

[72] Inventor **Shunichi Matsushima**  
 Hamakita-shi, Japan  
 [21] Appl. No. **806,576**  
 [22] Filed **Mar. 12, 1969**  
 [45] Patented **Mar. 16, 1971**  
 [73] Assignee **Nippon Gakki Seizo Kabushiki Kaisha**  
 Hamamatsu-shi,  
 [32] Priority **Mar. 18, 1968, Mar. 19, 1968, Mar. 19,**  
**1968**  
 [33] **Japan**  
 [31] **43/21005, 43/21169 and 43/21170**

[56]		References Cited	
UNITED STATES PATENTS			
3,148,724	9/1964	Chieger et al.....	160/201x
969,580	9/1910	Watanabe .....	160/35
1,017,808	2/1912	Rush .....	160/235
3,411,560	11/1968	Haury.....	160/33
FOREIGN PATENTS			
505,101	8/1954	Canada .....	160/235
543,342	6/1922	France .....	160/235
1,006,436	1/1952	France .....	160/235
222,310	12/1961	Austria.....	160/231
796,534	1/1936	France .....	160/35
1,358,330	3/1964	France .....	160/183

Primary Examiner—J. Karl Bell  
 Attorney—Wenderoth, Lind & Ponack

[54] **SLIDING COVER AND HOUSING DEVICE THEREOF**  
 2 Claims, 14 Drawing Figs.

[52] U.S. Cl..... 160/235,  
 160/35, 160/206  
 [51] Int. Cl..... **E06b 9/14,**  
 E05d 15/26  
 [50] Field of Search..... 160/35, 37,  
 235, 183, 231 (R), 206, 201; 16/171, 172, 130

**ABSTRACT:** A sliding cover and housing device thereof which comprises a sliding cover consisting of a plurality of cover pieces being linked with hinges and a pair of guides being provided along the upper inside walls of a cabinet, whereby the cover assembly can be housed in the rear and upper space of the cabinet in folded state.

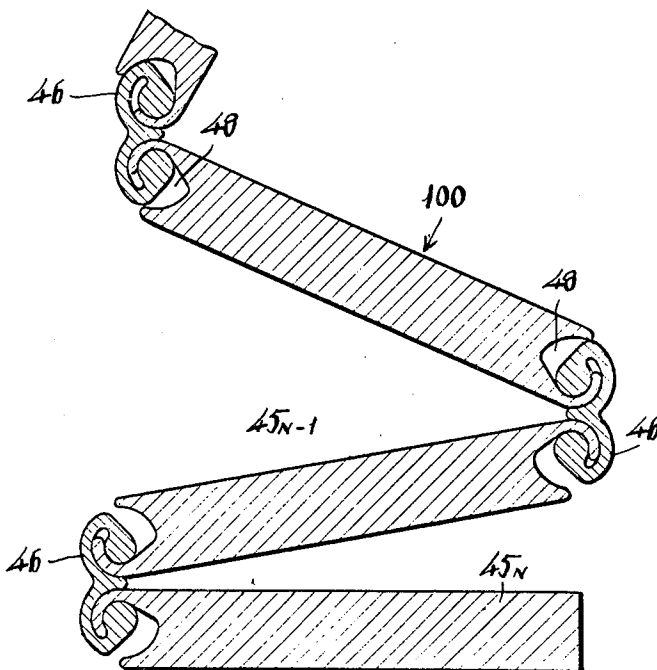


FIG. 1

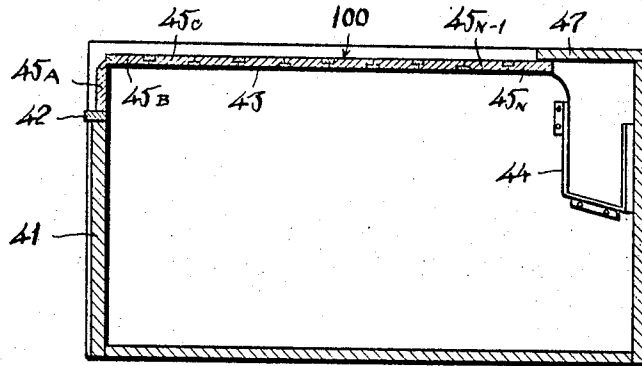


FIG. 2

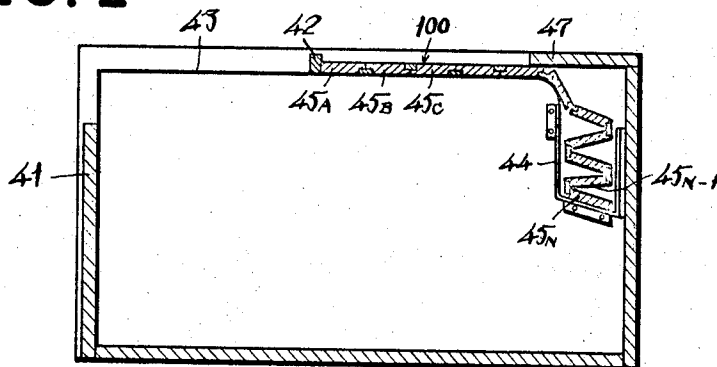
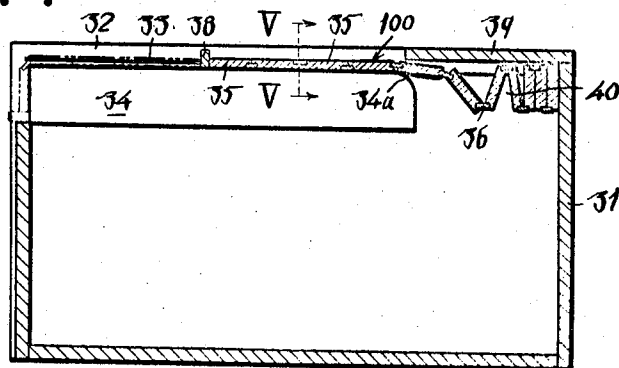


FIG. 4



INVENTOR.  
SHUNICHI MATSUSHI MA

BY  
*Wanda L. Linder, Esq.*  
*WLL*

FIG. 3

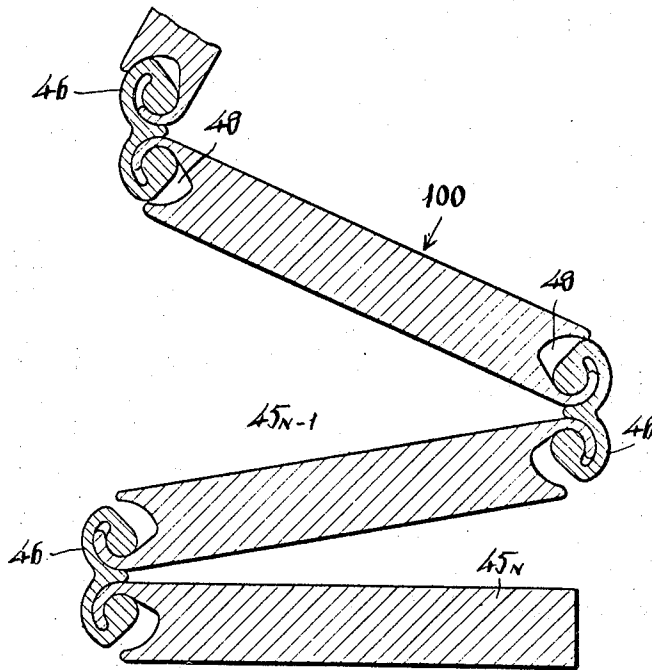
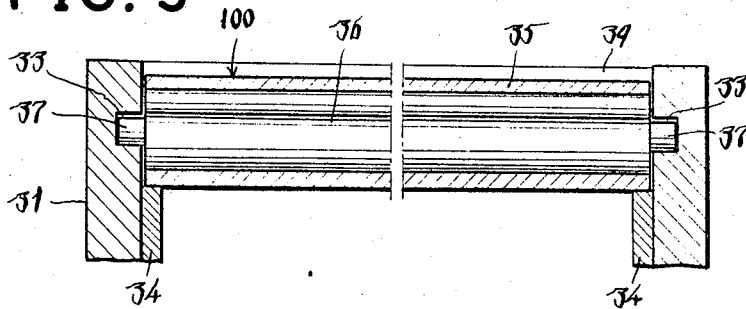


FIG. 5



INVENTOR.  
SHUNICHI MATSUSHIMA

BY  
*Wendell Lind + Assoc*  
*Attorneys*

FIG. 6

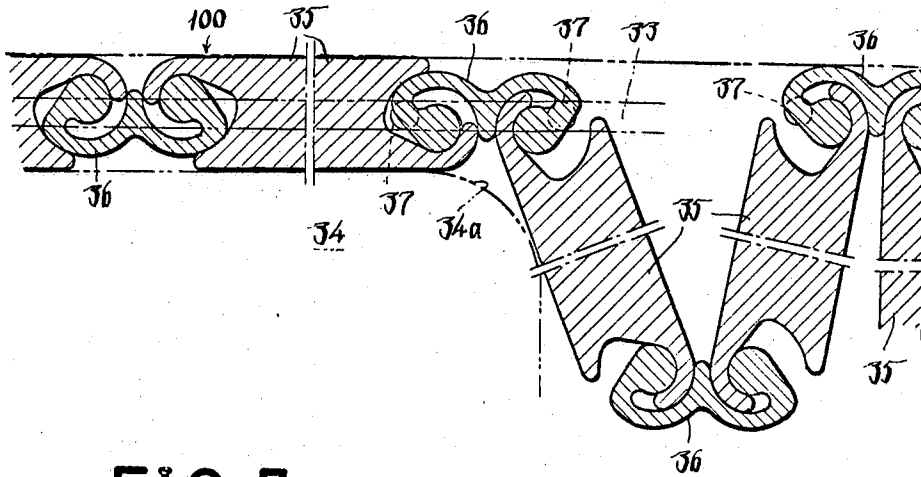


FIG. 7

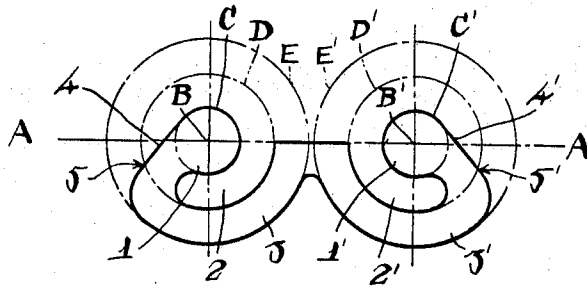
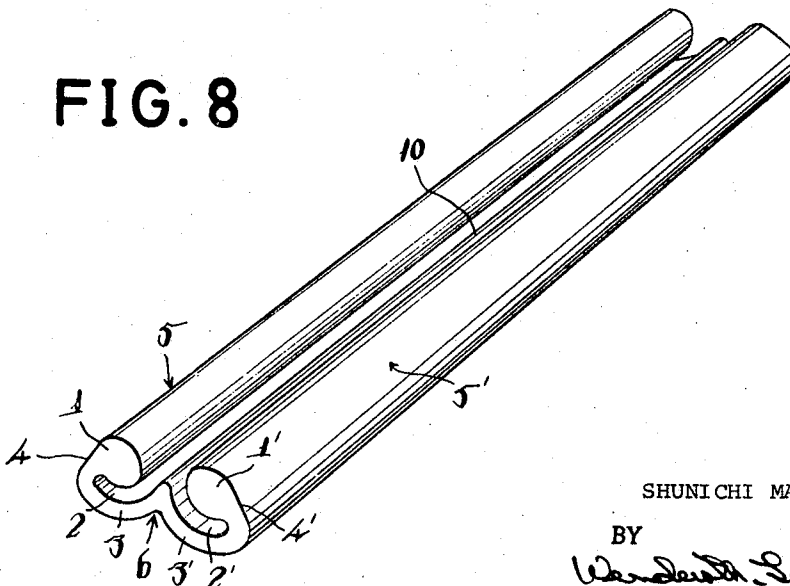


FIG. 8



INVENTOR.  
SHUNICHI MATSUSHIMA

BY  
*Wanda L. Lind & Associates*  
Attorneys

FIG. 9

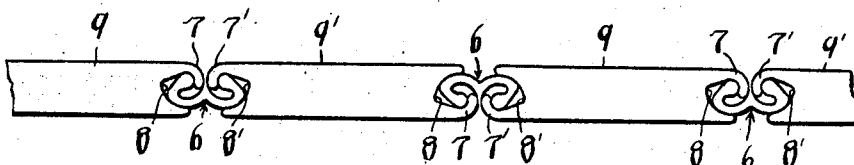


FIG. 10

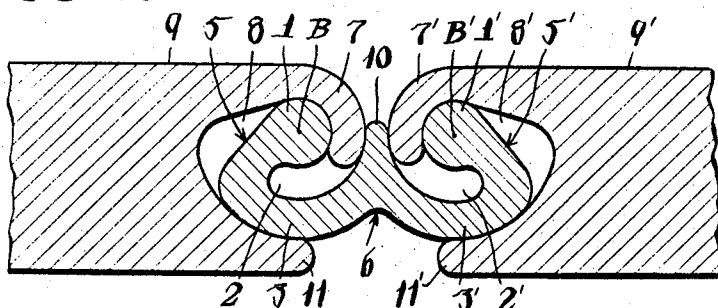
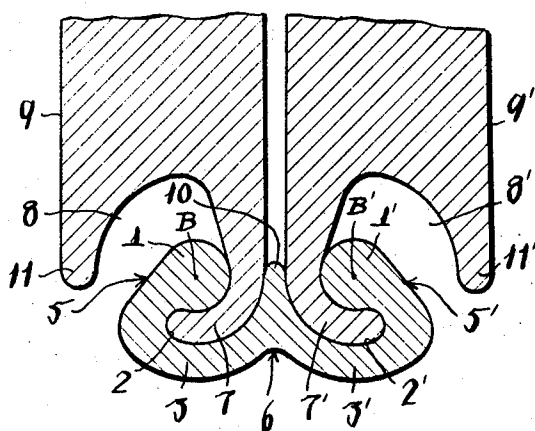


FIG. 11



INVENTOR.  
SHUNICHI MATSUSHIMA

BY  
*Wanderth. Lind & Ponsel*  
*attop*

FIG. 12

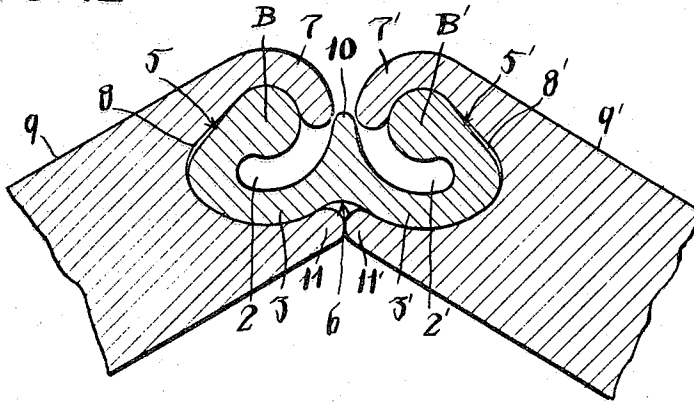


FIG. 13

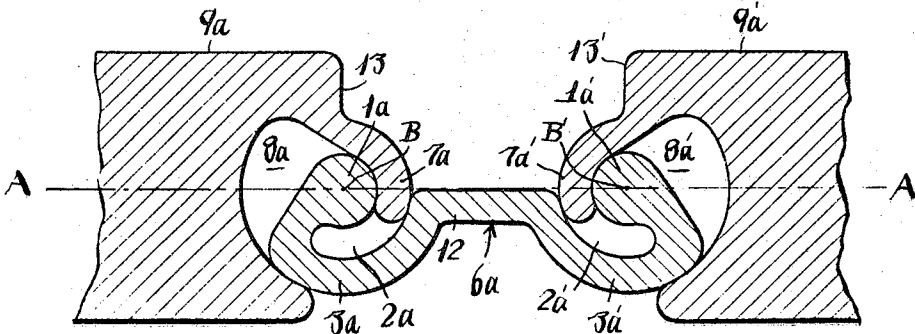
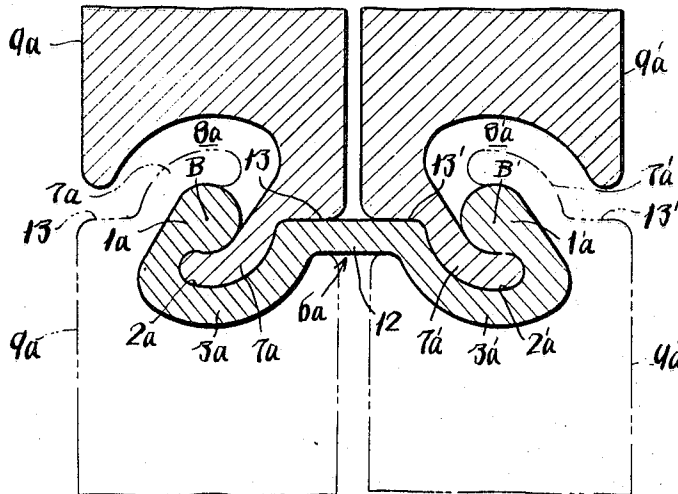


FIG. 14



INVENTOR.

SHUNICHI MATSUSHIMA

BY

*Lawrence S. Smith & Partners*  
25p

## SLIDING COVER AND HOUSING DEVICE THEREOF

The present invention relates to a sliding cover or shutter and a housing device thereof for cabinets, boxes, containers or the like such as record player cabinets, musical instruments cabinets, rolltop desks, filing cabinets and furnitures.

In the prior construction, the slide cover is merely housed in the rear portion of a cabinet, the inside rear portion of the cabinet is occupied by a housed portion of the slide cover, and considerable effort is required for drawing out the cover under all the weight of the cover acting thereon, so that the operation of the cover is not effected smoothly. In particular, with cabinets for record players or the like, the input and output leads of the amplifier are to be taken out from the rear portion of the cabinet, so that it is difficult to utilize a cabinet equipped with the slide cover device which hinders the rear portion thereof as a cabinet for record player.

The object of the present invention is to provide a compact slide cover housing device which leaves a space wide enough to utilize the inner rear portion of the cabinet, whereby the sliding action of the cover is smooth, and the opening and closing operation is very easy.

Now the present invention will be described referring to the drawings for each of the following examples.

FIG. 1 is a longitudinal, sectional side elevation of a cabinet equipped with housing mechanism of slide cover according to an embodiment;

FIG. 2 is a longitudinal, sectional side elevation of a cabinet when the slide cover is being housed;

FIG. 3 is a longitudinal, sectional side elevation showing a part of the mutually connected and folded condition of the slide cover pieces;

FIG. 4 is a longitudinal, sectional side elevation of a cabinet equipped with a slide cover housing mechanism of a slide cover according to another embodiment,

FIG. 5 is a longitudinal, sectional front elevation taken along the line V-V in FIG. 4;

FIG. 6 is a longitudinal, sectional side elevation of a portion showing a mutually connected and folded state of the slide cover pieces;

FIG. 7 is a diagrammatic view explaining the sectional construction of a hinge connecting a pair of cover pieces;

FIG. 8 is a perspective view of the hinge;

FIG. 9 is a side elevation of a slide cover assembled by connecting a plurality of the slide cover pieces;

FIG. 10 is a longitudinal, sectional side elevation of an essential part;

FIGS. 11 and 12 are longitudinal, sectional side elevations of the essential parts when the slide cover is folded or bent;

FIG. 13 is a longitudinal, sectional side elevation of the essential parts of the slide cover consisting of another form of embodiment; and

FIG. 14 is a longitudinal, sectional side elevation of the essential parts at the folding.

FIGS. 1 through 3 show an embodiment of slide cover housing mechanism, wherein guides 43 supporting the slide cover 100 at upper and inner portions on both side plates of the cabinet 41 are formed integrally, and a receiving member 44 is secured at the rear portion of the cabinet with its bottom somewhat inclined for receiving the slide cover.

A finger catch 42 is attached at the front end of said slide cover 100, and when the slide cover is to be housed (that is, when the cabinet is to be opened), said finger catch 42 abuts on a stopper 47 formed on the cabinet so as to prevent the slide cover 100 from falling. The slide cover 100 is formed by connecting a number of rectangular cover pieces 45A, 45B, 45C,—45N foldably by means of hinges 46.

The cover pieces 45A, 45B, 45C,—45N and each of the hinges 46 are so interconnected that they are rotatable for 90° in one direction and a few degrees (for about 30°) in the opposite direction with regard to the hinge 46, and the slots 48 at the ends of the cover pieces 45A, 45B, 45C,—45N are formed in opposite directions so that every other one of cover pieces 45A, 45B, 45C,—45N can be rotated for 90° and in opposite directions.

In the above constitution, when the slide cover 100 is opened (when the cover is to be housed), the slide cover 100 is moved rearward of the cabinet 41 along the guides 43 by pushing the finger catch 42, the cover piece 45N, which is disengaged from the guides 43, hung by its own weight at the same time it is bent at the portion of the hinge 46, and is made stable by contacting with the inclined bottom surface of the receiving member 44.

By pushing the slide cover 100 further, the cover piece 45N-1 is bent in a direction opposite to said cover piece 45N, and is folded upon the cover piece 45N.

In this manner, the slide cover 100 thus folded successively is housed in the receiving member 44 until the finger catch 42 abuts on the stopper 47.

Every other one of the cover pieces may be bent in the opposite direction to the direction of 90° rotation when the cover pieces are disengaged from the guides 43, but there is no obstacle because they can each rotate about 30° in one side.

Next, when the slide cover 100 is to be closed (that is, the slide cover is to be drawn out of the receiving member), the slide cover 100 is drawn out by pulling the finger catch along the guide 43. Since the slide cover 100 folded and housed in the receiving member 44 is connected by the hinges 46, it is drawn up successively and closes the opening of the cabinet 1 as a single plate cover.

In the example shown in FIG. 1, guides 43 are provided extending from front to rear at upper and inner portion on both side plates, the receiving member 44 is arranged at the rear portion, in which the slide cover 100 is folded as it is pushed successively at the opening of the cover, so that only a small space is required to house the slide cover 100, and the cabinet 41 can be made into a compact form, and a spacious room is obtained below the receiving member 44. Moreover, the pivoting motion between the connecting hinge and the cover piece is so smooth that there is no compulsion in the opening and closing operation, thus not only the opening and closing of the cover is effected very smoothly, but also that total weight of the cover is not applied except the time when the cover is fully closed. Furthermore, even at the full closing of the cover, the operation can be effected less heavily, because  $F$  (force required for operation) equals  $\mu$  (coefficient of friction)  $\times$   $W$  (weight of slide cover).

FIG. 4 through FIG. 6 show a cabinet similar to that above-mentioned but differ in the construction of the cover housing mechanism. The guide rails 33 are formed along forward and backward directions on both sidewalls of the cabinet body 31 including an opening 32. The numerals 34 designate supporting and guiding members each projectingly provided on both sidewalls immediately below the guide slots 33. These supporting and guiding members 34 are each formed by attaching a bar having about the same length as the depth of the opening 32 on the sidewall, but these members 34 may of course be stamped integral with the cabinet body 31. The numerals 35 are cover pieces constituting said slide cover 100, and pin-type projections 37 are provided on every other hinges 36 which rotatably interconnect each of the adjacent cover pieces 35, 35, 38 is a finger catch provided on the extreme front cover piece 35, 39 is a top plate, and when the slide cover 100 is opened, it is stopped by said finger catch 38 abutting on the front edge of the top plate 39. 40 shows a housing portion of the slide cover 100, and by forming curved surfaces 34a at the rear edge corners of the supporting and guiding members 34 placed in these positions, the drawing out and housing of the slide cover 100 can be effected smoothly.

In this embodiment, being thus constituted, when the slide cover 100 is pushed, the cover slides along the supporting and guiding members 34, each of the cover pieces 35, 35,—disengaged from the supporting and guiding members 34, and transferred into the housing 40 successively being folded as shown in FIG. 4 as the guide projections 37 provided on every other hinges 36 inserted into the guide slots 33.

Thus, all of the cover pieces 35, except the frontmost one, are housed in a suspended and folded state in the housing 40, and they do not occupy all of the rear side of the cabinet as in

the case of the conventional cover device. When the cover is to be closed, by pulling the frontmost cover piece 35, all the following cover pieces 35 are also drawn successively, and the opening 32 can be covered by the cover pieces presenting a plate as a whole, and the opening and closing operation can be carried out so smoothly and perfectly without rattling owing to the existence of guide slots 33 and the supporting and guiding members 34.

In the example shown in FIG. 4, the height or depth of the housing for the cover at the opening thereof requires only the breadth of single cover piece 35, so that it is possible to decrease the space of the receiving member 40, thus the effective serviceable area of the cabinet is increased.

The construction of the housing device for sliding cover of the present invention may be clearly understood from the above descriptions. In the following, a sliding cover or a shutter which is suitable for the above described housing device will be explained in detail, especially with regard to novel hinges for the sliding cover.

The hinge is formed as shown in FIGS. 7 and 8 by setting two axial points B, B' spaced at a predetermined spacing on a base line A, A', setting circles C, C' which are the fitting lines 1, 1' each with said axial points B, B' as centers, circles D, D' which become fitting slots 2, 2', and circles E, E' which become guide edges 3, 3' outwardly; connecting fitting edges 1, 1' formed by said circles C, C' and the guide edges 3, 3' formed between said circles D, D' and E, E' obliquely at one side of the base lines A, A' so that the fitting slots 2, 2' are formed deeply, whereby both side surfaces 4, 4' are formed. Thus, by connecting two fitting edges 1 and 1' by means of guide edges 3, 3' which exist through fitting slots 2, 2' of arcuate section having somewhat longer depth than one-fourth of the circumference; and at the same time, at the inside of the axial points B, B', connecting integrally the guide edges 3 and 3' which form a part of said pair of circles E and E', a hinge 6 is formed, having connected portions 5, 5' in the lengthwise direction had having a fan-shaped section.

In FIG. 9, on both side surfaces of the cover piece 9, there are provided curved pieces 7, 7' having the same curvature as said fitting slots 2, 2' and penetrating into the depth of fitting slot 2, 2' at the folding, and slots 8, 8' having a fan-shaped section and in which the connected portions 5, 5' of the hinge 6 is accommodated, with the positions of said curved pieces 7, 7' symmetrical. Said curved pieces 7, 7' being so arranged that each of them is inserted and positioned in each of the fitting slots 2, 2', thus a number of cover pieces 9, 9', 9, 9' are connected foldably.

The example shown in FIGS. 7 through 12 is formed by narrowing the distance between axial points B, B' and directly connecting arcuate guide edges 3, 3' formed by parts of circles E, E', leaving a projection 10, holding the tips of the curved pieces 7, 7' of cover pieces 9, 9' between fitting edges 1, 1', and at the same time forming edges 11, 11' of the slots 8, 8' confronting the curved pieces 7, 7' to be positioned somewhat outwardly of the axial points B, B'. In this case, as shown in FIGS. 11 and 12, it is so constructed that the cover pieces 9, 9' are bent at right angle on the side of fitting edges 1, 1', and reversely, they are bent at an angle of about 30° on the side of the guide edges 3, 3'.

In the example shown in FIGS. 13 and 14, the distance between the axial points B, B' is expanded, and the guide edges 3a, 3'a are connected integrally by a base plate 12, of which one surface lies on the baseline A, A', while the centers (where the axial points B, B' situate) of curved pieces 7a, 7'a inserted into the fitting slot 2a, 2'a formed between the fitting edges 1a, 1'a and the guide edges 3a, 3'a, are set on the centerline of the cross section of the cover, and the slots 8a, 8'a are formed shallower so as to form steps 13, 13' contacting with said baseplate 12 when folded. Cover pieces 9a, 9'a can be folded at right angle on both sides of the hinge 6a, as shown with solid lines and with chain lines in FIG. 14.

With the slide cover thus constituted, each of the cover pieces 9, 9' ... or 9a, 9'a rotates with fitting edges 1, 1' or 1a,

1'a as the axes, even when the configurations of hinges 6, 6a differ in some degree. That is, since the fitting edges 1, 1' of the hinge 6 as well as fitting slots 2, 2', the guide edges 3, 3', the curved pieces 7, 7' of the cover pieces 9, 9' and the wall surfaces of slots 8, 8' are all formed concentrically with axial points B, B' as the centers, when the cover pieces 9, 9' are bent on the sides of the fitting edges, the curved pieces 7, 7' enter into the fitting slots 2, 2' until they reach the bottoms thereof, and at the same time the outer edges of the guide edges 3, 3' slip out of the slots 8, 8', and are finally exposed perfectly outwardly in a state as shown in FIG. 11, with the curved pieces 7, 7' held by the fitting edges 1 and 1'.

When the base plate 12 is provided between the guide edges 3a and 3'a, sufficient clearance can be formed on both sides of the baseplate 12, so that the cover pieces 9a, 9'a can be bent in both directions at right angle with their curved pieces 7a, 7'a sliding along the fitting edges 1a, 1'a.

As stated above, the slide cover according to the present invention is so constructed that each parts of the hinge 6 and each parts of side surfaces of cover pieces 9, 9' are constituted basing on the portions of concentric circles having axial points B, B' as their centers, so that no inconvenience will ever occur at the bending or folding and each of the cover pieces can be bent or folded so smoothly. There are also formed between the fitting edges 1, 1' and the guide edges 3, 3' fitting slots 2, 2' having an angle 90° or more, and since the curved pieces 7, 7' having the same shape as the slots are inserted and held therein at the side of the cover pieces 9, 9', the bending angle of the cover pieces 9, 9' can be taken sufficiently large. Also the hinge 6 is usually supported by said curved pieces 7, 7' and the slots 8, 8', but on the contrary, when the slide cover is folded, the curved pieces 7, 7' are held, so that the hinge 6 will not separate away by the folding operation of the cover pieces 9, 9'.

Furthermore, according to the present invention, the hinge is held between a pair of cover pieces, so that the appearance of the cover is kept best.

As stated above, the slide cover according to the present invention can freely be bent without being restricted in angles, so that the housing mechanism may also be constituted as in each of the embodimental examples. Furthermore, since the cabinet equipped with the slide cover according to the present invention is allowed to be opened completely from front to rear in its lower portion, it has a number of advantages when it is applied on cabinets of electrical appliances, such as convenience in mounting and dismounting of terminals, smoothness in opening and closing operation of the cover, complete prevention of cover from being dropped into the cabinet owing to the provision of the guide projections, and easiness of practice because of the simple construction.

It goes without saying that the cover pieces, hinges, parts for housing devices etc. of the present invention may be made of a suitable material such as wood, metal and synthetic plastics.

The foregoing description contains a limited number of embodiments of the present invention. It will be understood, however, that such embodiments are only illustrative and that numerous variations are possible without departing from the purview of the invention as defined in the following claims.

I claim:

1. A sliding cover comprising cover pieces having at the opposite ends thereof curved projections the cross section of which are formed by the arcs of circles and edge projections, said curved and edge projections forming therebetween slots, said cover pieces having at the opposite ends thereof slots opening in the opposite direction to each other, the inner walls of said edge projections defining said slots being arched concentrically with the opposite surfaces of said curved projections; and a hinge connecting said cover pieces having two fitting edges extending towards each other, two guiding edges each connected to the corresponding fitting edge and formed into an arcuate portion to be received in said corresponding slot, and a central portion connecting said two guiding edges, said fitting and guiding edges forming fitting slots



5

6

therebetween receiving said curved projections, and said fitting slots having parallel walls concentric with the opposite surfaces of said curved projections.

2. A sliding cover as claimed in claim 1, wherein said cover pieces are provided at their opposite ends with stepped portions located at the sides of said curved projections opposite to

the sides defining said slots, and said central portion is formed into a plate having opposite flat surfaces allowing said stepped portions or said edge projections to be seated thereon when said cover pieces are turned with respect to said hinge.

10

15

20

25

30

35

40

45

50

55

60

65

70

75