

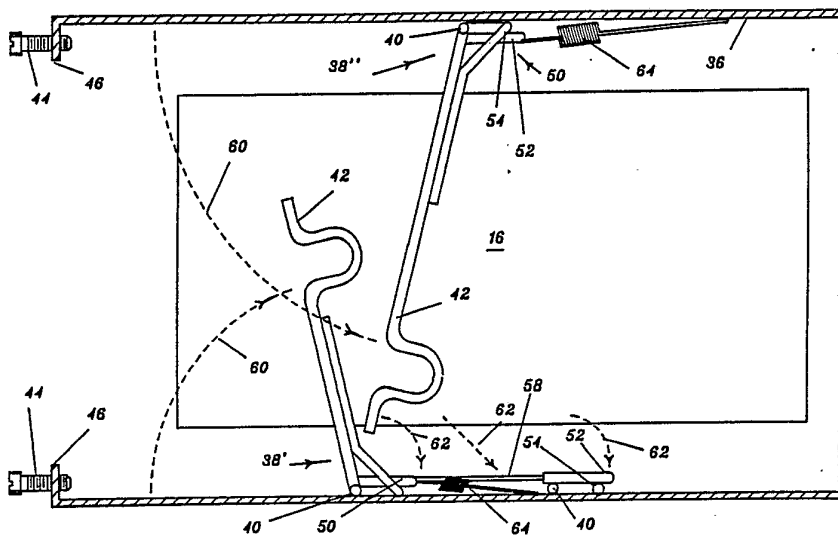


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: SHOCK AND VIBRATION ISOLATION LOCKING SYSTEM**(57) Abstract**

In a shock and vibration isolation system wherein a device (16) having a top, bottom, sides, front and back is mounted on moving isolators (34) between and in spaced relationship to top and bottom members, front operable locking apparatus for releasably holding the device in place against vertical, lateral and longitudinal movement during shipping. A top releasable locking assembly is disposed between the top member and the device and a bottom releasable locking assembly is disposed between the bottom member and the device. Each releasable locking assembly includes a first pivot bar (40) pivotally mounted to the adjacent member and extending perpendicular to and between the sides of the device. An operating arm (42) is attached to one end of the first pivot bar at right angles thereto and disposed so as to pivot in a plane close adjacent and parallel to the side of the device at the end between a first position lying along the adjacent member and a second position angularly disposed with respect to the adjacent member. A threaded bolt (44) is carried by the adjacent member at the front of the device for releasably holding the operating arm in the first position. A first locking assembly is carried by the first pivot bar and includes locking projections (52) having horizontal stabilizing bars for entering into locking relationship with the device to hold it from movement when the operating arm is in the first position and for moving out of locking relationship with the device to allow normal movement thereof when the operating arm is moved to the second position. Finally, a bias spring (64) is operably connected to urge the operating arm (42) towards the second position whereby when the locking apparatus is released following shipment the device will be unlocked for normal movement.



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SHOCK AND VIBRATION ISOLATION LOCKING SYSTEM

The present invention relates to shock and vibration isolation systems and, more particularly to a shock and vibration isolation system for locking a device such as a computer disk drive or the like in place against vertical, lateral and longitudinal movement during shipping.

Larger, commercial sized computers, such as that indicated as 10 in Figure 1, typically include a mass storage device 12, such as a disk drive, therein. If the device 12 is hard mounted to the chassis of the computer 10, shocks and vibrations which enter the computer 10 pass directly into the device 12. In an effort to protect the storage device 12, shock and vibration isolation mounting, such as that indicated as 14, may be employed. Such isolation systems are used in a variety of things well known in the art from record turntables to washing machines. Also well known in the art is that where an isolation system is used, typically some sort of bracing must be employed to prevent movement during shipment. As indicated by the simplified drawing of Figure 2, the isolation system usually allows movement of the protected and isolated device 16 in three directions - vertical, as indicated by the arrow 18; lateral (i.e. side to side), as indicated by the arrow 20; and longitudinal (i.e. front to back), as indicated by the arrow 22. In a device as simple as a record turntable, the shipping bracing may simply comprise a wad of cardboard jammed between moving parts which is removed before use. Several so-called "CD" or compact disk players have an externally accessible locking cam for shipping which can be set or released with a screwdriver without having to open the case. Many "hard drives" as employed with personal

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computers have a software activated "park" position wherein the moving heads are withdrawn into a safe position for shipment.

Larger and heavier devices usually employ more specialized and heavy duty shipping blocks. Several prior art approaches are shown in Figure 3 and include foam shipping blocks 24, special shipping braces 25 bolted between the device 16 and the surrounding cabinet 26, shipping bars 28 passing through holes provided therefore in the device 16 and cabinet 26, and wedges 30.

In our co-pending U.S. Application Serial No. 29,328 filed March 23, 1987, entitled SHOCK AND VIBRATION ISOLATION MOUNTING, now United States Patent No. 4,705,257, issued November 10, 1987, which is assigned to the common assignee of this application, we described novel apparatus for shock and vibration isolation of computer disk drives, and the like, which allows insertion and removal of the disk drive with access through the computer cabinet from only one side. The apparatus, as shown in simplified form in Figures 4 and 5, suspends the disk drives 32 between upper and lower elastomeric isolators 34 which are in tension and compression, respectively. As can be appreciated from a consideration of the prior art shipping block options of Figure 3 in combination with the movements possible as shown in Figure 2, it is impossible to insert and remove any of the prior art apparatus of Figure 3 to stop movement in all three axes shown in Figure 2 with access from only one side. Additionally, virtually all of the prior art shipping block systems employ parts which must be removed and stored in the event of later re-shipment. Usually, when unexpected re-shipment is required, the shipping materials have been discarded or are stored in a "safe" place, which nobody remembers.

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The present invention provides a shock and vibration isolation system wherein a device having a top, bottom, sides, front and back is mounted on moving isolators between and in spaced relationship to top and bottom members, by a front operable locking apparatus for releasably holding the device in place against vertical, lateral and longitudinal movement during shipping, and comprising, a top releasable locking assembly disposed between the top member and the device and a bottom releasable locking assembly disposed between the bottom member and the device. Each releasable locking assembly includes a first pivot bar pivotally mounted to the adjacent member and extending perpendicular to and between the sides of the device. An operating arm is attached to one end of the first pivot bar at right angles thereto and disposed so as to pivot in a plane close adjacent and parallel to the side of the device at the end between a first position lying along the adjacent member and a second position angularly disposed with respect to the adjacent member. A threaded bolt is carried by the adjacent member at the front of the device for releasably holding the operating arm in the first position. First locking means are carried by the first pivot bar and include locking projections having stabilizing bars thereon for entering into locking relationship with the device to hold it from movement when the operating arm is in the first position and for moving out of locking relationship with the device to allow normal movement thereof when the operating arm is moved to the second position. Finally, spring bias means are operably connected to urge the operating arm towards the second position whereby when the releasable holding means is released following shipment, the device will be unlocked for normal movement.

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In the preferred embodiment, the locking apparatus additionally comprises the bottom releasable locking assembly including a second pivot bar pivotally mounted to the adjacent member spaced from the first pivot bar and extending perpendicular to and between the sides of the device; second locking means carried by the second pivot bar and including locking projections having stabilizing bars thereon for entering into locking relationship with the device to hold it from movement when the operating arm is in the first position and for moving out of locking relationship with the device to allow normal movement thereof when the operating arm is moved to the second position; and, connecting means operably interconnecting the first and second locking means whereby to have them move in combination.

Figure 1 is a simplified perspective drawing of a computer having a mass storage device mounted therein on isolation mountings.

Figure 2 is a simplified drawing showing the various movements possible with an isolation mounting system which must be blocked during shipment.

Figure 3 is a simplified front view showing various prior art techniques for blocking or preventing movement of an isolation-mounted device during shipment.

Figure 4 is a simplified side view of a shock and vibration isolation mounting system according to our copending application showing the manner of operation of the present invention in conjunction therewith.

Figure 5 is a simplified front view of the shock and vibration isolation mounting system of Figure 5 showing the manner of operation of the present invention in conjunction therewith.

Figure 6 is a front view of the operating portion of the present invention.

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Figure 7 is a front view of the auxiliary operating portion of the present invention showing the manner in which the locking of the device during shipment is affected thereby.

5 Figure 8 is a side view of the apparatus of Figure 6.

Figure 9 is a side view of the connecting link used to operably connect the operating portions of Figure 7 and 8 to affect combined operation thereof.

10 Figure 10 is a detailed side view of the present invention in its locked for shipment position.

Figure 11 is a detailed side view of the present invention in its unlocked for normal use position.

15 The present invention is shown in simplified form in Figures 4 and 5. As previously mentioned in our co-pending shock and vibration isolation system, a device 16 having a top, bottom, sides, front and back is mounted between top and bottom elastomeric isolators 34 disposed between the device 16 and an adjacent computer chassis member 36. Front operable locking apparatus according to the present invention, generally indicated as 38, is used at the top and bottom for releasably holding the device 16 in place against vertical, lateral and longitudinal movement during shipping. Each of the locking apparatus includes a pivot bar 40 pivotally mounted to the adjacent member 36 and extending perpendicular to and between the sides of the device 16. Where two or more devices 16 are mounted side by side as shown in Figure 5, a single locking apparatus 38 can be used for all the devices to lock them and unlock them simultaneously. In such case, the pivot bar 40 extends between the two outermost sides of the devices 16. In the preferred embodiment, an operating arm 42 is attached to each end of the pivot bar 40 at right angles thereto and disposed so as to pivot in a plane close adjacent and parallel to the side of the device 16 at

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the ends between a first position lying along the member 36, as shown in solid Figure 4 and 5, and a second position angularly disposed with respect to the member 36, as shown ghosted therein. A bolt 44 threaded through a tab 46 adjacent the front of the device 16 is used to releasably hold the operating arm 42 in the first position. Locking means (not yet shown but to be described in detail shortly) are carried by the pivot bar 40 and include locking projections having horizontal stabilizing bars. The projections and stabilizing bars are urged into locking relationship with the device 16 to hold it from movement when the operating arm 42 is in the first position. The locking projections are moved out of locking relationship with the device 16 to allow normal movement thereof when the operating arm 42 is moved to the second position as indicated by the arrows 48 in Figures 4 and 5. Spring bias means (not shown) are operably connected to urge the operating arm 42 towards the second position whereby when the locking apparatus 38 is released following shipment by unscrewing the bolts 44, the device 16 is automatically unlocked for normal movement. The above-described apparatus, of course, stays safely out of the way in the second position where it is instantly and readily available for use in locking the device 16 for shipment or movement if needed. To relock the device 16, the operating arms 42 are simply moved to the first position and held in place by screwing the threaded bolts 44 into engagement therewith. The apparatus of the present invention will now be described in more detail.

While those skilled in the art will recognize that the components of the present invention could be constructed of different materials to obtain the same results and benefits, the Applicants herein found that adequate operation coupled with ease of manufacture,

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lightweight, and non-restriction of airflow was obtained through the use of formed wire for most of the apparatus to be described. Assembly thereof was easily accomplished with standard techniques such as spot welding after bending of the wire into the desired shape on a jig made for the purpose. Preferred operation was obtained through the use of a bottom assembly having two points of locking contact disposed in front and behind one another and a top assembly having one point of locking contact between the two of the bottom assembly. This is best seen with initial reference to Figure 10 wherein the bottom locking apparatus is generally indicated as 38' and the top locking apparatus is generally indicated at 38".

15 The bottom locking apparatus 38' employs a composite operating bar 50, as shown in Figures 6 and 8, which includes the pivot bar 40, the operating arm 42 and the locking projections 52 attached thereto. The locking projections 52 also have stabilizing bars 54

20 horizontally attached thereto. Additionally, there is an auxiliary operating bar 50', as shown in Figure 7 which is also a composite bar including the components described above for the bar 50 but eliminating the operating arm 42. The pivot bars 40 are pivotally

25 attached to the adjacent chassis member 36 by any of several ways well known in the art which form no part of the present invention such as curved clips 56, or the like, as shown in Figure 10. In the bottom locking apparatus 38', a pair of the locking projections 52 on

30 respective ones of the bars 50, 50' are operably interconnected with a connecting link 58 of strap metal, or the like, as shown in Figure 9 so as to move in combination between the first (i.e. locked) position of Figure 10 and the second (i.e. unlocked position of

35 Figure 11).

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The top locking apparatus 38" employs only the composite operating bar 50 described above and shown in Figures 6 and 8, which includes the pivot bar 40, the operating arm 42 and the locking projections 52. To hold the operating arms 42 in the first position, the adjacent chassis member 36 has a tab 46 formed therein through which the threaded bolt 44 is screwed. As shown in Figure 10, when the bolt 44 is screwed all the way into the tab 46 with the operating arm 42 in the first position, the operating arm 42 is firmly wedged and held between the bolt 44 and the adjacent member 36. When the bolts 44 are unscrewed to the retracted position of Figure 11, the operating arms 42 swing to the second position as indicated by the dotted arrows 60 causing the locking projections 52 to swing out of locking engagement as indicated by the dotted arrows 62.

To affect automatic unlocking and to hold the locking apparatus 38', 38" in its unlocked position during non-use, a coil spring 64 is connected between one of the locking projections 52 and the adjacent chassis member 36 as shown in Figures 10 and 11. Spring 64 is a bias spring which urges the apparatus 38', 38" in each case, towards its unlocked position.

To obtain the desired locking in the various directions, the locking projections 52 and horizontal stabilizing bars 54 are formed to interface with channels or other projections of the device 16 or its isolation mounting system, shown ghosted as 66, as indicated in Figures 7 and 11. Vertical movement is prevented by the opposed wedging forces of the locking apparatus 38', 38". Lateral and longitudinal movement is prevented by frictional bearing of the locking projections 52 against the device 16 or mounting system 66 and/or the bearing of the locking projections 52 against some outward facing projection such as the sides

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of the channel as in Figure 7. In the preferred embodiment as incorporated into commercial computers as manufactured by the assignee of the present application the stabilizing bars 54 fit into slots, such as at 68 in Figure 11, in the mounting system of the disk drive, thus providing secure resistance to any and all lateral and longitudinal movements. As will be appreciated by those skilled in the art, while designed primarily for use in conjunction with the isolation mounting system of our above-referenced co-pending application, the locking apparatus of the present invention could also be employed with other isolation mounting systems as employed in other devices.

Thus, from the foregoing description it can be seen that the present invention has truly met its stated objects by providing a locking system for a shock and vibration isolation mounting system which is lightweight, efficient, self-storing and operable with access from only one side.

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CLAIMS

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1. In an assembly including a device and a shock and vibration isolation system therefor wherein the device (16) has a top, bottom, sides, front and back and is mounted on isolators (34) in spaced relationship to a support therefor (36) and locking apparatus is provided for releasably holding the device in place against vertical, lateral and longitudinal movement during shipping, and comprising:

(a) a first pivot bar (40) pivotally mounted to the support (36) and extending perpendicular to and between the sides of the device;

(b) an operating arm (42) carried by one end of said first pivot bar (40) at right angles thereto and disposed so as to pivot in a plane close adjacent and parallel to the side of the device at said end between a first position lying along the member and a second position angularly disposed with respect to said member;

(c) means (44) carried by the support adjacent the front of the device and accessible therefrom for releasably holding said operating arm (42) in said first position;

(d) first locking means carried by said first pivot bar (40) and including locking projections (52) for urging said locking projections into locking relationship with the device to hold it from movement when said operating arm is in said first position and for moving said locking projections out of locking relationship with the device to allow normal movement thereof when said operating arm is moved to said second position; and,

(e) spring bias means (64) operably connected to urge said operating arm (42) towards said second position whereby when said releasable holding means is released following shipment the device will be unlocked for normal movement.

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2. The assembly of claim 1 wherein:
said locking projections (52) include
horizontal stabilizing bars (54) for engaging mating
slots provided in the device therefor.

5 3. The assembly of claim 1 or 2 and additionally
comprising:

a second operating arm (50') carried by the
other end of said first pivot bar at right angles
thereto and disposed so as to pivot in a plane close
10 adjacent and parallel to the side of the device at said
other end between a first position lying along the
member and a second position angularly disposed with
respect to said member.

4. The assembly of any of claims 1 to 3 wherein:
15 said means for releasably holding said
operating arm in said first position comprises a bolt
(44) threadably inserted into a tab (46) carried by the
support and positioned such that with said operating arm
disposed against the support and said bolt threaded into
20 said tab said operating arm is trapped between the
support and said bolt.

5. The assembly of any of claims 1 to 4 and
additionally comprising:

(a) a second pivot bar (40) pivotally mounted
25 to the support spaced from said first pivot bar and
extending perpendicular to and between the sides of the
device;

(b) second locking means carried by said
second pivot bar and including locking projections (52)
30 for urging said locking projections (52) into locking
relationship with the device to hold it from movement
when said operating arm is in said first position and
for moving said locking projections out of locking
relationship with the device to allow normal movement
35 thereof when said operating arm is moved to said second
position; and

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(c) connecting means (58) operably interconnecting said first and second locking means whereby to have them move in combination.

6. The assembly of claim 5 wherein:

5 said locking projections (52) of said second locking means include horizontal stabilizing bars (54) for engaging mating slots provided in the device therefor.

10 7. The assembly of any of claims 1 to 6 wherein said device is mounted between upper and lower supports, and comprising:

 (a) a first pivot bar (40) pivotally mounted to the upper support and extending perpendicular to and between the sides of the device;

15 (b) a first operating arm (42) carried by one end of said first pivot bar (40) at right angles thereto and disposed so as to pivot in a plane close adjacent and parallel to the side of the device at said end between a first position lying along the upper support
20 and a second position angularly disposed with respect to said upper support;

 (c) first means (44) carried by the upper support adjacent the front of the device and accessible therefrom for releasably holding said first operating
25 arm (42) in said first position;

 (d) first locking means carried by said first pivot bar (40) and including locking projections (52) for urging said locking projections into locking relationship with the device to hold it from movement
30 when said first operating arm is in said first position and for moving said locking projections out of locking relationship with the device to allow normal movement thereof when said first operating arm is moved to said second position;

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(e) first spring bias means (64) operably connected to urge said first operating arm (42) towards said second position;

5 (f) a second pivot bar (40) pivotally mounted to the lower support and extending perpendicular to and between the sides of the device;

(g) a second operating arm (42) carried by one end of said second pivot bar (40) at right angles thereto and disposed so as to pivot in a plane close
10 adjacent and parallel to the side of the device at said end between a first position lying along the lower support and a second position angularly disposed with respect to said lower support;

(h) second means (44) carried by the lower
15 support adjacent the front of the device and accessible therefrom for releasably holding said second operating arm (42) in said first position;

(i) second locking means carried by said second pivot bar (40) and including locking projections
20 (52) for urging said locking projections into locking relationship with the device to hold it from movement when said second operating arm is in said first position and for moving said locking projections out of locking relationship with the device to allow normal movement
25 thereof when said second operating arm is moved to said second position; and

(j) second spring bias (64) means operably connected to urge said second operating arm (42) towards said second position.

30 8. The assembly of claim 7, and additionally comprising:

(a) a third pivot bar (40) pivotally mounted to the lower support spaced from said second pivot bar and extending perpendicular to and between the sides of
35 the device;

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(b) third locking means carried by said third pivot bar and including locking projections (52) for urging said locking projections into locking relationship with the device to hold it from movement when said second operating arm is in said first position and for moving said locking projections out of locking relationship with the device to allow normal movement thereof when said second operating arm is moved to said second position; and,

(c) connecting means (58) operably interconnecting said second and third locking means whereby to have them move in combination.

9. The assembly of claim 8 wherein:

said first, second and third locking projections each include horizontal stabilizing bars for engaging mating slots provided in the device therefor.

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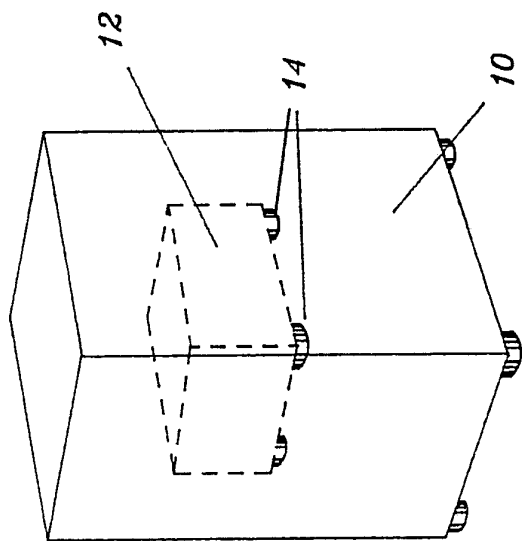
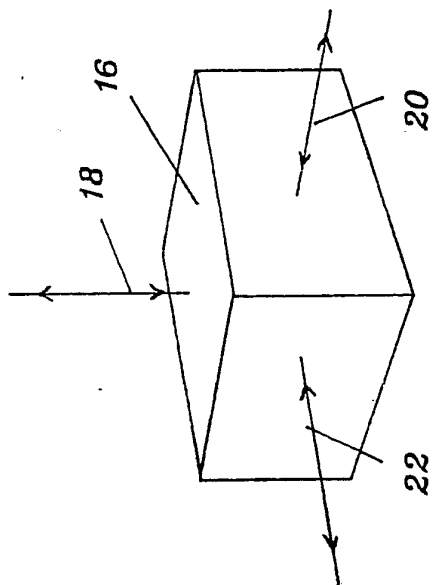
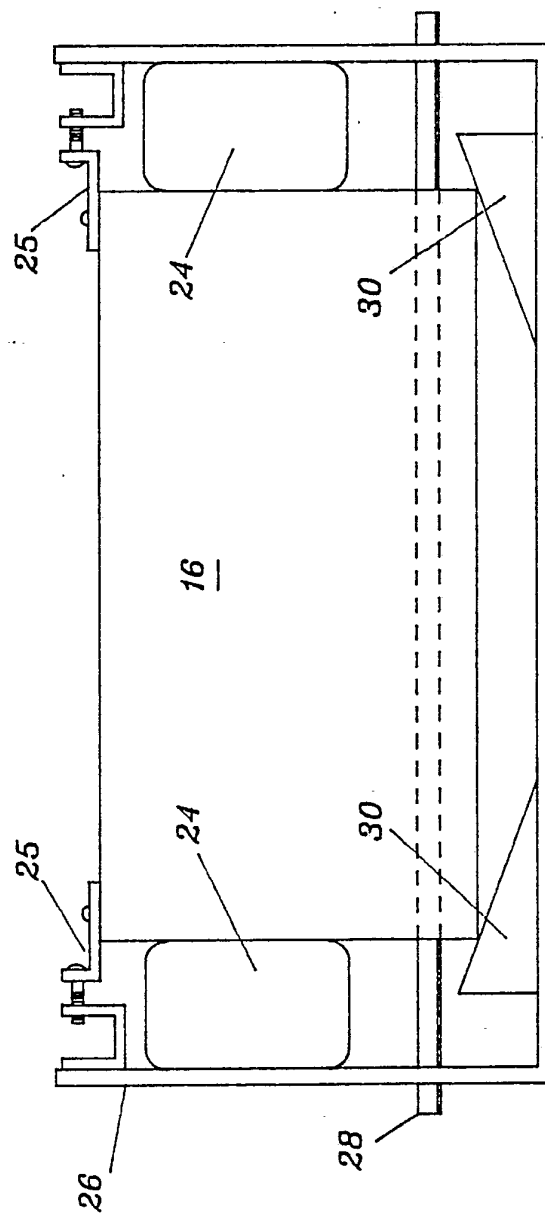


Fig. 1



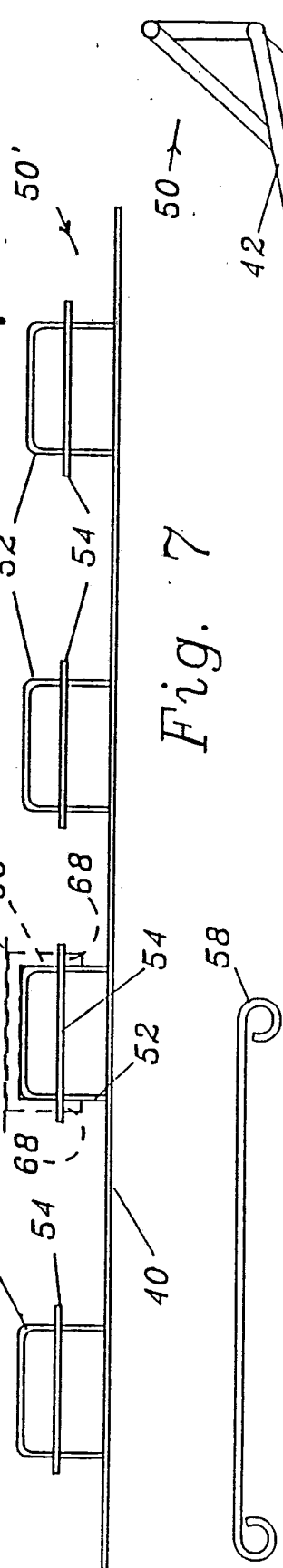
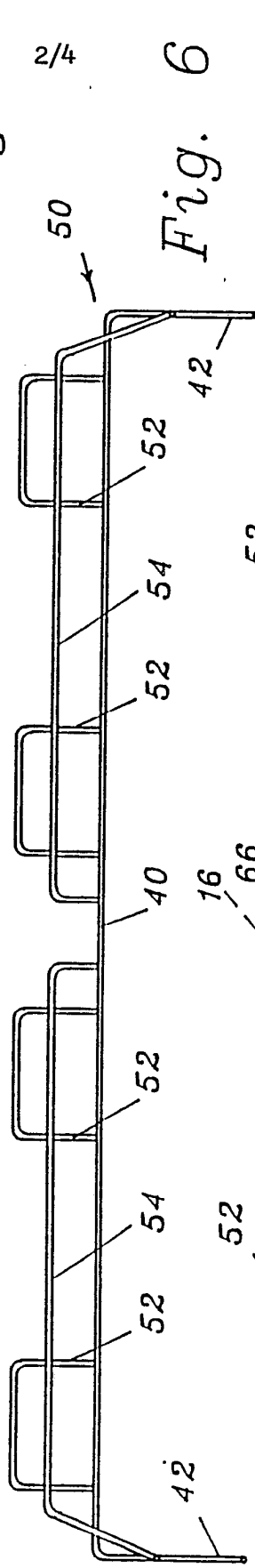
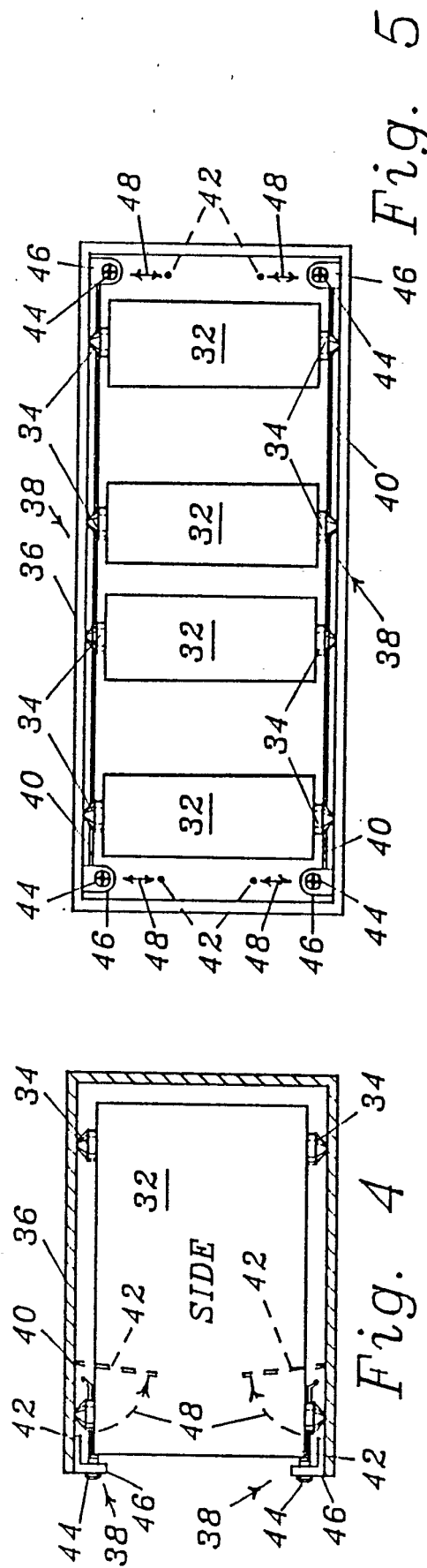
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Fig. 2



PRIOR ART

Fig. 3



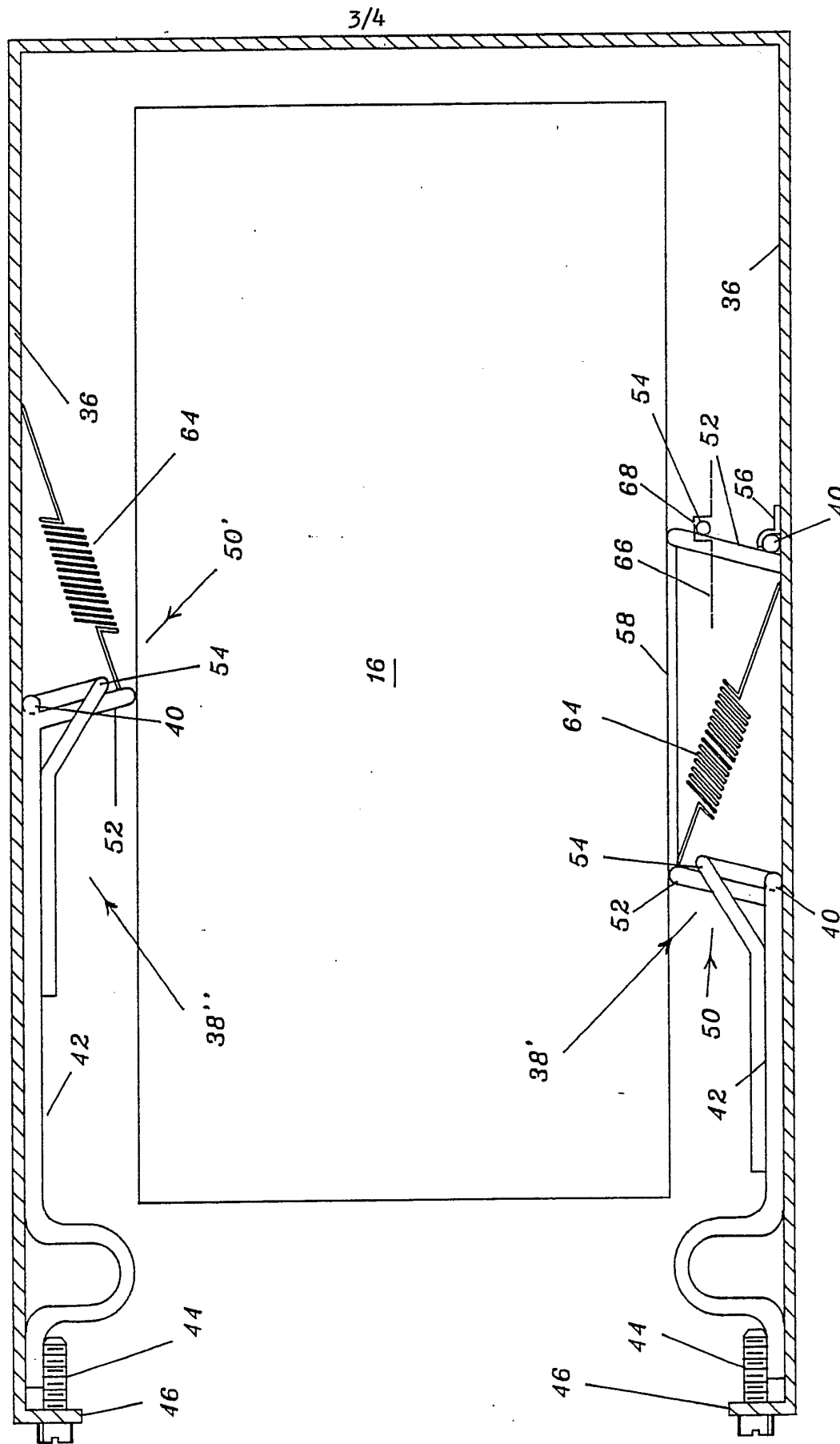
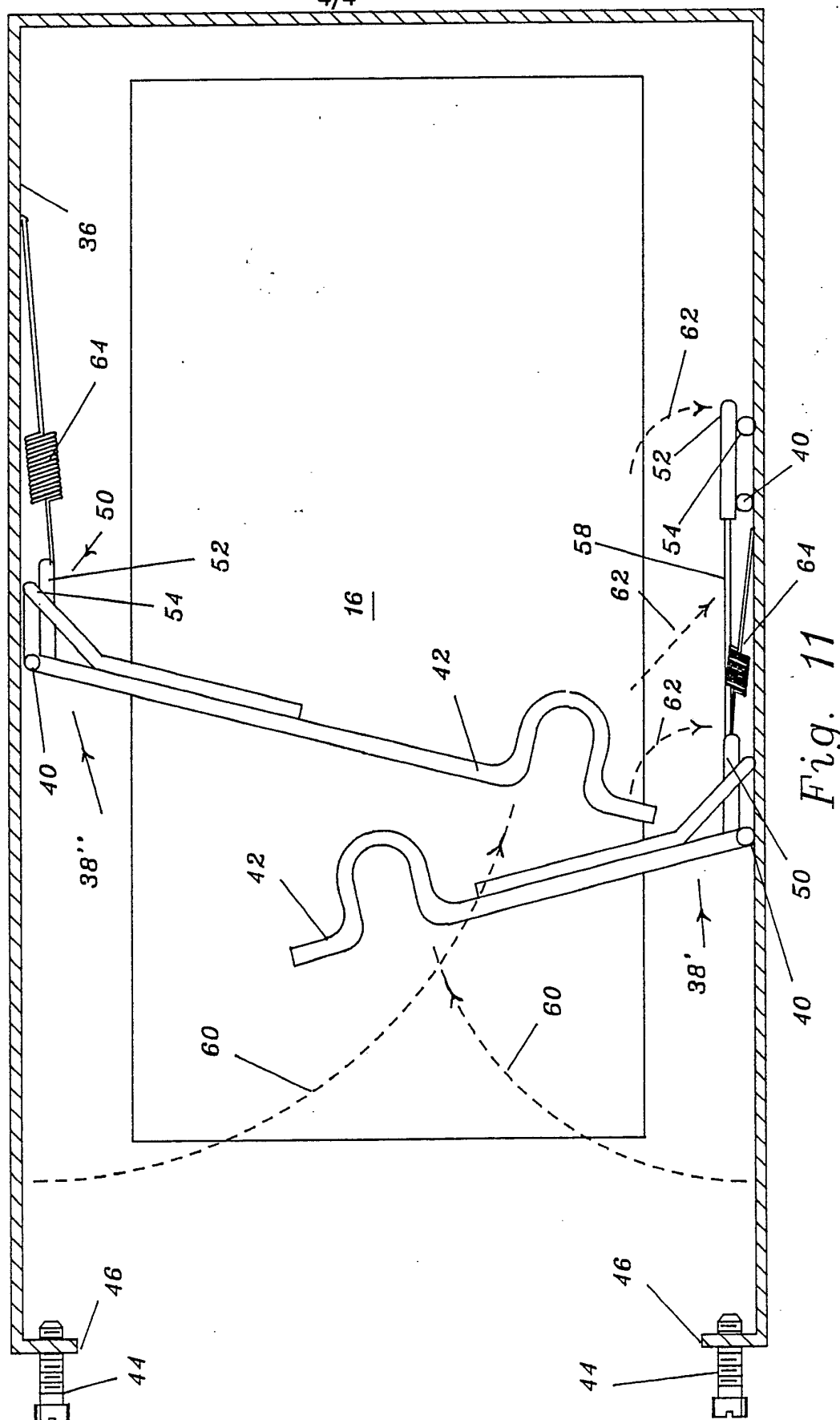


Fig. 10



INTERNATIONAL SEARCH REPORT

International Application No PCT/US 88/00713

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ⁴ : G 11 B 33/02; G 11 B 33/08		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC ⁴	G 11 B; F 16 F; F 16 C	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	BE, A, 571814 (M. STAAR) 6 April 1962 see page 2, line 20 - page 3, line 49; figures	1
A	BE, A, 545216 (PERPETUUM-EBNER FABRIK FÜR FEINMECHANIK UND ELEKTROTECHNIK STEIDINGER & CO.) 9 October 1959 see pages 4,5; figures	1
A	EP, A, 0206831 (PIONEER ELECTRONIC CO.) 30 December 1986 see pages 11,21-23; figures	1
A	EP, A, 0148553 (SONY CO.) 17 July 1985 see page 7, line 7 - page 13; figures	1

* Special categories of cited documents: ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
1st June 1988	04 JUL 1988	
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

US 8800713

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
BE-A- 571814		None	
BE-A- 545216		None	
EP-A- 0206831	30-12-86	JP-A- 61256312	13-11-86
EP-A- 0148553	17-07-85	AU-A- 3139384	18-07-85
		JP-A- 60147964	05-08-85