

SPECIFICATION

SAFETY MECHANISM OF A PAPER SHREDDER

FIELD OF THE INVENTION

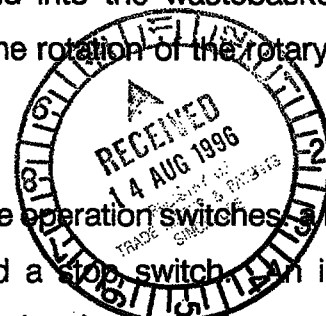
REPLACED SHEETS		SG
☐ Description	: paged to paged	
☒ Claim(s)	: paged 22 to paged 24	
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The present invention relates to a shredder for cutting waste paper into small pieces, and in particular, to a plurality of safety mechanisms of the shredder to prevent hazards. Specifically, the present invention discloses a design that causes the rotary cutter of a shredder to stop safely and immediately in the event of an emergency. The present invention also discloses a construction that allows the rotary cutter to rotate automatically depending on the presence or absence of paper for shredding. The present invention also discloses a design for preventing hazards in a wastebasket that is made of a flexible material such as plastic.

BACKGROUND OF THE INVENTION

Regardless whether it is for office use or home use, a paper shredder should have a provision that assures an operator's safety, because it has a rotary cutter for shredding paper. A construction that allows a rotary cutter to continuously rotate even with a wastebasket for keeping waste taken out exposes an operator to the risk of injury. The operator could inadvertently put his hand into the wastebasket. To preclude such a danger, it is vitally important to stop the rotation of the rotary cutter without fail while the wastebasket is not in place.

An ordinary shredder is typically provided with three operation switches, a normal rotation (shred) switch, a reverse rotation switch and a stop switch. An internal shredder cutter is rotated to shred papers automatically by simply placing paper into an inlet port or manually by the normal rotation switch. If a paper jamming takes place in the course of shredding, the reverse rotation switch may be pressed to cause the rotary cutter to rotate in the reverse direction for removal of the paper. The stop



switch is provided to stop the rotary cutter in an emergency situation or after any document is fully shredded.

In many cases, these switches are disposed on the top cover of the shredder near a paper inlet port, and have similarly sized design with identical height dimension. Each switch is depressed for activation. These switches are identified for their function by associated labels, or by symbols or colorings of their caps.

Since the paper inlet port is relatively large, there is a possibility that the clothing or a tie of an operator, possibly due to inexperience or inadvertence, may be caught by a rotary cutter in rotation. In such an emergency situation, it is very difficult to press a small stop switch in the top cover. The operator may be too panicky to coolly operate the switch.

The automatic start mechanism of the shredder has a sensor in the paper inlet port. When papers are introduced into the inlet port, the sensor senses the presence of the papers, causing the rotary cutter to rotate in a controlled fashion. In this case, the location of the sensor and the shredding position of the rotary cutter are spaced apart with some separation therebetween. When the rear end of a sheet of paper moves past the sensor with no paper existing in the coverage of the sensor, the rear end of the sheet does not yet reach the rotary cutter. Thus, the rotary cutter should be continuously rotated for some time thereafter to completely shred the paper. To perform such an operation, an extra delay circuit is required, making the entire circuitry complex and manufacturing the shredder needs more processes.

In another type of shredder, a mechanical start lever as a sensor is provided. When papers introduced presses the start lever, the driving motor of a rotary cutter is powered on. This type of shredder is manufactured at a relatively lower cost. When the papers move past the start lever, a micro switch is turned off, causing the driving motor to stop before the papers pass through the rotary cutter. The operator thus needs to continuously rotate the driving motor until the papers are fully shredded, by manually pressing the normal rotation switch.

The prior art shredder may present another problem. With a view to manufacturing a shredder at a low cost and in a simple way, it is typically constructed of a moulded synthetic resin such as plastic in order to achieve lightweight design and to make quantity production possible. Since the entire cabinet of the shredder is of a moulded synthetic resin that is flexible, a side wall 91 is deformed inwardly when the wastebasket (a drawer) 90 is subjected to lateral force. This causes to a shredder section 91 a gap through which a finger of the operator could enter. Horizontally the deeper the wastebasket in the direction of the drawing and vertically the higher the wastebasket, such an incident is likely. This should be eliminated for the safety of the operator.

SUMMARY OF THE INVENTION

The automatic start mechanism of the shredder has a sensor in the paper inlet port. When papers are introduced into the inlet port, the sensor senses the presence of the papers, causing the rotary cutter to rotate in a controlled fashion. In this case, the location of the sensor and the shredding position of the rotary cutter are spaced apart with some separation therebetween. When the rear end of a sheet of paper moves past the sensor with no paper existing in the coverage of the sensor, the rear end of the sheet does not yet reach the rotary cutter. Thus, the rotary cutter should be continuously rotated for some time thereafter to completely shred the paper. To perform such an operation, an extra delay circuit is required, making the entire circuitry complex and manufacturing the shredder needs more processes.

OBJECT OF THE INVENTION

It is a first object of the present invention to provide a mechanism which causes a cutter to stop its motion without fail with a wastebasket not in place for the purpose of a safe operation of a shredder.

It is another object of the present invention to provide a mechanism which helps an operator make an emergency stop in the event of an emergency by making an emergency stop switch easy to use.

It is yet another object of the present invention to provide a mechanism which performs automatic start and stop operations in an assured manner without using a photosensor, wherein the mechanism sets a cutter in motion when detecting papers that are introduced into the shredder and stops the cutter when detecting absence of papers.

It is yet another object of the present invention to provide a mechanism which restrains deformation of a wastebasket that is made of a deformable material such as plastic.

To achieve the first object, a safety mechanism for use in a shredder having a drawer type wastebasket disposed under it has been developed. This mechanism has a switching projection for activating a switch. The switching projection is provided on the top portion of a side wall perpendicular to the direction of drawing the wastebasket, namely a front side wall or rear side wall. While the wastebasket is in its closed position, this switching projection moves the actuator of the switch to close the circuit of the driving power supply of a rotary cutter and thereby feeding power to the rotary cutter. The switch that is switched on or off by the actuator is provided in the middle of the driving power supply circuit of the rotary cutter. When the wastebasket is put into its closed position, the switching projection presses the actuator, causing the circuit of the power supply to be closed and thereby feeding power. More specifically, the switching projection is mounted on the top portion of the front side wall of the wastebasket. The bottom portion of the shredder section of the shredder is provided with a bottom cover. The bottom cover has a slit in a position matching the switching projection in a manner that the switching projection passes through the slit. The bottom cover has also a micro switch actuator within the slit. With the wastebasket in its closed position, the switching projection drives the actuator.

To achieve the second object, the present invention comprises a switching plate having a wide area and constantly upwardly biased, at substantially the same level as the top cover of the shredder section. A micro switch is disposed at any convenient position just under the switching plate in a manner that the lowering of the switching plate activates the micro switch to stop the rotary cutter. A pair of actuator arms has on their ends a switching plate having a wider area than other switches, wherein the pair of actuator arms are rotatably supported at support members provided at the middle portions of both sides of the top cover of the shredder section. This switching plate is upwardly biased by a wide plate spring attached onto the top cover of the shredder section. A micro switch is disposed at any convenient position just under the switching plate in a manner that the lowering of the switching plate activates the micro switch to stop the rotatory cutter. With the wide-area switching plate upwardly biased, the operator lowers the switching plate with the slight motion of his hand or body, activating the internal micro switch and reliably stopping the rotary cutter, without paying any attention to the position of the switching plate in an emergency situation.

To achieve the third object, the present invention comprises a paper sensor plate projected into a paper inlet port. The paper sensor plate is secured to one end of a transmission shaft rotatably supported at a paper sensor protective bracket. A start lever is secured to the other end of the transmission shaft so that both the paper sensor and the start lever integrally rotate. The end of the start lever is placed within the range of the actuator of a micro switch. A tangentially aligned push projection is provided on the outer surface of a switching cam that is rotated integrally with the rotary cutter to activate the actuator. A locking projection that is projected into the area of rotation of the start lever is provided on the end of the movable portion of the start lever stopper mounted on the left-hand side frame of the shredder. A release projection is provided in a position where it can contact the push projection provided on the outer surface of the switching cam.

In the above mechanism of the present invention, the paper sensor rotates when papers are inserted. The start lever that rotates integrally with the paper sensor by

means of the transmission shaft activates the actuator of the micro switch. A driving motor starts moving, rotating the rotary cutter and starting shredding. The locking projection temporarily restrains the start lever from returning, and even when the end of the sheet is detected, the cam face of the switching cam presses the actuator to continue the rotation of the rotary cutter. As the switching cam rotates, the push projection presses the start lever stopper outwardly, releasing the locking of the start lever to putting it to its initial state, and stopping the rotary cutter. Therefore, for some time after the end of the sheet is detected, the rotary cutter continuously rotates until the push projection of the switching cam releases the locking of the start lever. The sheet of paper is thus fully shredded.

To achieve the fourth object, the present invention comprises a safety guide that is supported in a manner that the safety guide is pivoted in the direction of drawing. The safety guide has a stopper provided in a position, at least corresponding to the top edge of the side wall of the wastebasket, where inward deformation of the side wall is restrained. According to this mechanism, the stopper of the safety guide abuts the side wall when the wastebasket is subject to lateral force, and restrains further inward deformation of the side wall. No fingers are thus allowed into between the shredder section and the wastebasket. Since the safety guide is pivotally supported in the direction of drawing, no difficulty is presented in pulling out or pushing in the wastebasket. The present invention requires that the stopper be arranged "at least corresponding to the top edge of the side wall." This is because the object of the present invention is achieved as long as the abutting of the stopper with the top edge of the side wall is sufficient enough to restrain inward deformation of the top edge with the abutment. The length of the stopper may be enlarged to effectively restrain deformation of the wastebasket.

These and other objects, advantages and features of the present invention will become more apparent when the following detailed description of the invention is considered with the following drawings.

DESCRIPTION OF THE DRAWINGS

- FIG. 1 is a perspective view showing generally the shredder.
- FIG. 2 is a perspective view showing partly the bottom cover of the shredder.
- FIG. 3 is a perspective view showing the wastebasket of the shredder.
- FIG. 4 is a perspective view showing the relationship between the wastebasket and the micro switch.
- FIG. 5 is a perspective view showing an example of pull handle.
- FIG. 6 is a plan view showing the shredder section of the shredder.
- FIG. 7 is a partial cross-sectional view showing the stop switch.
- FIG. 8 is a partial cross-sectional view showing the operation of the micro switch.
- FIG. 9 is a cross-sectional view showing another configuration of the micro switches.
- FIG. 10 is a cross-sectional view of FIG. 9.
- FIG. 11 is a plan view showing the cutter portion of the shredder for achieving the third object.
- FIG. 12 is a front view showing the mechanism for achieving the

third object.

- FIG. 13 is an enlarged view of a portion A of FIG. 12.
- FIG. 14 is a side view of the portion A.
- FIG. 15 is a cross-sectional view of the switching cam.
- FIG. 16A is a perspective view of a pivoting member, and FIG. 16B is a cross-sectional view of the pivoting member.
- FIGS. 17A and 17B are explanatory views showing the locking state of the pivoting member.
- FIGS. 18A through 18F show a series of operations of the start lever, micro switch and cam mechanism.
- FIG. 19A is a front view showing another embodiment of the locking projection, and FIG. 19B is an enlarged view of the locking projection.
- FIGS. 20A and 20B are explanatory views showing another embodiment of the locking projection.
- FIG. 21 is a perspective view showing the relationship between the safety guide and the wastebasket for achieving the fourth object of the present invention.
- FIG. 22 is a diagrammatic view showing restraining of deformation of the wastebasket by the safety guide.
- FIG. 23 is a diagrammatic view showing the pivotal motion of the

safety guide.

- FIG. 24 is a perspective view showing the safety guide of another embodiment.
- FIG. 25 is a diagrammatic view showing the deformation of the wastebasket of the prior art shredder.

DESCRIPTION OF THE EMBODIMENTS OF THE INVENTION

Referring now to the drawings, the embodiments of the present invention are discussed. FIG. 1 is the perspective view of the shredder into which the present invention is embodied. Designated 1 is a shredder section, in which a rotary cutter, (not shown) is provided. The shredder section 1 is further provided with a paper inlet port, a power switch and the like on its outside surface. Such a construction is not limited to the one shown in FIG. 1. Any known construction of shredder is acceptable. Also shown are a bottom cover 2 of the shredder section 1, a wastebasket 3 that is a box-like structure matching the bottom portion of the bottom cover 2, and a container 4 having a structure similar to the wastebasket 3. Both the wastebasket 3 and the container 4 need to function as a drawer, and are housed within a frame 5 constructed of a set of frame members. Both the wastebasket 3 and the container 4 are free to be pushed in or pulled out of the frame 5. The frame 5 is basically constructed of four struts vertically extended, with its four sides left open. The four corners of the bottom cover 2 reliably rests on the top end of the frame 5. In the safety mechanism of the present invention, power to the driving section of the cutter remains disconnected unless the wastebasket 3 is assuredly put into its closed position. Casters 6 are provided on the lower ends of the frame 5 to help the user move the shredder. The top cover 7 of the shredder section 1 have a normal rotation switch 9a and a reverse rotation switch 9b in the vicinity of the paper inlet port 8. The top cover 7 continues to a stop switch 10 having a switching plate (to be described later) having a wide area compared to other switches. The switching plate, coextensive with the

width across the top cover 7, extends downwardly from the level of the top cover 7 to join the front side of the shredder section 1.

The safety mechanism with a view to the first object is now detailed FIG. 2 is the perspective view showing the bottom cover 2. Showing herein are an opening 11 through which shredded waste passes through, a micro switch 12 that works as a safety switch, an actuator 12a for the micro switch, and slits 13 that are arranged in positions operationally accessible from the outside. FIG. 13 is the perspective view showing the wastebasket 3. Designated 21 are switching projections for the actuator 12a. The switching projections 21 drive the actuator 12a with the wastebasket 3 in its fully closed position to control the micro switch 12 for on or off operations. FIG. 4 shows the relationship between the switching projections 21 and the micro switch 12 when the wastebasket 3 remains in its closed position. When the micro switch 12 is closed by the switching projections 21, the power supply circuit of the driving section of the rotary cutter is closed as well. When the wastebasket 3 is pulled out, even if slightly, the micro switch 12 is turned off, opening the power supply circuit and emergency stopping the rotation of the rotary cutter. In FIG. 3, a pair of switching projections 21 are provided. Alternatively, the purpose of driving the actuator 12a is fully achieved by arranging a single switching projection only within a range A as shown. A pair of slits 13 are provided in FIG. 3. For the same reason, a single slit works. In this embodiment, the pairs are symmetrically arranged for aesthetic reasons only. The left-hand slit and switching projection may be occasionally omitted. If the micro switch 12 is re-oriented as necessary, the opposite slit and switching projection function.

In FIG. 3, the switching projections 21 are integrally formed with the wastebasket 3. As shown in FIG. 5, however, the switching projections 21 are integrally formed with a pull handle 22 that is produced separately from the wastebasket 3. The pull handle 22 may be secured to the pull portion of the wastebasket 3. In this embodiment, the switching projections 21 are not integrally formed with the wastebasket 3. Thus, as long as both the wastebasket 3 and the container 4 are produced to be identical in structure except for their height dimension, both are

interchangeable as necessary. Namely, if the user shreds very often, a deeper container may be used as a wastebasket. If the user does not shred so often, a shallower container may be used as a wastebasket. This arrangement offers ease of use to the user. The embodiment in FIG. 1 employs a single container 4. The present invention is equally advantageous even if two or more containers are stacked.

In the above embodiment, the bottom cover 2 is produced separately from the shredder section 1, and the micro switch 12 is mounted within the bottom cover 2. The present invention is not limited to the separate shredder section 1 and the separate bottom cover 2. Alternatively, the micro switch 12 and the slits 13 may be arranged on the shredder section 1 side. The requirement of the present invention is that the switching projections 21 activate the actuator 12a of the micro switch 12 to supply the driving power to the rotary cutter when the wastebasket 3 with the switching projections 21 on it is at its fully closed position. As long as this requirement is achieved, the bottom cover 2 may be appropriately modified. For example, the necessary structures of the bottom cover 2, namely, the micro switch 12, the slits 13 and the four corner resting portions may be arranged on the shredder section 1.

Mounting the switching projections and the micro switch deeper into the wastebasket is technically equal to mounting them on the front of the shredder as already described in the above embodiment. In this case, also, a single switching protection is arranged within a range B in FIG. 3, and with the wastebasket 3 in its fully closed position, the actuator of the micro switch is activated to close the power supply circuit of the rotary cutter.

The above safety mechanism assures safety of the operator, because the rotary cutter rotates only when the wastebasket is in its fully closed position. When disposing of shredded waste, the user simply pulls the wastebasket out and the rotation of the cutter stops. No manipulation of switches is required. The shredder of a type having a detachable pull handle allows different-height container and wastebasket to be interchanged with each other as appropriate. A different size wastebasket may be used at the option of the operator. Thus, ease of use of the

shredder is enhanced.

Discussed next is a preferred embodiment to achieve the second object. The construction of the shredder in FIG. 1 is basically employed in this embodiment. When the normal rotation switch 9a is turned on, the rotary cutter under a known control circuit (not shown) starts rotating to shred papers. The reverse rotation switch 9b is used to rotate the rotary cutter in a reverse direction to remove a paper jam if it takes place. The stop switch 10 is used to stop the rotary cutter as already described. If the clothing or tie of the operator should be caught by the rotary cutter or the like, the operator simply press the front portion of the top cover 7 with his palm or part of his body without paying attention to the position of the switch. Thus, the stop switch 10 reliably operates to stop the rotation of the rotary cutter and an accident is thus prevented. As shown in FIG. 6, the switching plate 31 of the switch 10 has a substantially wide area compared to the other switches, 9a, 9b, and extends along the top front contour of the shredder section. The stop switch 10 is activated by a simple tapping operation on the front contour rather than by pressing the button on the top cover of the prior art shredder. Since the switching plate 31 is curved on the front contour, a hand slides along the inclined curvature of the plate 31 regardless of the direction of pressing, activating the switch 10 in a reliable fashion.

FIGS. 6 through 8 show an example of the structure related to the stop switch 10 of the rotary cutter. As shown, the switching plate 31, substantially coextensive with the top cover 7, has a substantially wide area compared to the switches 9a, 9b. The switching plate 31 is frontward downwardly inclined from the level of the top cover 7. Support members 32, 32 are attached on the inside of the top cover 7, approximately at the middle positions from back to front along both long sides of the top cover 7. Pivotaly supported by the support members 32, 32 are elongated actuator arms 33, 33 having a switching plate 31 at their ends. Designated 34 is a wide plate spring secured to the front inner surface of the top cover 7. The plate spring 34 biases upwardly the switching plate 31 from below. The switching plate 31 is movable upward or downward keeping its substantially horizontal position by the elongated actuator arms 33 and the plate spring 34. Since the switching plate 31 is

biased by the wide plate spring 34, pressing anywhere on the switching plate 31 lowers the switching plate 31 uniformly entirely. In cooperation with the micro switch that is activated by a slight displacement, the switching plate 31 causes the stop switch to reliably work. Designated 35 is the micro switch that is supported by a fixing plate 36 below the switching plate 31. The micro switch 35 constitutes the power supply circuit or control circuit (not shown). When it is turned on, the rotation of a pair of cutters is immediately stopped. Designated 37 is the actuator lever of the micro switch 35. As the switching plate 31 is lowered, a spring 38 projected inwardly from the switching plate 31 lowers, turning the micro switch 35 on. The spring 38 works as a buffer so that no excess load is exerted on the micro switch 35. Designated 40 is a motor for driving the pair of cutters 39.

FIGS. 9 and 10 show another embodiment of the construction in FIG. 6. Designated 41 are a plurality of springs (four springs in FIGS. 9 and 10) attached underside of the switching plate 31. Each spring is guided around a pair of vertically extending guiding shafts 42 to support the switching plate 31. When the switching plate 31 is pressed, the switching projection 43 mounted on the underside of the switching plate 31 presses the actuator lever 37 of the micro switch 35, activating the micro switch 35 and stopping the rotary cutters. In the switching plate 31 supported in this way, pressing the switching plate 31 on its end may lower the switching plate 31 in its tilted position, causing the actuator lever 37 to be insufficiently pressed and the micro switch 35 to fail to function. For this reason, at least two micro switches are desirably mounted as shown so that they are logically OR to stop the cutters as long as any of them is activated.

The stop switch is applied not only to the above shredder but to all types of shredder. The position of the switching plate 31 is not limited to the above described position. Alternatively, the switching plate 31 may be positioned in front of, on the left-hand side of or on the right-hand side of the paper inlet port, depending on the type of shredder or the positional relationship relative to the paper inlet port. The second object of the present invention is achieved by providing the stop switch having a wide-area switching board on any side of the shredder section.

The automatic start and stop mechanism for the third object of the present invention is now discussed. FIGS. 11 and 12 are plan and front views showing the cutter portion of the shredder in which the present invention is embodied. Shown are a right-hand frame 51, a left-hand frame 52, and a pair of cutters 53, 53 rotatably supported between both frames 51, 52. The end of the shaft of each of the rotary cutters 53, 53 has a gear 54. Both gears 54 are in mesh so that the rotary cutters 53, 53 are rotated in mutually reverse directions. A driving motor 56 has a driving gear 55 on its shaft end. The driving gear 55 transmits torque of the driving motor 56 to the gears 54 via a transmission gear 57 to drive the rotary cutters 53. The frame of the shredder body and electronics are not shown. The paper inlet port 58 faces the top of the rotary cutters 53 between both frames 51, 52 and guides sheets of paper into between the engagement portion of the rotary cutters 53. Paper sensor plates 59, 59 are projected into the paper passage of the paper inlet port 58 from one side of the paper inlet port 58. The end of each paper sensor plate 59 is secured to a transmission shaft 60, to be described later, in a manner that they are pivoted. The other end of each paper sensor plate 59 is interposed between guiding projections 61, 61, which are provided on the other side inner wall of the paper inlet port 58 with predetermined spacing there between. Designated 62 is a sensor plate protective frame provided on one side of the paper inlet port 58. The protective frame 62 allows the paper sensor plates 59 to rotate while rotatably supporting the transmission shaft 60.

The operation of the paper sensor plates 59 is now discussed. When a sheet of paper to be shredded is inserted in position, the front end of the sheet moves along the guiding projections 61, 61, pushing the paper sensor plates 59 outwardly. As long as the paper exists, the paper sensor plates 59 stay there. Namely, the paper sensor plates 59 are pivoted backward about the transmission shaft 60, and insertion and passage of the paper are detected through rotation of the transmission shaft 60. When the paper has gone, the paper sensor plates 59 reversibly rotate because of their moment, and return to their initial positions, and thus the absence of the paper is detected.

In the above embodiment, two paper sensor plates 59 are employed near the center across the width of the paper inlet port. To detect the rear end of the paper, non-rectangular paper in particular, a plurality of sensor plates are preferably installed over the entire width of the paper inlet port.

FIG. 13 is the enlarged view of the portion A in FIG. 12, and FIG. 14 is its side view. As shown, the transmission shaft 60 is rotatably supported by the sensor protective frame 62. The paper sensor plate 59 is secured to one end of the transmission shaft 60 and a vertical start lever 63 is secured to the other end of the transmission shaft 62. The start lever 63 rotates integrally with the paper sensor plate 59 by means of the transmission shaft 60. Designated 64 is a switch cam secured to one end of the rotary shaft 53a of one of the pair of the rotary cutters 53. Along with the shaft 53a, the switch cam 64 rotates touching the actuator 72 of a micro switch 71, thereby turning on and off the micro switch 71. As shown in FIG. 15, the switch cam 64 has a cutout portion, namely the switch cam 64 has a large diameter cam face 64a around approximately half its circumference and a small diameter cam face 64b. The switch cam 64 presses the actuator 72 of the micro switch 71 with its large diameter cam face 64a to turn on the micro switch and the switch cam 64 is parted from the actuator 72 to turn off the micro switch when the actuator 72 is within the range of the small diameter cam face 64b. The switch cam 64 has, on its outer side along its circumferential direction, a semi-cylindrical push projection 65 that pushes a release projection 70 of a start lever stopper 66 to be detailed later.

The start lever stopper 66 is secured at its lower end to the left-hand frame 52 and has a movable portion 66a that extends upward near the side surface of the start lever 63. The movable portion 66a supports a pivotal shaft 67. The pivotal shaft 67 pivotally supports a pivotal member 68. The pivotal member 68 has on its lower end a triangular locking projection 69 that projects into the area of rotation of the start lever 63. The triangular projection 69 has on its front side a slide surface 69a and on its rear side a locking surface 69b (refer to FIG. 16). The release projection 70 is provided on the movable portion 66a where it can contact the push projection 65. The pivotal member 68 normally contacts the start lever 63 as shown in FIG. 17. When

the start lever 63 rotates backward along with the paper sensor plate 59, the start lever 63 pushes the pivotal member 68 back while sliding along the slide surface 69a. When the start lever 63 moves fully past the pivotal member 68, the pivotal member 68 returns back to its initial position with its own moment. With its locking surface 69b, the pivotal member 68 prevents the start lever 63 from returning back.

The above-described locking mechanism is employed for the following reason. In the paper sensing mechanism of the present invention, the insertion of the paper pivots the paper sensor plate 59, along with which the start lever 63 is pivoted pushing the locking projection 69. If the start lever 63 meets resistance in its rotation, a sheet of paper, if too thin, possibly fails to push the paper sensor plate 59 that remains in integral motion with the start lever 63. For this reason, any resistance the start lever 63 suffers should be minimized.

The micro switch 71, connected to the power supply circuit for the entire shredder, directly controls the start and stop of the driving motor 56. The end of the actuator 72 remains in contact with the end of the start lever 63 when the micro switch 71 is off. The micro switch 71 is positioned such that it is on while the large diameter cam face 64a contacts the actuator 72 in the course of rotation of the switch cam 64 along with the cutter 53. The related electronic wiring is not shown in the drawings.

The operation of the automatic start and stop mechanism thus constructed is now discussed. Switches typically available on the shredder are ones for the normal rotation, reverse rotation, and automatic (automatic start and stop) operations. The following discussion of the mechanism of this embodiment is related to the automatic operation.

FIG. 18(A) shows the stop condition of the mechanism before insertion of the paper. In this condition, the paper sensor plate 59 is projected into the paper passage of the paper inlet port 58. The start lever 63 that integrally moves with the paper sensor plate 59 via the transmission shaft 60 remains vertically suspended by its own weight. The actuator 72 of the micro switch 71 is now off, and the motor 56 remains

inactive. The switch cam 64 is turned with its small diameter cam face 64b facing the actuator 72.

As shown in FIG. 18(B), a sheet of paper P placed into the paper inlet port 58 moves along the guiding projection 61 in a manner that the paper sensor plate 59 is pushed outwardly. The paper sensor plate 59 is pivoted about its transmission shaft 60, causing the stall lever 63 secured on the other end of the transmission shaft 60 to pivot together. The pivotal motion of the start lever 63 presses the actuator 72 of the micro switch 71, turning on the micro switch 71. The driving motor 56 stalls rotating, causing the cutters 53 to rotate to shred the paper P. The stall lever 63 slides along the slide surface 69a of the locking projection 69 provided at the bottom end of the pivotal member 68, thereby causing the pivotal member 68 to pivot backward about its pivotal shaft 67. When the start lever 63 moves past the pivotal member 68, the pivotal member 68 returns to its initial position by its own moment. The switch cam 64 rotates integrally with the rotary cutters 53. While the paper P is passing the paper sensor plate 59, the start lever 63 continuously presses the actuator 72 of the micro switch 71. Thus, the rotary cutters 53 continue to rotate regardless of the position of the cam face of the switch cam 64.

When the end of the paper P moves past the paper sensor plate 59 as shown in FIG. 18(C), the start lever 63 attempts to return to its initial position by its own moment. However, since the pivotal member 68 is now back at its initial position, the start lever 63 touches the locking surface 69b of the locking projection 69, and thus, the start lever 63 is prevented from returning back to its initial position. The large diameter, cam face 64a of the switch cam 64 now presses the actuator 72, keeping the micro switch 71 turned on and thus allowing the rotary cutters 53 to continuously rotate.

When the switch cam rotates further as shown in FIG. 18(E), the push projection 65 provided on the outer side of the switch cam 64 touches and pushes outwardly the release projection 70 of the start lever stopper 66. This motion moves the entire pivotal member 68 provided on the top of the movable portion 66a and disengages

the start lever 63 from the locking projection 69. The start lever 69 returns to its initial position by its own moment. The actuator 72 now contacts the large diameter cam face 64a of the switch cam 64, thereby causing the micro switch 71 to be turned on and allowing the rotary cutters 53 to rotate continuously.

When the switch cam 64 rotates further as shown in FIG. 18(F), the engagement face of the switch cam 64 with the actuator 72 is shifted from the large diameter cam face 64a to the small diameter cam face 64b. This turns the micro switch 71 off, causing the driving motor 56 and thus the rotary cutters 53 to stop. Namely, the shredder returns back to the condition shown in FIG. 18(A).

As shown in FIGS. 18(D) through 18(F), the micro switch 71 remains on to allow the driving motor 56 to rotate, so that the switch cam 64, namely, the rotary cutters 53 continuously rotate half a turn or more before they stop. Thus, the paper is reliably shredded fully to its end.

In the above embodiment, the duration of the on operation of the micro switch 71, namely the duration of rotation of the driving motor 56 is prolonged by changing the ratio of the circumferential length of the large diameter cam face 64a to that of the small diameter cam face 64b, or by arranging a reduction gear between the switch cam 64 and the rotary shaft 53a of the rotary cutter 53 rather than rigidly connecting the switch cam 64 to the rotary shaft 53a.

FIGS. 19(A), 19(B) show another embodiment of the stall lever stopper 66. The locking member 73, corresponding to the locking projection 69 in the preceding embodiment, is integrally formed with the end of the movable portion 66a. When the paper is inserted, the start lever 63 is pivoted along with the paper sensor plate 59 as shown in FIG. 20. The start lever 63 moves along the slide surface 73a of the locking member 73 while pushing the movable portion 66a backward. At the moment the start lever 63 moves past the movable portion 66a, the movable portion 66a returns to its initial position by its own elasticity. The subsequent operation remains unchanged from the preceding embodiment. When the paper moves past the paper sensor plate

59, the locking surface 73b of the locking member 73 prevents the start lever 63 from returning to its initial position. The rotary cutters 53 thus continuously rotate. When the push projection 65 of the switch cam 64 pushes the release projection 70 of the start lever stopper 66, the start lever 63 is disengaged from the locking member 73. The start lever 63 returns to its initial position by its own moment. In this embodiment, the locking member 73 needs no pivotal shaft 67 and is of a simple construction. The manufacturing cost is thus reduced. In this embodiment, however, when the start lever 63 pivots pushing the locking member 73 outwardly, the start lever 63 must overcome elasticity of the movable portion 66a. To this end, the paper to be shredded should be thick enough to forcibly push the paper sensor plate 59.

In the start and stop mechanism, which is one of the objects of the present invention, the rotary cutters are continuously rotated for a fixed duration of time after the end of the paper is detected, using a simple cam mechanism rather than an extra electronic circuit as in the prior art. The manufacturing cost for the mechanism is low.

Finally discussed is the preferred embodiment of the mechanism to achieve the fourth object of the present invention. This embodiment precludes any personal danger to the operator when, for example, in FIG. 1, the wastebasket 3 and the container 4 are constructed of a deformable material such as plastic to achieve light-weight design and to make quantity production possible.

FIG. 21 is the perspective view showing the relationship between a safety guide 81 and a wastebasket 3 as a preferred safety device. For convenience of explanation, the shredder section 1, container 4, frame 5 and the like in FIG. 1 are not shown in FIG. 21. In this embodiment, the wastebasket 3 has top edge portions 3b, 3b of side walls 3a, 3a. Disposed inside the top edge portions 3b, 3b are stoppers 81a, 81a that constitute a safety guide 81. The safety guide 81 is pivotally supported by the guide bracket 2a formed on the bottom cover 2. The stoppers 81a, 81a are connected by a connecting member 82. The safety guide 81 has a generally U-shaped crank configuration. Because of this shape, the side wall 3a is prevented from deforming inwardly with the top edge portion 3b touching the stopper 81a even when an external

force P is laterally inwardly exerted to the wastebasket 3 as shown in FIG. 22. No gap takes place between the wastebasket 3 and the bottom cover 2, and no finger is let in between. Even if the wastebasket 3 is constructed of a deformable material, no finger is admitted into the shredder section 1, and the personal safety is thus assured. If some clearance is allowed between the stopper 81a and the side wall 3a to assure smooth insertion and removal of the wastebasket 3, the side wall 3a may be accordingly deformed or the safety guide 81 may be accordingly shifted sideways. In this embodiment, the length L of the connecting member 82 and the inner spacing width W of the wastebasket 3 are properly matched to minimize the above clearance. Therefore, this embodiment presents no such problem as shifting of the safety guide 81. As a means for restraining the safety guide 81 in its axial shifting, a split pin may be mounted to the axial end portion 81b of the safety guide 81. Any other prior art means is acceptable as restraint means, and gives no effect of the construction of the present invention.

The safety guide 81 is supported in a manner that it is pivoted in the direction of drawing of the wastebasket 3. As shown in FIG. 23, the safety guide 81, which is normally suspended by its own weight, pivots along the rear wall of the wastebasket 3c as the wastebasket 3 moves. The wastebasket 3 is pulled out and pushed in without any difficulty. Each time the wastebasket 3 is pushed in or pulled out, the connecting member 82 pivots, flattening shredded paper piled up in the wastebasket 3 with its stirring function. This prevents the rotary cutters from stopping due to shredded paper jamming.

Referring to FIG. 24, another embodiment of the safety mechanism is now discussed. This embodiment is different from the preceding embodiment in that the connecting member 82 that connects the two stoppers is dispensed with and that left and right safety guides 83 are separately arranged. In this arrangement, axial end portions 83b, 83b are prevented from slipping off the guide bracket 2a, and the inward deformation of the side walls 3a, 3a is restrained while the wastebasket 3 can be still pulled out and pushed in without any resistance.

In the above two embodiments, the bottom cover 2 and the shredder section 1 are separate structures, and the safety guides 81, 83 are pivotally supported by the guide bracket 2a of the bottom cover 2. When the bottom cover 2 is unitary with the shredder section 1 or when the bottom cover 2 is dispensed with, the safety guides 81, 83 are pivotally supported directly by the shredder section 1. In the above two embodiments, the safety guides 81, 83 are positioned at a single location on one side wall 3a. The present invention is not limited to the single position installation. By installing a plurality of safety guides 81, 83 along the wastebasket, the side wall 3a is assuredly restrained. If the safety guides 81, 83 are installed at a single position only on the side wall 3a, they are preferably installed in the middle position, halfway from the rear end of the wastebasket 3. This is because the middle portion of the side wall 3a is most likely to deform. The stopper 81a should touch at least the top edge portion 3a. A longer stopper 81a increases its contact area with the side wall 3a, and the longer the stopper 81a, the greater the deformation restraint effect becomes.

In the above embodiments to achieve the fourth object, the safety guides work as a deformation restraint member when lateral force is exerted onto the wastebasket. A large deformation of the wastebasket is thus prevented. Such a gap that can admit a finger therethrough is not generated between the wastebasket and the shredder section, and thus a safe operation of the shredder is assured. Since the safety guide has a U-shaped crank configuration, shredded paper piled up in the wastebasket is flattened each time the wastebasket is removed or mounted. This prevents shredded paper jamming on the rotary cutters and effectively deposits shredded paper in the wastebasket.



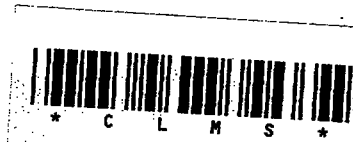
CLAIMS

1. A safety mechanism of a paper shredder of a type that is constructed of a shredder section having a paper inlet port and a rotary cutter and a drawer-type wastebasket under the shredder section, said safety mechanism comprising a switching projection provided on the top portion of a side wall perpendicular to the direction of the drawing of the wastebasket, whereby said switching projection moves an actuator of a switch mounted on the shredder section to feed power to the rotary cutter when the wastebasket is in its closed position.
2. A safety mechanism of a paper shredder of a type that is constructed of a shredder section having a paper inlet port and a rotary cutter and a drawer-type wastebasket under the shredder section, said safety mechanism comprising a switching projection provided on the top portion of the front wall of the wastebasket, and said shredder section comprising a bottom cover which is provided with a slit in a position matching the switching projection in a manner that the switching projection passes through the slit and provided with a micro switch actuator within the slit, whereby said switching projection moves the actuator of the micro switch when the wastebasket is in its closed position.
3. The safety mechanism of a paper shredder according to claim 2, wherein the switching projection is provided on the pull handle of the wastebasket.
4. The safety mechanism of a paper shredder according to claim 3, wherein the said pull handle of the wastebasket is detachable mounted to the wastebasket.
5. A safety mechanism of a paper shredder comprising a switching plate having a wide area and constantly upwardly biased, said switching plate disposed at substantially the same level as the top cover of a shredder section and a micro switch disposed at any convenient position just under the switching plate in a manner that the lowering of the switching plate activates the micro switch to stop the rotary cutter.

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6. A safety mechanism of a paper shredder comprising a pair of actuator arms rotatably supported at support members provided inside the top cover of a shredder section at the middle positions, halfway, along both sides of the top cover, a switching plate having a wider area than other switches and provided at the ends of the pair of actuator arms, said switching plate upwardly biased by a wide plate spring attached to the top cover, and a micro switch disposed at any convenient position just under the switching plate in a manner that the lowering of the switching plate activates the micro switch to stop the rotary cutter.

7. A safety mechanism of a paper shredder comprising a switching plate having a wider area than other switches and supported by a plurality of springs that are guided around guiding shafts vertically extending from the underside of the switching plate in a manner that said switching plate is vertically upwardly and downwardly movable, and a micro switch disposed at any convenient position just under the switching plate in a manner that the lowering of the switching plate activates the micro switch to stop the rotary cutter.

8. The safety mechanism of a paper shredder according to claims 6 or 7, wherein a plurality of micro switches are mounted so that any of the micro switches activated stops the cutter by OR-gating the micro switches.

9. A safety mechanism of a paper shredder comprising a paper sensor plate projected into a paper inlet port and secured to one end of a transmission shaft rotatably supported at a paper sensor protective bracket, a start lever secured to the other end of the transmission shaft so that both the paper sensor and the start lever integrally rotate, said start lever positioned within the range of the actuator of a micro switch, a tangentially aligned push projection provided on the outer surface of a switching cam that is rotated integrally with the rotary cutter to activate the actuator, a locking projection that is provided on the end of the movable portion of the start lever stopper mounted on the left-hand side frame of the shredder, said locking projection being projected into the area of rotation of the start lever and a release projection provided in a position where the release projection can contact the push

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projection provided on the outer surface of the switching cam.

10. The safety mechanism of a paper shredder according to claim 9 further comprising a pivotal shift provided on the end of the movable portion, a pivotal member pivotally supported about the pivotal shaft, and a locking projection provided at the lower end of the pivotal member, said locking projection having a tapered sliding surface on the front side and a locking surface on the rear side.

11. The safety mechanism of a paper shredder according to claim 9, wherein a locking member having a tapered sliding front surface and a locking rear surface is integrally formed of the top end of the movable portion.

12. A safety mechanism of a paper shredder of a type that is constructed of a shredder section having a paper inlet port and a rotary cutter and a drawer-type wastebasket under the shredder section, said safety mechanism comprising a safety guide having a stopper provided in a position, at least corresponding to the top edge of the side wall of the wastebasket, to restrain inward deformation of the side wall, said safety guide pivotally supported in a manner that the safety guide is pivoted in the direction of the drawing of the wastebasket.

13. The safety mechanism of a paper shredder according to claim 12, wherein said safety guide comprises a connecting member that connects the stoppers in a U-shaped crank configuration.

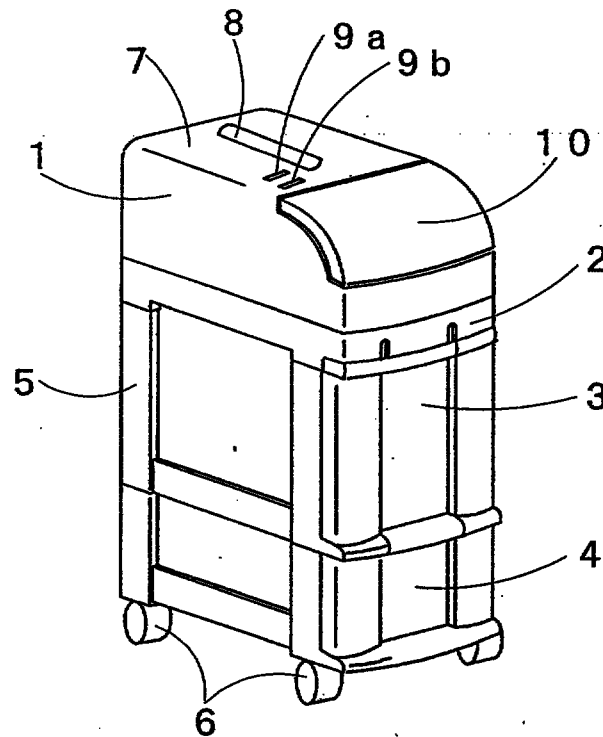
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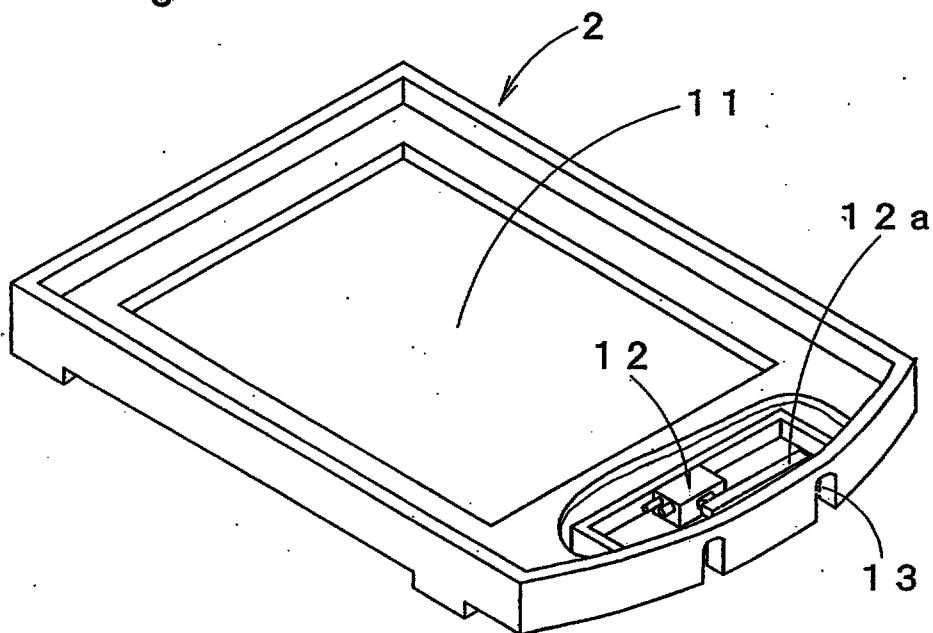
1
DRAWINGS

Fig.1



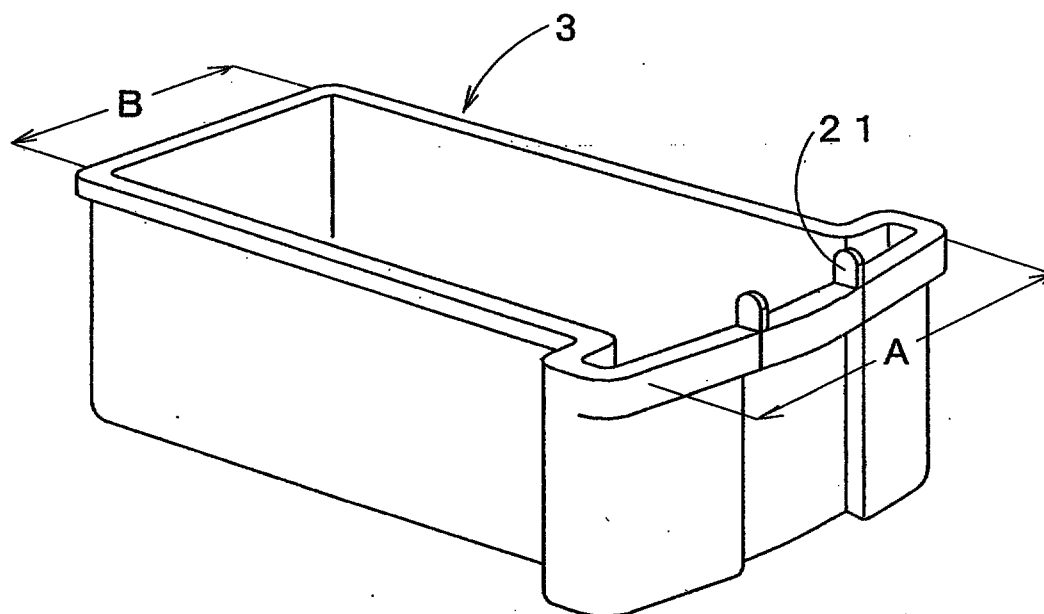
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Fig.2



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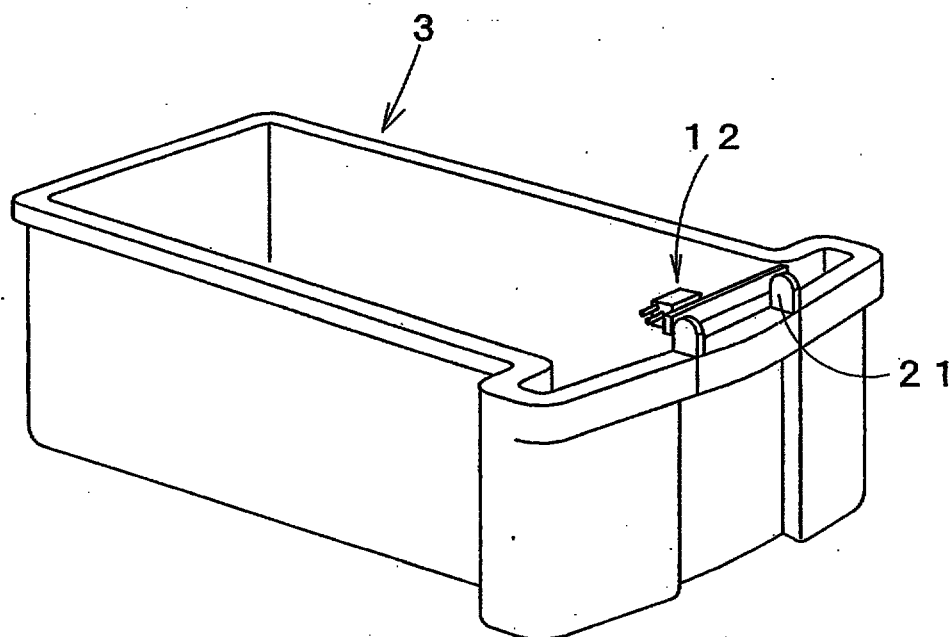
Fig. 3



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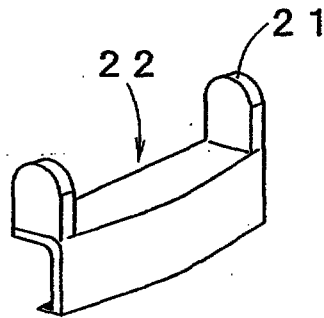


Fig. 4



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Fig.5



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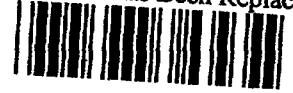


Fig.6

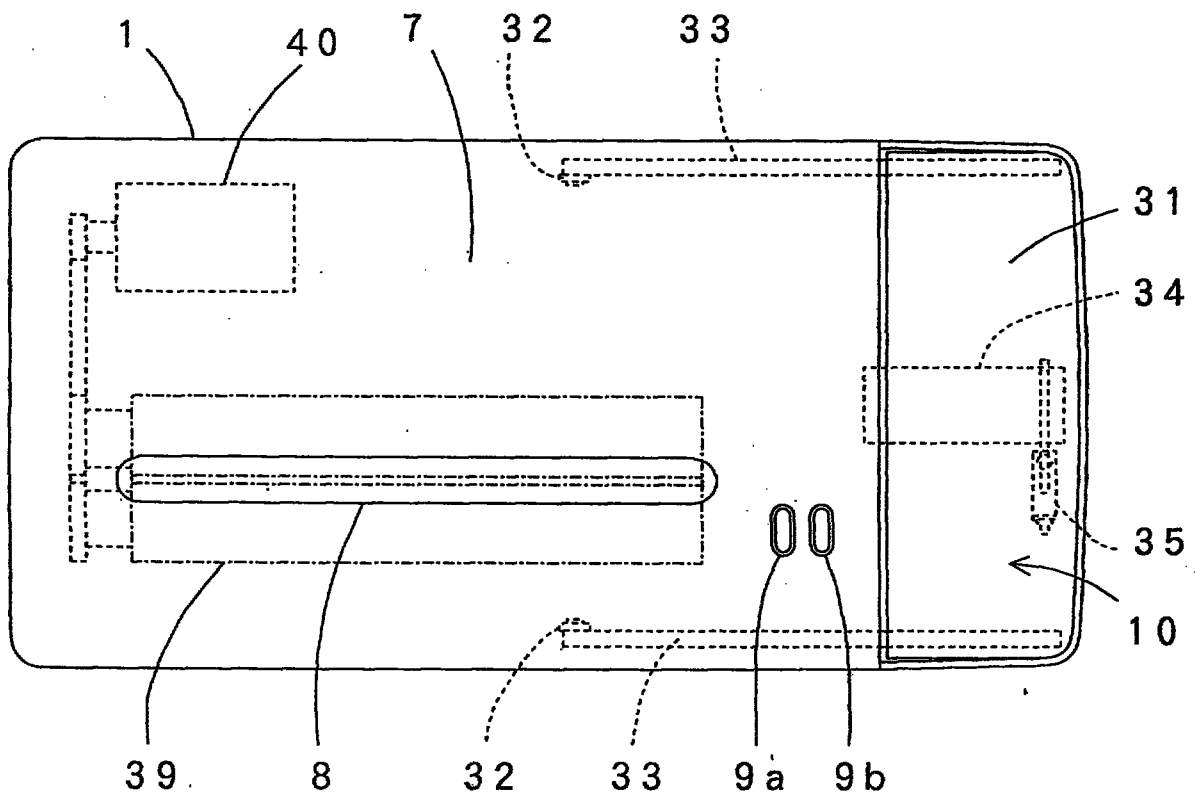


Fig. 7

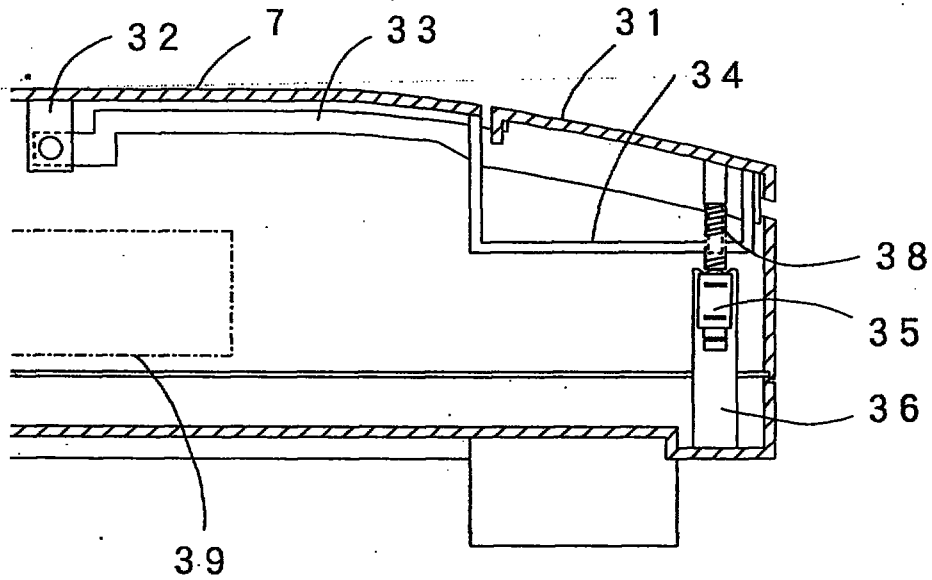
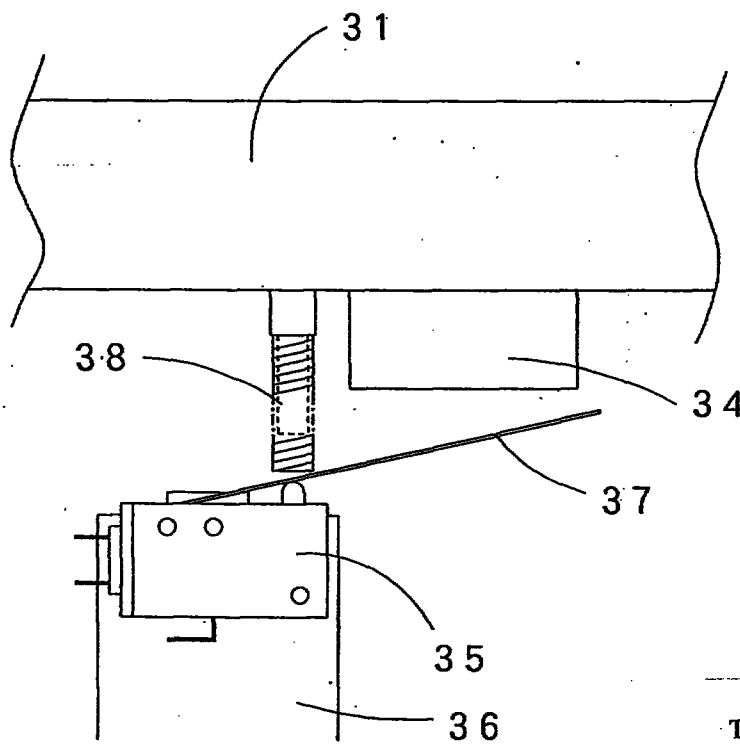


Fig. 8



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Fig. 9

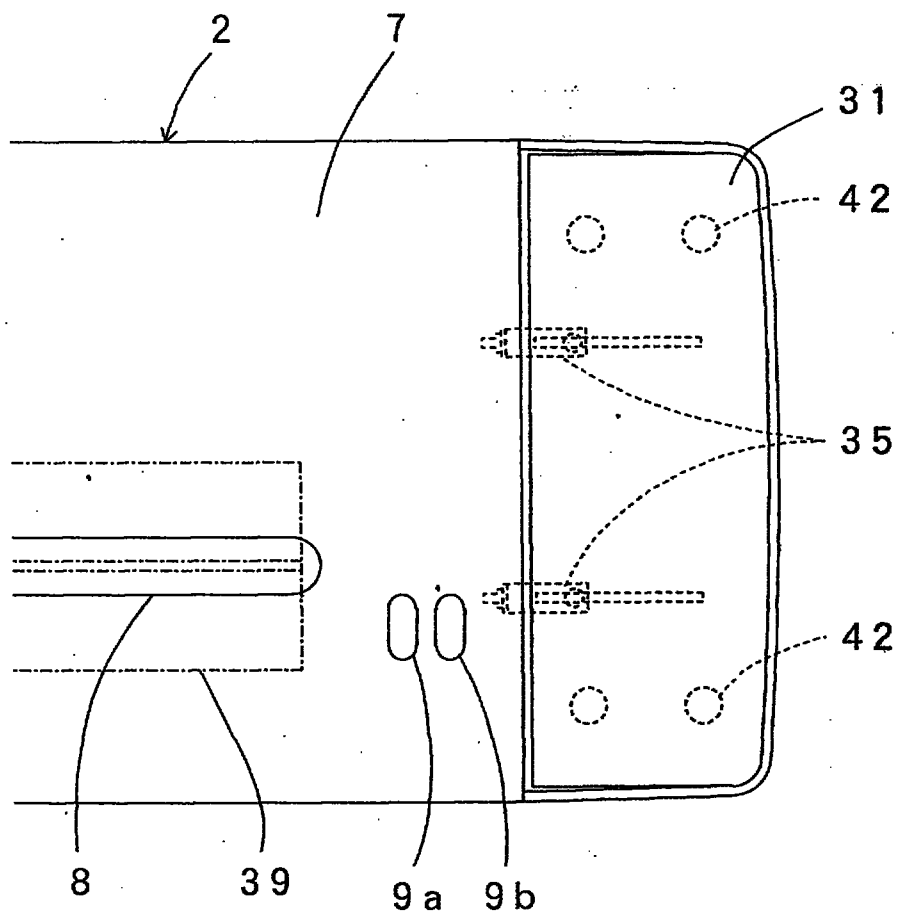
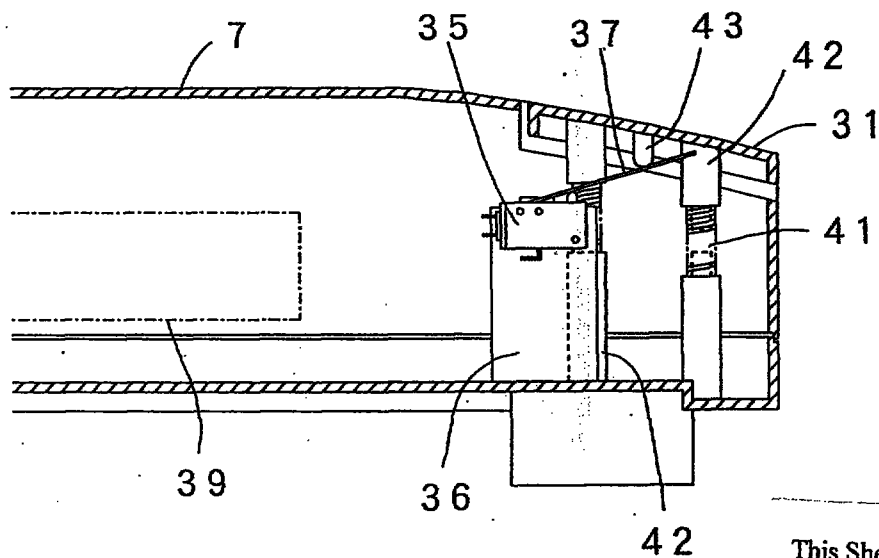


Fig. 10



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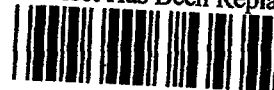


Fig. 11

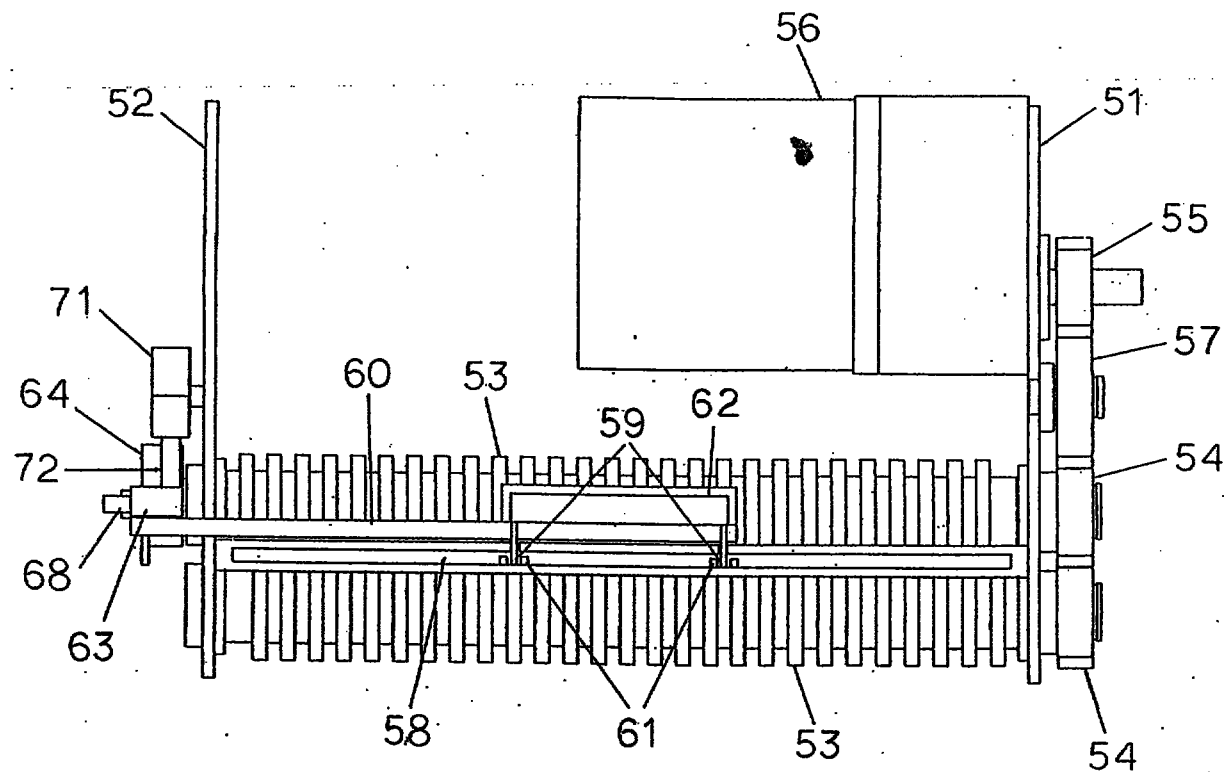
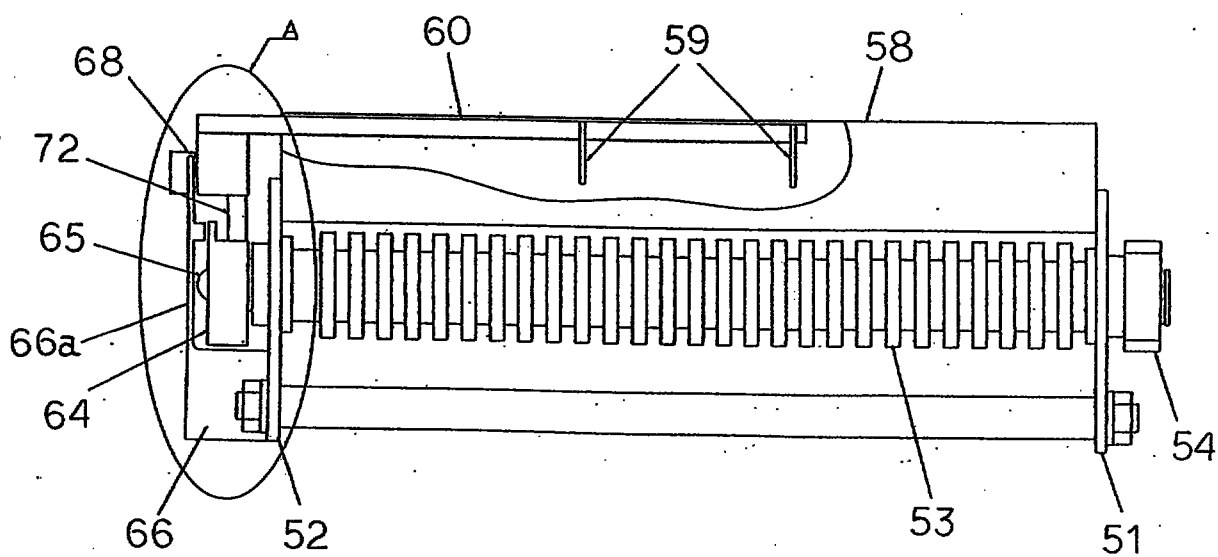


Fig. 12



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Fig. 13

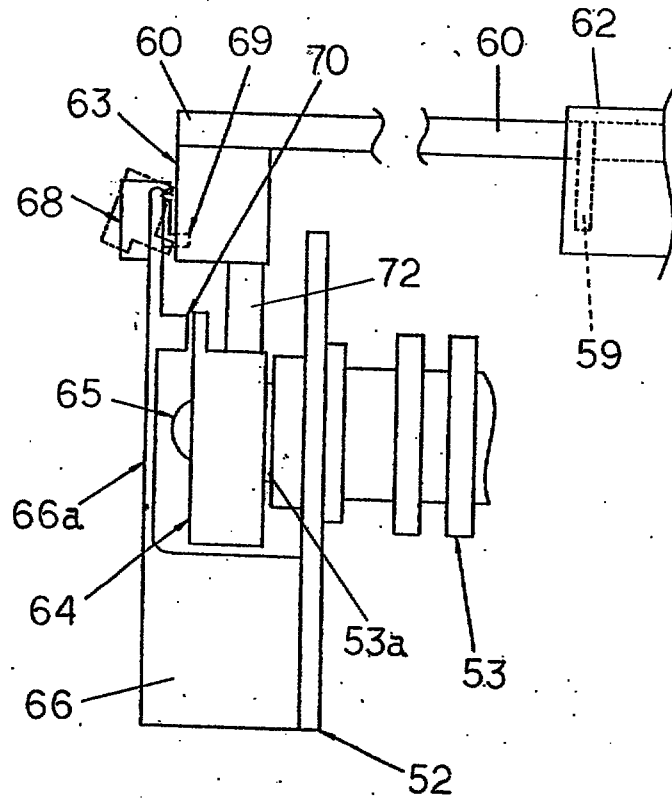
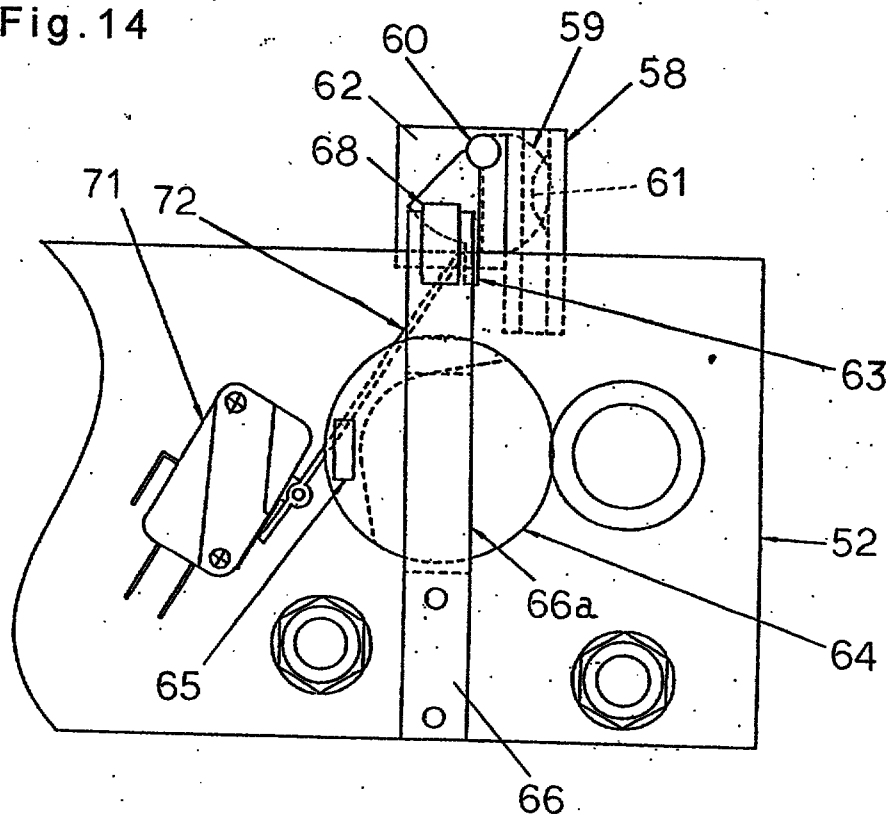


Fig. 14



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Fig. 15

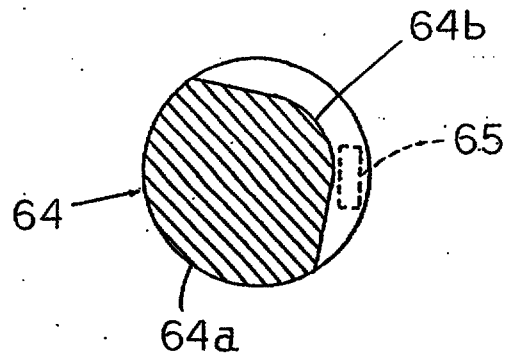
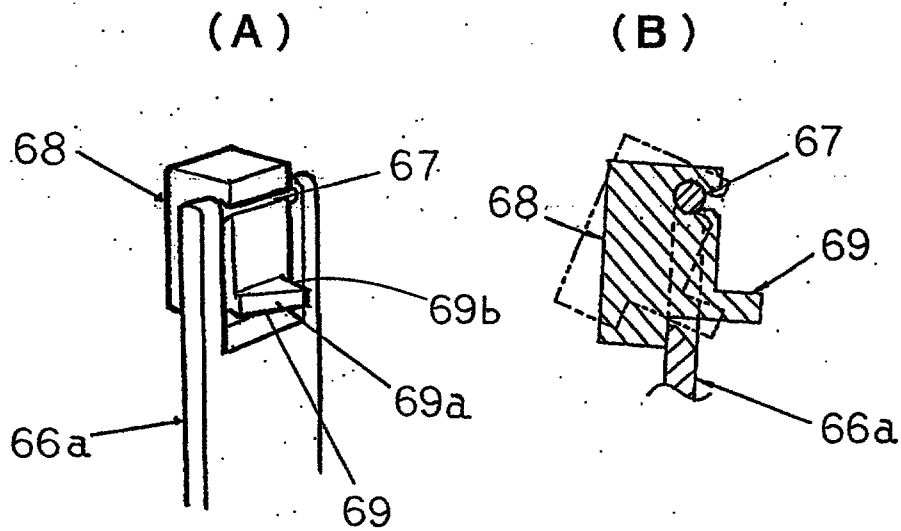


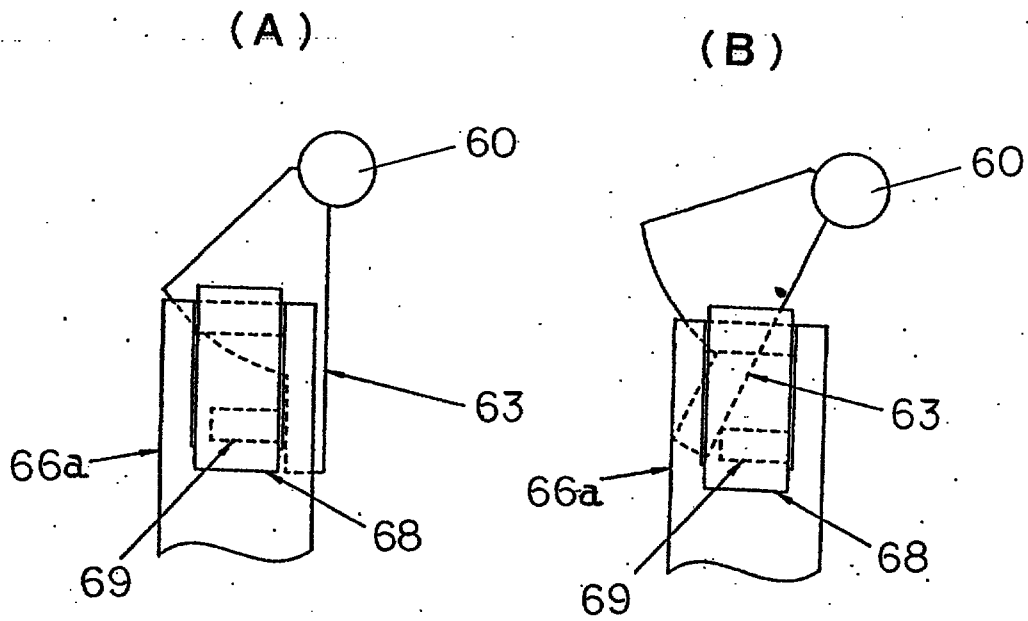
Fig. 16



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Fig. 17

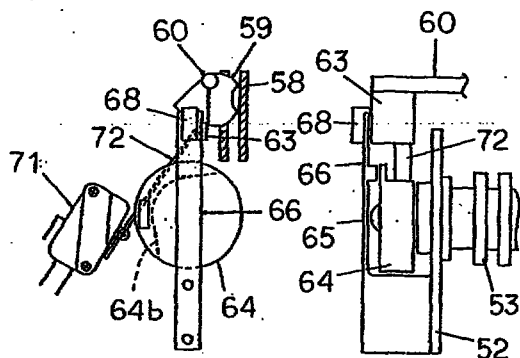


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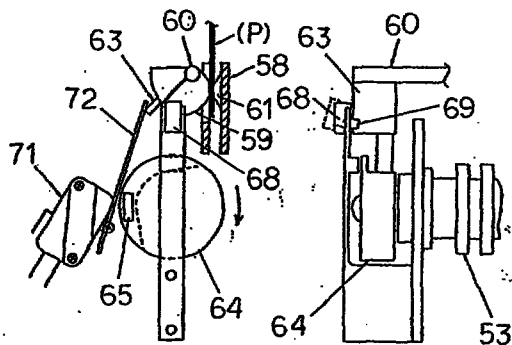


Fig. 18

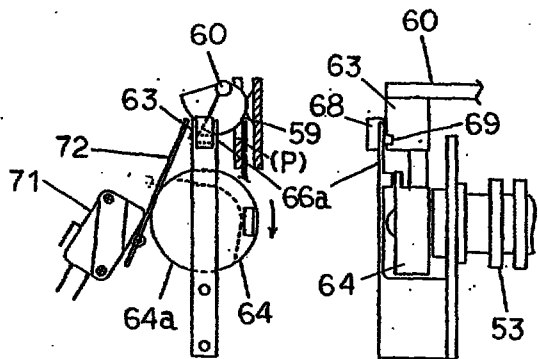
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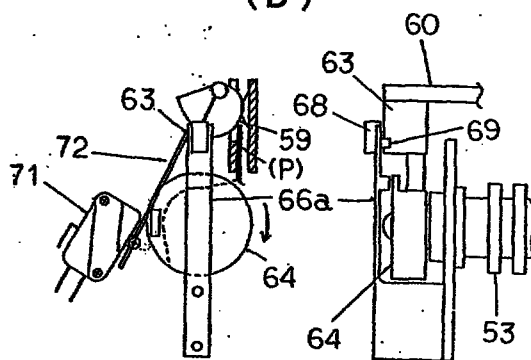
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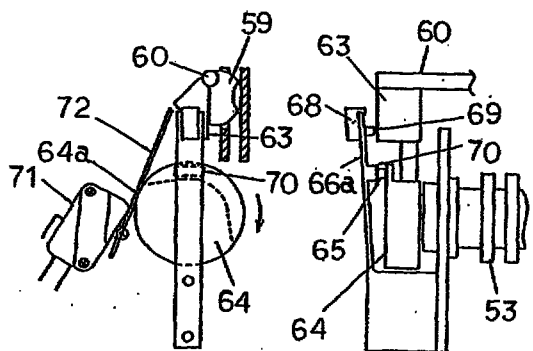
(C)



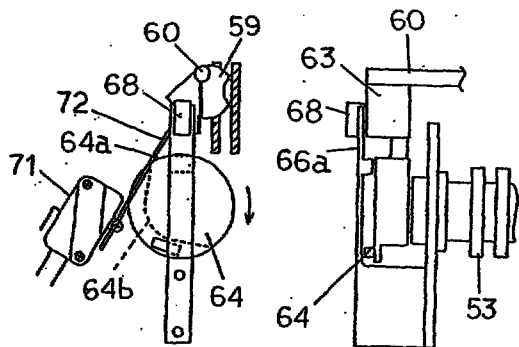
(D)



(E)



(F)



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11
Fig. 19

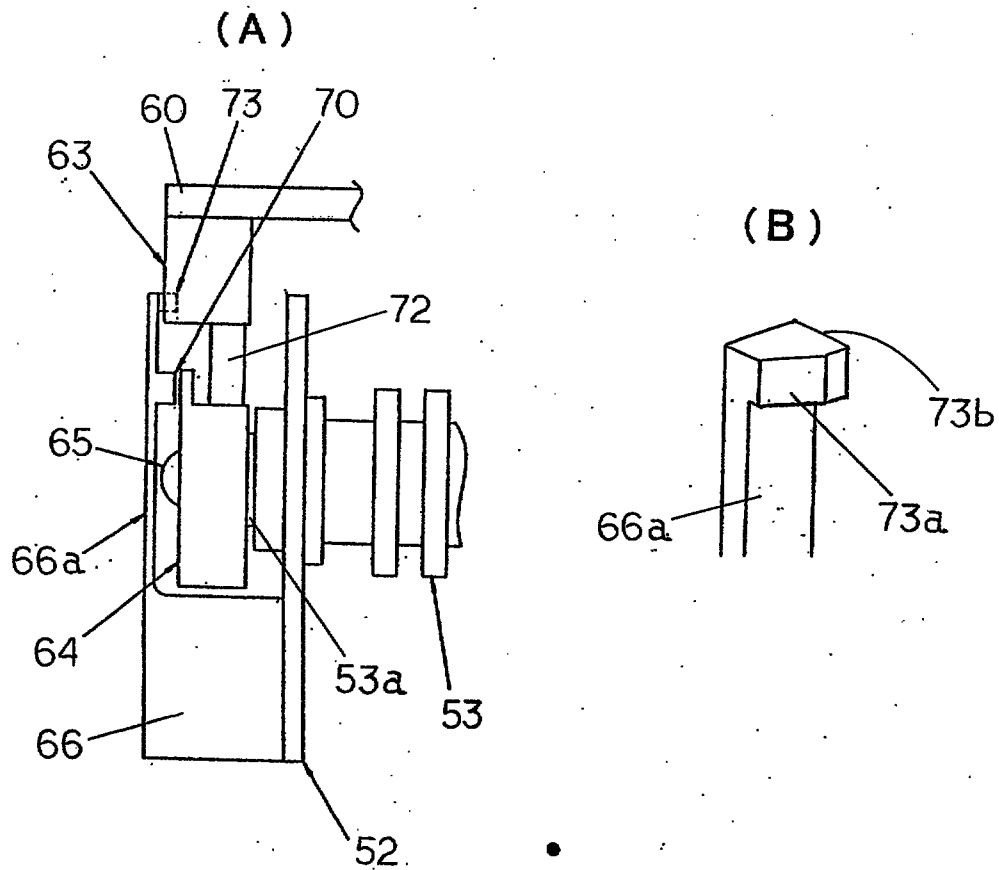
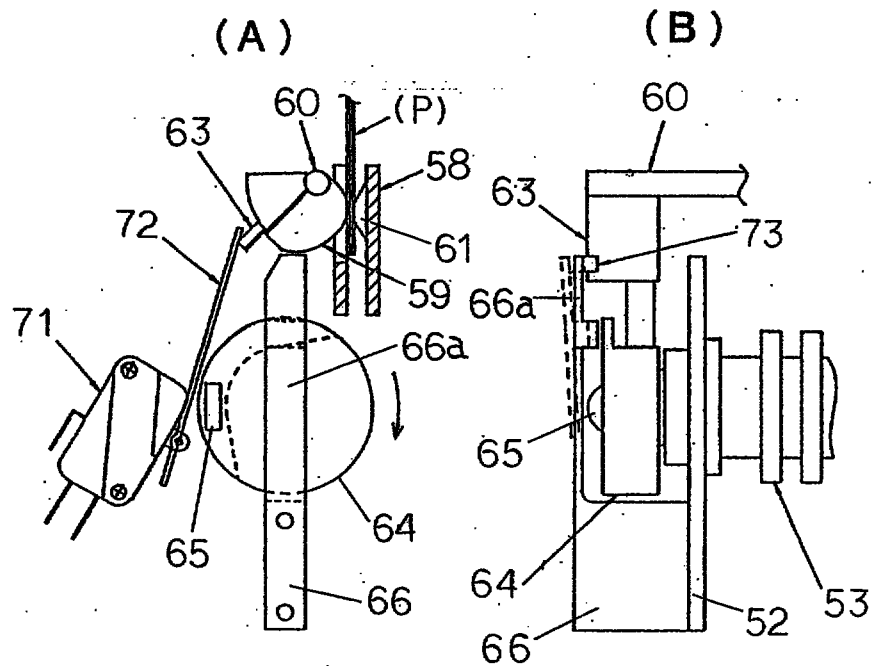


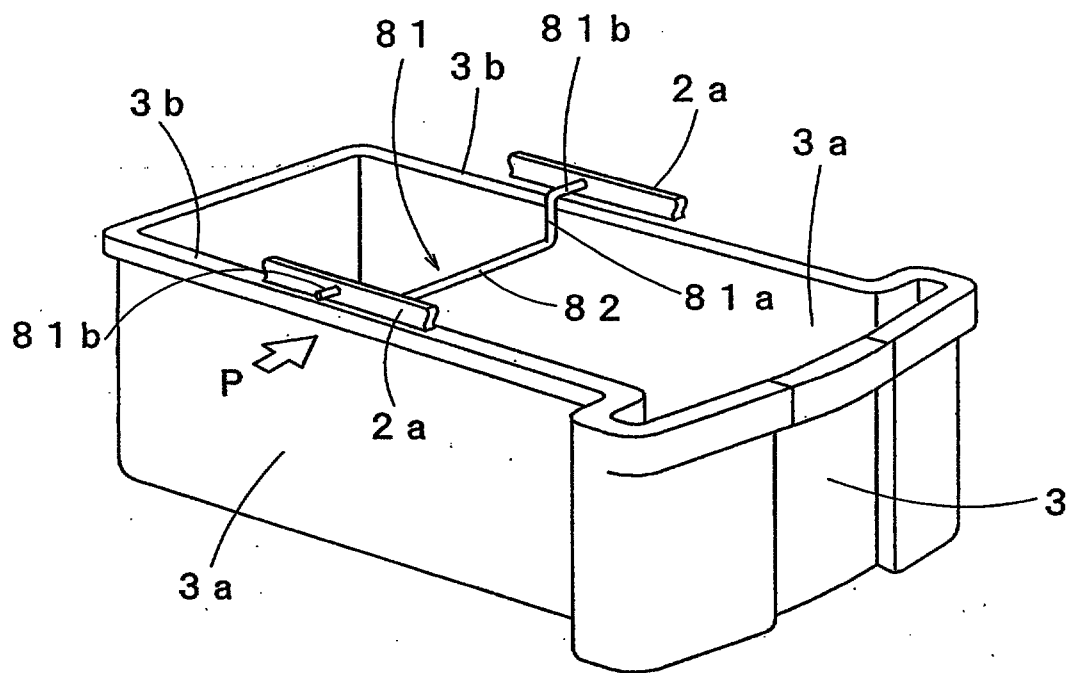
Fig. 20



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Fig. 21



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Fig.22

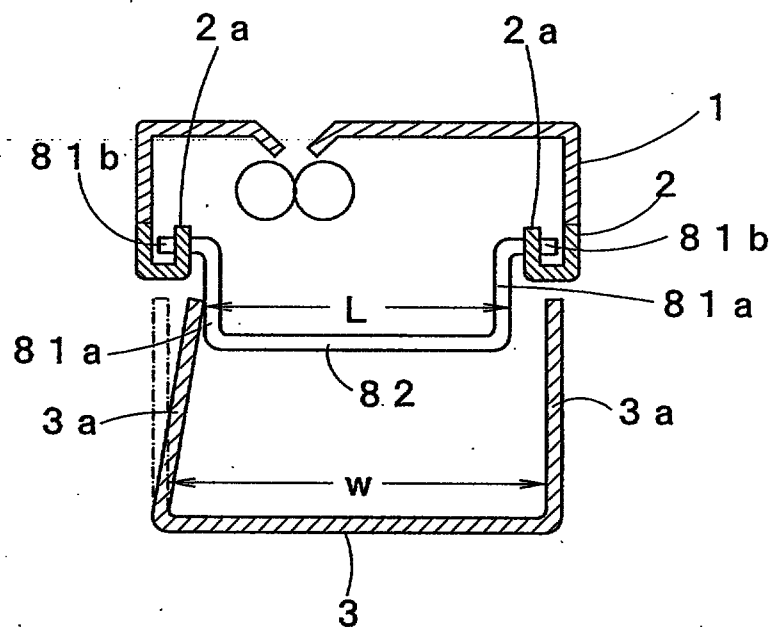
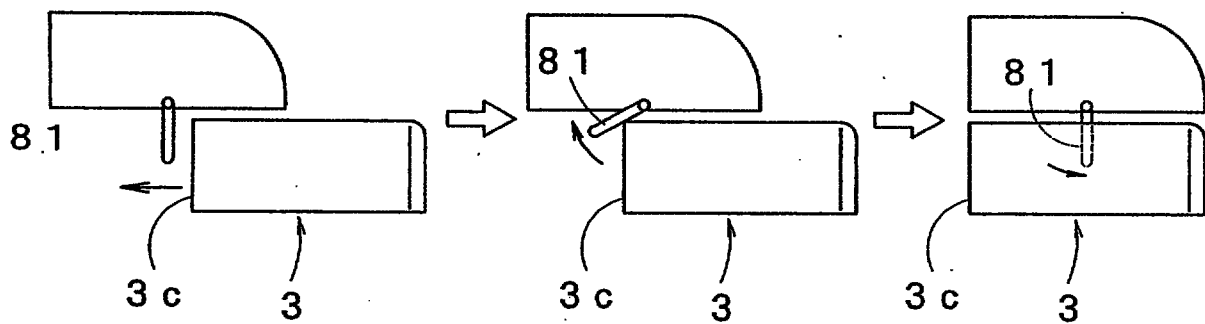


Fig.23



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Fig.24

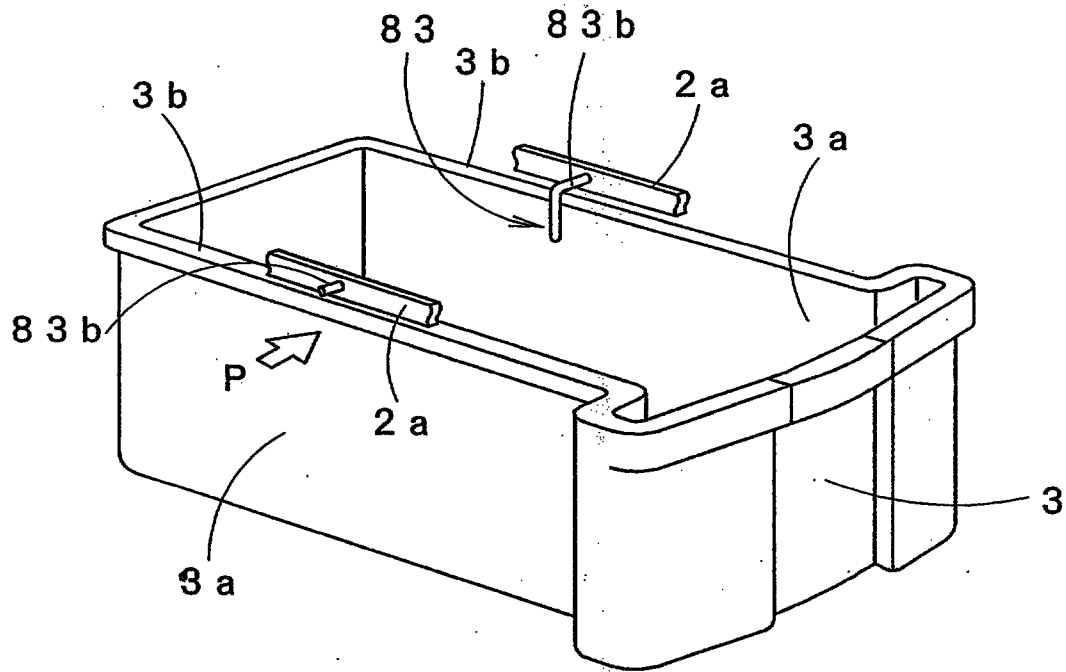
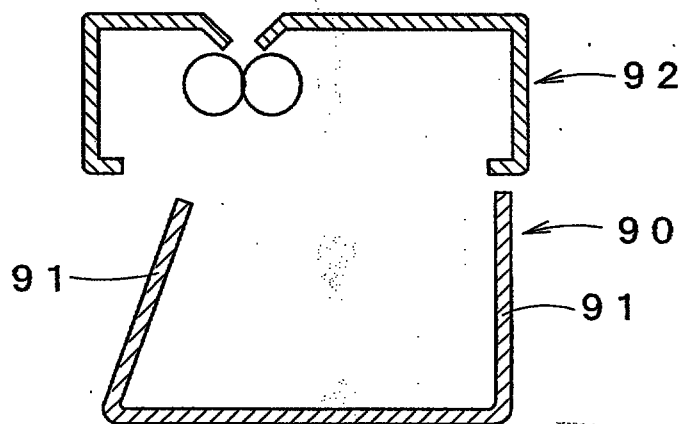


Fig.25



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ABSTRACT

SAFETY MECHANISM OF A PAPER SHREDDER

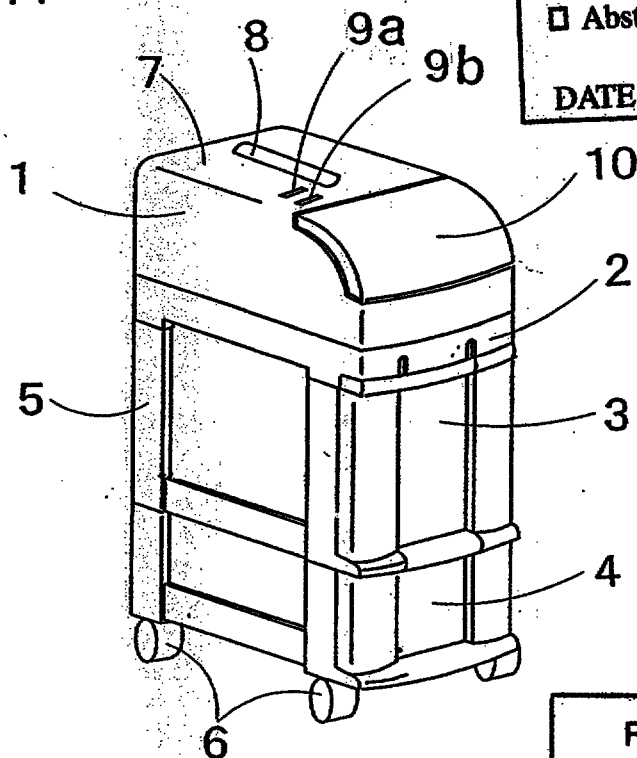
A safety mechanism of a paper shredder having a rotary cutter for precluding any personal danger to an operator. A switching projection is provided on a wastebasket. The switching projection drives the actuator of a micro switch to stop the rotary cutter without fail while the wastebasket is out of place in the shredder. A large stop switch for emergency purpose is provided on the top of the shredder so that the rotary cutter is immediately and reliably stopped in the event of an accident. The presence of papers to be shredded is detected and a cam is employed to perform automatic operation so that the rotary cutter is run all the time from insertion of the papers to completion of shredding. When the wastebasket is constructed of a deformable material, a safety guide is provided to restrain inward deformation of the wastebasket so that no gap is generated to keep out any finger of the operator.

It is suggested that Fig. 1 should accompany the abstract when published.

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Fig. 1



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☒ Drawing(s) : paged ~~14~~ to paged ~~14~~

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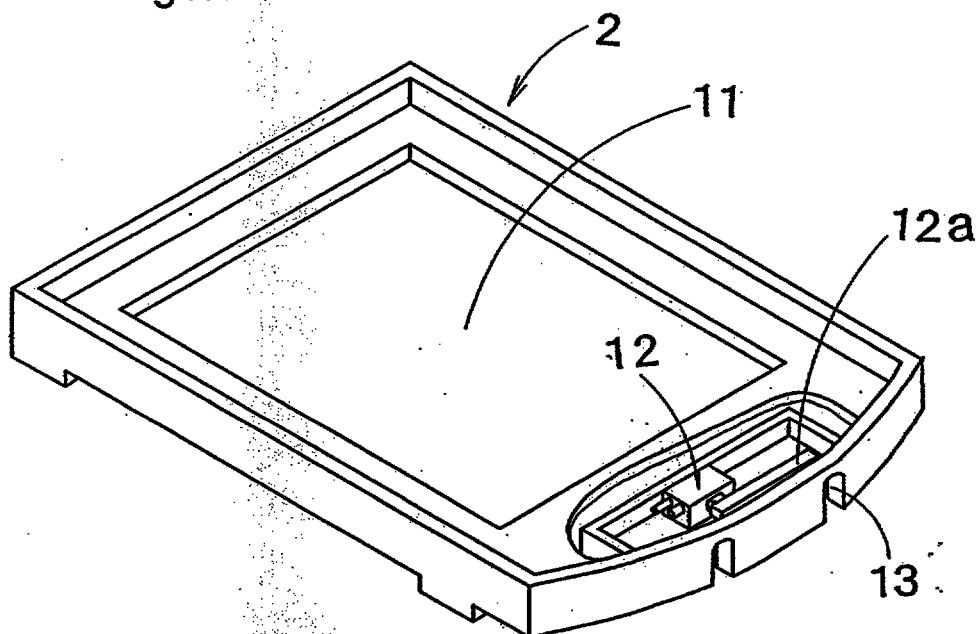
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☒ Drawing(s) : paged ~~14~~ to paged ~~14~~

☐ Abstract : paged to paged

Fig. 2



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Fig. 3

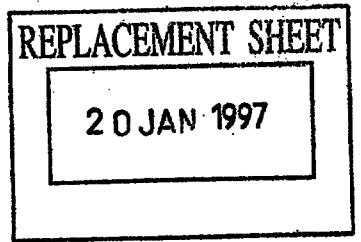
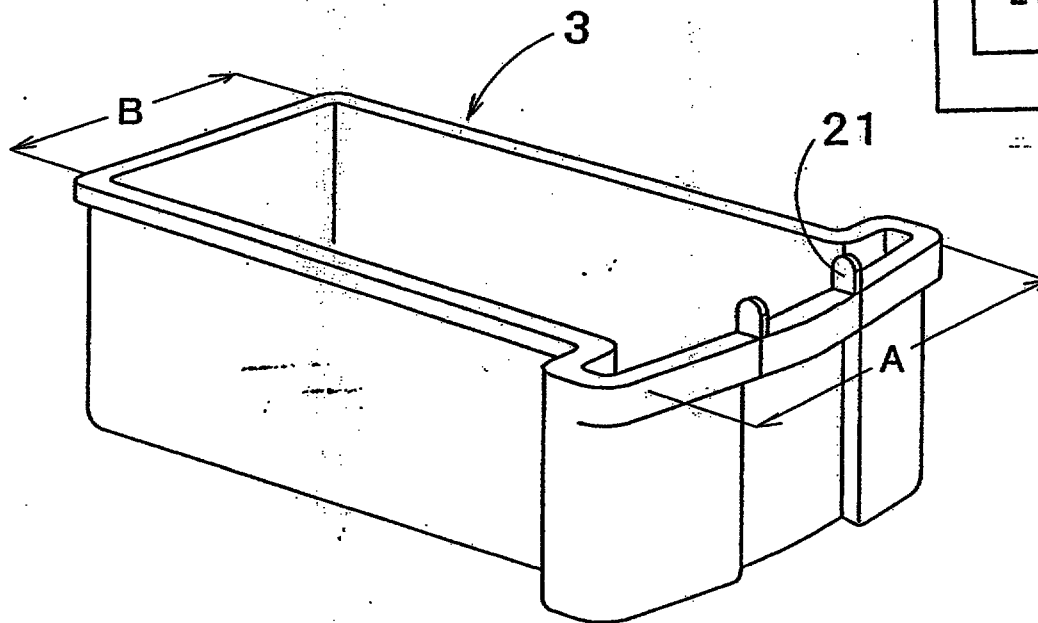
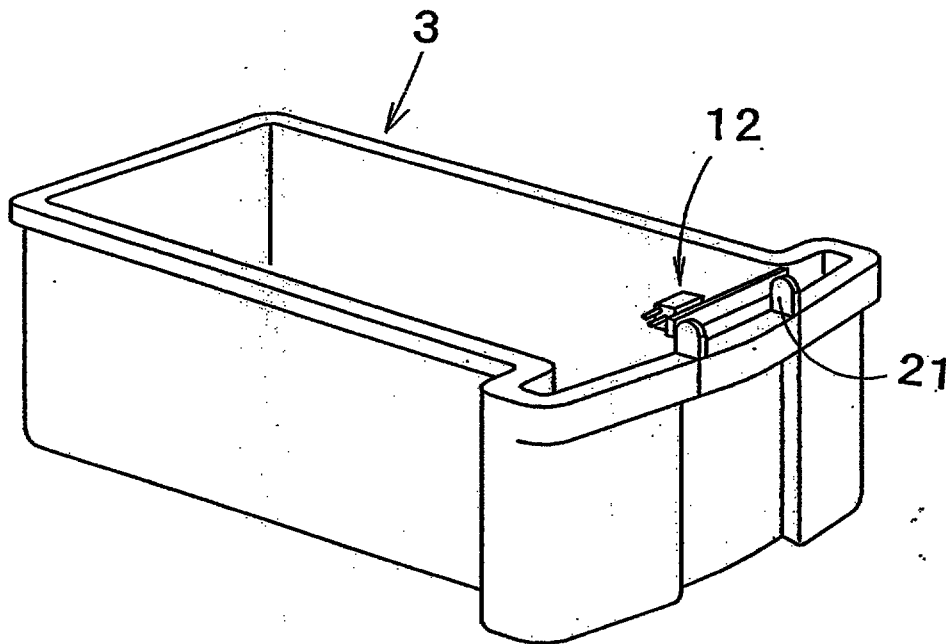


Fig. 4



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Fig. 5

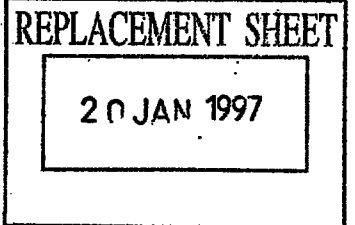
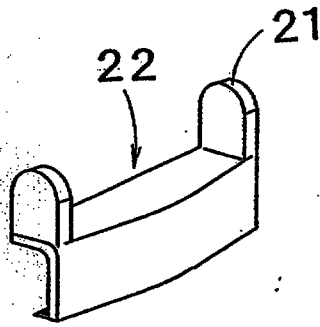
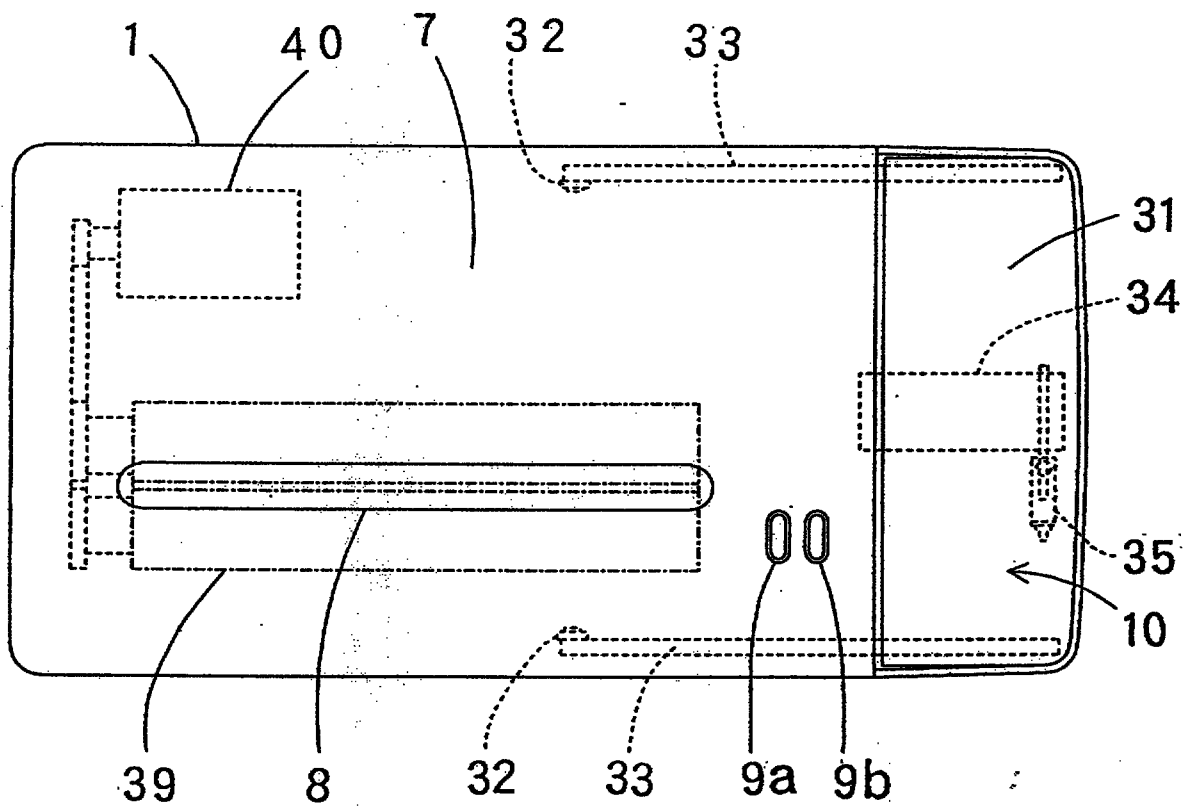


Fig. 6



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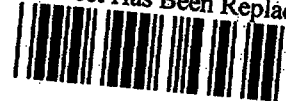


Fig. 7

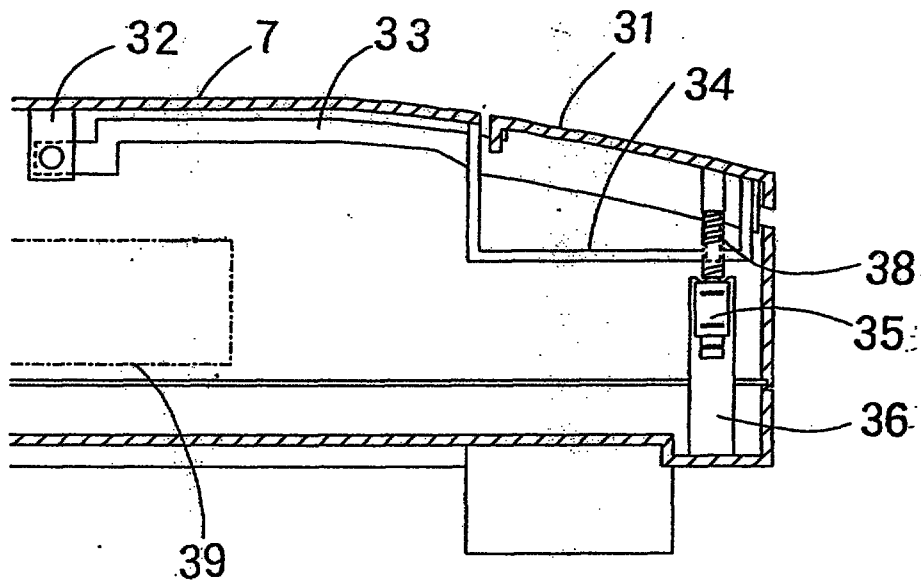
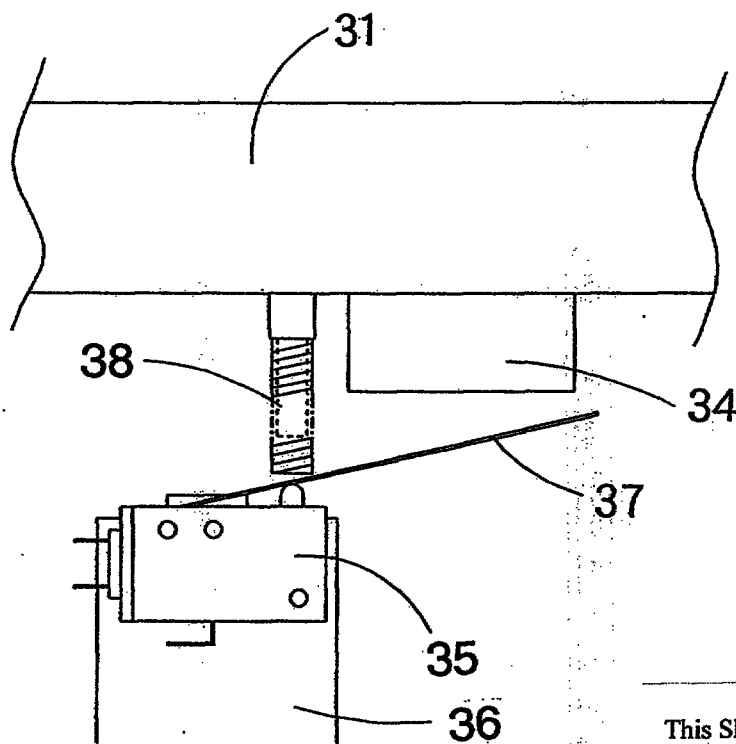


Fig. 8



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Fig.9

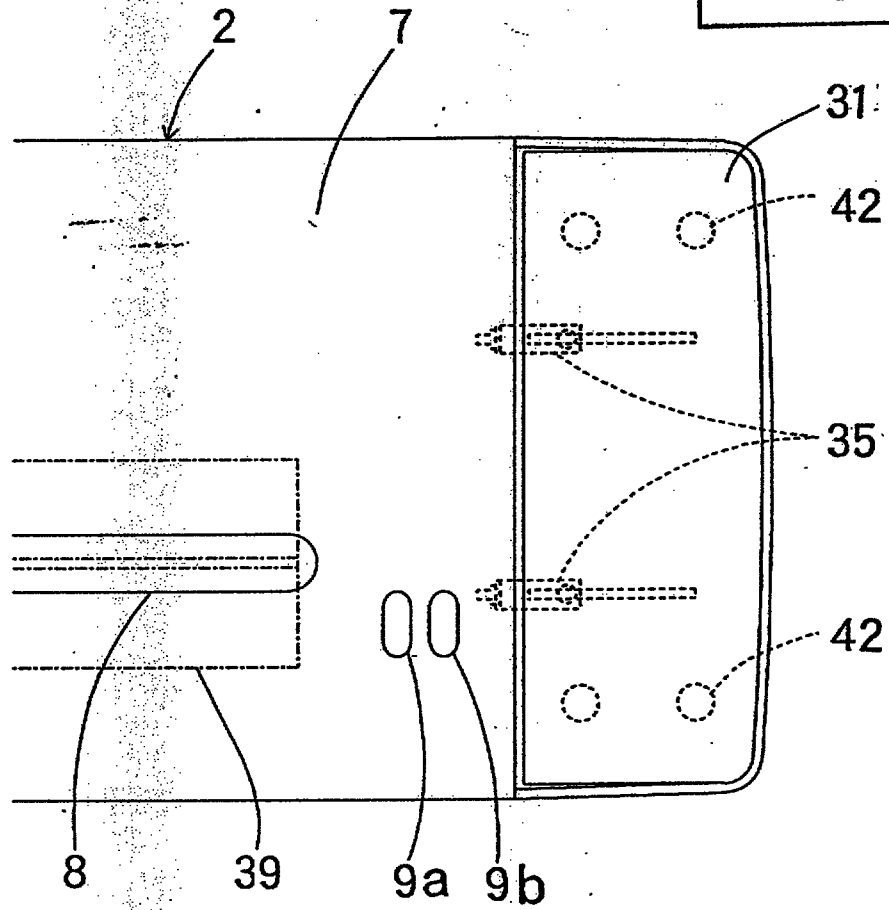
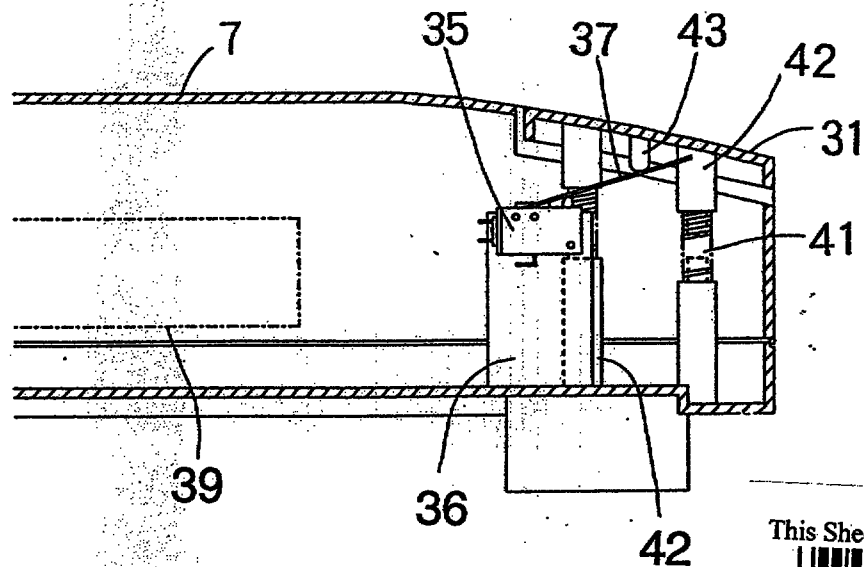


Fig.10



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Fig.11

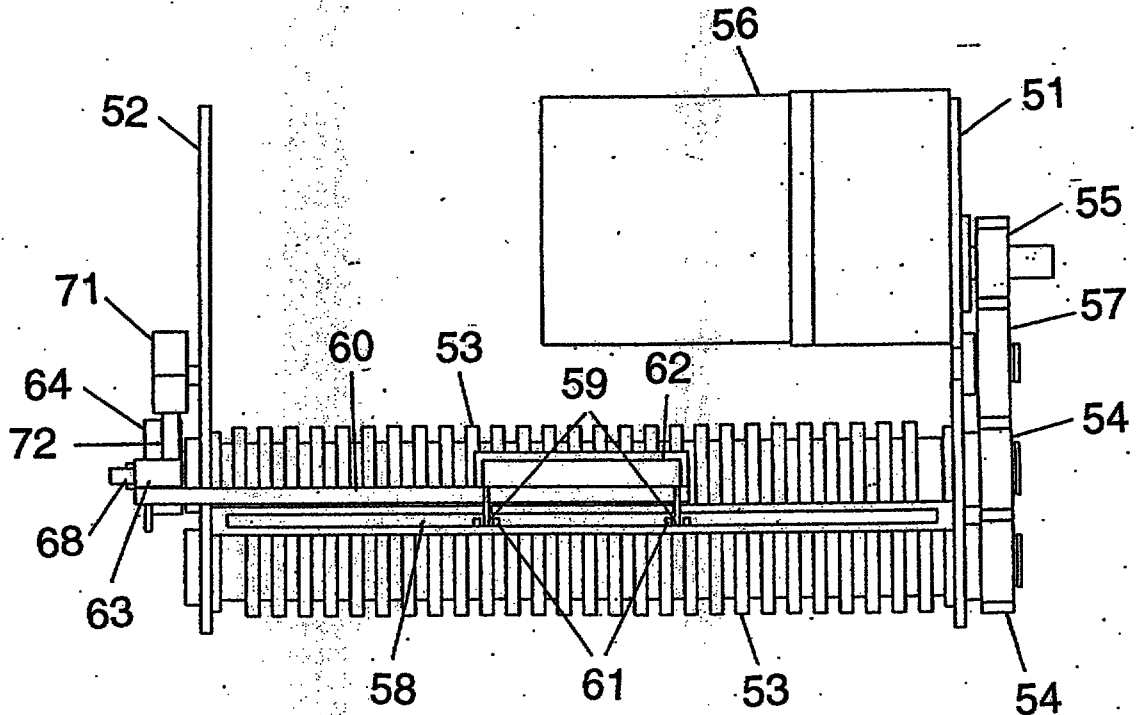
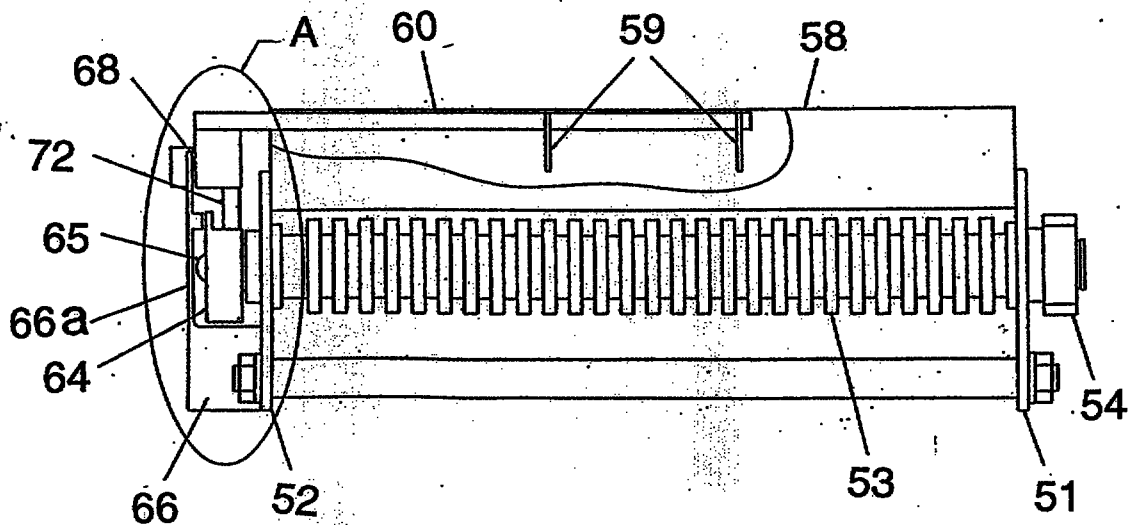


Fig. 12



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Fig. 13

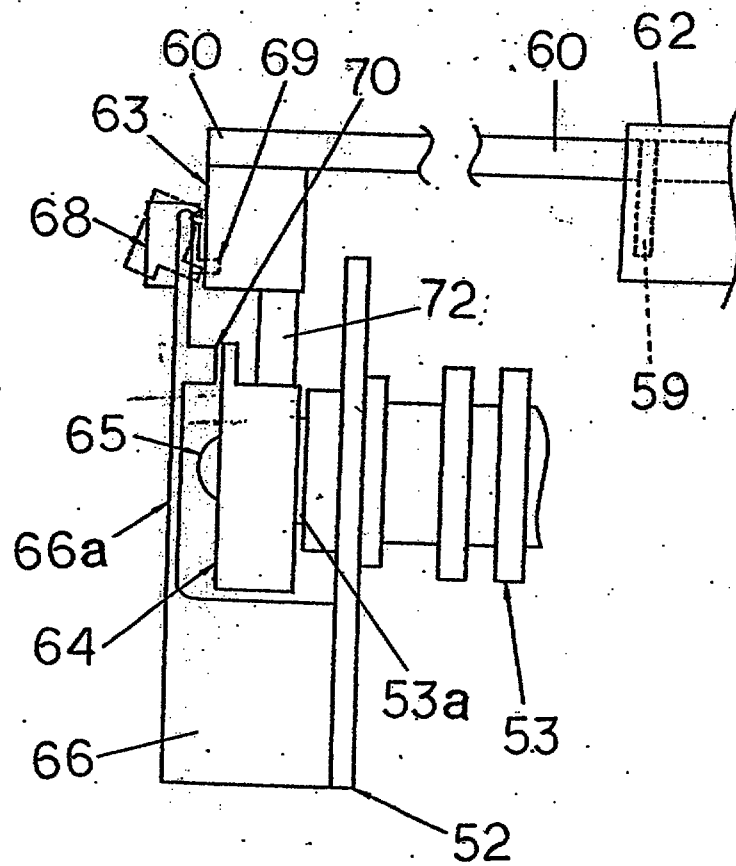
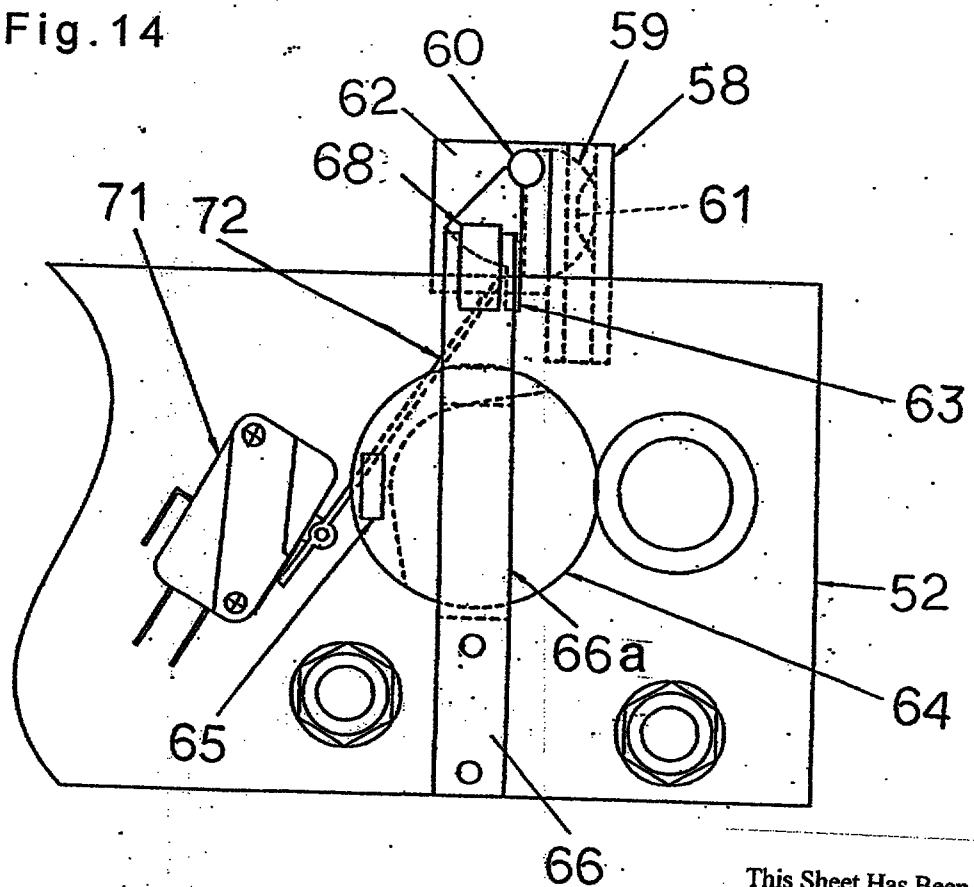


Fig. 14



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Fig. 15

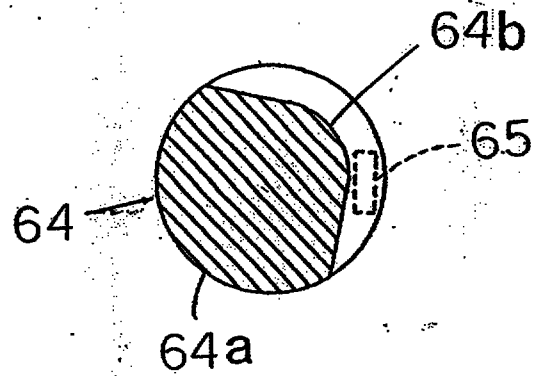
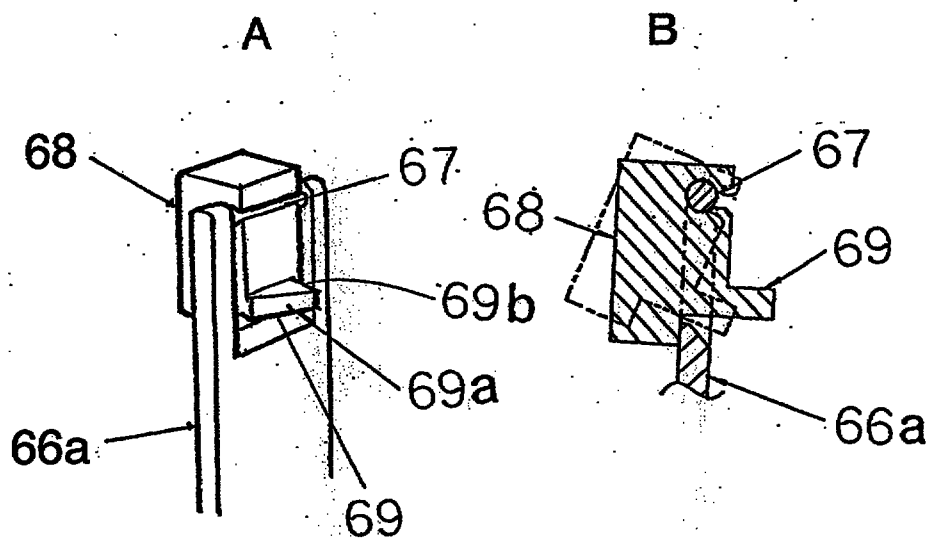


Fig. 16



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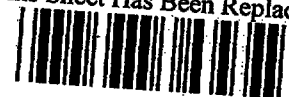
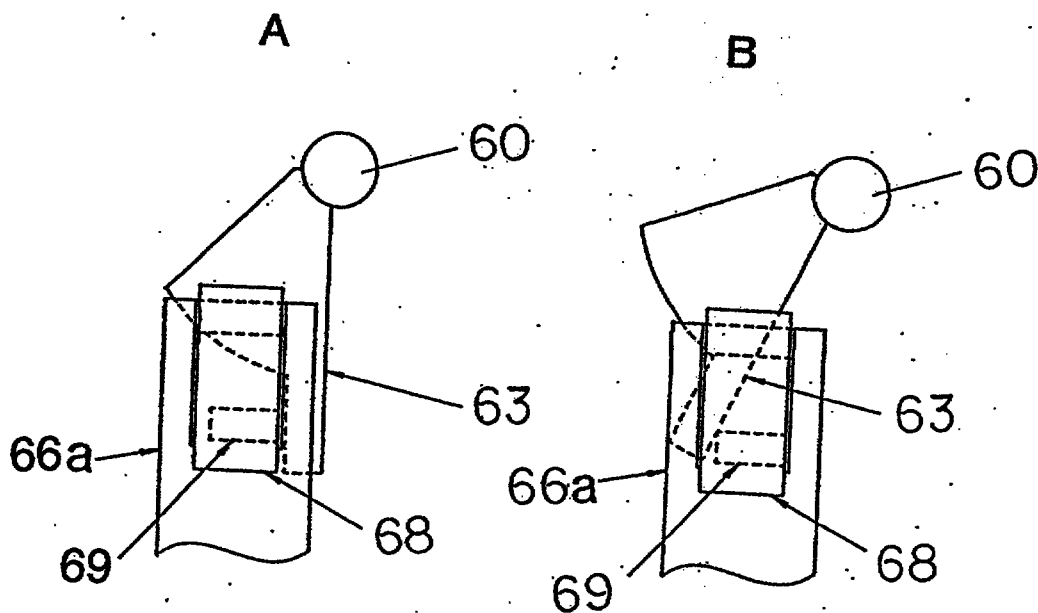


Fig. 17



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Fig. 18

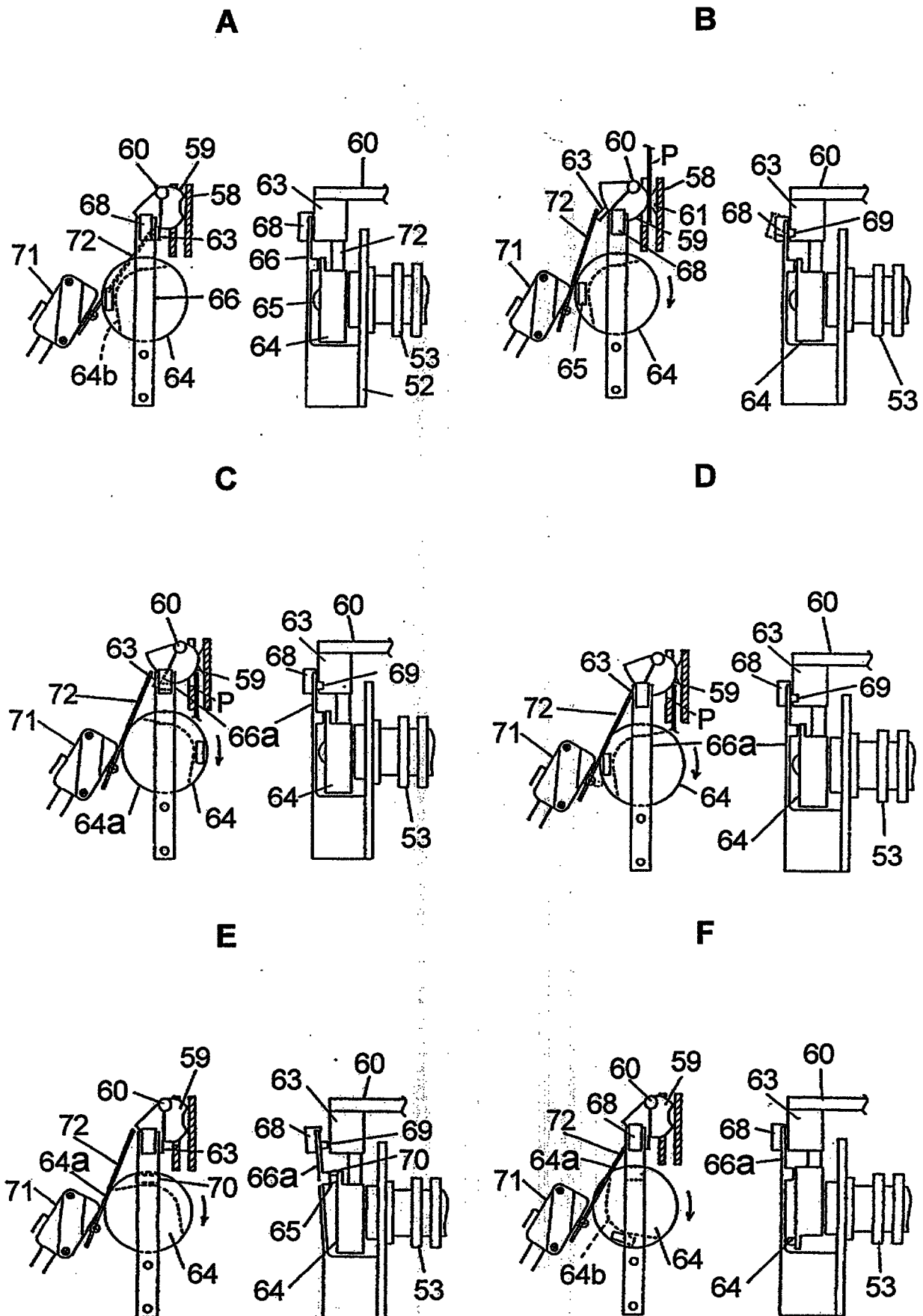


Fig. 19

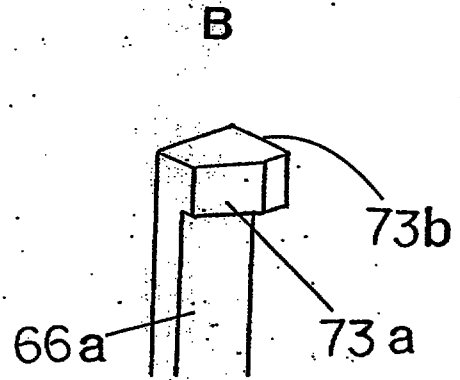
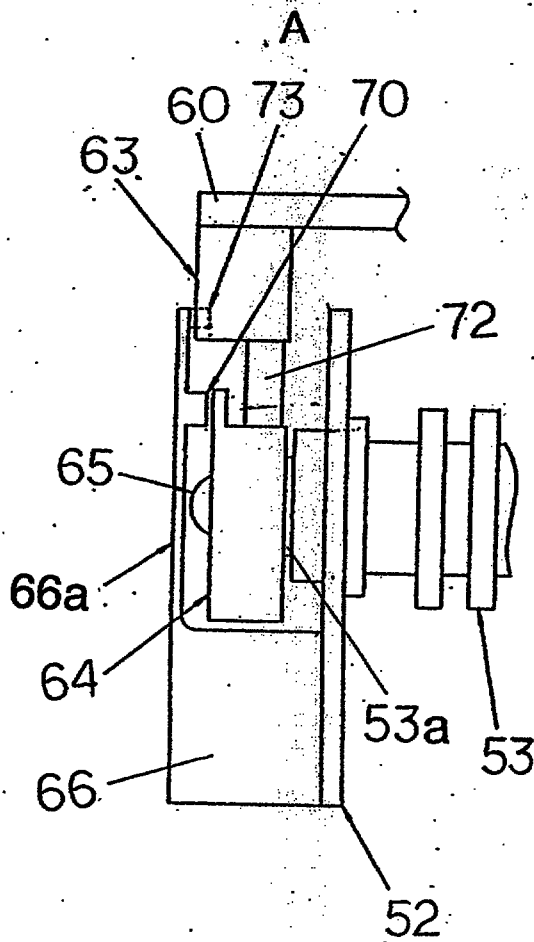
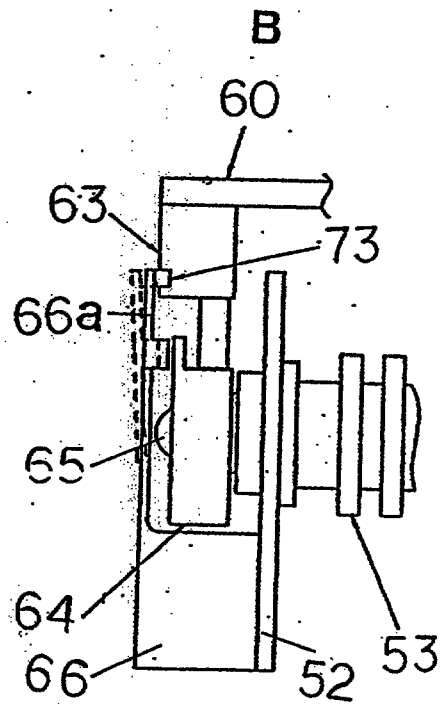
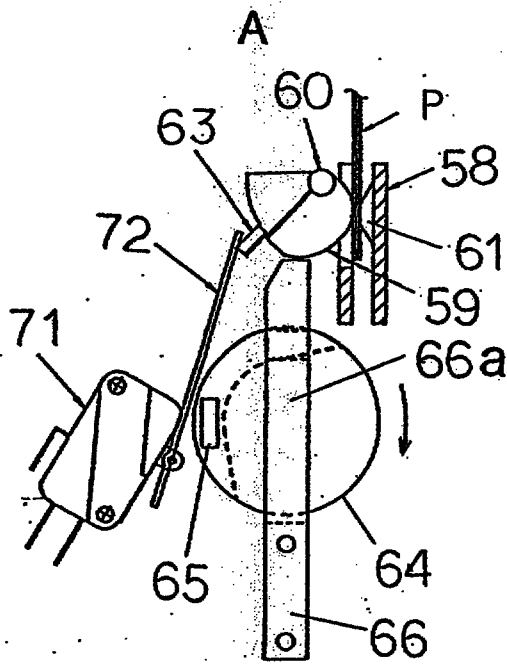


Fig. 20



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Fig. 21

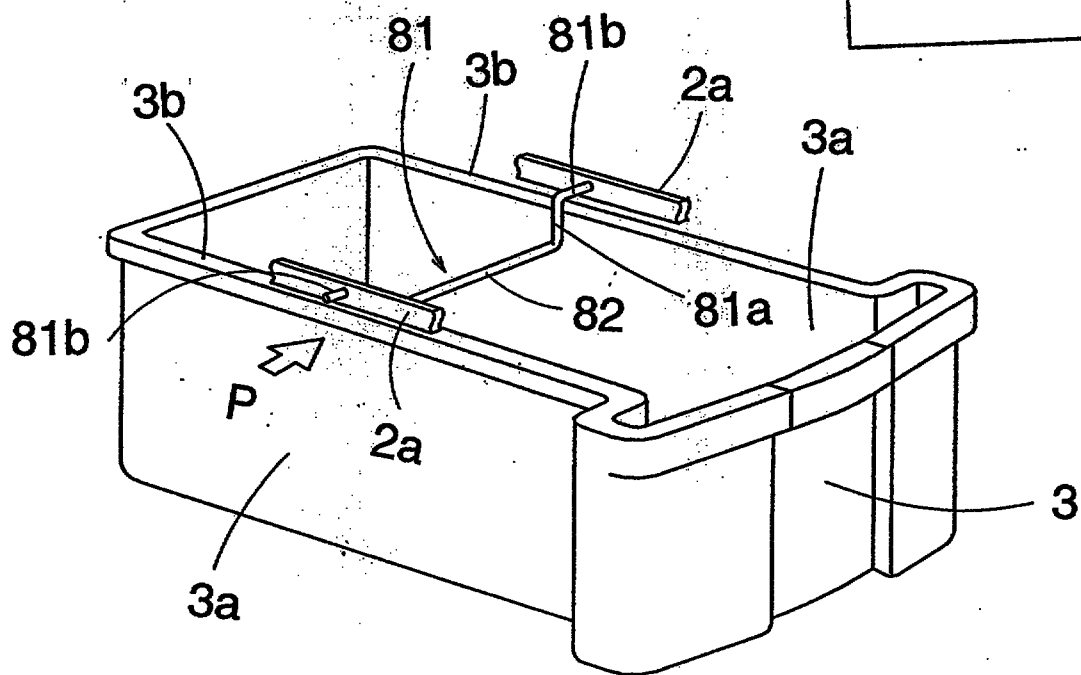


Fig.22

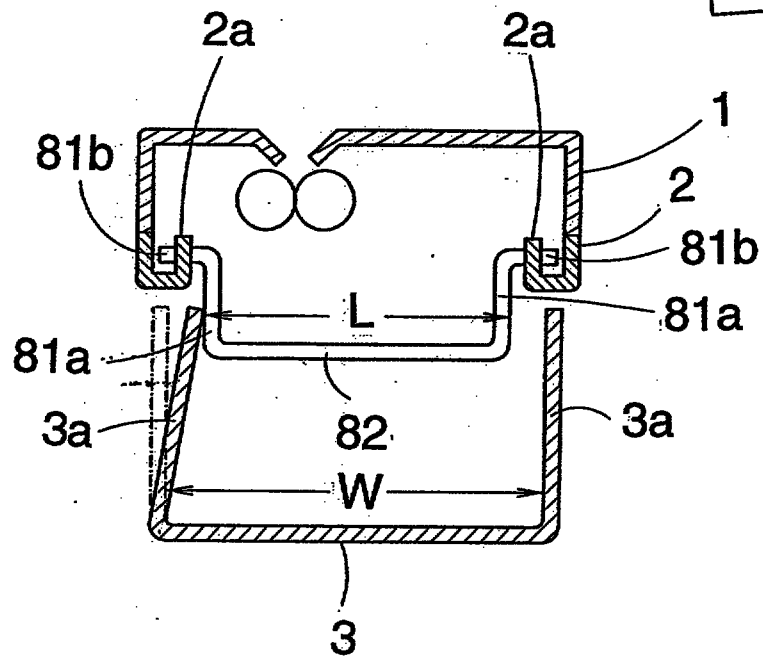
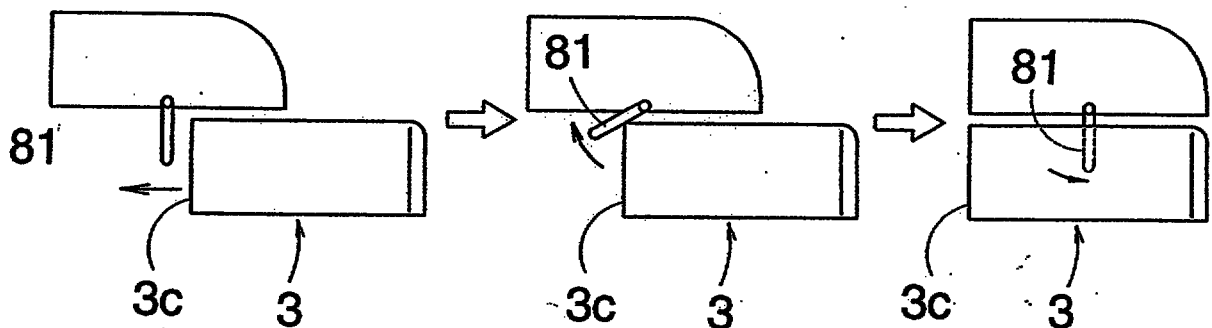


Fig.23



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Fig.24

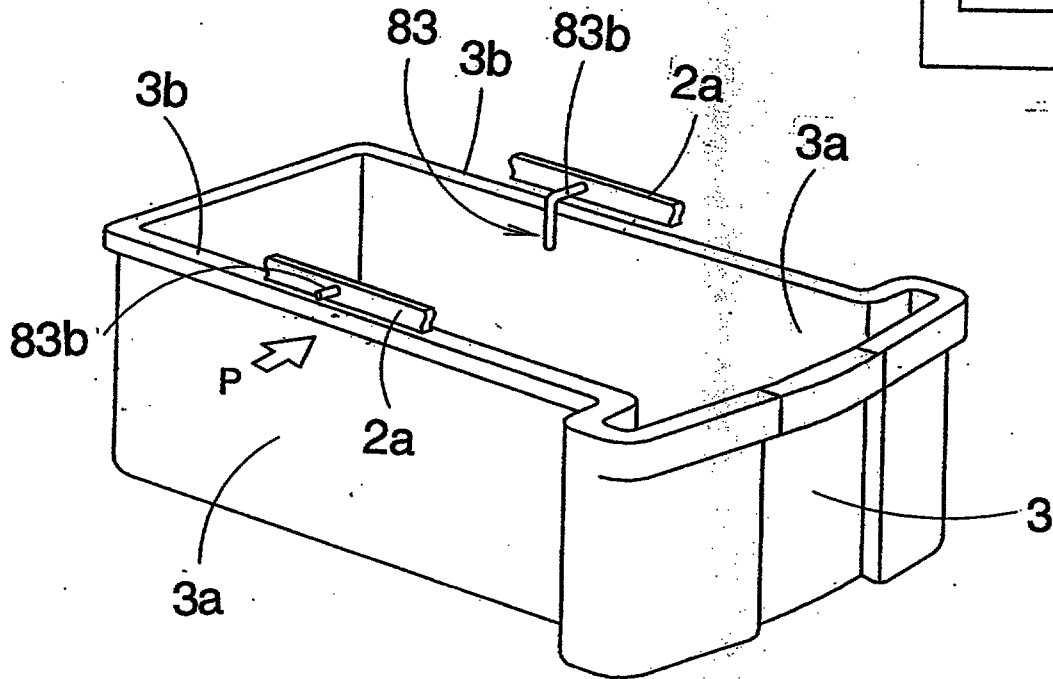
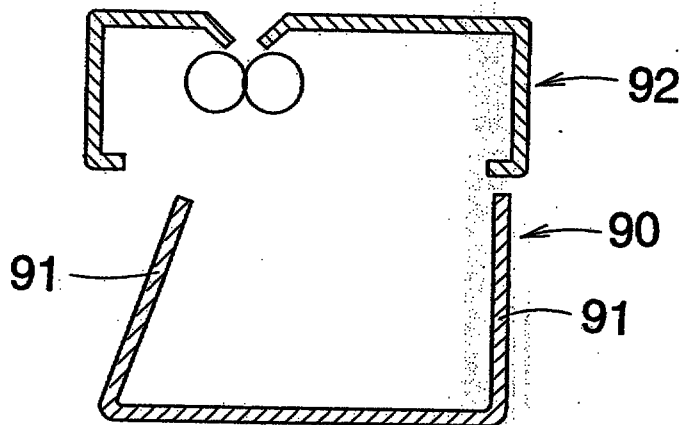


Fig.25

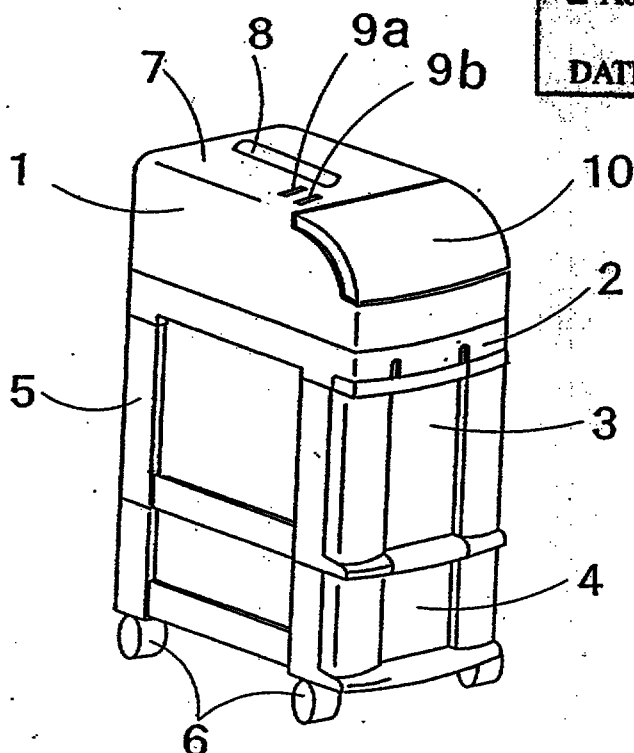


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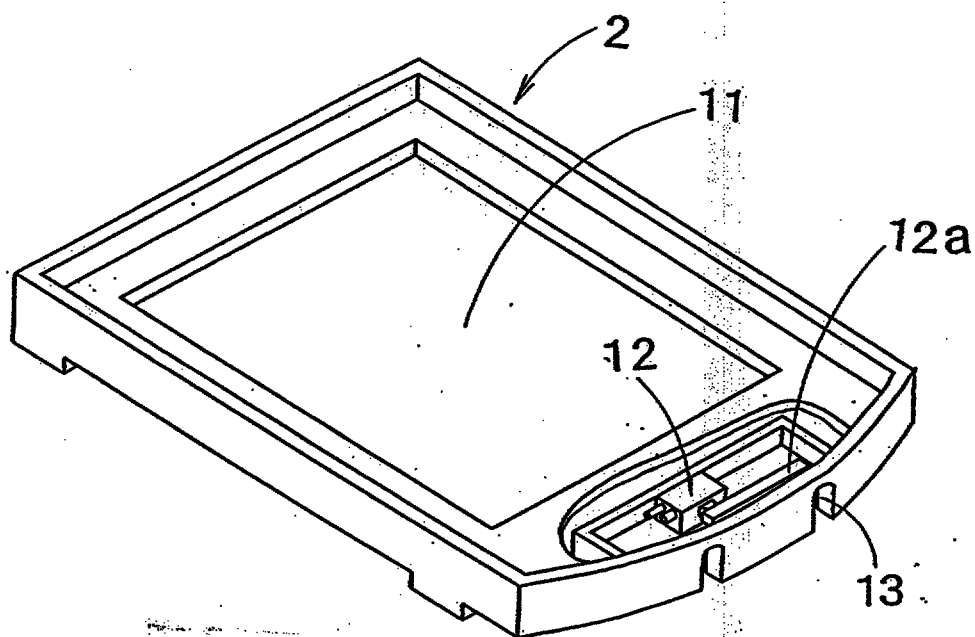
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Fig.1



REPLACEMENT SHEET
05 MAR 1997

Fig.2



8-2240130

REPLACEMENT SHEET
05 MAR 1997

Fig.3

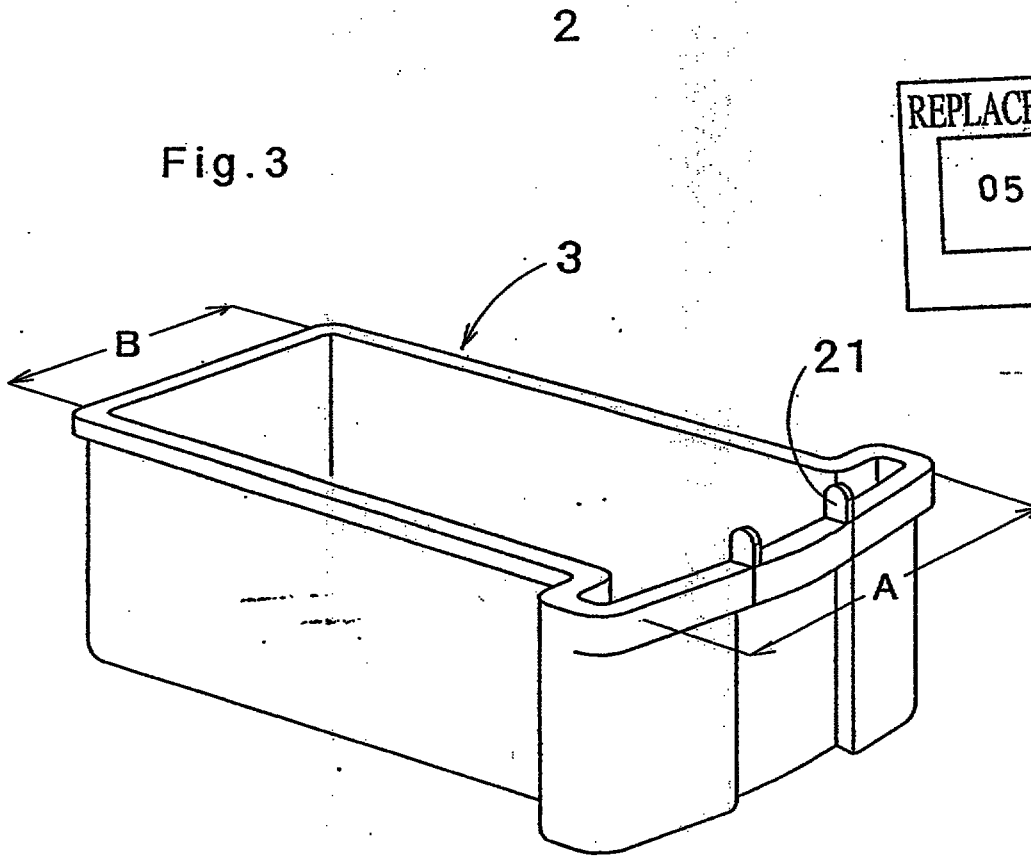
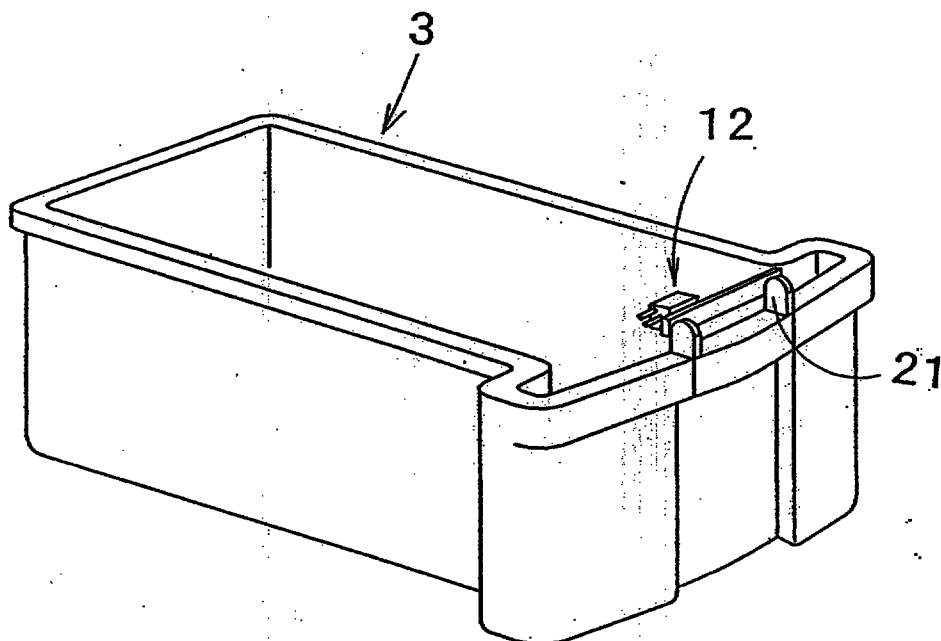
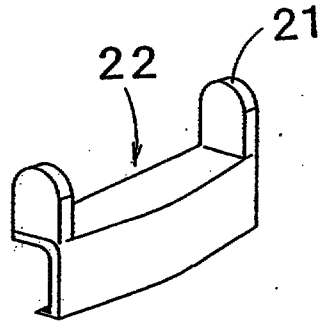


Fig.4



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Fig.5



REPLACEMENT SHEET
05 MAR 1997

Fig.6

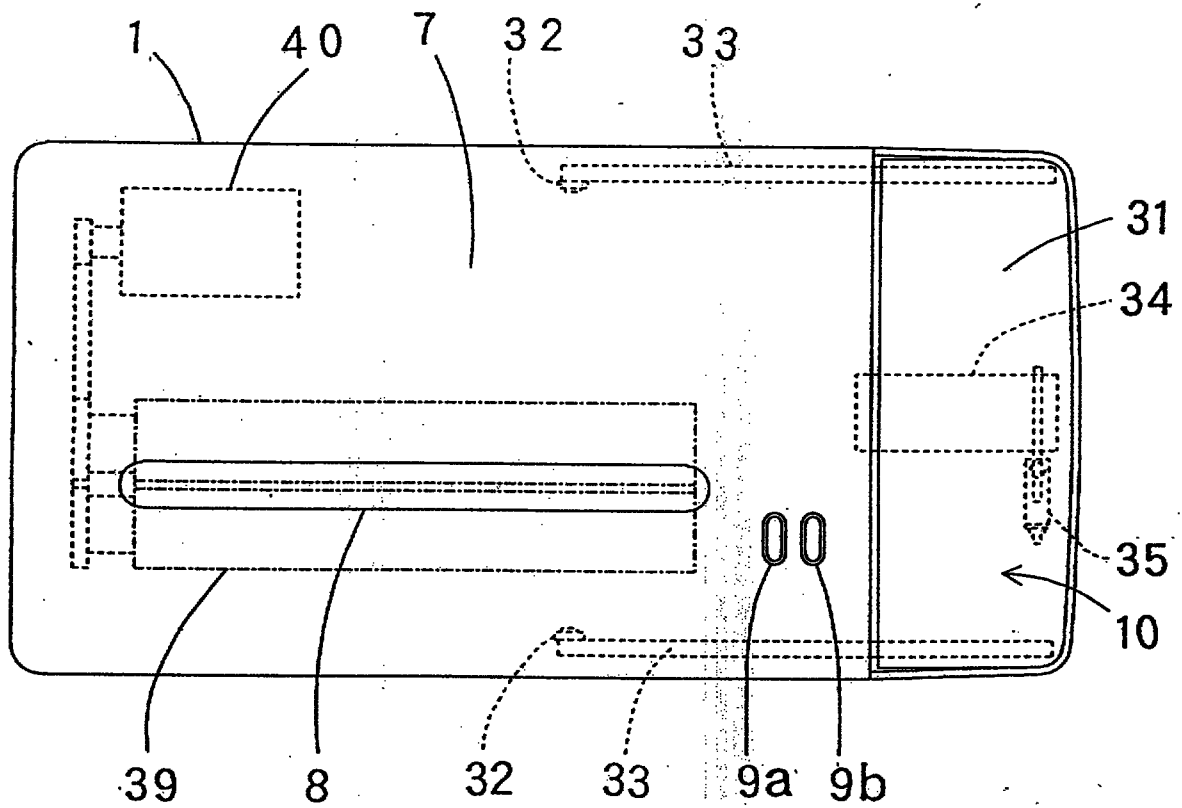


Fig. 7

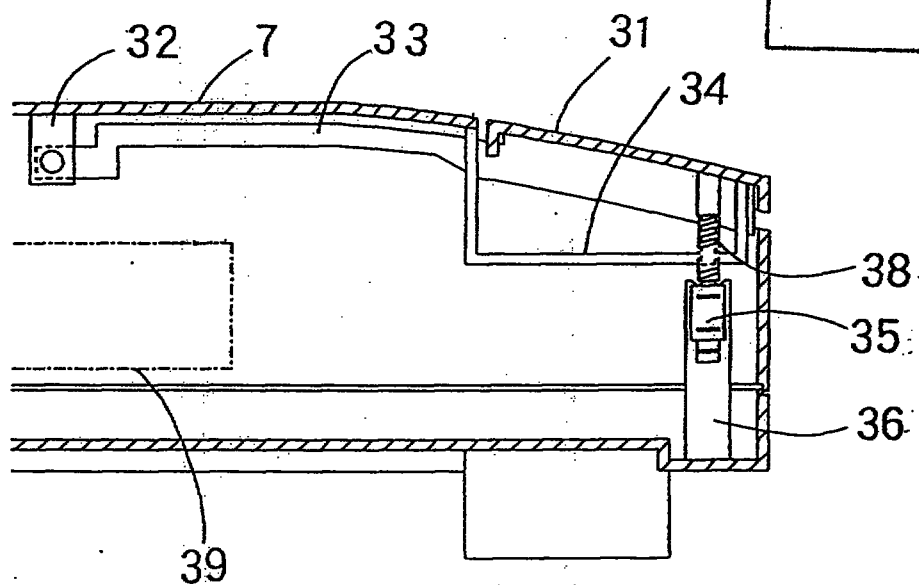
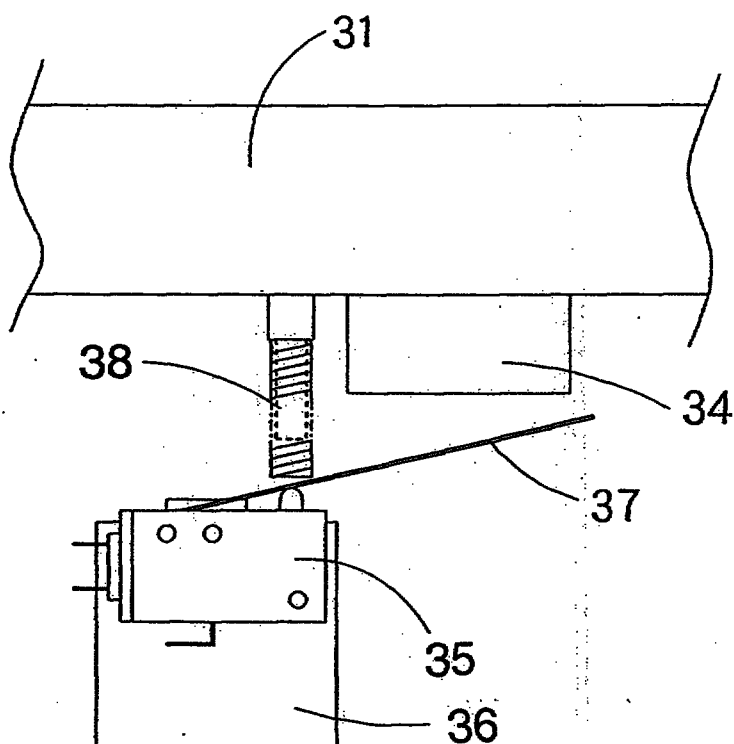


Fig. 8



REPLACEMENT SHEET

05 MAR 1997

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Fig. 9

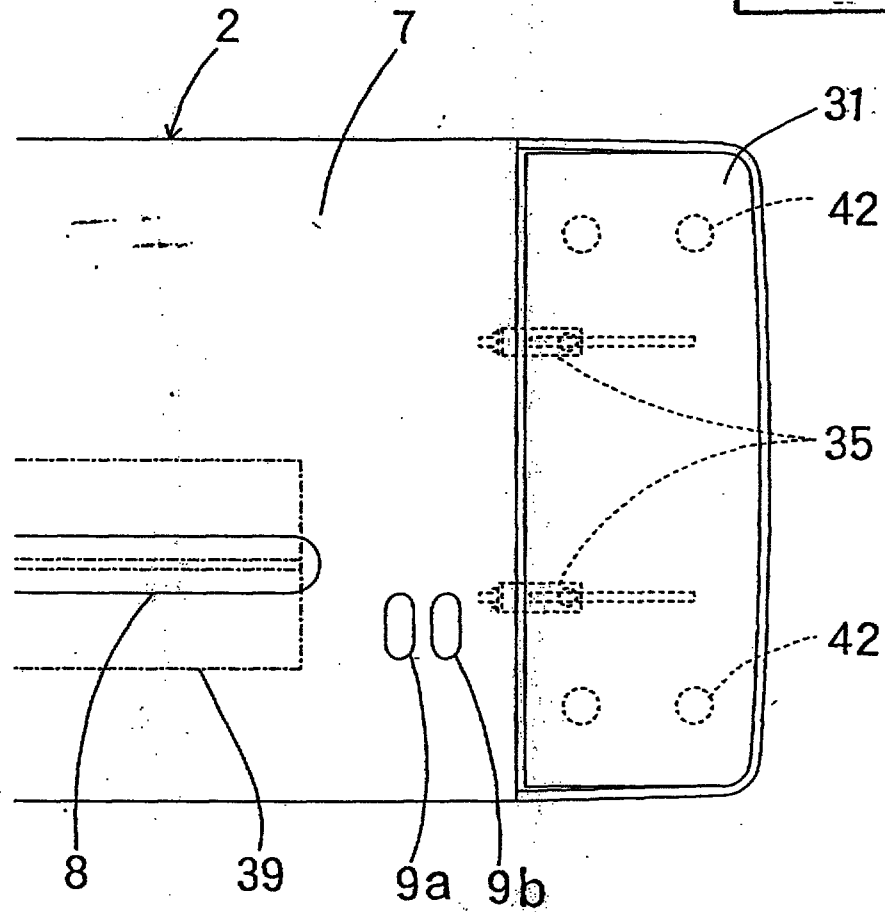
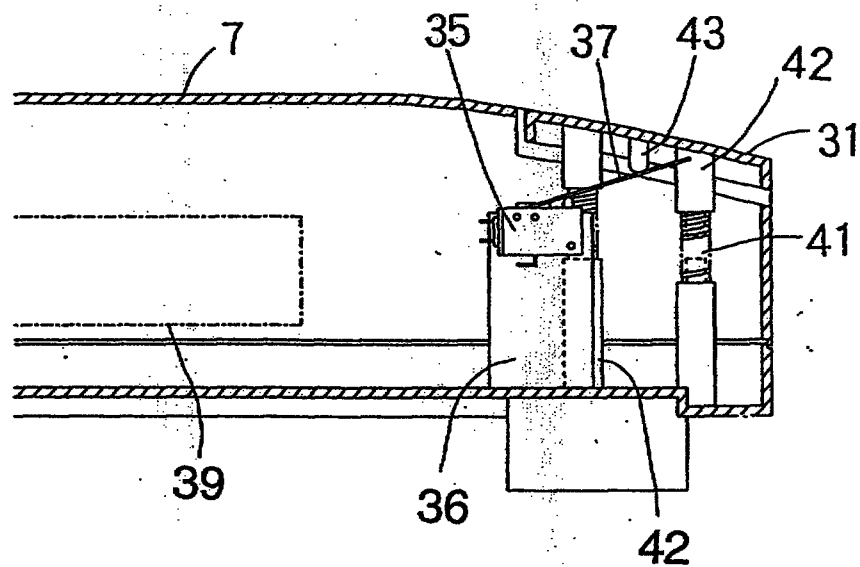


Fig. 10



6

Fig.11

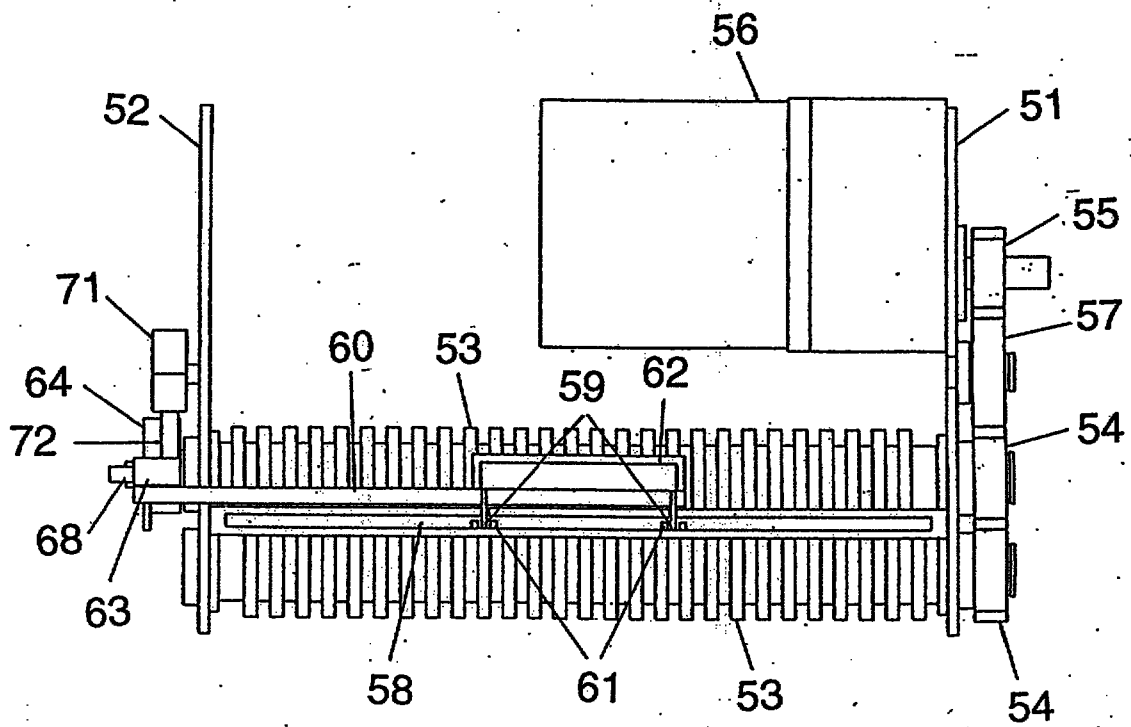
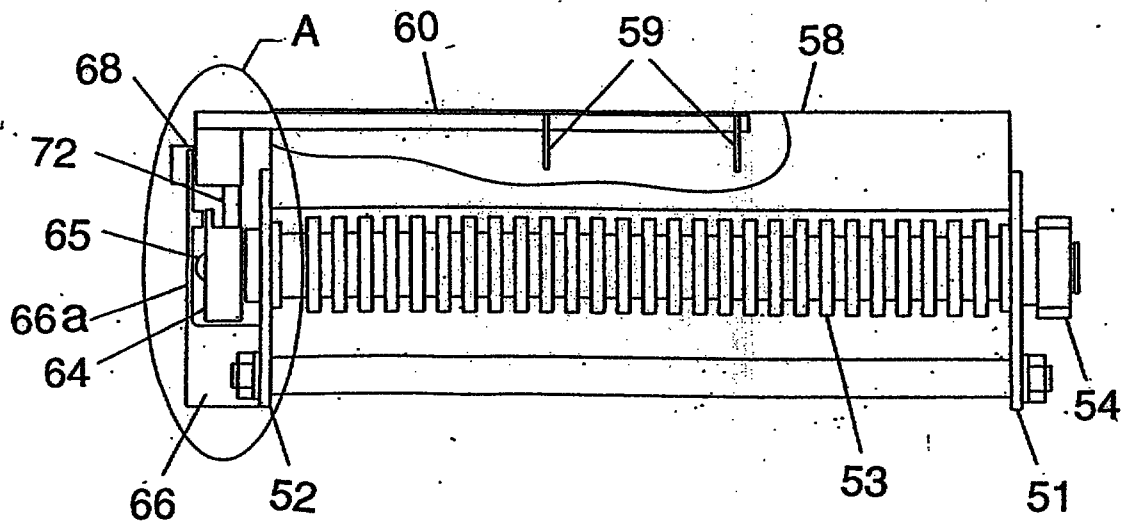


Fig. 12



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Fig. 13

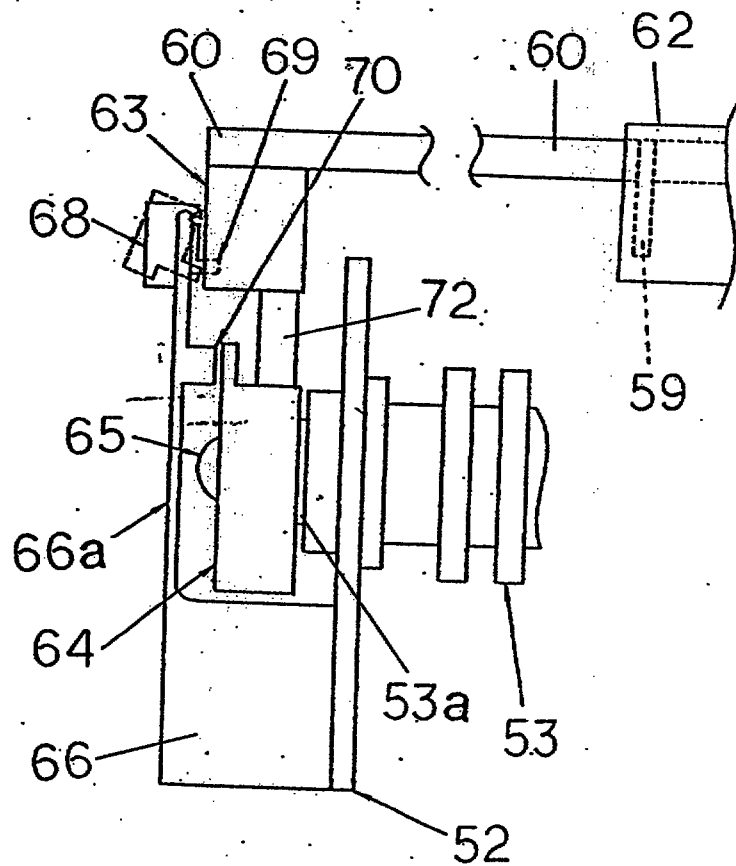
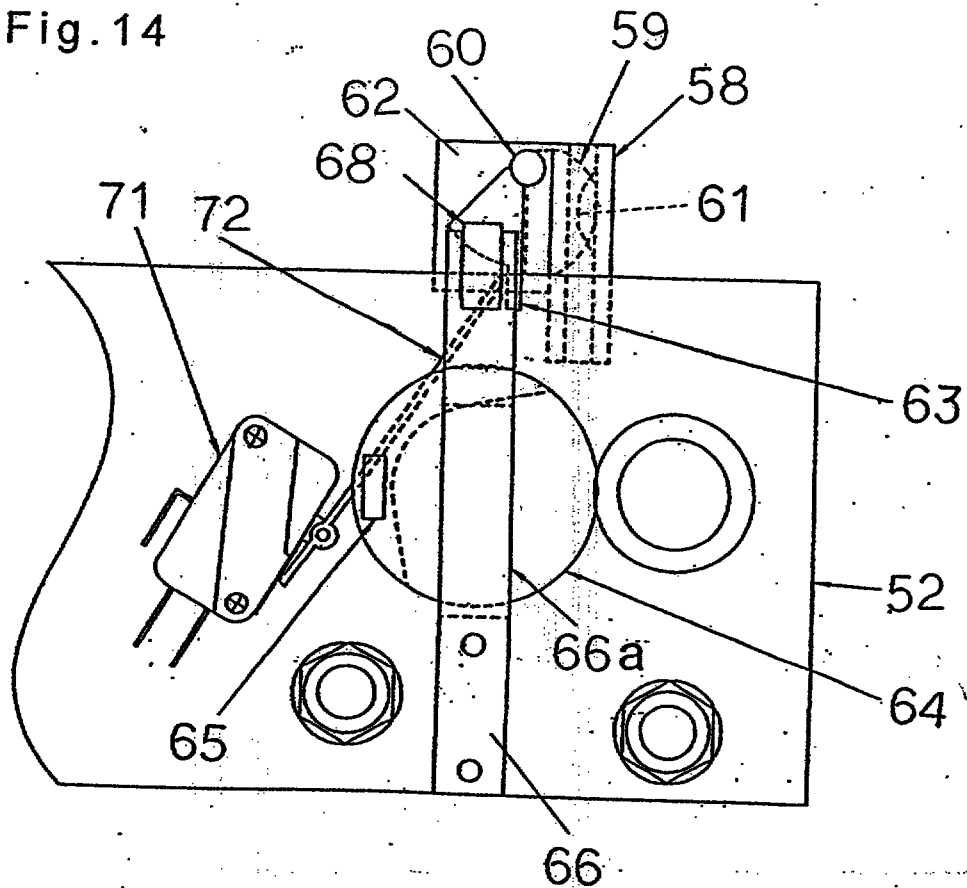


Fig. 14



8

Fig. 15

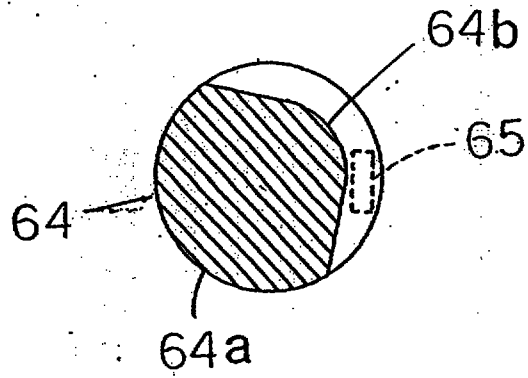


Fig. 16

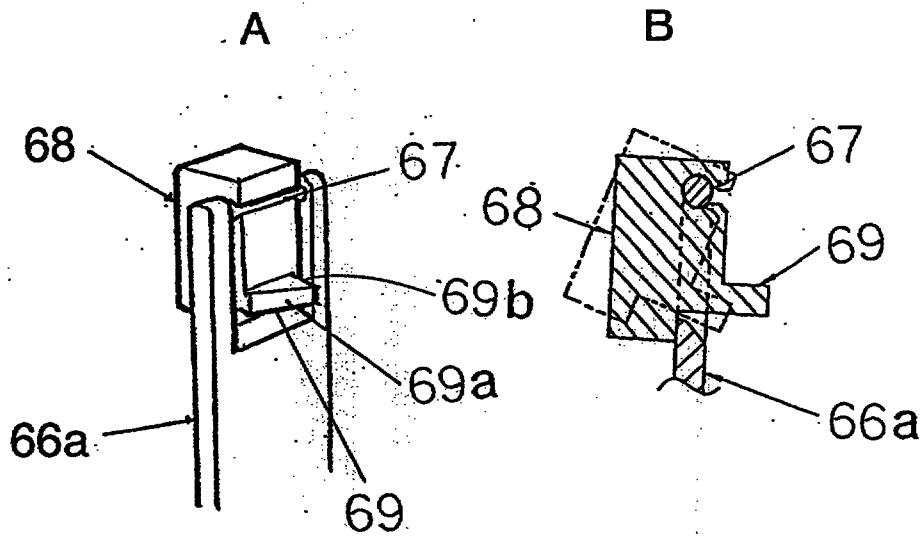
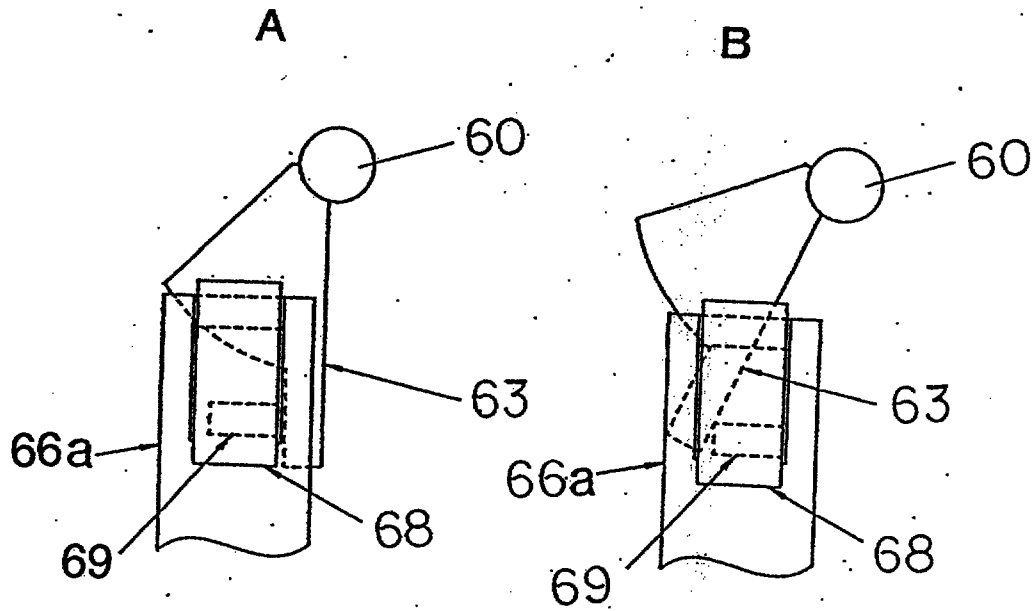
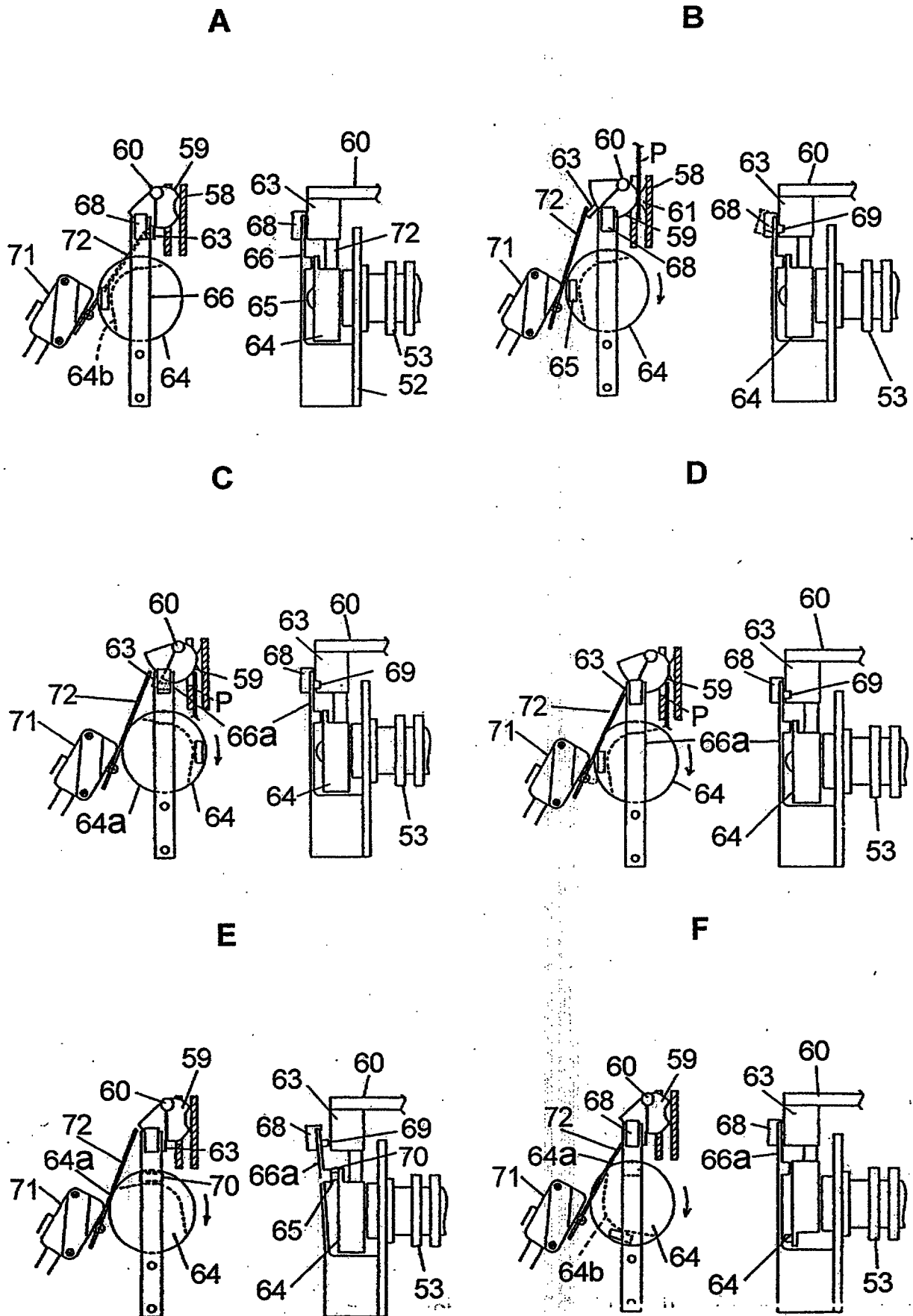


Fig. 17



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Fig. 18



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Fig.19

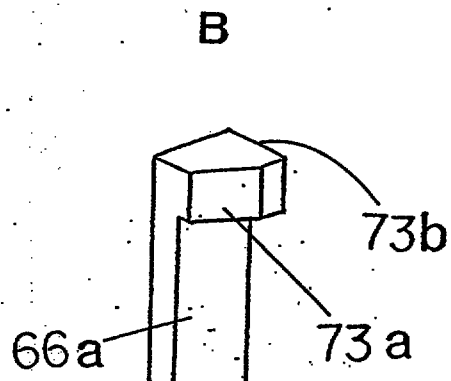
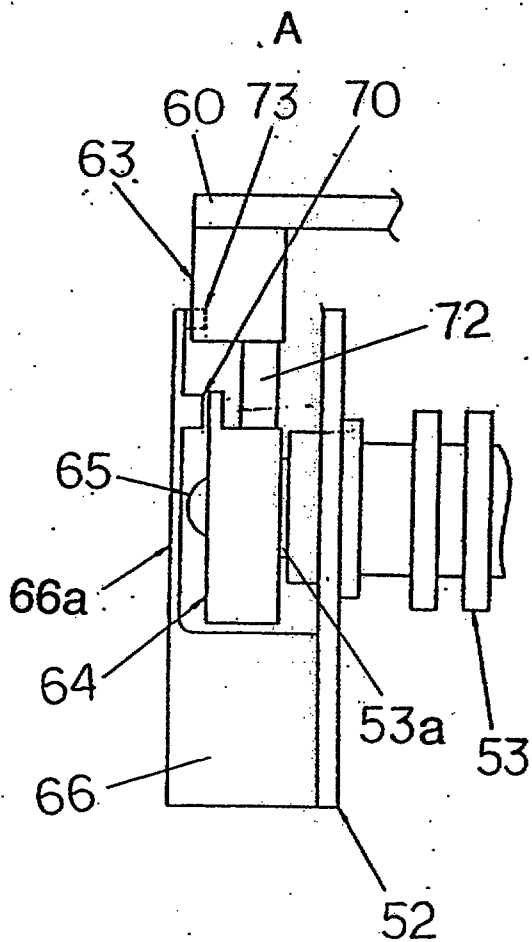
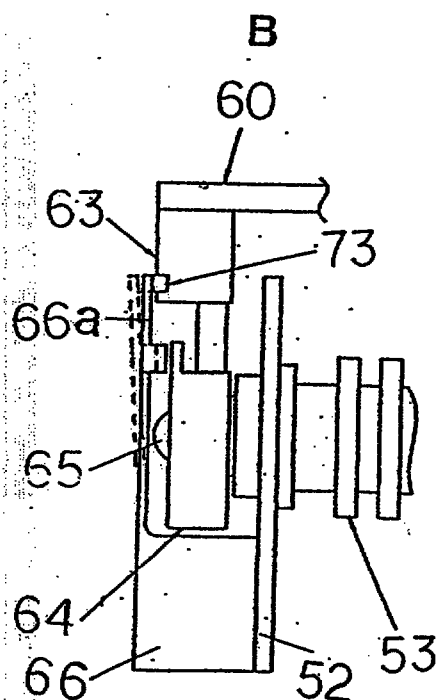
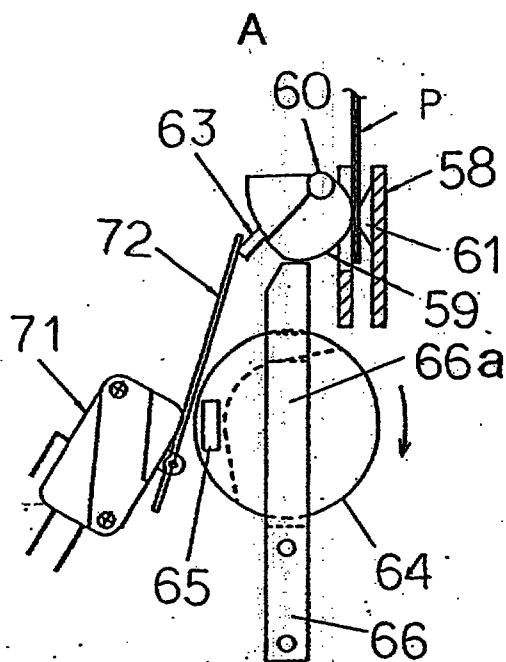


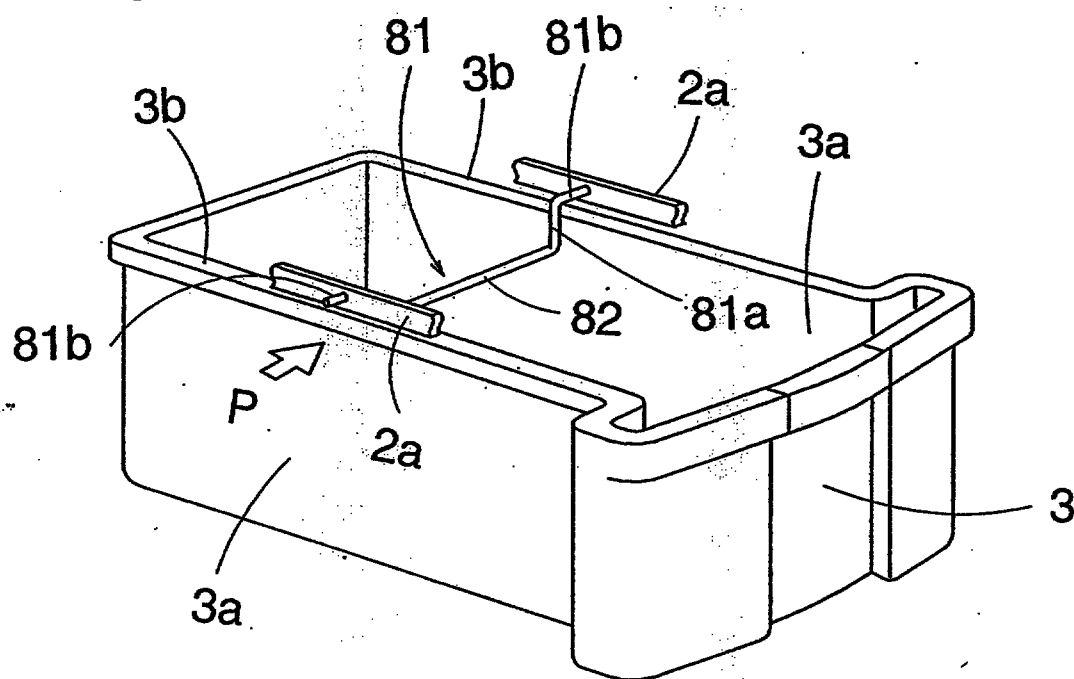
Fig.20



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Fig.21



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Fig.22

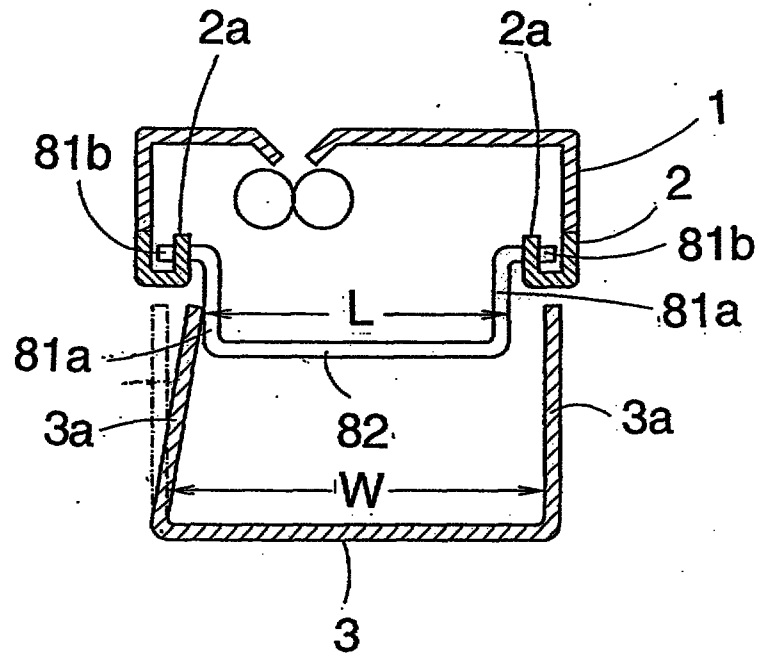


Fig.23

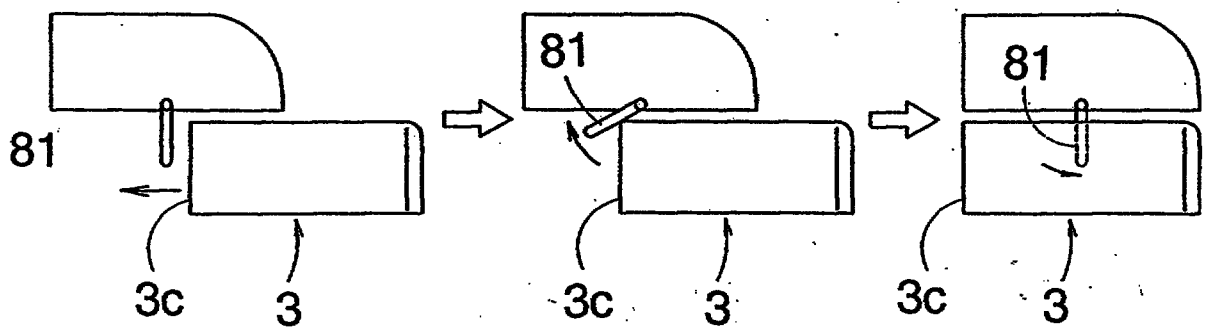


Fig.24

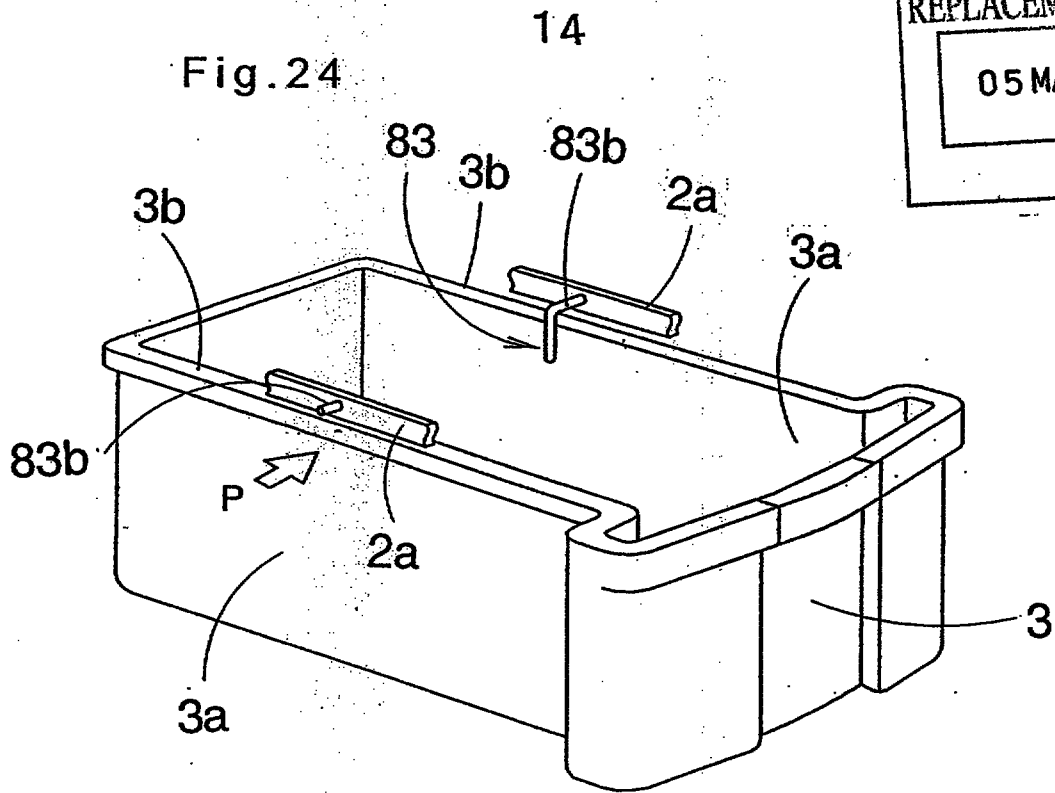
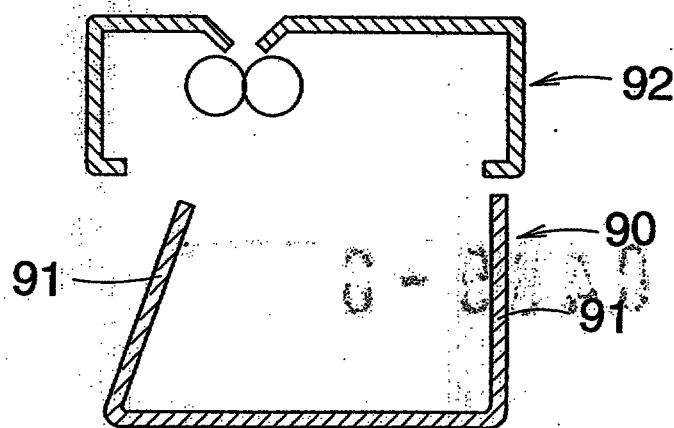
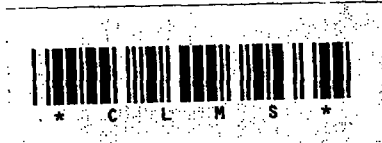


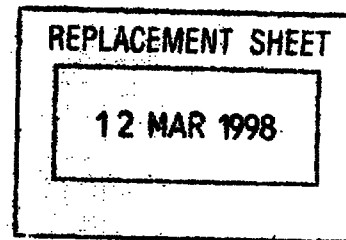
Fig.25





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CLAIMS



1. A safety mechanism of a paper shredder of a type that is constructed of a shredder section having a paper inlet port and a rotary cutter and a drawer- type wastebasket under the shredder section, said safety mechanism comprising a switching projection provided on the top portion of a side wall perpendicular to the direction of the drawing of the wastebasket, whereby said switching projection moves an actuator of a switch mounted on the shredder section to feed power to the rotary cutter when the wastebasket is in its closed position.
2. A safety mechanism of a paper shredder of a type that is constructed of a shredder section having a paper inlet port and a rotary cutter and a drawer- type wastebasket under the shredder section, said safety mechanism comprising a switching projection provided on the top portion of the front wall of the wastebasket, and said shredder section comprising a bottom cover which is provided with a slit in a position matching the switching projection in a manner that the switching projection passes through the slit and provided with a micro switch actuator within the slit, whereby said switching projection moves the actuator of the micro switch when the wastebasket is in its closed position.
3. The safety mechanism of a paper shredder according to claim 2, wherein the switching projection is provided on the pull handle of the wastebasket.
4. The safety mechanism of a paper shredder according to claim 3, wherein the said pull handle of the wastebasket is detachable mounted to the wastebasket.
5. ~~A safety mechanism of a paper shredder comprising a switching plate having a wide area and constantly upwardly biased, said switching plate disposed at substantially the same level as the top cover of a shredder section and a micro switch disposed at any convenient position just under the switching plate in a manner that the lowering of the switching plate activates the micro switch to stop the rotary cutter.~~



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5.6. A safety mechanism of a paper shredder comprising a pair of actuator arms rotatably supported at support members provided inside the top cover of a shredder section at the middle positions, halfway, along both sides of the top cover, a switching plate having a wider area than other switches and provided at the ends of the pair of actuator arms, said switching plate upwardly biased by a wide plate spring attached to the top cover, and a micro switch disposed at any convenient position just under the switching plate in a manner that the lowering of the switching plate activates the micro switch to stop the rotary cutter.

6.7. A safety mechanism of a paper shredder comprising a switching plate having a wider area than other switches and supported by a plurality of springs that are guided around guiding shafts vertically extending from the underside of the switching plate in a manner that said switching plate is vertically upwardly and downwardly movable, and a micro switch disposed at any convenient position just under the switching plate in a manner that the lowering of the switching plate activates the micro switch to stop the rotary cutter.

7.8. The safety mechanism of a paper shredder according to claims 6 or 7, wherein a plurality of micro switches are mounted so that any of the micro switches activated stops the cutter by OR-gating the micro switches.

8.8. A safety mechanism of a paper shredder comprising a paper sensor plate projected into a paper inlet port and secured to one end of a transmission shaft rotatably supported at a paper sensor protective bracket, a start lever secured to the other end of the transmission shaft so that both the paper sensor and the start lever integrally rotate, said start lever positioned within the range of the actuator of a micro switch, a tangentially aligned push projection provided on the outer surface of a switching cam that is rotated integrally with the rotary cutter to activate the actuator, a locking projection that is provided on the end of the movable portion of the start lever stopper mounted on the left-hand side frame of the shredder, said locking projection being projected into the area of rotation of the start lever and a release projection provided in a position where the release projection can contact the push

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projection provided on the outer surface of the switching cam.

- 9.10. The safety mechanism of a paper shredder according to claim 9 further comprising a pivotal shift provided on the end of the movable portion, a pivotal member pivotally supported about the pivotal shaft, and a locking projection provided at the lower end of the pivotal member, said locking projection having a tapered sliding surface on the front side and a locking surface on the rear side.
- 10.11. The safety mechanism of a paper shredder according to claim 9, wherein a locking member having a tapered sliding front surface and a locking rear surface is integrally formed of the top end of the movable portion.
- 11.12. A safety mechanism of a paper shredder of a type that is constructed of a shredder section having a paper inlet port and a rotary cutter and a drawer-type wastebasket under the shredder section, said safety mechanism comprising a safety guide having a stopper provided in a position, at least corresponding to the top edge of the side wall of the wastebasket, to restrain inward deformation of the side wall, said safety guide pivotally supported in a manner that the safety guide is pivoted in the direction of the drawing of the wastebasket.
- 12.13. The safety mechanism of a paper shredder according to claim 12, wherein said safety guide comprises a connecting member that connects the stoppers in a U-shaped crank configuration.

