



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

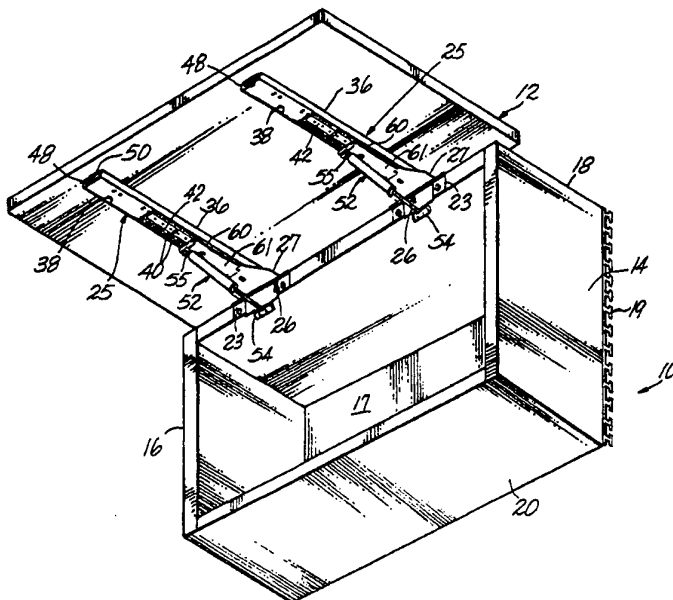
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(54) Title: BRAKING MECHANISM FOR OVER-TOP FLIPPER DOOR SLIDE SYSTEM



## (57) Abstract

A self-braking door slide mechanism (25) particularly adapted for use with cabinets (10) that have front doors (12) that open upwardly and are retracted using the slide mechanism (25) to a position in which the door (12) is aligned with the top (18) of the cabinet (10) in either an over or under top position. A dampening cylinder (52) extends between the top (18) of the cabinet (10) and the door (12) to slow its downwardly hinging action when the door (12) is being closed. Auxiliary brake pads (60) are also provided on a stationary slide member (32) which bear against the moving portion (36) of the slide mechanism (25) to slow the sliding action during closing due to the force of the dampening cylinder (52).

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## **BRAKING MECHANISM FOR OVER-TOP FLIPPER DOOR SLIDE SYSTEM**

### **Background of the Invention**

5 This invention relates to an improvement in wall-mounted cabinets of the type employed in offices, laboratories and the like. In one type of prior art wall cabinet with a stored door feature, the door generally slides to a stored position above the cabinet itself. Other prior art cabinets also utilize this feature and in these embodiments the door slides into a stored position inside the cabinet, either at the top or at the side of the cabinet. The cabinet doors of the over the top variety have a drawback in that when the door is slid forward to close the enclosure, the weight of the door tends to cause the door to accelerate and swing rapidly downwardly and slide forwardly at the same time creating the possibility of striking the person who is attempting to close the cabinet causing pain and possible injury.

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### **Summary of the Invention**

15 The over the cabinet door assembly of this invention is significantly superior to prior art cabinets in that the door of the cabinet is equipped in such a way as to allow the door to be easily raised and moved to a stored position while requiring minimal effort at any point during movement along the path of closure. The assembly also has the added feature that the hardware is mostly hidden from view when it is in the stored position. When the door is moved forward to bring it to the closed position, a dampening mechanism is provided which extends between the enclosure and the door to retard and slow the door in its forward sliding motion and downward rotation motion to the closed position.

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The foregoing is accomplished in accordance with the present invention, by providing an enclosure having a door which is slidably and hingedly retractable from a closed to an open position. The door comprises at least one ball bearing slide mechanism attached to the interior side of the door and a hinge mechanism attached at one side to the enclosure and to the slide mechanism at the end of the slide mechanism adjacent to the top of the enclosure. A motion dampening mechanism extends between the slide and the underside of the cabinet whereby the closing movement motion of the door is substantially retarded and slowed by the dampening mechanism as it swings and slides downwardly and rotates toward the enclosure.

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### **Brief Description of the Drawing**

35 Many of the intended advantages of the present invention would be more readily apparent and better understood as the following detailed description is considered in connection with the accompanying drawing in which

1           FIG. 1 is a perspective view of a portion of an enclosure door and slide mechanism and attendant dampening mechanism according to the present invention in the raised position before being slid over the top of the enclosure to the open position;

5           FIG. 2A is a sectional view of the door slide with dampening mechanism in the closed door position;

          FIG. 2B is a sectional view of the door slide with dampening mechanism in the open door position;

10          FIG. 3 is a perspective view of an enclosure according to the present invention wherein the door is equipped with the pair of slide mechanisms and a pair of dampening mechanisms to enable the door to be opened and slid over the top of the enclosure to the fully open position; and

          FIG. 4 is a sectional view of the slide mechanism taken along lines 4-4 of FIG. 1.

#### **Description of the Preferred Embodiment**

15          In FIGs. 1 to 3 as shown, a cabinet or enclosure according to the present invention generally designated 10 with the door 12 in the closed and partially open positions. The cabinet includes a pair of side walls 14 and 16 to which a top wall 18 and a bottom wall 20 are secured in any convenient well known fashion such as by screws, bolts, dowels, etc. The pair of side walls 14 and 16 and the top and bottom walls 18 and 20 form a rectangular cabinet to which door 12 is fixed and for which door 12 serves as a closure. Bracket means are provided at the rearward edges of each of the side walls to mount the enclosure to a wall or space dividing panel. Any conventional mounting means may be employed with the cabinet and in one embodiment, mounting brackets 19 which include a plurality of T-shaped hooks which are compatible with conventional slotted standards employed in many modern modular space dividing systems are provided and are particularly suitable. Such space dividing systems are available from a number of manufacturers including Herman Miller and Steelcase. The cabinet may be provided with a back 17 or it may be backless when it is unnecessary for the cabinet itself to have its own rear wall.

20          The door member or closure 12 is affixed to the remainder of the cabinet by one or more hinge members 26 and slide mechanisms 25. Each of the hinge members 26 includes a plate 23 secured to the front edge of the top wall 18 and a second plate 27 that is secured to a stationary inner track member 32 which carries an inner ball bearing race 34. In an alternative embodiment shown in FIGS. 2A and 2B, an angle bracket 23a is secured under top wall 18 and extends upwardly along the front edge to a hinge member 26 which is located in the same position as shown in FIG. 1. An outer movable track or channel member 36 is attached to the interior side or backside of the door 12 and extends for substantially the full height of the door as is best seen in FIG. 3. The outer movable track member 36 includes an outer ball bearing race 38. A plurality of ball bearings 40 are carried on a

1 moving ball carriage 42 which locates the balls 40 between the inner race 34 and outer race  
38. In the preferred embodiment, the length of moving ball carriage 42 is significantly  
greater than the length of its associated stationary inner track member 32. Furthermore, the  
stationary inner track member is shorter in length than either of the moving ball carriage 42  
5 or the outer movable track member 36. The outer movable track members extend for  
substantially the full height of the door 12. This multi-track feature allows the door member  
to move in almost frictionless fashion from the closed position of FIG. 2A to the open  
position of FIG. 2B with little effort on the part of the person opening the cabinet. A pair  
of spaced hinge members 26 and slide mechanisms 25 (FIG. 3) allow the cabinet door to be  
10 raised and moved to a stored position by grasping the door at any point along the door  
bottom. The double track system provides for almost frictionless relative movement between  
the stationary track and the moving track through the multiple speed effect provided by the  
movable ball carriage. The movable ball carriage moves with respect to the fixed track at  
a first speed and the rotation of the balls doubles that speed in imparting movement to the  
15 movable track and hence door 12. A pair of stop flanges are formed on the underside of the  
inner stationary track member 32 which co-acts with a pair of raised stop members on the  
upper side of the ball carriage 42 to prevent the stationary track member from being overrun  
by the ends of the ball carriage. At each end of the fixed outer track member 36 is a raised  
stop or end 48 which has mounted on it a bumper 50 which serves to cushion the impact  
20 when either the end of the inner track member or the ball carriage reaches the end of its  
travel against the stop 48.

The present invention provides a dampening mechanism 52 which is attached to the  
underside of the cabinet at one end 54 and at its opposite end 55 to a hinged brake plate 61  
attached to the stationary track member 32. The dampening mechanism is typically a fluid  
25 containing cylinder and piston or slide mechanism and can be any one of a number of  
products which are available from companies which make products referred to variously as  
gas cylinders, gas springs, dampers, damper cylinders, linear decelerators, non-cavitating  
dampers, adjustable velocity control mechanisms and hydraulic check cylinders.  
Manufacturers of such equipment include Ace Controls Inc., Farmington, Michigan;  
30 Deschnar Corporation, Santa Ana, California, AVM (Arvin), Marion, South Carolina,  
Stabilus Corp., Colmar, Pennsylvania; Enidine, Orchard Park, New York; and Camloc Co.,  
Madison Heights, Michigan. A non-cavitating damper such as manufactured by AVM is  
particularly suitable for this application.

As best seen in FIG. 2A with the door in the closed position, the dampening  
35 mechanism 52 is in its fully closed position with the piston 56 shown in ghosted  
representation in Fig. 2A retracted for its full length to the bottom of the cylinder 58. When  
the door is opened, the cylinder, being attached at its end adjacent the door to the slide  
mechanism, is extended, drawing the cylinder outwardly over the piston. This action of

1 opening movement continues until the door has rotated approximately 90° to the horizontal  
position shown in FIG. 2B. As shown therein, the cylinder has now extended approximately  
half again as long as its original length from the end of the piston, and the entire dampening  
5 mechanism has likewise rotated approximately 90° from a position in FIG. 2A where the  
mechanism is nearly vertical to a position in FIG. 2B where it has moved past the horizontal.

When the door is in the position shown in FIG. 2B, it is then moved in the direction  
of the arrow toward the rear of the enclosure under the control of the user until the door has  
moved to the point where the slide is in the fully closed position while the dampening  
10 mechanism is in the fully extended position. In this position the door overlies the top of the  
enclosure and the front edge of the door extends a predetermined distance in front of the  
leading edge of the sidewalls, top and bottom of the enclosure corresponding to the length  
of the extended cylinder.

In closing the door, the dampening mechanism comes into full play as the door is slid  
15 forward and reaches a point where its center of gravity passes the leading edge of the  
enclosure. At this point, the weight of the door causes it to hinge downwardly and begin to  
slide forward on the slide mechanism. As the door is allowed to rotate toward the closed  
position, the weight of the door bears on the cylinder and piston dampening mechanism 52  
and the dampening action takes place, slowing the rotation of the door at a rate controlled  
20 by the rate of deceleration determined by the specific rating of the dampening mechanism.

The action of the weight of the door on the cylinder causes an equal and opposite  
reaction and the dampening mechanism exerts a force against the brake plate 61 causing it  
to hinge forward and exert a braking action on the movable outer member of the slide  
mechanism. A brake pad 60 is provided on each side of the brake plate which makes  
25 frictional contact with the edges of the moving channel member 36 and produces braking  
action on the edges of member 36.

The brake pad members 60 are chosen of a material with a high coefficient of friction  
such that the downward sliding action of the slide mechanism is retarded by the frictional  
braking force exerted by the brake pads on the sliding channel member 36.

30 The cooperative action of the dampening mechanism and the auxiliary brake pads  
caused the door to slowly slide forward and slowly rotate toward the closed position at a  
controlled rate such that there is no free fall or rapid closure of the door. This eliminates  
a rapid movement of the door which frequently results in striking the user on the head or  
slamming shut on the hand of the user.

35 As will be apparent from the foregoing, the cabinet door slide and dampening  
mechanism of the present invention provides a simple and efficient means for providing an  
easily opened, easily closed cabinet with a much improved performance and elimination of  
the annoyance of the tendency of the door to slam or fall shut.

1 **WHAT IS CLAIMED IS:**

1. A braking mechanism for a cabinet which has a top and a door which opens and closes from the top of the cabinet, the door having an interior side facing the cabinet comprising:

5 a hinge mechanism extending between the top of the cabinet and the door, the hinge mechanism comprising a hinge, a cabinet plate on one side of the hinge and a door plate on the opposite side of the hinge,

a slide mechanism attached to the underside of the door, the slide mechanism having a stationary member and a moving member,

10 a dampening mechanism attached at one end to the top of the cabinet and at the opposite end to the stationary member, the dampening mechanism being between the slide mechanism and the top of the cabinet and being oriented so as to slow the movement of the door as it is moved from an open to a closed position on the cabinet.

15 2. A braking mechanism according to claim 1 wherein the dampening mechanism is a fluid containing cylinder.

3. A braking mechanism according to claim 2 wherein the fluid containing cylinder is a gas containing cylinder.

20 4. A braking mechanism according to claim 2 wherein the fluid containing cylinder is a hydraulic fluid containing cylinder.

25 5. A braking mechanism according to claim 2 including auxiliary brake means mounted on the stationary member for slowing linear movement of the moving member relative to the stationary member during the closing motion of the door.

30 6. A braking mechanism according to claim 5 wherein the brake means is at least one brake pad mounted on the stationary member which functionally engages the moving member during closing motion of the door.

7. A braking mechanism according to claim 6 where a brake pad is mounted on the stationary member at each side thereof for engaging each side of the moving member.

35 8. A braking mechanism according to claim 2 wherein a hinged brake plate is mounted on the stationary member for operative braking engagement with the moving member during the closing motion of the door.

1           9.     A cabinet including side walls, a bottom wall and a top wall defining a front opening:

              a door normally closing off said front opening defined by said side walls, said bottom wall and said top wall;

5               at least one hinge member secured to said top wall, said hinge member including a hinge, a plate secured to said top wall on one side of said hinge and an inner stationary track member on the other side of said hinge;

              at least one outer movable track member secured to the back side of said door collinearly with said stationary track member on said hinge member;

10              a movable ball bearing carrying carriage interconnecting said inner stationary track member with its adjacent movable track member on said door, said door thereby being slidably movable from a position closing off said front opening to a position overlying said top wall; and

15              a dampening unit interconnecting the hinge member and the stationary track member to slow the movement of the door during closing, the dampening mechanism extending between the stationary track member and hinge member.

20           10.    A cabinet according to claim 9 including a spaced apart pair of hinge members, a pair of outer movable track members secured to said door and positioned collinearly with inner stationary track members on said hinge members, a pair of ball bearing carriages interconnecting each of said inner members with its adjacent moveable track member, and a pair of fluid containing damper units interconnecting their respective hinge members and stationary track members.

25           11.    A cabinet according to claim 9 wherein the dampening unit is a fluid containing cylinder.

30           12.    A cabinet according to claim 10 wherein auxiliary brake means attached to the stationary track members are oriented so as to operationally engage the moveable track members for slowing the sliding movement of the door during closing.

35           13.    A cabinet according to claim 12 wherein the length of each of said ball bearing carrying carriages is significantly greater than the length of its associated inner stationary track member.

              14.    The cabinet according to claim 13 wherein the inner stationary track members are shorter in length than either of their interconnected ball bearing carrying carriages or movable track members.



1           15. A cabinet according to claim 14 wherein the movable track members extend for substantially the full height of said door.

5           16. A cabinet according to claim 15 wherein means are associated with each of side walls to facilitate the mounting of said cabinet to a support wall.

10           17. An enclosure having a door which is slidably and rotatably retractable from a closed to an open position at the top of the enclosure comprising:

                  at least one ball bearing slide mechanism attached to the interior side of the door;

                  a hinge member interconnecting the enclosure and the slide mechanism located adjacent the top of the enclosure; and

15                   a motion dampening mechanism extending between the slide mechanism and the top portion of the enclosure whereby the closing movement of the door is substantially slowed by the dampening mechanism as it hinges and slides downwardly and inwardly toward the enclosure.

20           18. An enclosure according to claim 17 wherein the hinge member includes a hinge, a first plate connected to the hinge and attached to the enclosure adjacent the top thereof and a second plate connected to the hinge and attached to a stationary member on the slide mechanism.

25           19. An enclosure according to claim 18 wherein the dampening mechanism is attached to the first plate at one end and the second plate at its opposite end.

30           20. An enclosure according to claim 17 wherein the dampening mechanism is attached to the enclosure adjacent the top front thereof at one end and the stationary member on the slide mechanism at its opposite end.

35           21. An enclosure according to claim 20 wherein the dampening mechanism is a fluid containing cylinder.

                  22. An enclosure according to claim 21 wherein the dampening mechanism is a fluid containing piston and cylinder apparatus.

                  23. An enclosure according to claim 21 wherein the dampening mechanism is a non-cavitating damper cylinder.

1 [received by the International Bureau on 21 January 1997 (21.01.97);  
original claims 1-23 cancelled; new claims 24-43 added; (3 pages)]

24. A braking mechanism for a cabinet which has a top and a door which opens and  
closes from the top of the cabinet, the door having an interior side facing the cabinet comprising:  
5 a hinge mechanism extending between the top of the cabinet and the door, the hinge  
mechanism comprising a hinge, a cabinet plate on one side of the hinge and a door plate on the  
opposite side of the hinge;

a slide mechanism attached to the underside of the door, the slide mechanism  
having a stationary member and a moving member; and

10 brake means mounted on the stationary member for slowing linear movement of  
the moving member relative to the stationary member as the door is moved from an open to a  
closed position on the cabinet.

25. A braking mechanism according to claim 24 wherein the brake means is at least one  
15 brake pad mounted on the stationary member which frictionally engages the moving member  
during closing motion of the door.

26. A braking mechanism according to claim 25 where a brake pad is mounted on the  
stationary member at each side thereof for engaging each side of the moving member.

27. A braking mechanism according to claim 24 further comprising a dampening  
mechanism attached at one end to the top of the cabinet and at the opposite end to the stationary  
member, the dampening mechanism being between the slide mechanism and the top of the  
cabinet and being oriented so as to slow the movement of the door as it is moved from an open  
25 to a closed position on the cabinet.

28. A braking mechanism for a cabinet which has a top and a door which opens and  
closes from the top of the cabinet, the door having an interior side facing the cabinet comprising:  
30 a hinge mechanism extending between the top of the cabinet and the door, the hinge  
mechanism comprising a hinge, a cabinet plate on one side of the hinge and a door plate on the  
opposite side of the hinge;

a slide mechanism attached to the underside of the door, the slide mechanism  
having a stationary member and a moving member; and

35 a brake plate mounted on the stationary member for operative braking engagement  
with the moving member during the closing motion of the door.

29. A cabinet including side walls, a bottom wall and a top wall defining a front  
opening:

1 a door normally closing off said front opening defined by said side walls, said  
bottom wall and said top wall;

at least one hinge member secured to said top wall, said hinge member including  
a hinge, a plate secured to said top wall on one side of said hinge and an inner stationary track  
5 member on the other side of said hinge;

at least one outer movable track member secured to the back side of said door  
collinearly with said stationary track member on said hinge member;

a movable ball bearing carrying carriage interconnecting said inner stationary track  
member with its adjacent movable track member on said door, said door thereby being slidably  
10 movable from a position closing off said front opening to a position overlying said top wall; and

at least one brake pad mounted on the stationary member which frictionally engages  
the moving member as the door is moved from an open to a closed position on the cabinet.

30. The cabinet of claim 29 further comprising a dampening unit interconnecting the  
15 hinge member and the stationary track member to slow the movement of the door during closing,  
the dampening mechanism extending between the stationary track member and hinge member.

31. A cabinet according to claim 30 including a spaced apart pair of hinge members,  
a pair of outer movable track members secured to said door and positioned collinearly with inner  
20 stationary track members on said hinge members, a pair of ball bearing carriages interconnecting  
each of said inner members with its adjacent moveable track member, and a pair of fluid  
containing damper units interconnecting their respective hinge members and stationary track  
members.

32. A cabinet according to claim 30 wherein the dampening unit is a fluid containing  
25 cylinder.

33. A cabinet according to claim 31 wherein the length of each said ball bearing  
30 carrying carriages is significantly greater than the length of its associated inner stationary track  
member.

34. The cabinet according to claim 33 wherein the inner stationary track members are  
shorter in length than either of their interconnected ball bearing carrying carriages or movable  
35 track members.

35. A cabinet according to claim 34 wherein the movable track members extend for  
substantially the full height of said door.

1           36. A cabinet according to claim 35 wherein means are associated with each of side  
walls to facilitate the mounting of said cabinet to a support wall.

5           37. An enclosure having a door which is slidably and rotatably retractable from a closed  
to an open position at the top of the enclosure comprising:

at least one ball bearing slide mechanism attached to the interior side of the door,  
the at least one ball bearing slide mechanism having a stationary member and a moving member;  
a hinge member interconnecting the enclosure and the slide mechanism located  
adjacent the top of the enclosure;

10           a motion dampening mechanism extending between the slide mechanism and the  
top portion of the cabinet whereby the closing movement of the door is substantially slowed by  
the dampening mechanism as it hinges and slides downwardly and inwardly toward the  
enclosure; and

15           brake means mounted on the stationary member for slowing linear movement of  
the moving member relative to the stationary member as the door is moved from an open to a  
closed position on the cabinet.

20           38. An enclosure according to claim 37 wherein the hinge member includes a hinge,  
a first plate connected to the hinge and attached to the enclosure adjacent the top thereof and a  
second plate connected to the hinge and attached to the stationary member on the slide  
mechanism.

25           39. An enclosure according to claim 38 wherein the dampening mechanism is attached  
to the first plate at one end and the second plate at its opposite end.

40. An enclosure according to claim 37 wherein the dampening mechanism is attached  
to the enclosure adjacent the top front thereof at one end and the stationary member on the slide  
mechanism at its opposite end.

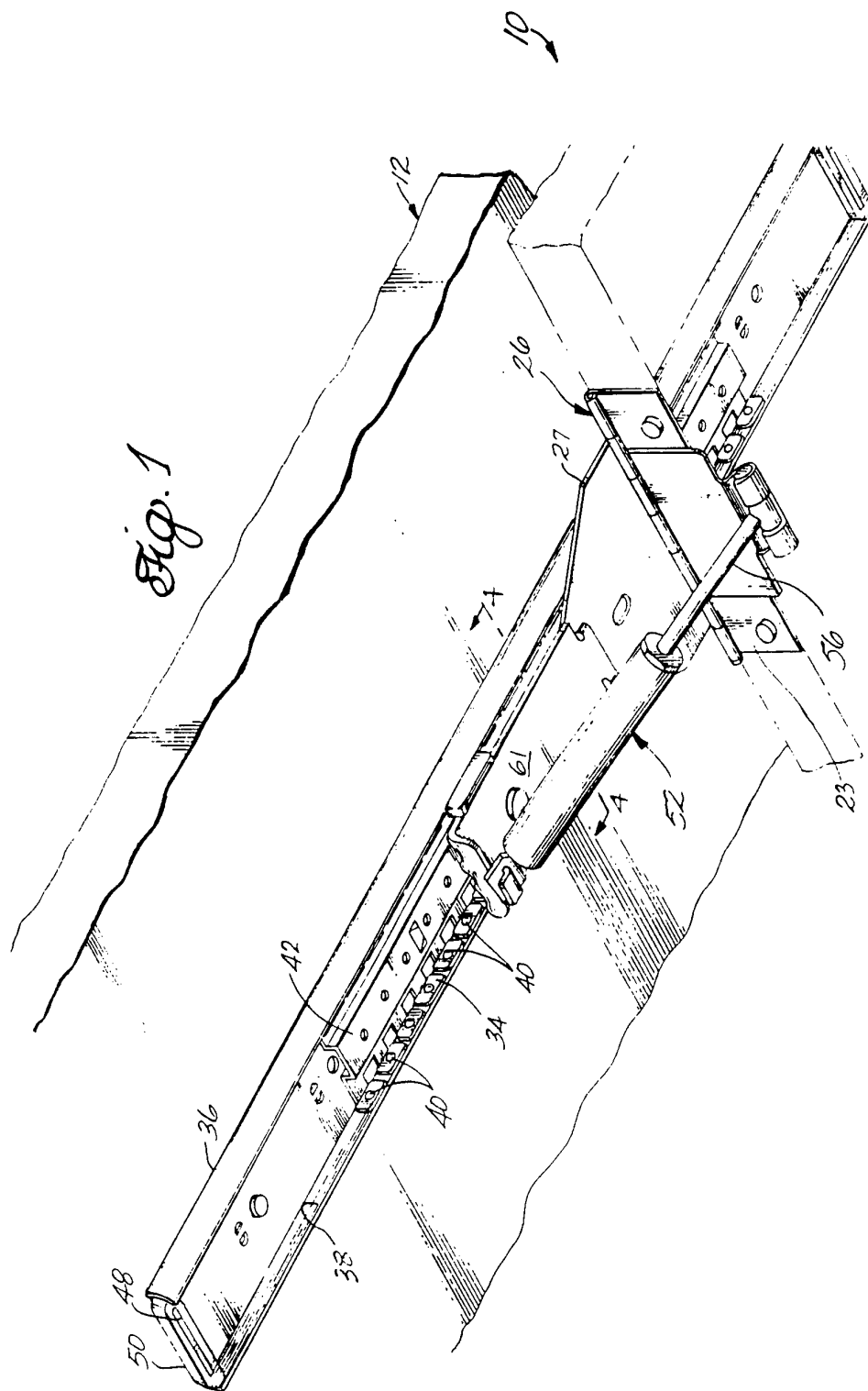
30           41. An enclosure according to claim 40 wherein the dampening mechanism is a fluid  
containing cylinder.

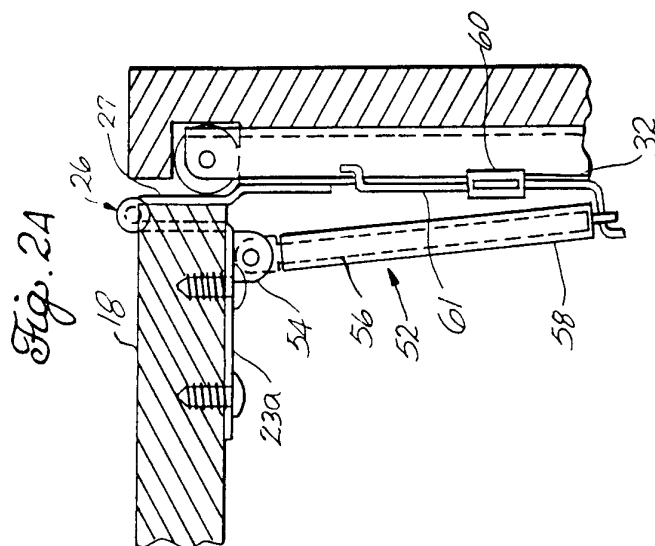
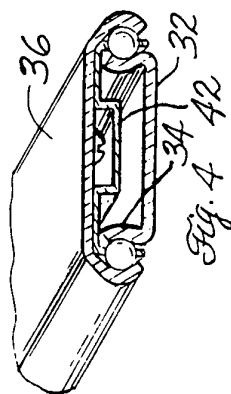
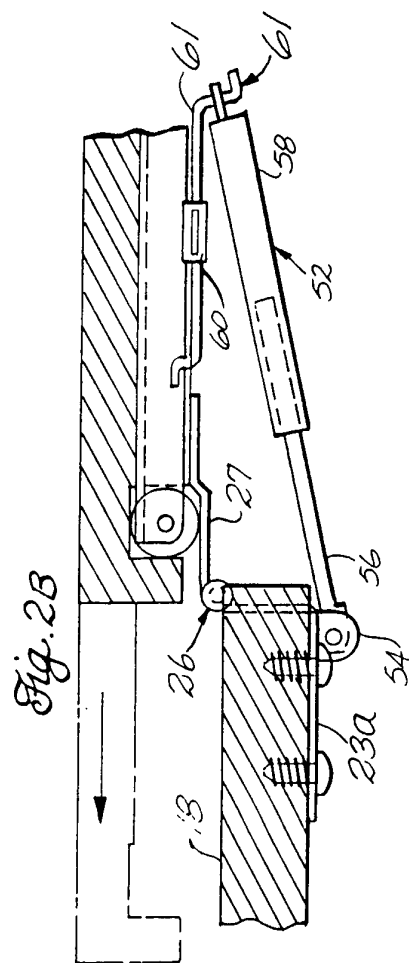
35           42. An enclosure according to claim 41 wherein the dampening mechanism is a fluid  
containing piston and cylinder apparatus.

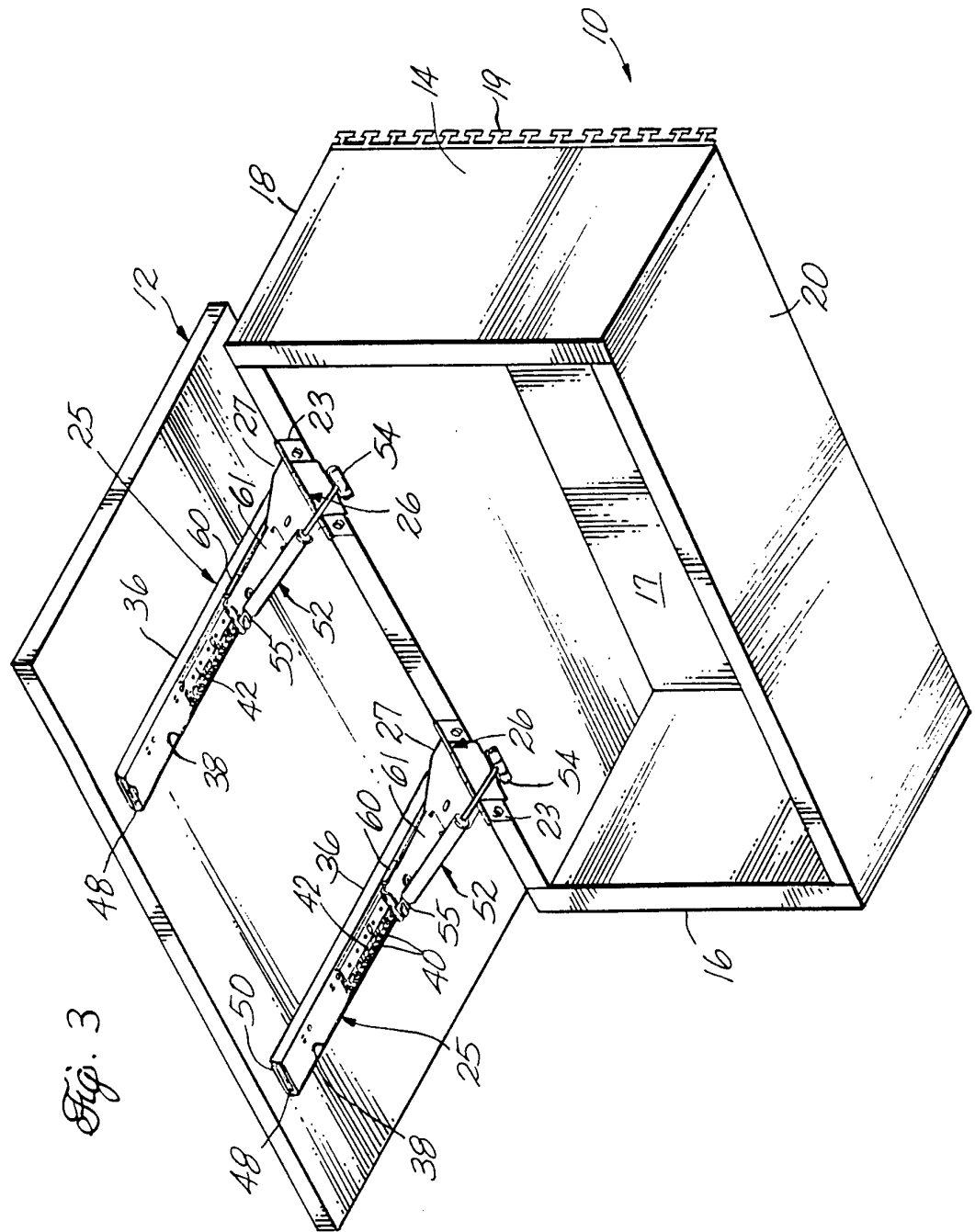
43. An enclosure according to claim 41 wherein the dampening mechanism is a  
non-cavitating damper cylinder.

**STATEMENT UNDER ARTICLE 19**

The present amendment brings this international application into conformance with the continuation application of the priority application, U.S. Application Serial No. 08/520,952. The amendment is fully supported by the specification as originally filed.









# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US96/13662

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : A47B 67/02; A47F 3/00

US CL : 312/323, 328, 329; 49/254, 386; 16/84

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 312/323, 328, 329; 49/254, 386; 16/84; 312/322, 326, 327; 16/319, 362, 364; 49/197

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US RE28,994 E (AYLWORTH) 05 OCTOBER 1976 (10/05/76), column 2, lines 55-68, and column 3, lines 1-30.	17-18
Y	US 4,620,743 A (EKE) 04 NOVEMBER 1986 (11/04/86), see entire document, especially column 2, lines 48-51.	17-18
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☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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