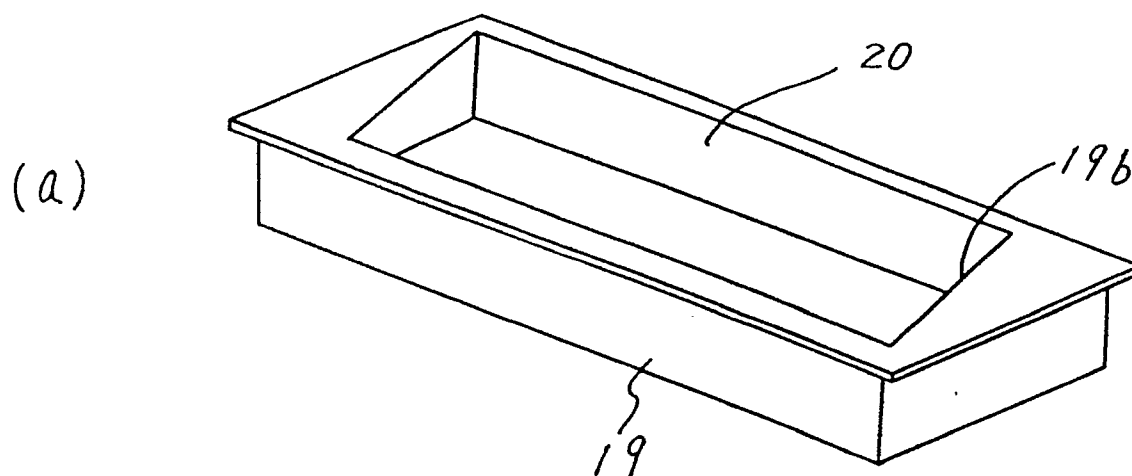


FIG. 7

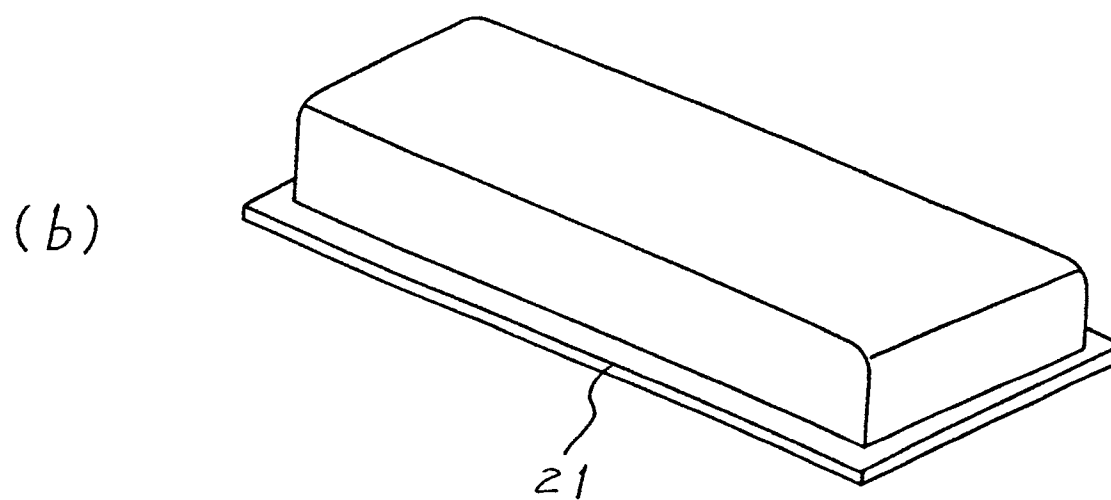
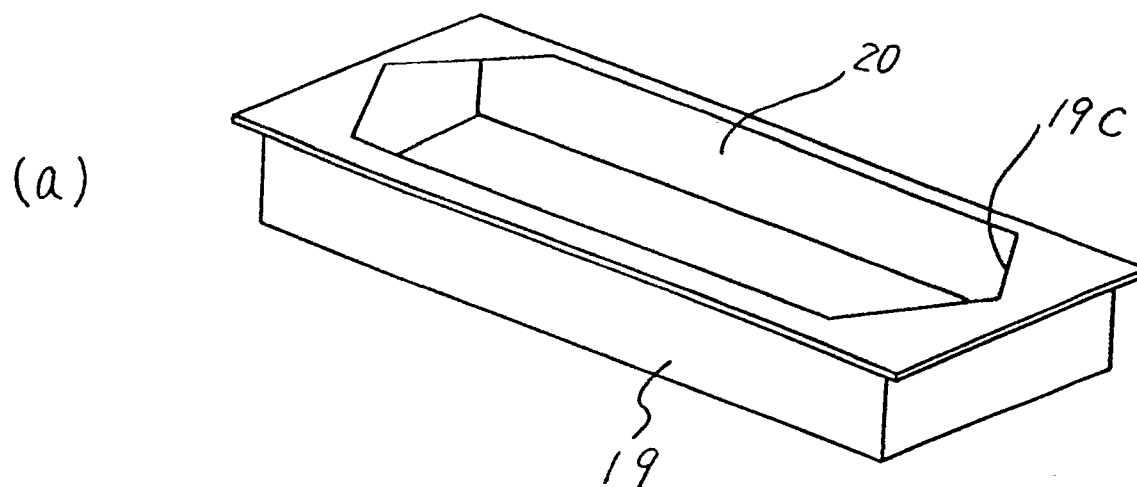


FIG. 8

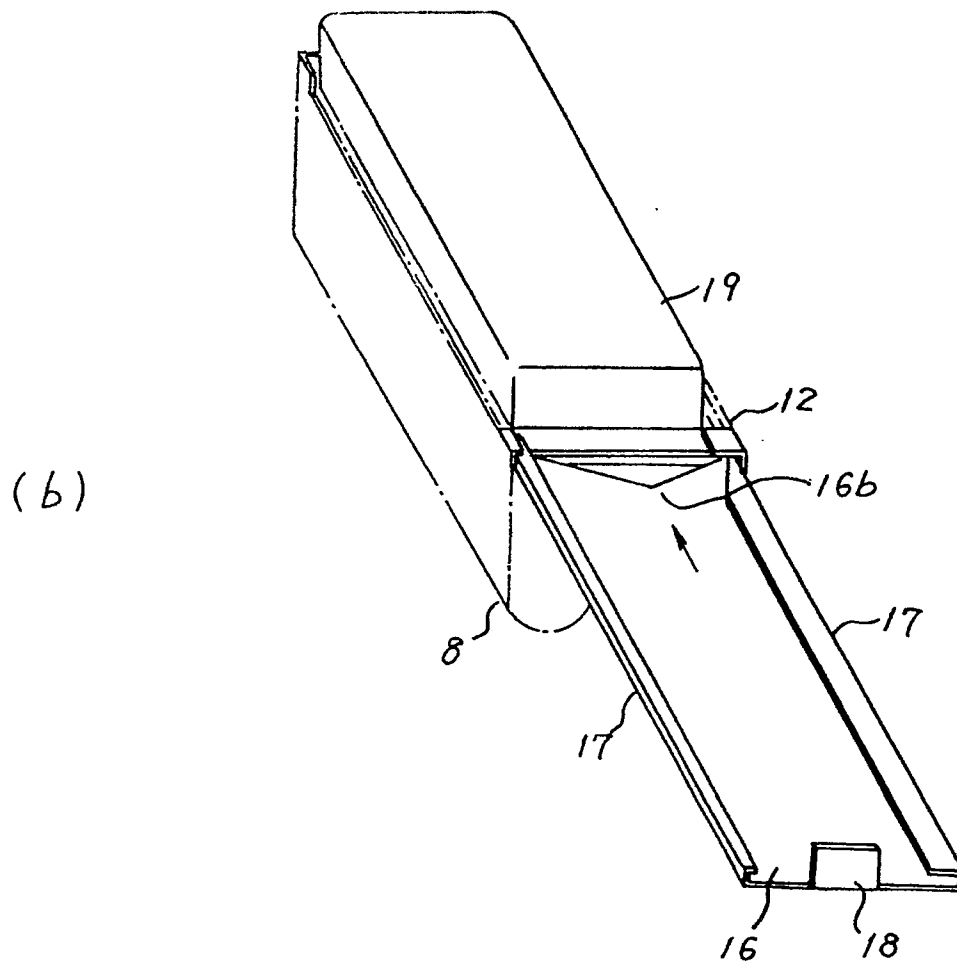
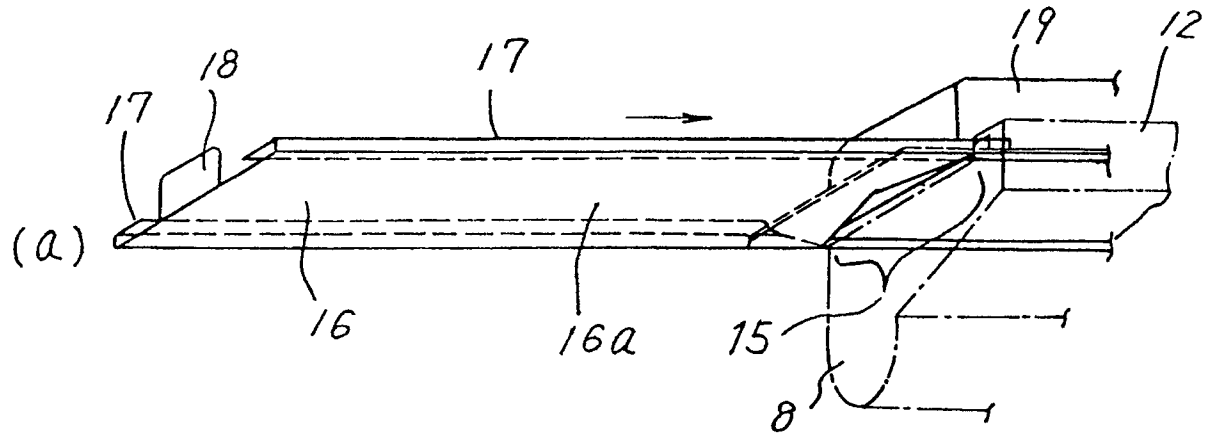


FIG. 9

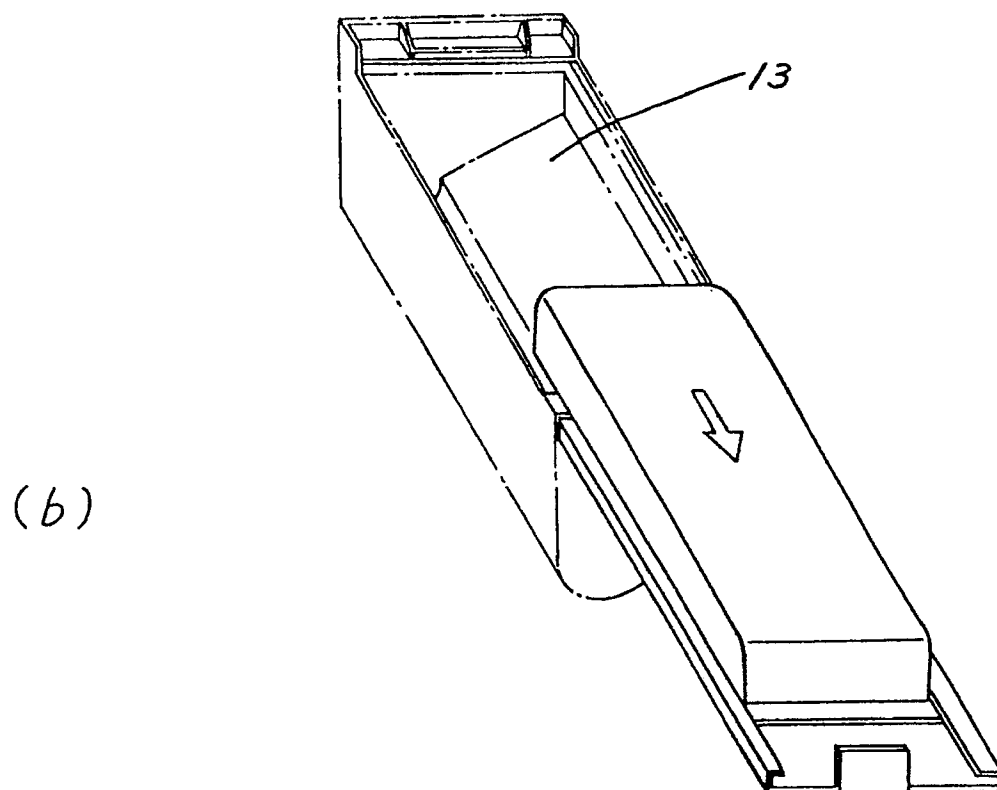
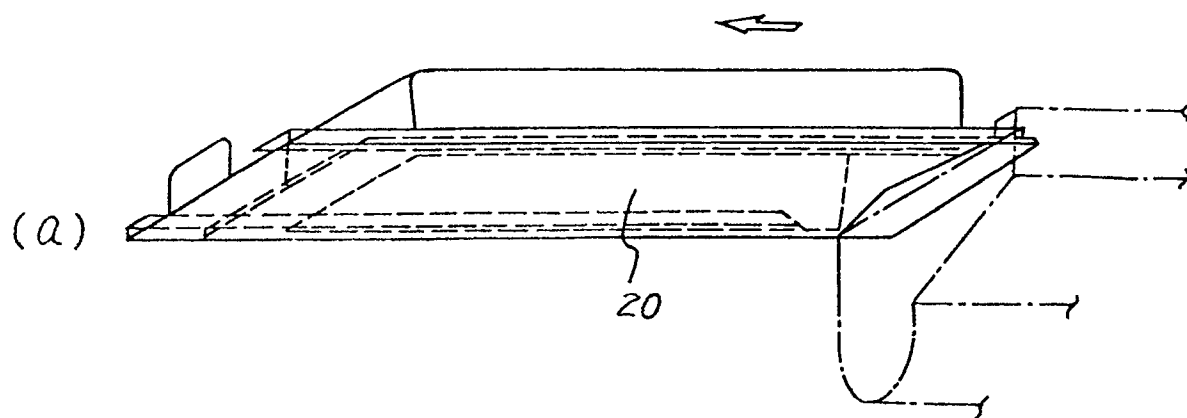
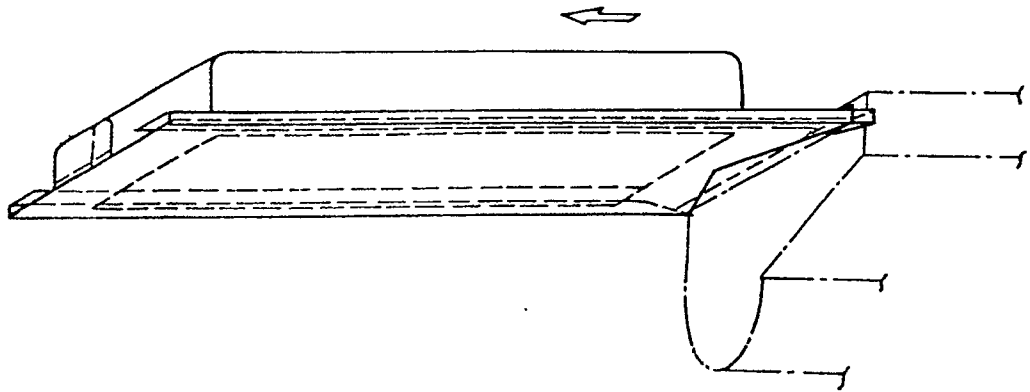


FIG. 10

(a)



(b)

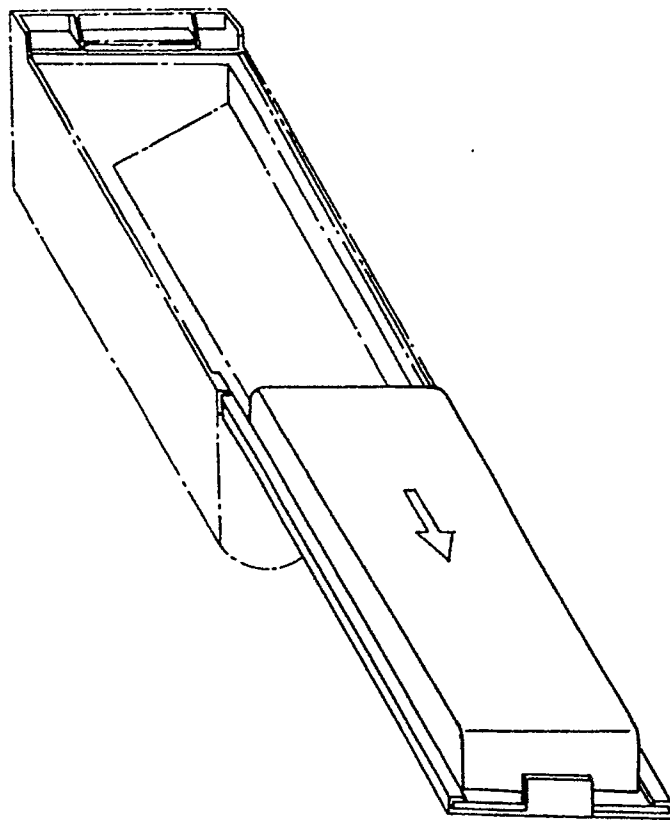


FIG. 11

PRIOR ART

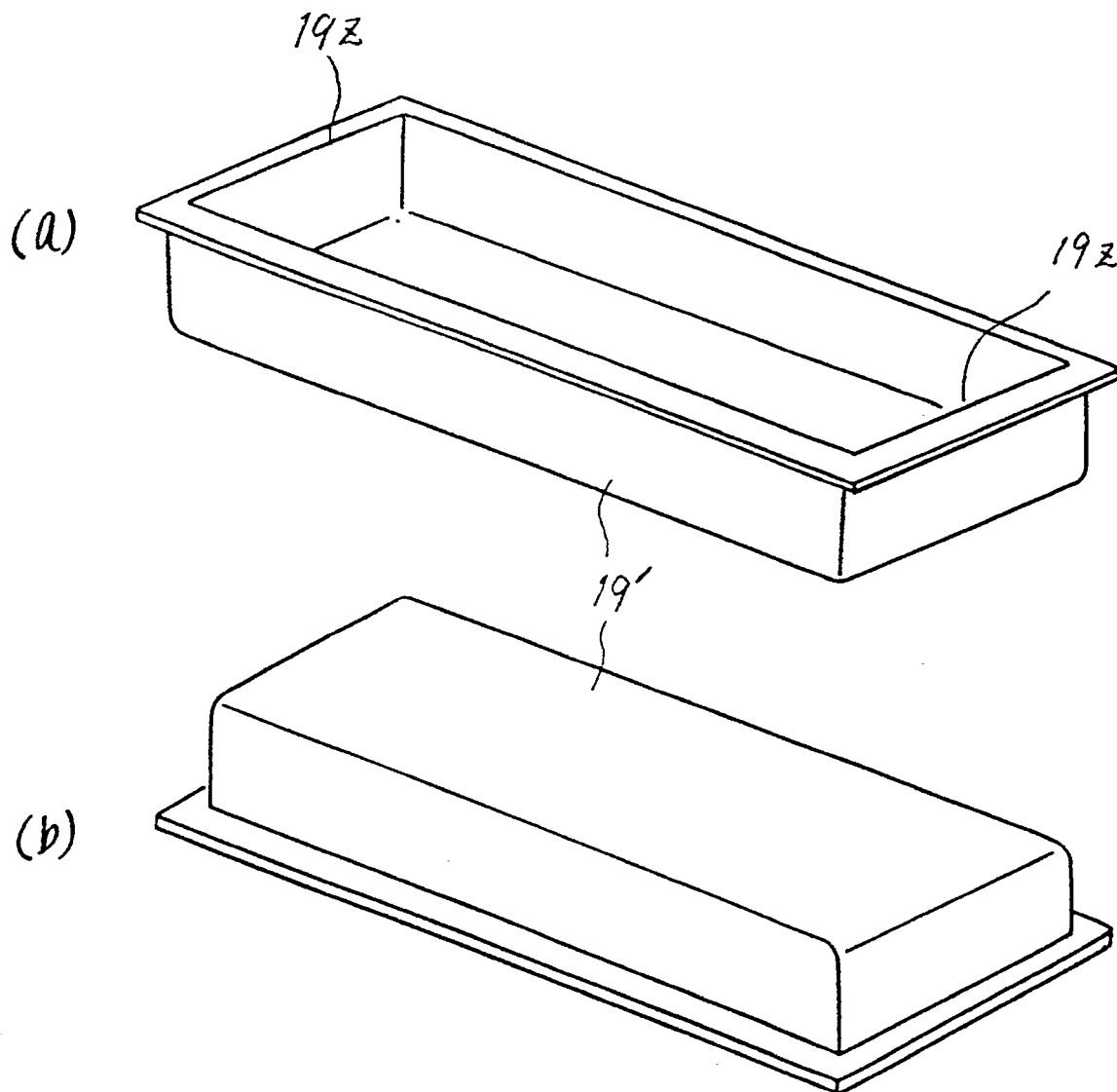


FIG. 12

PRIOR ART

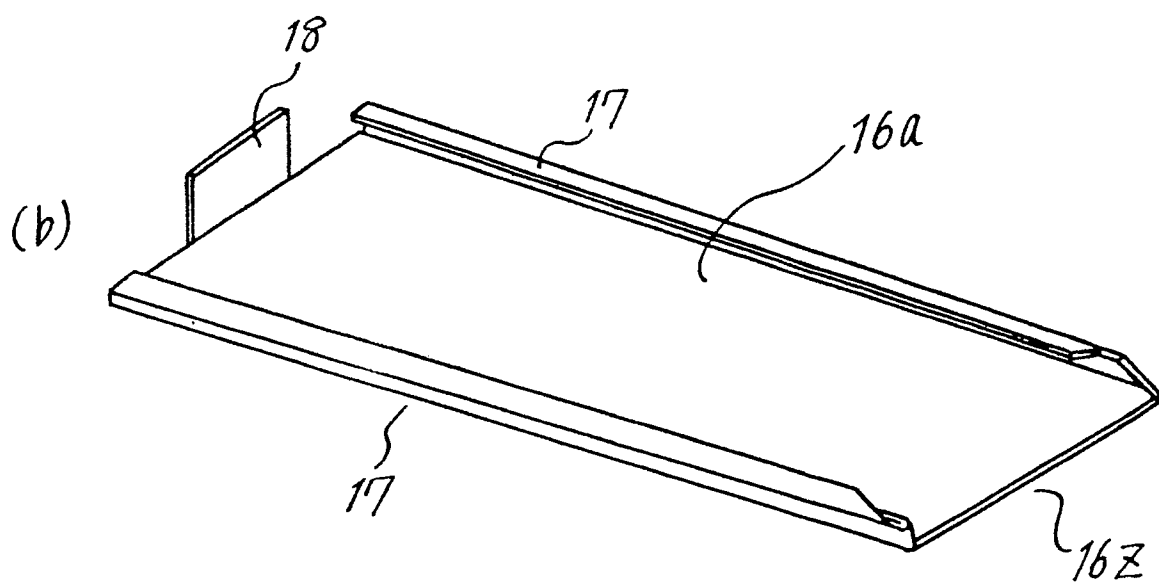
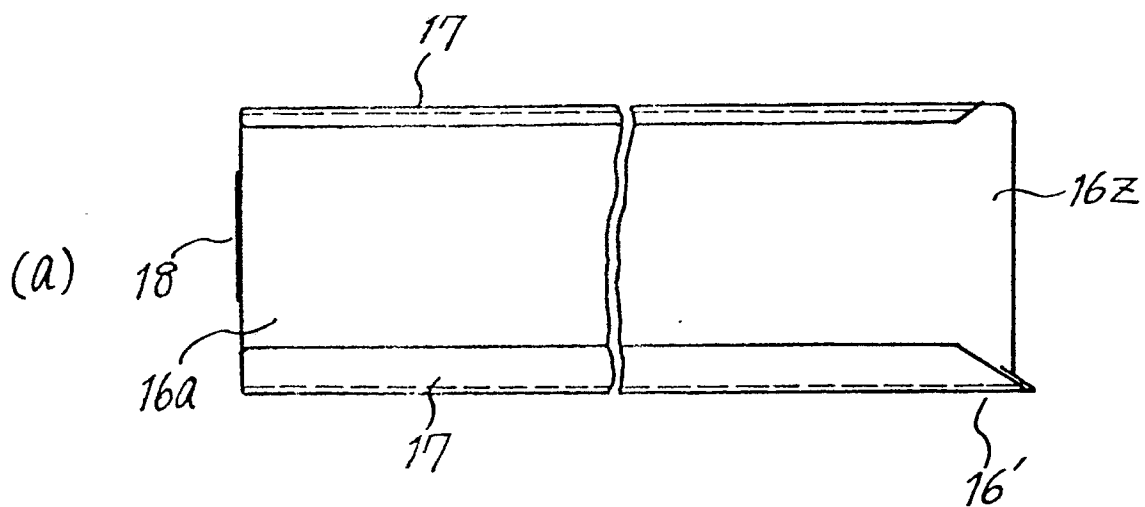


FIG. 13

PRIOR ART

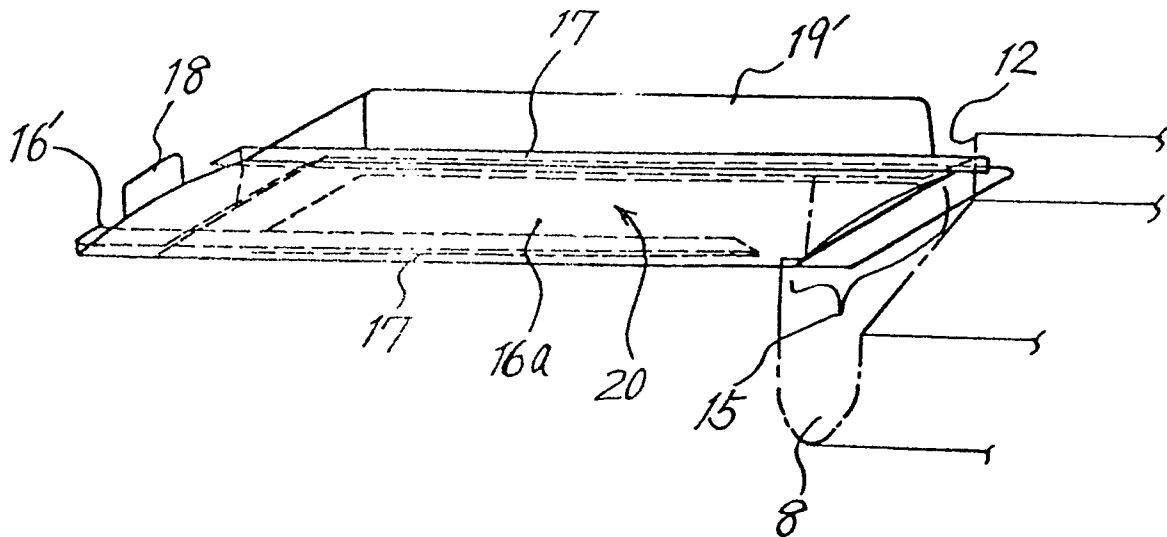


FIG. 14

PRIOR ART

