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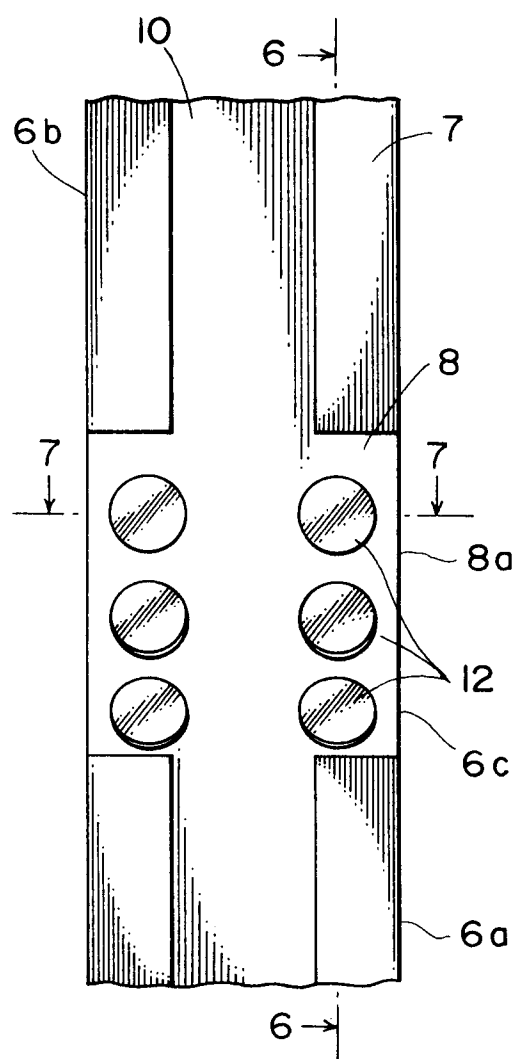
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(54) **Coin conveyor for successively transporting coins.**

(57) A coin conveyor for successively transporting coins comprises an elongated back plate (8) and a plurality of tapered guide rollers (12) arranged at respective opposite side edge portions (8a, 8a) of the back plate so as to guide and retain coins transported on the back plate.

F I G . 5



The present invention relates to a coin conveyor such as a coin escalator or the like for successively transporting coins dispensed or delivered from a coin payout hopper in an automatic bending machine, automatic payout machine, coin exchanger, game machine or the like.

Hitherto, there is a coin payout hopper as described in US Patent No. 4,437,478 and as shown in Fig. 1 comprising a hopper 1 for storing coins A in bulk, and a coin feeding rotary disc 2 rotatably mounted within the hopper at an angle to the horizontal. The rotary disc 2 has a central shelf 3 and a plurality of delivery pins 4 spaced in the peripheral direction of the rotary disc and extended from the surface of the rotary disc to define a plurality of coin pockets for picking up a coin from the hopper lower portion and feeding the coin to an upper delivery portion by the respective coin pocket upon rotation of the rotary disc. The coin payout hopper further comprises an outlet chute 5 for receiving coins discharged from the upper delivery portion and for dispensing coins one at a time by a pushing force of the delivery pin or a coin counting switch actuating roller B.

Some coin payout hoppers of the type mentioned above are provided with an outlet device as shown in Fig. 1 comprising an escalator 6 connected to the upper end of the outlet chute 5 at the lower end thereof and upwardly extended from the outlet chute 5 for transporting coins to a coin tray (not shown) which is elevated from the hopper mounted on a bottom plate in for example a coin changer, game machine or the like.

The coin escalator 6 is an example of a coin conveyor in the form of an elongated trough composed of front and back side plates 7 and 8 and a pair of edge plates 9 interposed between the side edges of the side plates, respectively, for spacing the side plate by a distance corresponding to a thickness of the coin to be transferred to define a coin passage 10.

As mentioned above, the coin escalator 6 is connected to the upper end of the outlet chute 5 which receives coins delivered from the upper delivery portion of the rotary disc which is inclined at an angle to the horizontal in the coin payout hopper. Thus, the coin escalator 6 may be upwardly extended at an angle from the upper end of the outlet chute 5 up to a height of more than two meters in case of a game machine. In such a case, the coin escalator may be bent from the inclined lower end portion 6a to the vertically extending portion 6b through a curved portion 6c in order to decrease a space depth required for the coin escalator.

When the escalator 6 is provided with a curved portion 6c to change the direction of transferring coin, if the curved portion 6c has a large radius of curvature as shown in Fig. 2, the distance between the front and back side plates 7 and 8 in the curved portion 6c can be 0.2 to 0.5 mm more than a thickness of the coin to

be transferred similar to that in the straight portions 6a and 6b in order to pass the coin through the curved portion 6c without dragging of coins and/or jamming, but a large space as shown by a dimension D-1 is required for changing of direction, in particular when the transferring direction of the coin transporting duct or the like is changed by a right angle.

On the other hand, if the curved portion 6c is bent with a small radius of curvature as shown in Fig. 3 because of a limited space, the distance between the front and back side plates 7 and 8 in the curved portion 6c must be increased as shown by "d" so as to easily pass coins through the curved portion. As a result, one of the successive coins A and B can overlap on the other to be dragged and/or jammed in the curved portion 6c.

Hitherto, a leaf spring 11 has been used to urge a coin against the side plate 7 in the curved portion 6c as shown in Figs. 1 and 4. Such a leaf spring however could not completely prevent coins from overlapping in the coin passage 10.

An object of the invention is to provide a coin conveyor adapted for smoothly guiding and retaining coins in curved portions as well as straight portions so as to be transported without coin dragging or jamming regardless of dimensions of radius of curvature of the curved portion.

According to the present invention, as shown in Figs. 5 and 6, a coin conveyor comprises an elongated back plate 8 and a plurality of tapered guide rollers 12 arranged along respective opposite side edge portions 8a and 8a of the back plate 8 so as to guide and retain coins transported on the back plate 8.

The back plate may be a curved elongated plate or a straight elongated plate.

In a preferred embodiment, each of the tapered guide rollers 12 is rotatably supported on a spring loaded roller shaft 15 which is perpendicularly extended through the back plate 8 and has an inverted conical surface 13 opposed to the front surface 8b of the back plate 8, whereby engaging with the coin edge to resiliently retain the transporting coin on the back plate as shown in Figs. 7 and 8.

In a preferred embodiment, as shown in Fig. 7, a spring 17 is interposed between the rear surface 8c of the back plate 8 and an extended end 15a of the roller shaft 15, so that the tapered guide roller 12 is resiliently movable in a direction of the axis of the roller shaft 15 on the side of the front surface of the back plate 8.

In another embodiment, as shown in Fig. 8 a tension spring 22 is interposed between the extended ends of roller shafts 15, 15 of a pair of opposed tapered guide rollers 12 and 12. The roller shafts of the opposed tapered guide rollers are movable in a lateral direction in respective slots 20, 20 formed in the base plate 8, so that the tapered guide rollers 12, 12 are resiliently movable toward and away from each other.

The tapered surface of the guide roller may be semispherical surface.

According to the aforementioned arrangement of the present invention, when coins are successively transported on the back plate by pushing force of the coin feeding pins on the rotary disc rotating in the payout hopper, each coin passes between a pair of left and right opposed tapered guide rollers against spring force of springs 17, 17 or 22 so that the downward tapered surfaces of the opposed guide rollers resiliently engage the peripheral edge of the coin to retain the coin on the front surface of the back plate while the coin non-frictionally contacts with the tapered guide rollers so that coin is easily and smoothly transported on the back plate.

Moreover, when the payout hopper is stopped and the coins in the coin escalator are not subjected to any push up force applied by following coins, the coins in the coin escalator are retained on the back plate by the spring force acting on the tapered guide rollers.

Furthermore, when the coin passage is jammed by a deformed coin or deposited dust, such a deformed coin or deposited dust can be easily removed by simply detaching one or two tapered guide rollers from the back plate. On the other hand, the conventional coin conveyor composed of a back plate, side edge plates and front plates is required to disassemble at least one of the long front plates and remove some of coins from the coin passage in order to remove the deformed coin or deposited dust.

Fig. 1 is a schematic perspective view illustrating a conventional coin payout hopper provided with a coin escalator;

Fig. 2 is a schematic sectional view of a conventional coin escalator having a curved portion of a large radius of curvature;

Fig. 3 is a schematic sectional view of a conventional coin escalator having a curved portion of a small radius of curvature;

Fig. 4 is an enlarged schematic perspective view of a curved portion of the conventional coin escalator shown in Fig. 1;

Fig. 5 is a front view of a portion of an embodiment of a escalator according to the present invention; Fig. 6 is a vertical sectional view of the escalator taken along line 6-6 in Fig. 5;

Fig. 7 is a cross sectional view of the escalator taken along line 7-7 in Fig. 5;

Fig. 8 is a cross sectional view of another embodiment of the escalator according to the present invention;

Fig. 9 is a schematic perspective view illustrating another embodiment of the present invention;

Fig. 10 is a front view of a curved portion of the coin conveyor shown in Fig. 9;

Fig. 11 is a sectional view taken along line 11-11 of Fig. 10; and

Fig. 12 is a schematic perspective view illustrating another embodiment of the present invention.

The present invention will now be more fully described with reference to Figs. 5 - 12.

Referring to Figs. 5 - 7 illustrating one embodiment of a coin escalator according to the present invention having an inclined lower end portion 6a having a coin passage 10 which is conventionally defined by a portion of an elongated back plate 8, a pair of opposed edge plates 9 and front plates 7; a curved portion 6b which is composed of a portion of the elongated back plate 8 and a plurality of tapered guide rollers 12 loaded by respective springs 17 and arranged along respective opposite side edges 8a, 8a of the back plate 8 so as to guide and retain coins transported in the coin passage 10 on the back plate 8; and a vertically extending portion 6b which is also conventionally composed by a portion of the elongated back plate 8, a pair of opposed edge plate 9 and front plates 7.

In this embodiment, the tapered guide rollers are arranged only in the curved portion 6c, but may be also arranged in the inclined lower end portion 6a and the vertically extending portion 6b in place of the front and edge plates as shown in Figs. 9 - 11.

The tapered guide roller 12, as shown in Fig. 7, has an inverted conical surface 13 and a central through hole 14 through which is extended a roller shaft 15 so that the tapered guide roller 12 is rotatably supported on the roller shaft 15. The roller shaft 15 is extended through a hole 16 formed in the back plate 8. A spiral spring 17 is interposed between the rear surface of the back plate 8 and a spring sear 18 secured to the extended end of the roller shaft 15.

With the aforementioned arrangement of the spring loaded tapered guide rollers 12, a coin A pushed up to the curved portion 6c of the coin escalator 6 by the following coins enters between a pair of the left and right tapered guide rollers 12 as shown in Fig. 7 against the spring force of the spiral springs 17 and engages with the downward faced inverted conical surface 13 at the peripheral edge of the coin A to be urged to the front surface of the back plate 8. Thus the coin transported in the curved portion 6c is resiliently retained on the front surface of the back plate 8.

Fig. 8 illustrates another embodiment of the present invention. In this embodiment, the roller shafts 15 and 15 of a pair of opposed tapered guide rollers 12 and 13 are extended through respective slots 20 and 20 formed in the back plate 8 and are secured at the extended ends to respective slide plates 21 and 21 which are connected by a tension spring 22 so that the opposed tapered guide rollers 12 and 12 can be moved toward and away from each other in the lateral direction, that is in a direction of width of the back plate 8 when a coin passes between the opposed tapered guide rollers. In this embodiment, when a coin enters

between the tapered guide rollers at the opposed side edge portions, the coin also is subjected to a downward urging force so as to be resiliently retained on the front surface of the back plate by the action of the tapered surfaces.

Referring to Figs. 9 - 11 illustrating another embodiment of the invention, a plurality of tapered guide rollers 12 are arranged in both the side edge portions of the back plate 8 and spaced to each other along the side edge over the whole length thereof.

Referring to Fig. 12 illustrating further embodiment of the invention; a plurality of tapered guide rollers 12 are arranged in one side edge portion of the back plate 8 and spaced to each other along the side edge over the whole length thereof. In the other side edge portion there is a guide groove 30 formed by an edge plate 9 and a front plate 7 for guiding a half portion of a coin.

so that the tapered guide rollers (12, 12) are resiliently movable toward and away from each other against spring force.

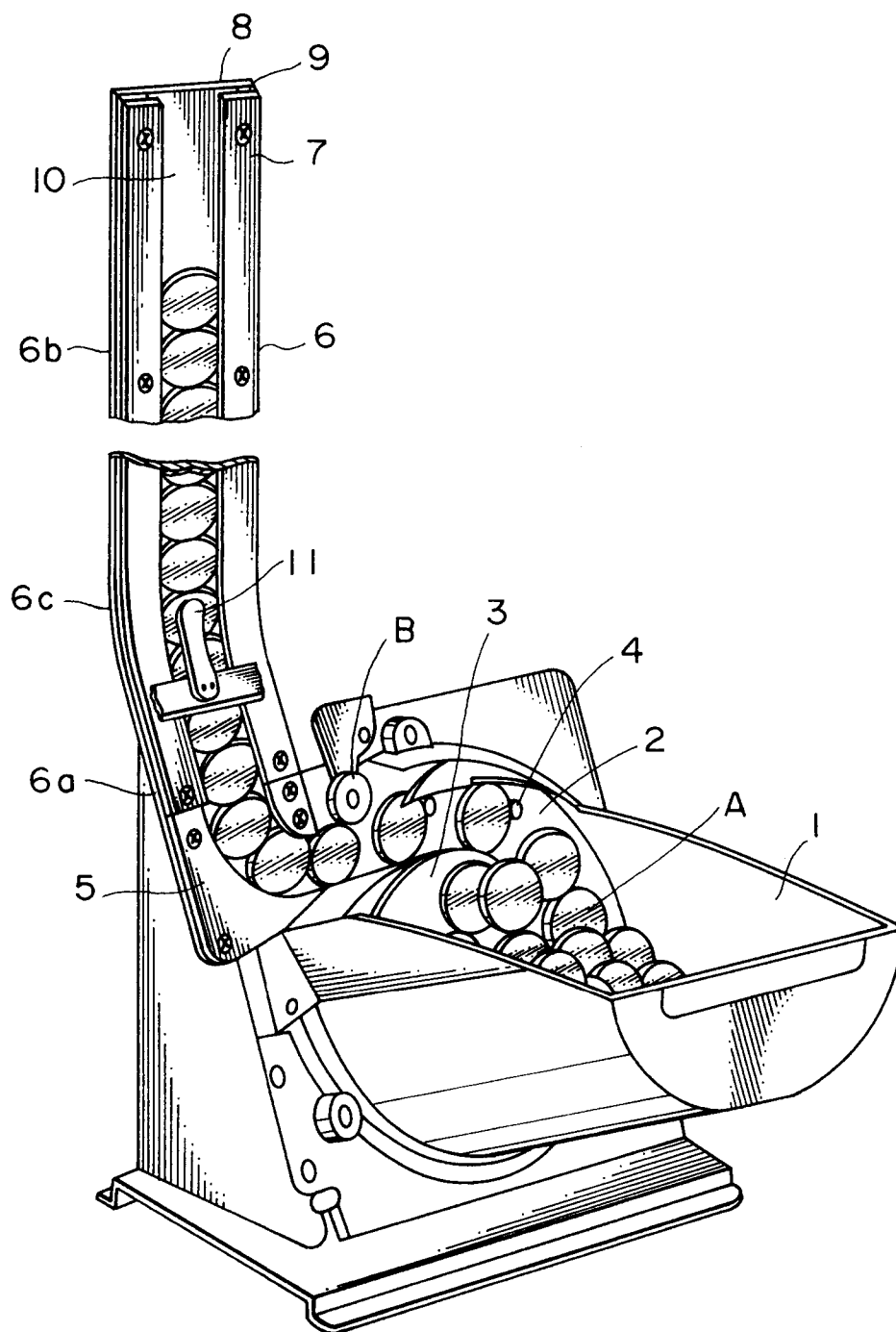
7. The coin conveyor claimed in claim 1, wherein a plurality of tapered guide rollers (12) are arranged in one of side edge portions of the back plate (8) and the other side edge portion is provided with a groove (30) for guiding a half side portion of a coin.

## Claims

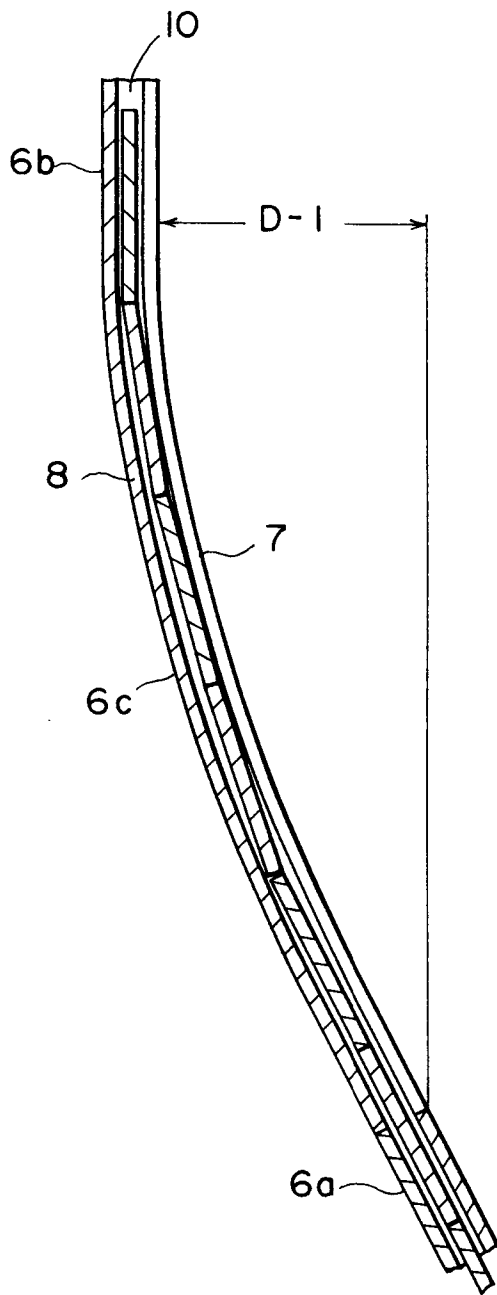
1. A coin conveyor for successively transporting coins comprising an elongated back plate (8) and a plurality of tapered guide rollers (12) arranged at respective opposite side edge portions (8a, 8a) of the back plate so as to guide and retain coins transported on the back plate.
2. The coin conveyor claimed in claim 1, wherein the back plate (8) is a curved elongated plate.
3. The coin conveyor claimed in claim 1, wherein the back plate (8) is a straight elongated plate.
4. The coin conveyor claimed in claim 1, wherein the tapered guide roller (12) is rotatably supported on a spring loaded roller shaft (15) which is perpendicularly extended through the back plate (8) and has an inverted conical surface (13) opposed to the front surface (8b) of the back plate (8), whereby engaging with the coin edge to resiliently retain the transporting coin on the back plate.
5. The coin conveyor claimed in claim 4, wherein a spring (17) is interposed between the rear surface (8c) of the back plate (8) and an extended end (15a) of the roller shaft (15), so that the tapered guide roller (12) is resiliently movable in a direction of the axis of the roller shaft (15) against spring force.
6. The coin conveyor claimed in claim 4, wherein a tension spring (22) is interposed between extended ends (15a, 15a) of roller shafts (15, 15) of a pair of opposed tapered guide rollers (12, 12) and the roller shafts are movable in a lateral direction in respective slots (20, 20) in the back plate (8),

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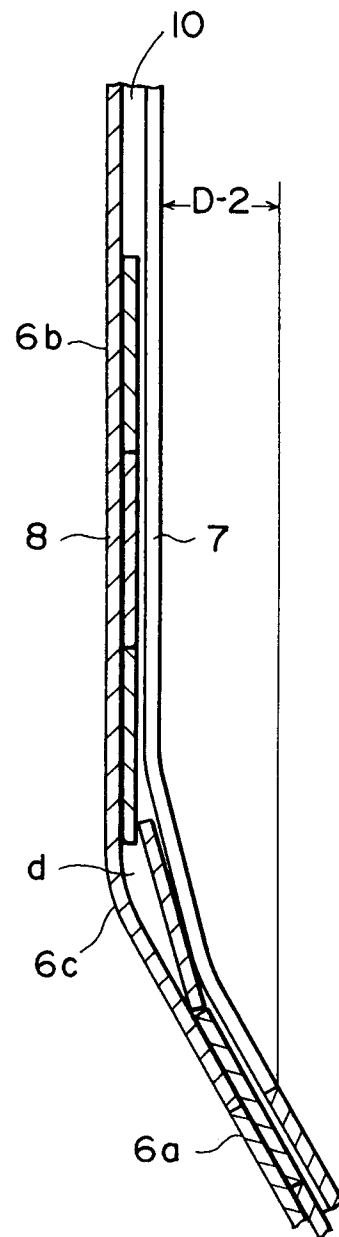
PRIOR ART



F I G . 2  
PRIOR ART

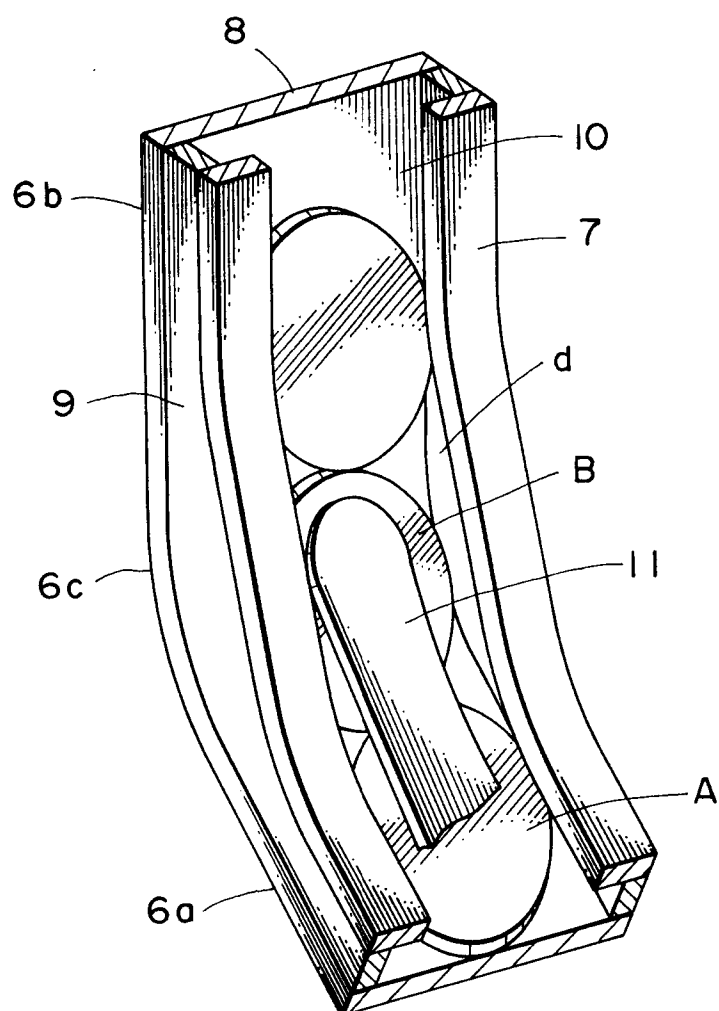


F I G . 3  
PRIOR ART



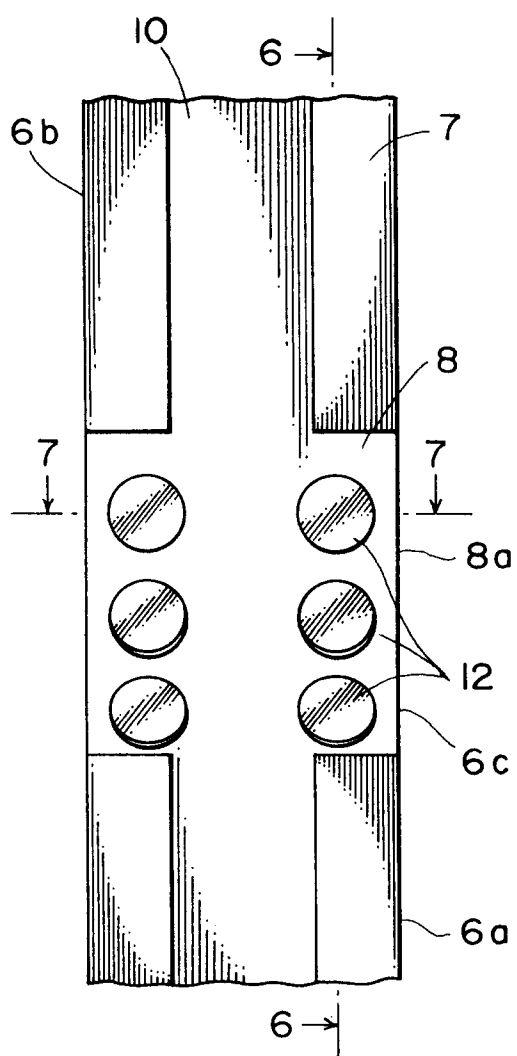
F I G . 4

PRIOR ART

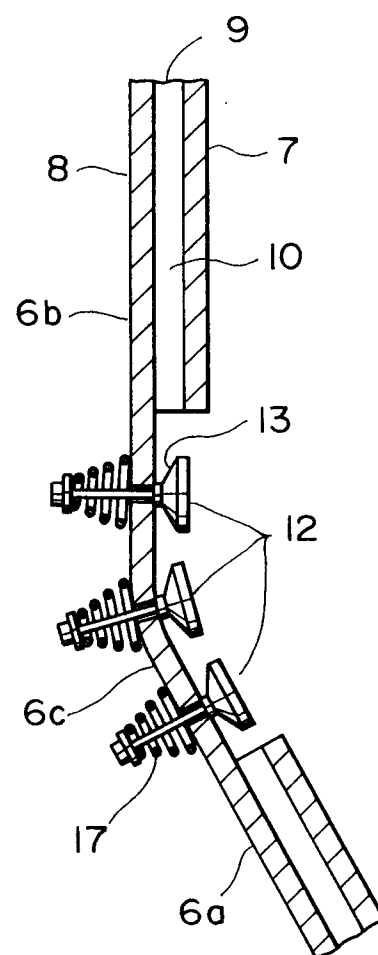




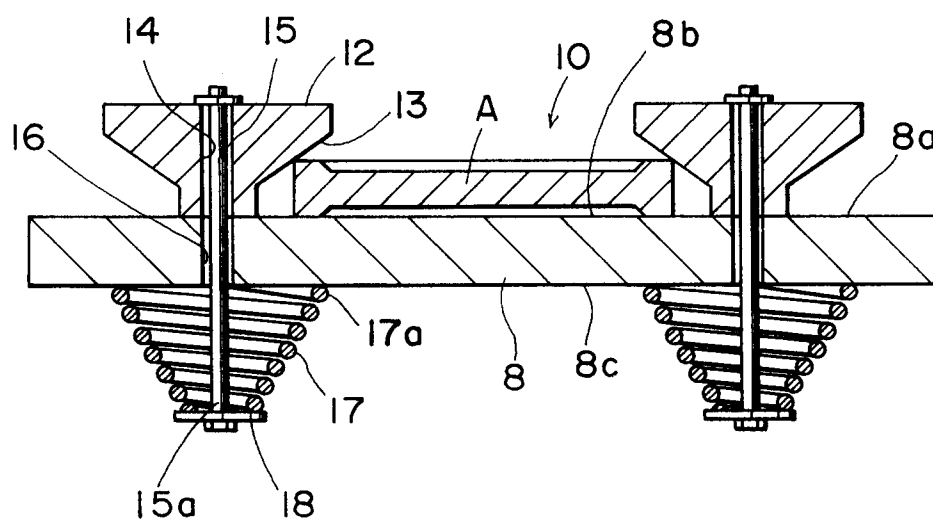
F I G . 5



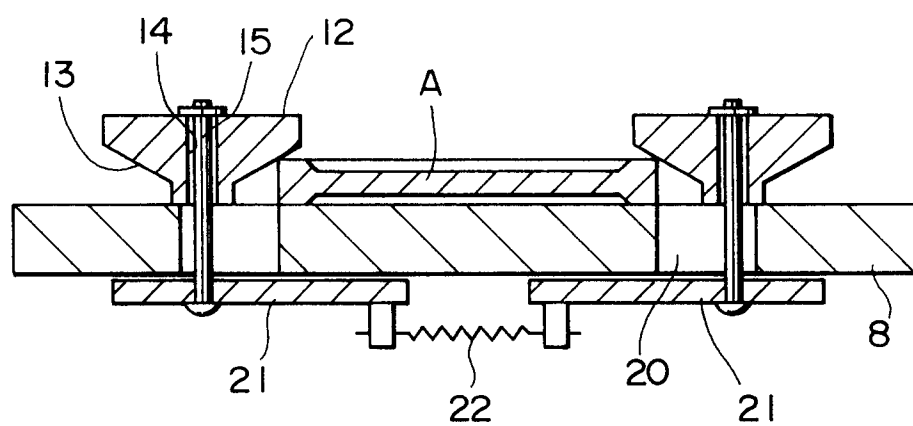
F I G . 6



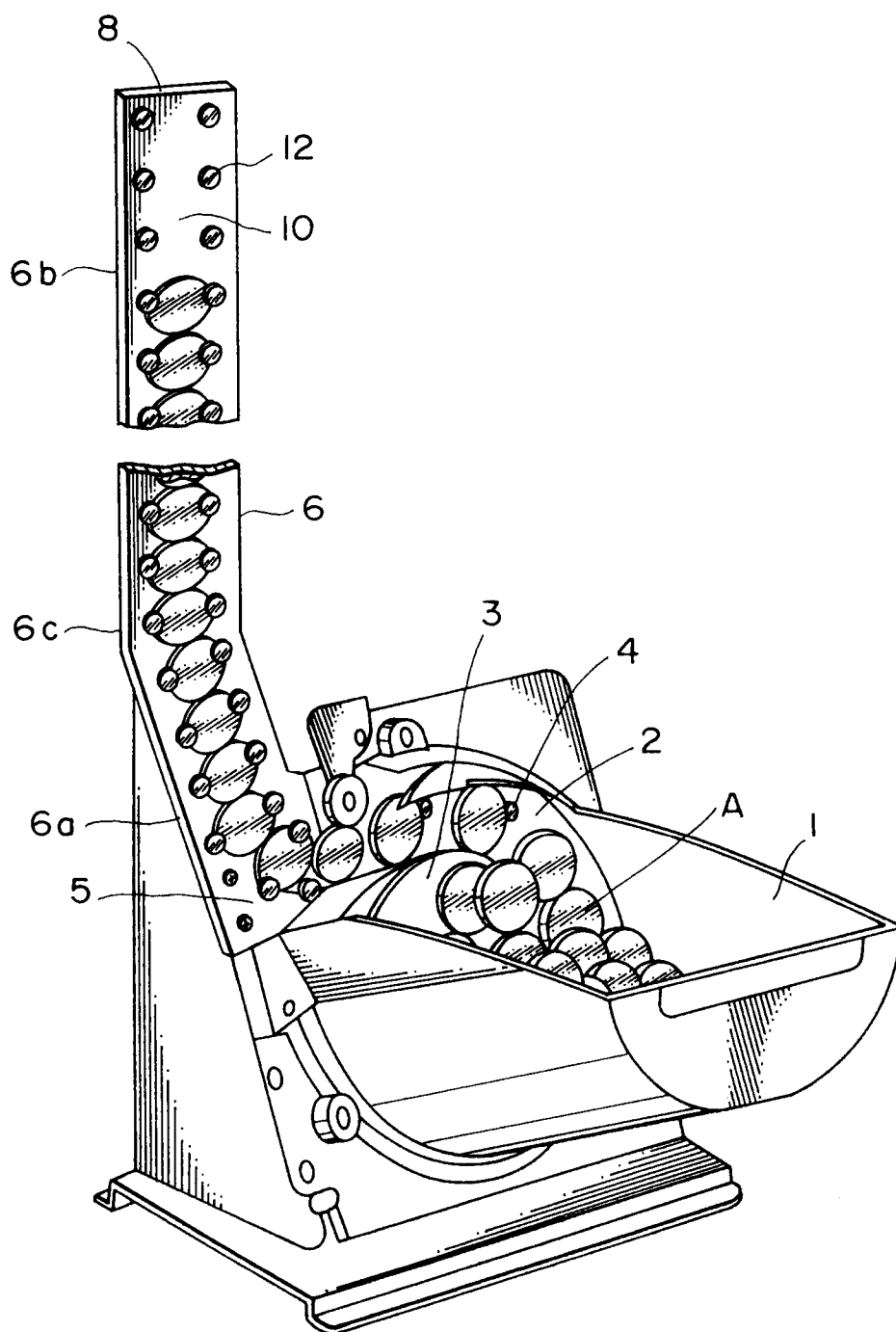
F I G . 7



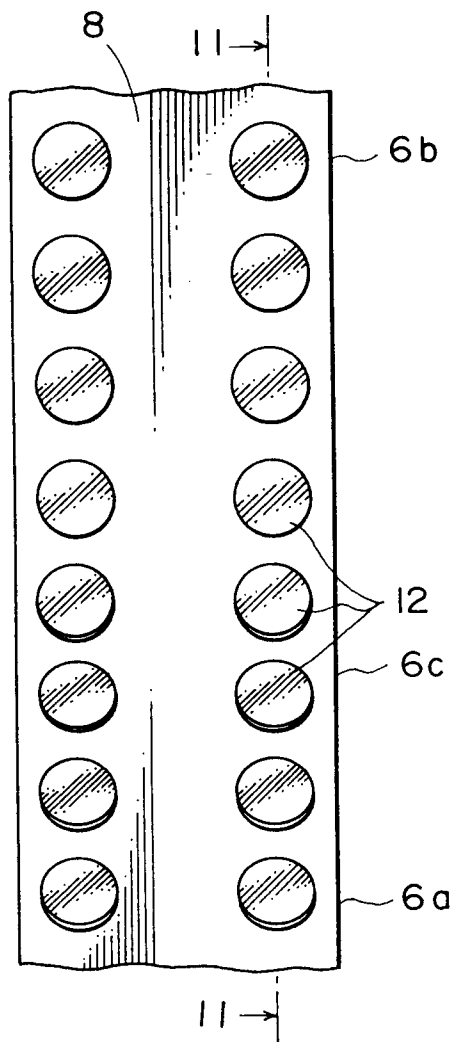
F I G . 8



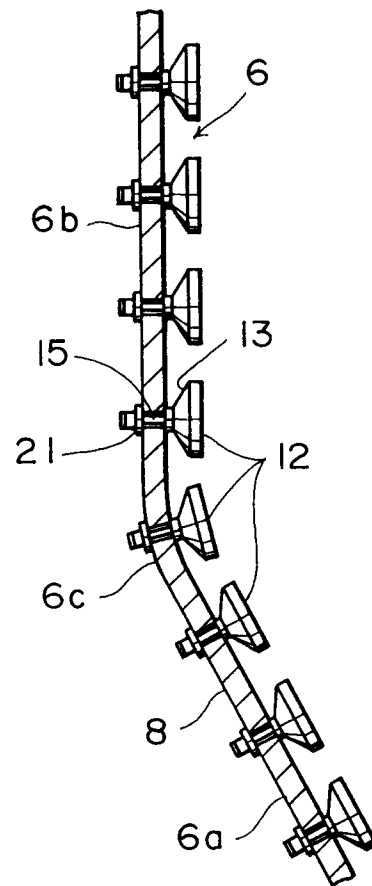
F I G . 9



F I G . 10



F I G . 11



F I G . 12

