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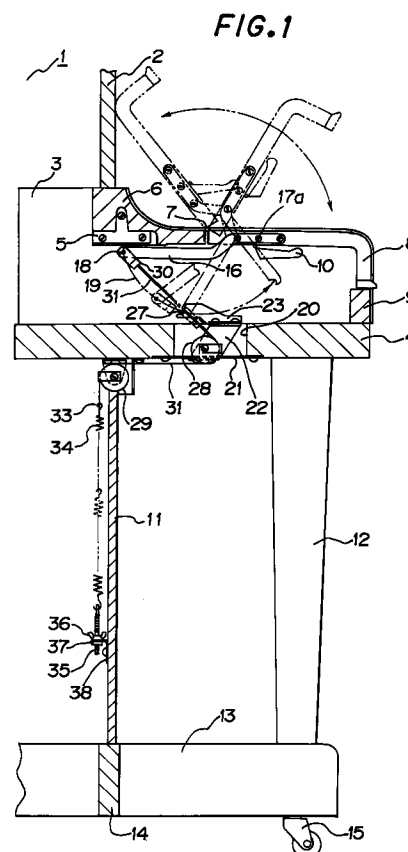
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(54) **Opening/closing apparatus of piano Fallboard**

(57) An opening/closing apparatus of a fallboard of a piano comprising a fallboard (8) disposed above a key bed (4) and adapted to cover a keyboard, a rear end of the fallboard (8) being pivotally attached to a piano body, a lever (16) fixed to one side surface of the fallboard (8) and extending backwardly beneath a pivotal portion (7) of the fallboard (8), an engaging recess formed in a rear end of the lever and facing upwardly, a wire holder catcher (23) fixed to the key bed (4) and including an retaining recess (27), the retaining recess (27) being formed in an intermediate part of a turning path for the engaging recess (28) and facing upwardly, a wire (31) having a wire holder (30) fixed to an upper end thereof, the wire holder (30) being capable of engagement with the engaging recess (18) and the retaining recess (27), and a pull member (34) for pulling a lower end of the wire downwardly.



EP 0 833 301 A2

Description

BACKGROUND OF THE INVENTION

This invention relates generally to a acoustic musical instrument and more particularly to an opening/closing apparatus of a fallboard for covering the keyboard of a musical instrument such as an upright piano and a grand piano.

A typical conventional piano will be briefly described with reference to Fig. 12 which shows a vertical sectional side view of an upright piano. The upright piano has a piano body generally denoted by reference numeral 1. The piano body 1 is provided at an upper portion of a front surface thereof with an upper front plate 2. Beneath the front plate 2, arms 3 are fixed to opposite sides of the piano body 1. A horizontal key bed 4 is fixed to lower ends of the arms 3. The key bed 4 extends forwardly and backwardly beneath the front plate 2. An upper sill attachment element 5 is fixed to each of the arms 3. An upper sill 6 is removably attached to the upper sill attachment element 5 such that said upper sill 6 is in contact with a lower end of said front plate 2.

A rear end of a fallboard 8 is pivotally attached to a front end of the upper sill 6 through a pivotal portion 7 such as a hinge. By virtue of this arrangement, the fallboard 8 is capable of making a pivotal movement about the pivotal portion 7 between a closed position as indicated by a solid line and an open position as indicated by a two-dot chain line of Fig. 12. When the fallboard 8 is in the closed position, a front end of the fallboard 8 is in contact with a key slip 9 which is fixed to an upper part of a front end of a key bed 4. Reference numeral 10 denotes a music rack; 11, a lower front board; 12, a leg; 13, a toe block; 14, a bottom sill; and 15, a caster, respectively.

In the conventional piano, the weight of the fallboard 8 must be supported by hand when the fallboard 8 is opened or closed. The weight of the fallboard 8 is pretty heavy for the player. This is particularly true when the player is a little boy or girl. For such a little boy or girl, there is a fear that his or her finger is accidentally caught between the front end of the fallboard 8 and the key slip 9 which often results in injury.

The present invention has been accomplished in view of the above situation.

SUMMARY OF THE INVENTION

It is, therefore, an important object of the present invention to provide a opening/closing apparatus of a fallboard of a piano in which a fallboard can be opened and closed with a reduced force, so that a player's finger will not be injured even if his or her finger is accidentally caught between the fallboard and a key bed.

In order to achieve this object, there is essentially provided an opening/closing apparatus of a fallboard of

a piano comprising a fallboard disposed above a key bed and adapted to cover a keyboard, a rear end of the fallboard being pivotally attached to a piano body; a lever fixed to one side surface of the fallboard and extending backwardly beneath a pivotal portion of the fallboard; an engaging recess formed in a rear end of the lever and facing upwardly; a wire holder catcher fixed to the key bed and including an retaining recess, the retaining recess being formed in an intermediate part of a turning path for the engaging recess and facing upwardly; a wire having a wire holder fixed to an upper end thereof, the wire holder being capable of engagement with the engaging recess and the retaining recess; and pull means for pulling a lower end of the wire downwardly.

It is preferred that the pull means includes a plurality of weights slidably attached of the lower end of the wire, and a plurality of weight support portions for supporting the weights excepting one which is located in the lowest position, in accordance with a lowering of the wire.

It is also preferred that the pull means includes a first group of weights slidably attached to the lower end of the wire, a second group of weights hung down beneath the first group of weights through a flexible string-like member, and a plurality of weight support plates for supporting the weights in accordance with a lowering of the wire.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete application of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

Fig. 1 illustrates one embodiment of the present invention and is a vertical sectional side view taken along a side surface of a keyboard;

Fig. 2 is a side view showing one example of a lever in Fig. 1;

Fig. 3 is a plan view of Fig. 2;

Fig. 4 is a side view showing one example of a wire holder catcher of Fig. 1;

Fig. 5 is a plan view of Fig. 4;

Fig. 6 is a front view showing one example of a wire holder and a wire of Fig. 1;

Fig. 7 is a side sectional view showing, on an enlarged scale, an engaged state between a wire holder and a wire holder catcher of Fig. 1;

Fig. 8 is a sectional view taken on line A-A of Fig. 7;

Fig. 9 is a sectional view taken on line B-B of Fig. 7;

Fig. 10 is a vertical sectional side view, similar to Fig. 1, showing another embodiment of the present invention, in which a feature of the present invention defined in claim 2 is illustrated;

Fig. 11 is a vertical sectional side view, similar to Fig. 1, showing a further embodiment of the present invention, in which a further feature of the present invention defined in claim 3 is illustrated; and

Fig. 12 is a vertical sectional side view, similar to Fig. 1, showing one example of a conventional upright piano.

DETAILED DESCRIPTION OF THE INVENTION

Some embodiments of the present invention will now be described in detail with reference to Figures of the accompanying drawings. Fig. 1 is a vertical sectional side view showing one embodiment of the present invention, in which the present invention is applied to an upright piano. In Fig. 1, identical parts to those of Fig. 12 are denoted by identical reference numerals respectively and description thereof is omitted.

A pair of levers 16 (only one lever is illustrated) are fixed respectively to opposite side surfaces of the fallboard 8 in the vicinity of its rear end. As shown in Figs. 2 and 3, this lever 6 has an elongate flat plate-like configuration. A plurality of attachment holes 17 are formed in a front part of the lever 6. The lever 6 is attached to the side surface of the fallboard 8 by small screws inserted into the attachment holes 17. The lever 6 is bent downwardly at an intermediate part thereof and then extends backwardly in parallel with the front part thereof. An engaging recess 18 is formed in a rear end of the lever 6 in a way to face upwardly.

As best shown in Fig. 1, the lever 16 firmly attached to the side surface of the fallboard 8 by screws 17a inserted into the attachment holes 17 passes beneath the pivotal portion 7 and extends backwardly beneath the upper sill 6. Owing to this arrangement, the lever 16 turns about the pivotal portion 7 in unison with the fallboard 8, in accordance with an opening/closing operation of the fallboard 8. At that time, the engaging recess 18 of the rear end of the lever 16 moves along an arcuate turning path 19 about the pivotal portion 7.

A through-hole 20 is formed in the key bed 4 in the vicinity of and beneath the intermediate part of the lever 16. A base plate 21 is attached to a lower surface of the key bed 4 in such a manner as to be astride the through-hole 20. A catcher plate 22, which penetrates the through-hole 20 diagonally upwardly, is attached to an upper surface of the base plate 21. A wire holder catcher 23 is attached to the top of the catcher plate 22 such that the wire holder catcher 23 projects towards the upper surface side of the key bed 4.

Fig. 4 is a side view showing one example of the wire holder catcher 23, and Fig. 5 is a plan view thereof. As shown in those Figures, the wire holder catcher 23 comprises an elongate horizontal bottom plate 24 and a pair of side plates 25 erected upwardly from opposite sides of the bottom plate 24 and extending backwardly in parallel relation. A plurality of attachment holes 26 are formed in the bottom plate 24. The wire holder catcher

25 is firmly attached to the top of the catcher plate 22 (see Fig. 1) by small screws inserted into the attachment holes 26. A retaining recess 27 is formed in a rear end of each side plate 25 in such a way to face upwardly.

When the wire holder catcher 23 is attached to the top of the catcher plate 22 as shown in Fig. 1, the retaining recess 27 is located in the turning path 19 for the engaging recess 18 at a location downwardly and rather backwardly of the pivotal portion 7.

A sheave 28 is turnably attached to the catcher plate 22 which penetrates the through-hole 20 diagonally upwardly as previously mentioned. Another sheave 29 is turnably attached to a lower surface of the key bed 4 at a area in the vicinity of the upper portion of the lower front board 11. A wire 31 with a wire holder 30 firmly attached to an upper end thereof is disposed between the engaging recess 18 formed in the rear end of the lever 16 and the back side of the lower front board 11 via the sheaves 28, 29.

Fig. 6 is a front view showing one example of the wire holder 30 and the wire 31. As shown in this Figure, the wire holder 30 has a generally U-shaped configuration bifurcated upwardly. The wire holder 30 is provided at upper end portions of its bifurcated portion with a laterally extending holder pin 32. An upper end of the wire 31 is firmly attached to a bottom portion of the wire holder 30. A loop portion 33 is formed on a lower end of the wire 31.

As shown in Fig. 1, for attaching the wire holder 30 on the upper end of the wire 31 to the engaging recess 18 formed in the rear end of the lever 16, the holder pin 32 is engaged in the engaging recess 18 with the rear end of the lever 16 interposed between the bifurcated portions of the wire holder 30 (see Fig. 2).

A tension spring 34 acting as means for pulling the lower end of the wire 31 downwardly is attached to the loop portion 33 at the lower end of the wire 31. A lower end of the tension spring 34 is attached to the back side of the lower front board 11 such that the tensile force of the tension spring 34 can be adjusted by an adjust bolt 35, a wing nut 36, a nut 37, and an adjust bolt plate 38.

Operation of the above-mentioned apparatus will now be described. When the fallboard 8 is in the closed position as indicated by a solid line of Fig. 1, the lever 16 is in its generally horizontal posture, the holder pin 32 of the wire holder 30 (see Fig. 6) is engaged in the engaging recess 18 formed in the rear end of the lever 17, and the wire holder 30 is supported by a rear end of the lever 16 which is held in its generally horizontal posture. And the lower end of the wire 31 is pulled downwardly by the maximum tensile force of the tension spring 34 which is in its fully stretched state as shown in Fig. 1.

The tensile force of the tension spring 34 for pulling the lower end of the wire 31 downwardly is transmitted to the rear end of the lever 16 through the wire 31, the wire holder 30, the holder pin 32, and the engaging recess 18, thereby to cause the lever 16 to turn counter-

clockwise about the pivotal portion 7. As a consequence, the weight of the fallboard 8 can be reduced so that the fallboard 8 can be opened with a reduced force.

In this way, the fallboard 8 can be opened by a reduced force. As the fallboard 8 is opened, the lever 16 is turned counterclockwise in unison with the fallboard 8 and the wire holder 30 is moved downwardly along the turning path 19 together with the engaging recess 18 formed in the rear end of the lever 16. Along with this movement, the wire 31 is also moved towards the lower end side and the tension spring 34 is slightly contracted to lose its tensile force slightly. Then, when the fallboard 8 is opened diagonally rightwardly upwardly as indicated by the two-dot chain line of Fig. 1, the engaging recess 18 formed in the rear end of the lever 16 and the holder pin of the wire holder 30 reach the retaining recess 27 which is located in the turning path 19.

Fig. 7 is a side sectional view showing, on an enlarged scale, the wire holder catcher 23 and its nearby area at that time, Fig. 18 is a sectional view taken on line A-A of Fig. 18, and Fig. 9 is a sectional view taken on line B-B of Fig. 7. As shown in those Figures, when the engaging recess 18 formed in the rear end of the lever 16 and the holder pin 32 of the wire holder 30 reach the retaining recess 27 of the wire holder catcher 23, the rear end of the lever 16 enters between the side plates 25 from the rear end side of the wire holder catcher 23 and the projecting ends of the holder pin 32 engaged in the engaging recess 18 formed in the rear end of the lever 16 are engaged with the retaining recess 27.

When the fallboard 8 is further opened from a half-open position located diagonally upwardly as indicated by the two-dot chain line of Fig. 1, the projecting ends at opposite sides of the holder pin 32 are kept engaged with retaining recess 27 of the wire holder catcher 23 and not moved. The holder pin 32 is disengaged from the engaging recess 18 formed in the rear end of the lever 16, the lever 16 is turned counterclockwise in unison with the fallboard 8 and without accompanying the wire holder 30, and the fallboard 8 reaches the fully opened position located leftwardly upwardly as indicated by two-dot chain line of Fig. 1.

During the time the fallboard 8 is turned from the half open position to the fully opened position, the wire holder 30 is disengaged from the engaging recess 18 formed in the rear end of the lever 16 and supported by the retaining recess 27 of the wire holder catcher 23. Accordingly, the tensile force of the wire 31 is not transmitted to the rear end of the lever 16 and the weight of the fallboard 8 is not reduced. However, since the fallboard 8 faces upwardly of the pivotal portion 7, the force required for turning the fallboard 8 in a direction of its fully opened position is small.

For closing the fallboard 8 in its fully opened position, no force for reducing the weight of the fallboard 8 is not applied to the fallboard 8 during the time the fallboard 8 moves from the full open position to the half

closed position. However, since the fallboard 8 faces upwardly of the pivotal portion 7 at this area of turning motion, the force required for turning the fallboard 8 is small.

In the course of this closing procedure, when the fallboard 8 is turned to the half closed position as indicated by the two-dot chain line of Fig. 1, the lever 16 is also turned clockwise together with the fallboard 8, a rear end of the lever 16 enters between the pair of side plates 25 from the front end side of the wire holder catcher 23, and the engaging recess 18 formed in the rear end of the lever 16 is engaged with the pin holder 32 as shown in Figs. 7 through 9. Then, when the lever 16 is turned further clockwise, the holder pin 32 is disengaged from the retaining recess 27 of the wire holder catcher 23 and the wire holder 30 is moved upwardly along the turning path 19 with the holder pin 32 engaged in the engaging recess 18 formed in the rear end of the lever 16.

When the wire holder 30 is brought into a position where the holder 30 is supported by the rear end of the lever 16, the tensile force of the tension spring 34 for pulling the lower end of the wire 31 is transmitted to the rear end of the lever 16, thereby the weight of the fallboard 8 is reduced. For this reason, the tension spring 34 is stretched as the fallboard 8 comes closer to its closed position. Since the tensile force of the tension spring 34 is increased, the force for reducing the weight of the fallboard 8 is gradually increased. As a consequence, the fallboard 8 can be closed slowly with a reduced force and it will never happen that the player's finger is accidentally caught between the fallboard and the key bed and injured.

When a maintenance is required, the wire holder 30 is supported by the retaining recess 27 of the wire holder catcher 23 with the fallboard 8 held in its open state and the upper sill 6 is removed from the upper sill attachment element 5. By doing so, the maintenance can be performed in the same manner as in the prior art.

Fig. 10 is a vertical sectional side view showing another embodiment of the present invention, in which a feature of the present invention defined in claim 2 is illustrated. Identical parts to those of Fig. 1 are denoted by identical reference numerals, respectively and description thereof is omitted.

In an apparatus shown in Fig. 10, an upper end of another wire 39 is attached to the loop portion 33 at the lower end of the wire 31. This wire 39 penetrates through the centers of a plurality of weights 40, 41, 42 such that the wire 39 can slide upwardly and downwardly. The wire 39 is provided at a lower end thereof with a stop 43 for preventing the weight 42 from escaping. A sleeve-like member 44 is fixed to the back side of the lower front board 11 in its upstanding posture such that a small gap is formed between the sleeve-like member 44 and the outer peripheral surfaces of the weights 40, 41, 42.

Of the weights 40, 41, 42, the uppermost weight 40 is dimensioned such that it has the largest diameter. The diameter of the weight 41, which is located downwardly of the weight 40, is smaller than that of the weight 40. The diameter of the weight 42, which is located in the lowest position, is the smallest.

On the other hand, the inside diameter of the sleeve-like member 44 is also gradually reduced downwardly so that the inside diameter corresponds to the diameters of the weights 40, 41, 42. A lower end of that portion of the sleeve-like member 44 surrounding the outer peripheral surface of the weight 40 is continuous with that portion which surrounds the outer peripheral surface of the weight 41 through a right-like weight support portion 45 at a lower position slightly away from the lower surface of the weight 40. A lower end of that portion of the sleeve-like member 44 surrounding the outer peripheral surface of the weight 41 is continuous with that portion which surrounds the outer peripheral surface of the weight 42 through a ring-like weight support portion 46 at a position longer distance away from the lower surface of the weight 41.

According to the apparatus shown in Fig. 10, when the fallboard 8 is in the closed position, the tensile force acting on the wire 31 is the largest because of the total weights of the weights 40, 41, 42. This tensile force is applied to the fallboard 8 through the lever 16 to reduce the weight of the fallboard 8 so that the fallboard 8 can be opened with a reduced force. As the opening operation of the fallboard 8 is progressed, the tensile force is reduced.

More specifically, when the fallboard 8 is brought into a slightly open position by the opening operation of the fallboard 8, first, the lower surface of the uppermost weight 40 contacts the weight support portion 45 and therefore, the tensile force acting on the wires 31, 39 are reduced to the extent of the portion of the weight 40 which is supported by the weight support portion 45. When the opening operation of the fallboard 8 is further progressed, the intermediate weight 41 contacts the weight support portion 46 so as to be supported by it. Therefore, the tensile force acting on the wire 31 is more reduced. That is, a biasing force for causing the lever 16 to turn counterclockwise about the pivotal portion 7 is reduced.

At this time, only the weight of the weight 42 is loaded on the stop 43, and the fallboard 8 is opened diagonally upwardly as indicated by two-dot chain line of Fig. 10. On the other hand, the engaging recess 18 formed in the rear end of the lever 16 and the holder pin 32 of the wire holder 30 reach the retaining recess 27 of the wire holder catcher 23. Thereafter, operations of the relevant members to be performed until the fallboard 8 is fully opened are the same as in the apparatus according to one embodiment of Fig. 1.

For closing the fallboard 8 in the fully opened position shown in Fig. 10, the fallboard 8 is turned in the closing direction until the fallboard 8 is turned to the

diagonally upward position as indicated by two-dot chain line of Fig. 10. As a consequence, the wire holder 30 is supported by the rear end of the lever 16. Then, the wires 31, 39 are pulled upwardly by a closing operation performed thereafter and the weights 41, 40 are gradually supported by the weight 42 so that the force for reducing the weight of the fallboard 8 is gradually increased. Thus, the fallboard 8 can be closed slowly with a reduced force.

Fig. 11 is a vertical sectional side view showing a further embodiment of the present invention, in which a further feature of the present invention defined in claim 3 is illustrated. Identical parts to those of Fig. 1 are denoted by identical reference numerals, respectively and description thereof is omitted.

In an apparatus shown in Fig. 11, a weight 47 is attached to the loop portion 33 formed at the lower end of the wire 31. Beneath this weight 47, a plurality of weights 48, 49 are hung through a flexible string-like member 50. A plurality of string-like member receiving recesses 51 are formed in the neighborhood of those areas of the weights 47, 48, 49 where the string-like member 50 is attached. A weight support plate 52 is fixed to the back side of the lower front board 11 such that the weight support plate 52 is located downwardly of the weight 49. A cushion felt 53 is attached to a horizontal upper surface of the weight support plate 52.

According to the apparatus of Fig. 11, when the fallboard 8 is in the closed position, the weights 47, 48, 49 are all in their hanging down states and the tensile force acting on the wire 31 is the largest due to the total weight of those weights 47, 48, 49. Since this tensile force is applied to the fallboard 8 through the lever 16, the weight of the fallboard 8 is reduced and therefore, the fallboard 8 can be opened with a reduced force. This tensile force is reduced as the opening operation of the fallboard 8 is progressed.

Specifically, during the time after the fallboard 8 begins to open until it reaches a diagonally rightwardly upward position as indicated by a two-dot chain line of Fig. 11, first, the lowest weight 49 sits on the cushion felt 53 of the weight support plate 52 and therefore, the tensile force acting on the wire 31 is reduced to the extent of that portion of the weight 49 supported by the cushion felt 53. As the opening operation of the fallboard 8 is further progressed, the intermediate weight 48 sits on the weight 49 and the uppermost weight 47 finally sits on the weight 48. As a consequence, no weight of the weights 47, 48, 49 is loaded on the wire 31.

At this stage, the wire holder 30 is supported by the wire holder catcher 23 and the weight of the weights is not loaded thereon. It is preferred, however, that the wire 31 is held in its tensioned state so that the wire holder 30 can support the wire 31 in a stable manner. When the weights 47, 48, 49 are supported gradually from those located in a lower position by the weight support plate 52, the string-like member 50 is flexed and received in the string-like member receiving recess 51.

As a consequence, the weights 47, 48, 49 are intimately superposed one upon another in a vertical direction.

For closing the fallboard 8 in the frilly opened position of Fig. 11, the fallboard 8 is turned in the closing direction to a diagonally rightwardly upper position as indicated by a two-dot chain line. As a consequence, the wire holder 30 is supported by the rear end of the lever 16. The wire 31 is pulled upwardly by a closing operation thereafter, and the weights 47, 48, 49 are gradually hung upwardly by the wire 31. The total weight of the weights 47, 48, 49 serves as a force for pulling the wire 31, and the force for reducing the weight of the fallboard 8 is gradually increased. Thus, the fallboard 8 can be closed slowly with a reduced force.

In the embodiments described hereinbefore, the present invention is applied to an upright piano. The present invention can, of course, be applied to a grand piano.

As apparent from the foregoing description, according to the present invention, the force of the pull means for pulling the wire downwardly increases the force for opening the fallboard, thereby to reduce the weight of the fall board. As a consequence, the fallboard can be opened/closed with a reduced force. Therefore, the problem, in which the player's finger is accidentally caught between the fallboard and the key bed and injured, can be obviated. Moreover, since no force in an opening direction of the fallboard is applied to the fallboard in the frilly opened position, the fallboard is not accidentally turned in the closing direction.

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

Claims

1. An opening/closing apparatus of a fallboard of a piano comprising:
 - (a) a fallboard disposed above a key bed and adapted to cover a keyboard, a rear end of said fallboard being pivotally attached to a piano body;
 - (b) a lever fixed to one side surface of said fallboard and extending backwardly beneath a pivotal portion of said fallboard;
 - (c) an engaging recess formed in a rear end of said lever and facing upwardly;
 - (d) a wire holder catcher fixed to said key bed and including an retaining recess, said retaining recess being formed in an intermediate part of a turning path for said engaging recess and facing upwardly;
 - (e) a wire having a wire holder fixed to an upper end thereof, said wire holder being capable of

engagement with said engaging recess and said retaining recess; and

(f) pull means for pulling a lower end of said wire downwardly.

2. An opening/closing apparatus of a fallboard of a piano according to claim 1, wherein said pull means includes a plurality of weights slidably attached of the lower end of said wire, and a plurality of weight support portions for supporting said weights excepting one which is located in the lowest position, in accordance with a lowering of said wire.
3. An opening/closing apparatus of a fallboard of a piano according to claim 1, wherein said pull means includes a first group of weights slidably attached to the lower end of said wire, a second group of weights hung down beneath said first group of weights through a flexible string-like member, and a plurality of weight support plates for supporting said weights in accordance with a lowering of said wire.

FIG. 1

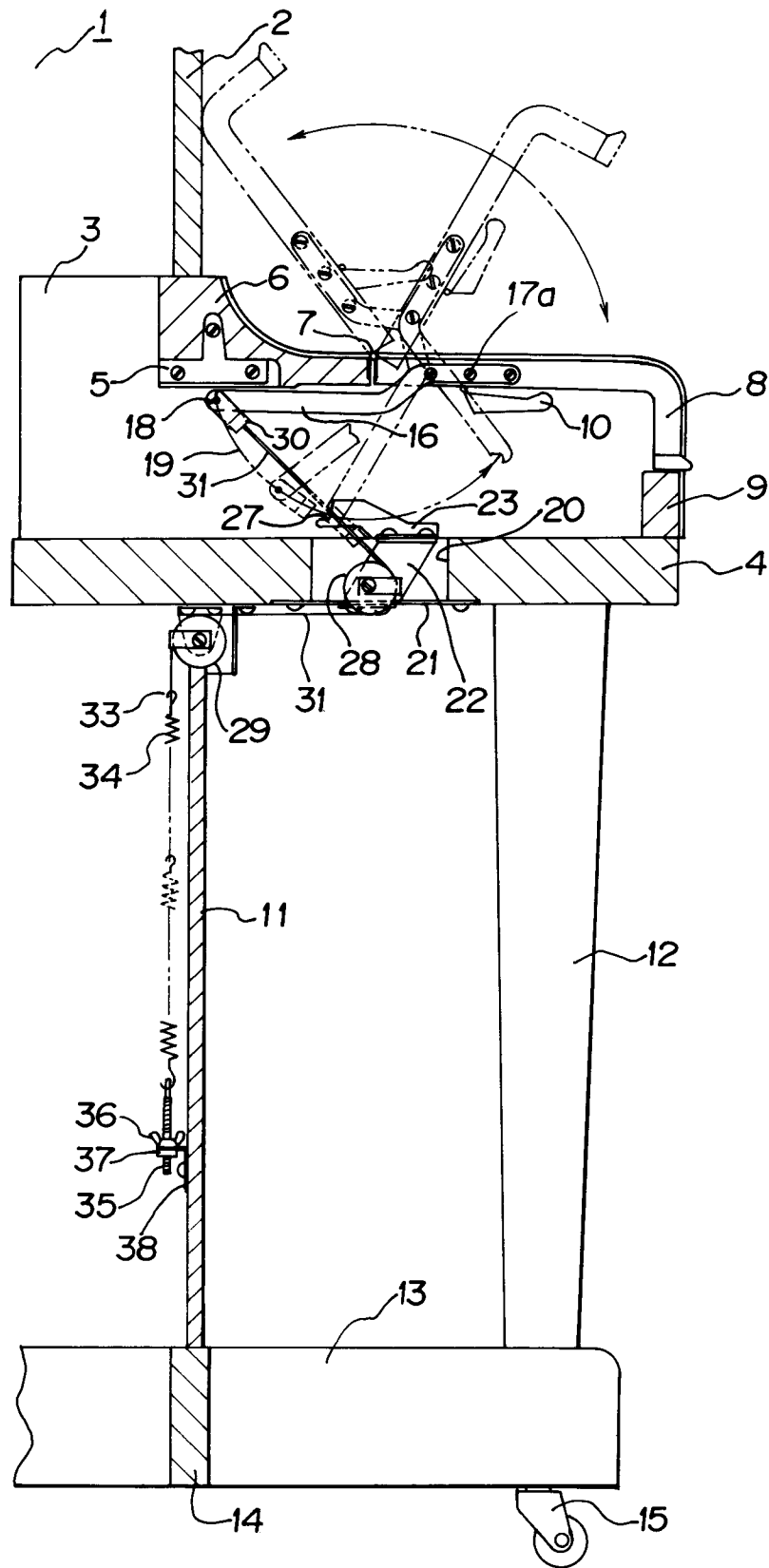


FIG.2

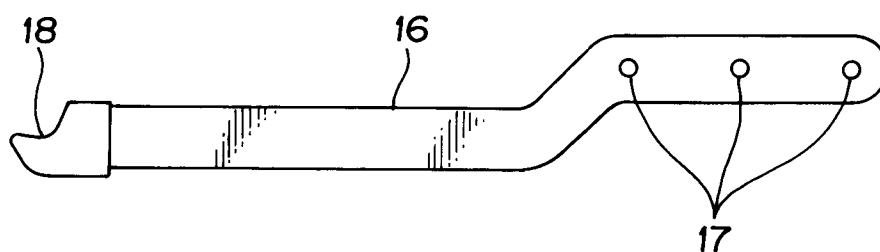


FIG.3

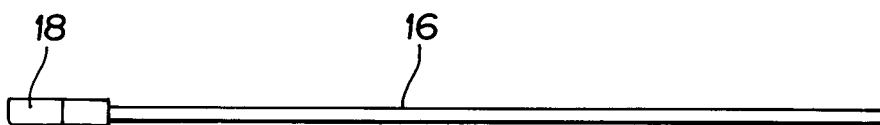


FIG. 4

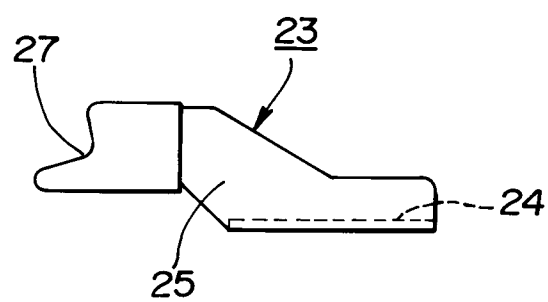


FIG. 5

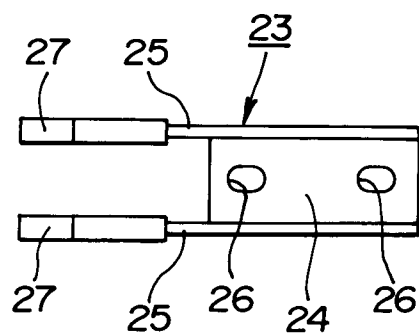


FIG. 6

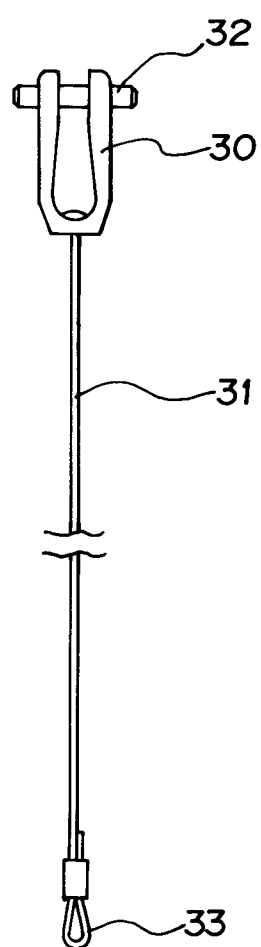


FIG. 7

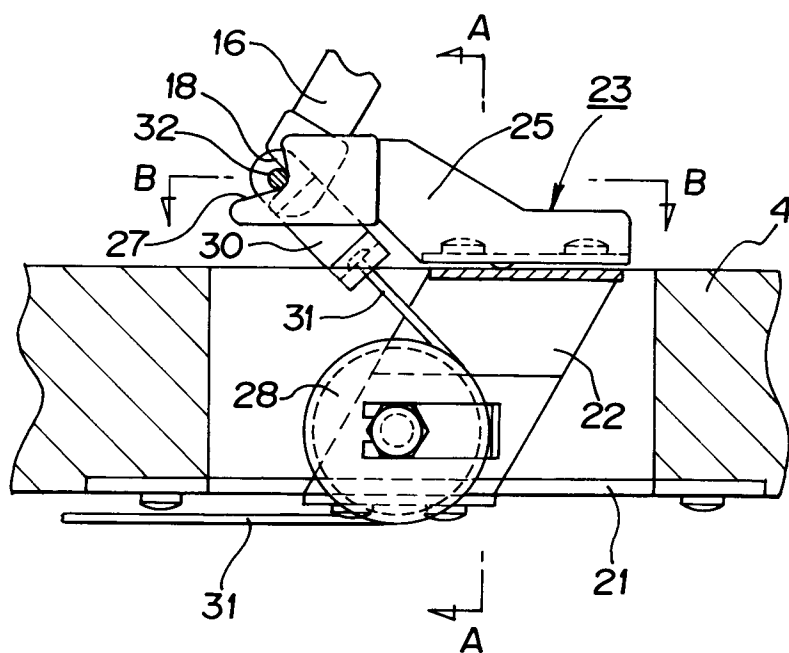


FIG. 8

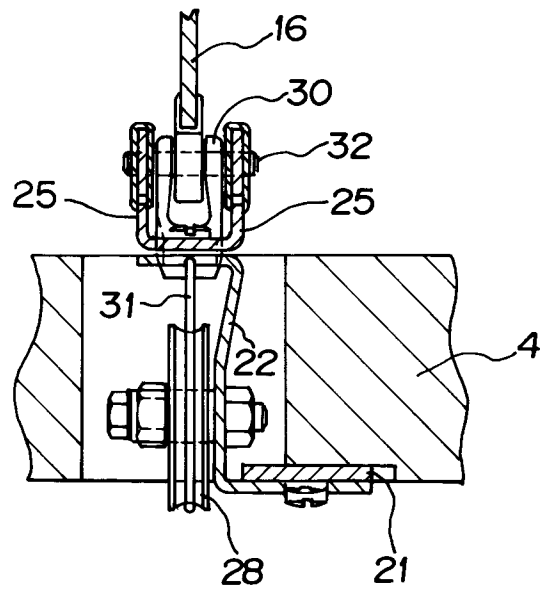


FIG. 9

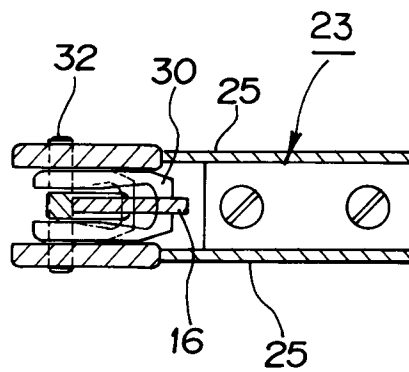


FIG.10

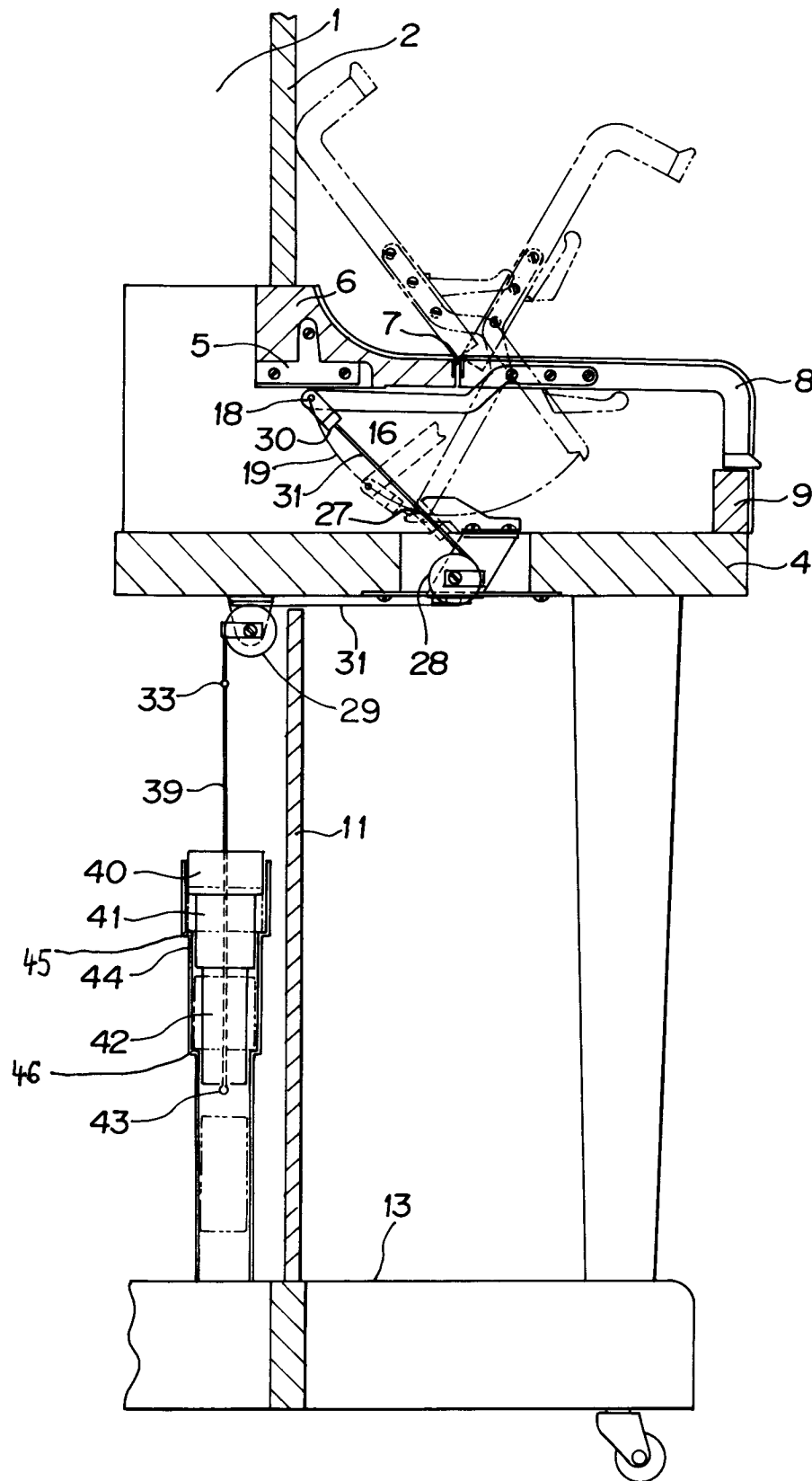


FIG. 11

