



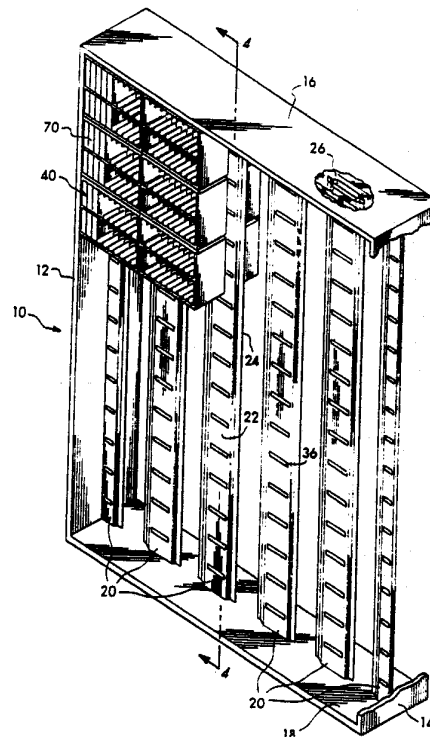
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<p>(21) International Application Number: PCT/US92/02725 (22) International Filing Date: 3 April 1992 (03.04.92) (30) Priority data: 679,796 3 April 1991 (03.04.91) US (71) Applicant: ENGINEERED DATA PRODUCTS INCORPORATED [US/US]; 2550 West Midway Boulevard, Broomfield, CO 80020 (US). (72) Inventors: PRICE, Macy, J., Jr. ; 113 West Elm Street, Louisville, CO 80027 (US). BALL, Laurance, G. ; 8601 Zuni Street, Denver, CO 80223 (US). WILDHABER, Andrew, W. ; 4210 East 100th Avenue, Thornton, CO 80229 (US).</p>		<p>(74) Agent: WEBB, Glenn, L.; Dorr, Carson, Sloan & Peterson, 3010 East Sixth Avenue, Denver, CO 80206 (US). (81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), MC (European patent), NL (European patent), SE (European patent). Published <i>With international search report.</i></p>

(54) Title: HIGH-DENSITY STORAGE RACK SYSTEM FOR MAGNETIC DATA STORAGE TAPE CARTRIDGES

(57) Abstract

A high-density storage system including an upstanding rack (10) having a plurality of vertical support members (20). Vertically aligned apertures (36) are formed in each support member and on both sides of the support members. An elongated dimple (38) is formed adjacent each of the apertures. The cartridges are stored in cartridge storage packs (40) which are designed to be mounted onto the rack. The cartridge storage packs include resilient suspension hooks (64) formed on the rear surface of each cartridge storage pack. The suspension hooks (64) are inserted into the apertures to support the cartridge storage packs on the rack. The suspension hooks include a resilient arm (66) which biases against the elongated dimple (38) to prevent accidental dislodgement of the cartridge storage packs (40). The apertures (36) are arranged so that the cartridge storage packs (40) are mounted in close proximity with one another. This increases the density of the cartridge storage capacity of the system to allow more cartridges to be stored within existing space.



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**HIGH-DENSITY STORAGE RACK SYSTEM FOR MAGNETIC DATA
STORAGE TAPE CARTRIDGES**

BACKGROUND OF THE INVENTION

1. Field of the Invention: This invention relates to the field of storage systems for magnetic data storage tape cartridges.

2. Statement of the Problem: In large computer information systems, data is typically stored in tape libraries, particularly on 3480-style one-half inch tape cartridges. As the use and capability of computer systems increase, the tape libraries needed to support these systems expand as well. The need to efficiently accommodate the expansion of these tape libraries is of immediate concern to the users of computer information systems.

There are presently several tape cartridge storage systems in use. One previous system disclosed in U.S. Patent 4,600,107, issued to Price et al, is produced by the assignee of the present invention, Engineered Data Products, Inc., Broomfield, Colorado.

This system utilizes a rack having horizontal shelves to hold tape cartridge storage holders side by side on the shelves. Twenty cartridges are stored in each tape cartridge storage holders.

5 There is still increasing pressure to store even more cartridges in existing space. Therefore, a need exists for a high-density storage system for tape cartridge libraries.

10 3. Solution to the Problem: The present invention provides a high-density storage system for tape cartridge libraries to solve this problem and others.

 The present invention provides a storage system that is able to store at least thirty-three per cent more tape cartridges in substantially the same space
15 as existing systems.

 The present invention provides a storage system that eliminates dead space created by the shelves on existing systems and by eliminating dead space on the tape cartridge storage holders.

20 The present invention provides a storage system that allows ease of access to the tape cartridges and to the tape cartridge storage holders.

 The present invention provides a storage system that allows ease of securing and removal of the tape
25 cartridges and the tape cartridge storage holders.

 These and other features will become evident from the ensuing description of the invention taken in conjunction with the drawings.

SUMMARY OF THE INVENTION

The present invention provides a high-density storage system for magnetic data storage tape cartridges. The system eliminates intervening structure between the cartridge storage packs to allow the packs to be mounted in close proximity to one another.

The system includes an upstanding rack having a plurality of vertical support members. Vertically and horizontally aligned apertures are formed in each support member and on both sides of the support members. An elongated dimple is formed adjacent each of the apertures.

Cartridge storage packs are used to store a plurality of cartridges therein. The cartridge storage packs are designed to be mounted onto the rack. The cartridge storage packs include resilient suspension hooks formed on the rear surface of each cartridge storage pack. The suspension hooks are inserted into the apertures to support the cartridge storage packs on the rack. The suspension hooks include a resilient arm which biases against the elongated dimple to prevent accidental dislodgement of the cartridge storage packs.

The apertures are arranged so that the cartridge storage packs are mounted in close proximity with one another. This increases the density of the cartridge storage capacity of the system to allow more cartridges to be stored within existing space.

The present invention can be applied to double-sided racks, slidable rack systems, carousel rack systems, double-density storage racks, movable rack systems, storage truck systems and other storage systems. The claimed invention will be evident from

the detailed description of a preferred embodiment taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a preferred embodiment of the present invention.

5 Figure 2 is a front perspective view of the cartridge holder pack of the present invention.

Figure 3 is a rear perspective view of the cartridge holder pack of Figure 2.

Figure 4 is a side cutaway view of Figure 1 along lines 4-4.

10 Figure 5 is a detail view of Figure 4 showing the suspension system.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

The present invention is designed to provide high-density storage for magnetic data storage tape cartridges in tape libraries for computer information systems. The increasing expansion of such tape libraries creates a demand to store more tape cartridges in existing space. The present invention provides a rack storage system that supports cartridge storage packs in close proximity to each other by eliminating "dead" space found in existing racks. This "dead" space includes shelves and other support structure for the cartridge packs. The racks of the present invention supports these packs by engaging the rear of the packs without intervening rack structure juxtaposed between adjacent packs.

One possible preferred embodiment of the present invention is illustrated in Figures 1 - 5. It is to be expressly understood that this descriptive embodiment is for explanatory purposes only and is not meant to limit the claimed invention. Other embodiments and variations are considered to be within the scope of the claimed inventive concept.

The storage system of the preferred embodiment, as shown in Figure 1, includes an upstanding rack 10. Rack 10 has a substantially rectangular shape with side walls 12, 14, top surface 16 and bottom surface 18. A plurality of vertical support members 20 extend between bottom surface 18 and top surface 16. In the descriptive embodiment, six support members 20 are provided. The side support members, that is the support members adjacent side walls 12, 14, are formed integrally with the adjacent side wall. This provides added rigidity to the rack and reduces the cost of manufacturing the system.

Each of support members 20 are formed of two elongated pieces of stamped sheet metal, each having a substantially shallow U-shaped. The two pieces are spot-welded together to form a tubular shape as shown on upper portion 26. The spacing between the two pieces allows entry of the suspension system of the cartridge holder packs as described below. Each of support members 20 has front side 22 and rear side 24.

As illustrated in Figure 4, the lower end 28 of each support member 20 extends through lower surface 18 and is secured to "hat" member 30 which extends the length of rack 10. Front support rib 32 and rear support rib 34 also extend the length of rack 10 beneath lower surface 18 to provide support for rack 10. The top surface 16 is formed similar to the lower surface 18.

The above-description of the support members is for explanatory purposes only and is not meant to limit the claimed invention. Other variations are considered to be within the inventive concept. For example, horizontal support members could be used in lieu of the vertical members. Also, the support members could be of different shapes or configurations and formed of other materials.

Elongated apertures 36 are formed in support members 20 as illustrated in Figure 1. Apertures 36 are vertically aligned in each support member 20 and spaced apart by a predetermined distance. This predetermined distance is a function of the cartridge holder packs described below. Apertures 36 are formed in front side 22 and rear side 24 of each support member 20 by stamping or pressing as the pieces of the support members are formed and shaped. Elongated dimples 38 are formed adjacent each aperture 36 as

shown in Figure 5. The function of dimples 38 is fully described below.

5 Cartridge storage pack 40, illustrated in Figures 2 and 3, is designed to provide an efficient system for handling a number of magnetic data storage tape cartridges, particularly prearranged groups of cartridges, for ease of storage and retrieval. The cartridge storage pack 40 of the present invention is an improvement on previous cartridge storage packs
10 owned by the present assignee, as disclosed in U.S. Patents 4,600,107; 4,815,795; 4,844,564; and 4,846,355; which are hereby incorporated into this application by reference. Cartridge storage pack 40 includes a one-piece, injection molded, box-like
15 structure having side surfaces 42, 46, top surface 44 and bottom surface 48. The front surface 50 and rear surface 60 both have substantially open faces.

Cartridge storage pack 40, in the present embodiment, has two tiers, 52 and 54. Each tier 52,
20 54 has a plurality of spaced partitions 55 extending partially downward from the top surface of each tier 52, 54 and up from the bottom surface of each tier 52, 54. Partitions 55 are spaced to form compartments to accommodate the magnetic data storage tape cartridges
25 70.

Lower edge portions 56 and 58 are formed on the lower front portion of each tier 52, 54. The height of lower edge portions 56, 58 is such that cartridges 70 may be inserted into the opening between lower edge
30 portions 56, 58 and the upper surface of each tier 52, 54. Cartridges 70 are then seated to abut against lower edge portions 56, 58 to prevent cartridges 70 from falling out of cartridge storage pack 40. Indexing labels (not shown) on cartridges 70 are

easily seen through the opening in the front surface of the cartridge storage packs 40.

Resilient restraining arms 62 are provided on the rear surface 60 of cartridge storage packs 40 as illustrated in Figure 3. Arms 62 are formed on a one-piece molded section 63 from Delrin or the like. Arms 62 provide two functions. First, arms 62 prevent cartridges 70 from exiting the rear of cartridge storage pack 40. Second, cartridges 70 are resiliently biased against arms 62 as the cartridges are placed in the compartments of the cartridge storage pack 40. Arms 62 forwardly bias cartridges 70 against lower edge portions 56, 58 to firmly retain cartridges 70 in cartridge storage pack 40.

Suspension hooks 64 are also integrally formed on each end of section 63. Sections 63 are then mounted on the rear surface 60 of cartridge storage pack 40 by resilient clips (not shown) formed on sections 63. In the descriptive embodiment, suspension hooks are provided at each end of the rear upper surface of tiers 52, 54. Suspension hooks include a resilient arm portion 66, as shown in Figure 5.

Cartridge storage packs 40 also include a narrow, upper flanged portion 68, shown in Figures 2 and 3. Upper flanged portion 68 provides support for the cartridge storage pack 40 mounted above on rack 10 as shown in Figure 4.

The above-description of the explanatory embodiment is not meant to limit the claimed invention. Other variations of cartridge packs are considered to be within the scope of the claimed inventive concept. For example, other shapes and configurations of the cartridge packs are usable or the suspension hooks could be varied in number or location.

In operation, the system of the present invention provides support for closely mounted cartridge storage packs 40 on rack 10. Cartridges 70 are either pre-loaded into cartridge storage packs 40, or else loaded into cartridge storage packs 40 once packs 40 are mounted on rack 10.

Cartridge storage packs 40 are then mounted onto rack 10 by inserting suspension hooks 64 on the rear of the cartridge storage packs 40 into apertures 36 on vertical support members 20. Suspension hooks 64 are designed to be resilient to allow arm 66 of the hooks to flex as the hooks are inserted into apertures 36. Arms 66 of hooks 64 flex over dimples 38 formed in the support members 20 as illustrated in Figure 5, so that the arms 66 have a resilient bias against the dimples 38 to prevent accidental dislodgement of the packs 40.

Apertures 36 are spaced apart and aligned vertically and horizontally to mount cartridge storage packs 40 in close proximity as shown in Figure 4. As illustrated in Figures 1, 4 and 5, cartridge storage packs 40 may be mounted on both sides 22, 24 of support members 20. As stated above, support members 20 are formed with sufficient internal space to allow opposing suspension hooks 64 in apertures 36 on both sides of the support members.

Thus, cartridge storage packs 40 can be mounted on rack 10 in close proximity with only a narrow gap between adjacent packs to allow mounting and removal of the packs from the rack.

In the descriptive embodiment for storage of one-half inch, 3480-style magnetic data storage tape cartridges, rack 10 includes a height of approximately seventy nine (79) inches, a width approximately fifty-six (56) inches and a depth of approximately sixteen (16) inches. Cartridge storage packs 40 have

an approximate height of nine and three tenths (9.3) inches, a width of less than eleven (11) inches, and a depth of approximately 5.9 inches. Each tier 52, 54 contains ten (10) compartments for a total of twenty (20) cartridges. Rack 10 is able to support five rows of eight packs in vertical alignment for forty (40) packs on each side or eighty packs per rack 10. Thus, the storage system of the descriptive embodiment is capable of storing sixteen hundred (1600) one-half inch magnetic data storage tape cartridges.

Other variations of the storage system include the use of additional slidable racks attached to the rack system. Typically, this would include units attached to the upper surface of the rack which will slide relative to the rack. These units might be one pack wide, two packs wide or three packs wide and are slidable to allow access to the packs mounted behind the slidable units.

Another variation includes movable racks, such as carousals or mobile trucks, which would allow the racks to be moved or rotated as needed. In all of these variations, the inventive concept includes supporting only the rear of the cartridge packs to the rack itself to allow high-density storage of the cartridge tapes.

It is to be expressly understood that the claimed inventive concept is not to be limited by the descriptive embodiment. Other embodiments and variations are considered to be within the scope of the claimed inventive concept.

CLAIMS

We Claim:

1. A system for storing magnetic data storage cassette tapes, said system comprising:

an upstanding rack;

5 cartridge holder means for storing a plurality of magnetic data storage cassette tape cartridges; and

10 means on said rack for securing only the rear of each of a plurality of said cartridge holder means to said rack to support said plurality of said cartridge holder means on said rack in close proximity to one another.

2. The system of claim 1 wherein said securing means include:

5 a plurality of support means spaced a predetermined distance apart from one another and parallel to one another;

means formed on each of said support means for securing said rear of said cartridge holder means; and

10 means on said rear of said cartridge holders for engagement with said securing means on said support means to secure said cartridge holders to said rack.

3. The system of claim 2 wherein said securing means include apertures formed in said support means; and

5 said engagement means on said cartridge holder means include suspension means adapted to fit into said apertures for engaging said support means to secure said cartridge holder means to said rack.

4. The system of claim 3 wherein each of said suspension means include a resilient arm; and

5 said securing means further include an elongated dimple formed adjacent each of said apertures for said arm to resiliently bias against to prevent accidental movement of said cartridge holder means relative to said rack.

5. The system of claim 4 wherein said support means include vertically extending support members spaced a predetermined distance horizontally from one another; and

5 said securing means on said support means include a plurality of said apertures formed in each of said vertically extending support members spaced in vertical alignment from each other by a predetermined distance.

6. The system of claim 1 wherein said securing means includes means for securing said cartridge holder means on the front side and on the rear side of said rack to form a double-sided storage rack.

7. The system of claim 1 wherein said cartridge holder means comprise a box-shaped structure having:
two end walls;

5 an open front for cartridge entry and retrieval;
partition means formed parallel to said end walls and spaced apart a predetermined distance forming compartments for said cartridges;

a retaining flange formed along said open front to retain said cartridges in said compartments; and

10 resilient retaining means along the back wall for resilient biasing said cartridges forward against said retaining flange.

8. The system of claim 7 wherein said cartridge holder means include two tiers of said compartments.

9. The system of claim 7 wherein said cartridge holder means are formed of one-piece injection molded plastic.

10. The system of claim 7 wherein said system includes eight of said cartridge holder means in vertical alignment on said rack.

11. The system of claim 10 wherein said cartridge holder means includes compartments for twenty one-half inch magnetic data storage cassette tape cartridges.

12. A system for storing magnetic data storage tape cartridges, said system comprising:

an upstanding rack;

5 a plurality of support members on said rack spaced a predetermined distance apart from one another and parallel to one another;

cartridge holder means for holding a plurality of tape cartridges;

10 means on each of said support members for supporting a plurality of said cartridge holder means; and

means on the rear of said cartridge holder means for engaging said supporting means on said support members.

13. The system of claim 12 wherein said supporting means on said support members include a plurality of apertures formed in each of said support members; and

5 said engagement means on the rear of said cartridge holder means include suspension members adapted to engage in said apertures to support said cartridge holder means on said rack.

14. The system of claim 13 wherein said supporting means further include an elongated dimple adjacent each of said apertures; and

5 each of said suspension members include a resilient arm to bias against said dimples to restrain said cartridge holder means from accidental movement relative to said rack.

15. The system of claim 12 wherein said support members include vertically extending support members spaced a predetermined distance horizontally from one another.

16. The system of claim 12 wherein said support members include said means for supporting said cartridge holder means on both sides of said support members to provide a double-sided storage rack.

17. The system of claim 12 wherein said cartridge holder means comprise a box-shaped structure having:

two end walls;

5 an open front for cartridge entry and retrieval; partition means formed parallel to said end walls and spaced apart a predetermined distance forming compartments for said cartridges;

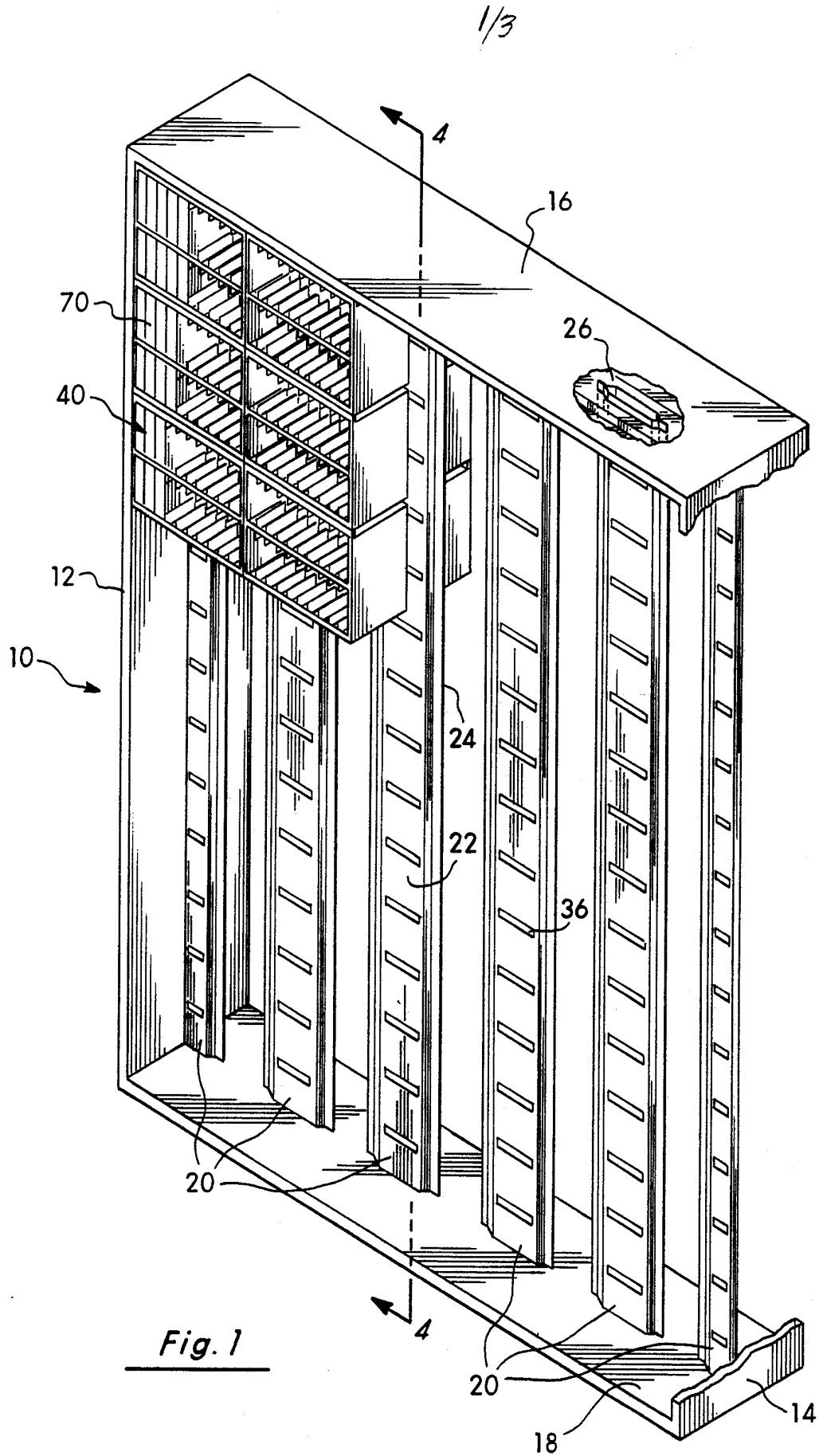
10 a retaining flange formed along said open side to retain said cartridges in said compartments; and resilient retaining means along the back wall for

resilient biasing said cartridges forward against said retaining flange.

5 18. The system of claim 17 wherein said rack has a height not greater than seventy-seven (77) inches and a width not greater than fifty-six (56) inches and is capable of storing up to sixteen hundred one-half inch 3480-style standard magnetic data storage tape cartridges

19. A method for storing magnetic data storage tape cartridges, said method comprising the steps of:
5 providing a cartridge storage pack having compartments for a plurality of cartridges to be stored therein;
providing suspension hooks on the rear of said cartridge storage pack;
10 providing an upstanding rack having a plurality of support members with aligned apertures formed therein;
mounting said cartridge storage pack on said rack by inserting said suspension hooks into said apertures on said support members; and
15 storing magnetic data storage tape cartridges in said compartments of said cartridge storage pack either before said cartridge storage pack is mounted on said rack or after said cartridge storage pack is mounted on said rack.

20. The method of claim 19 wherein said method further comprises the steps of:
5 mounting a plurality of said cartridge storage packs in close proximity with one another on said rack.



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Fig. 2

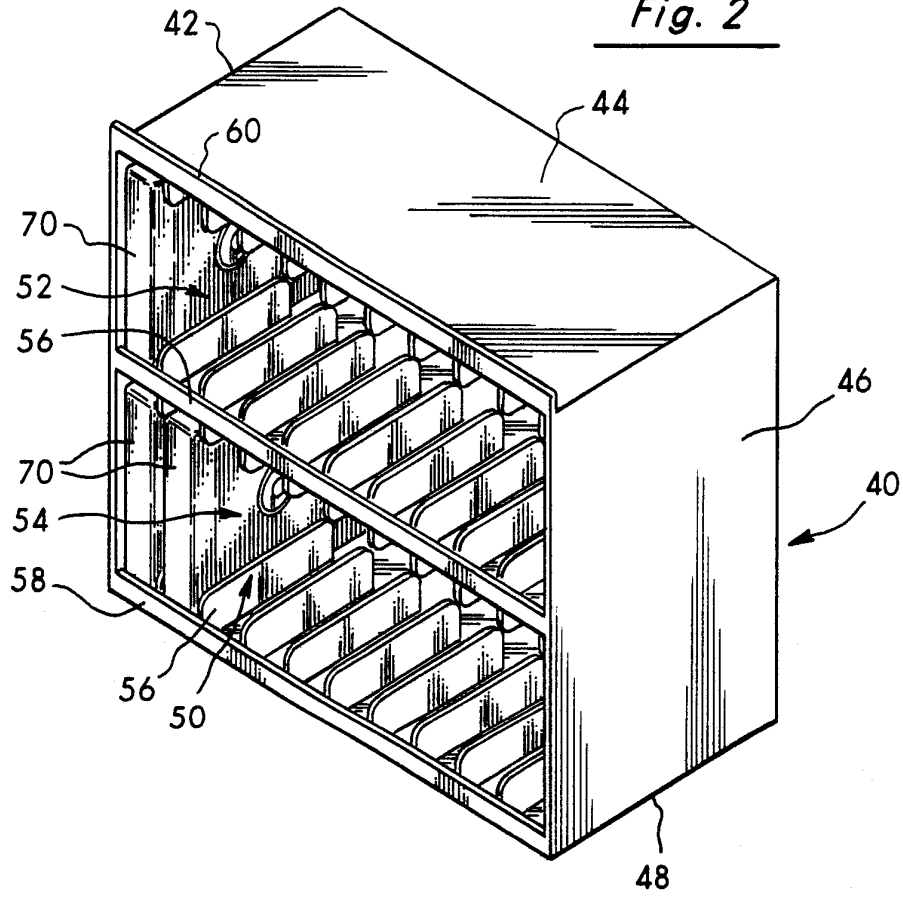
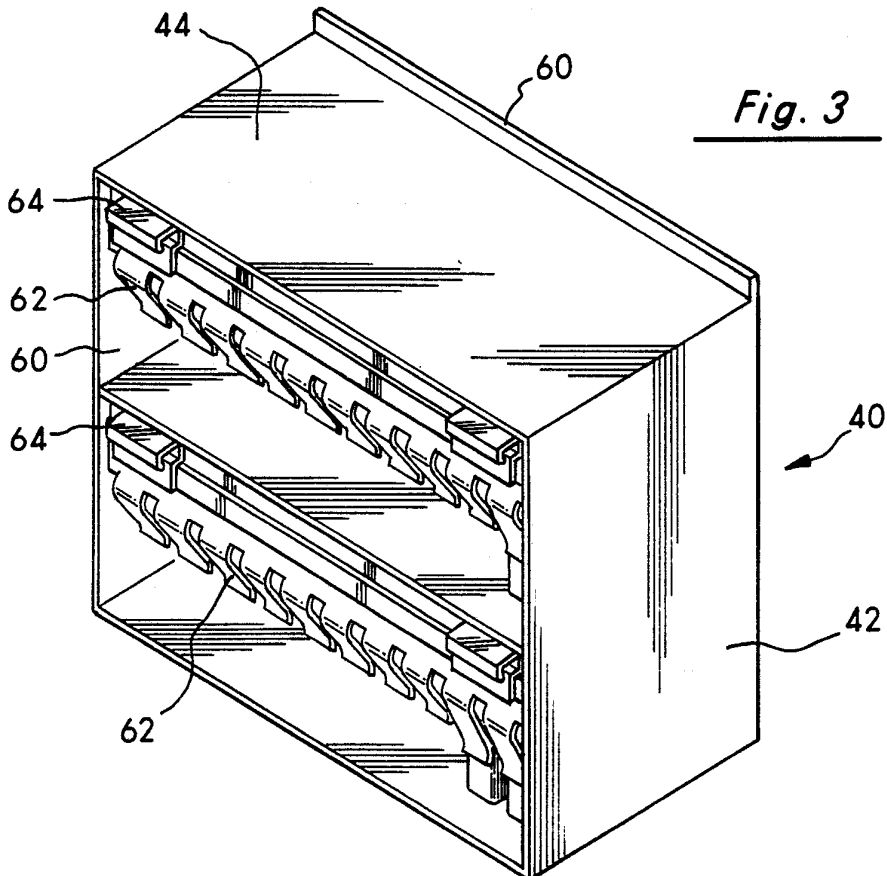
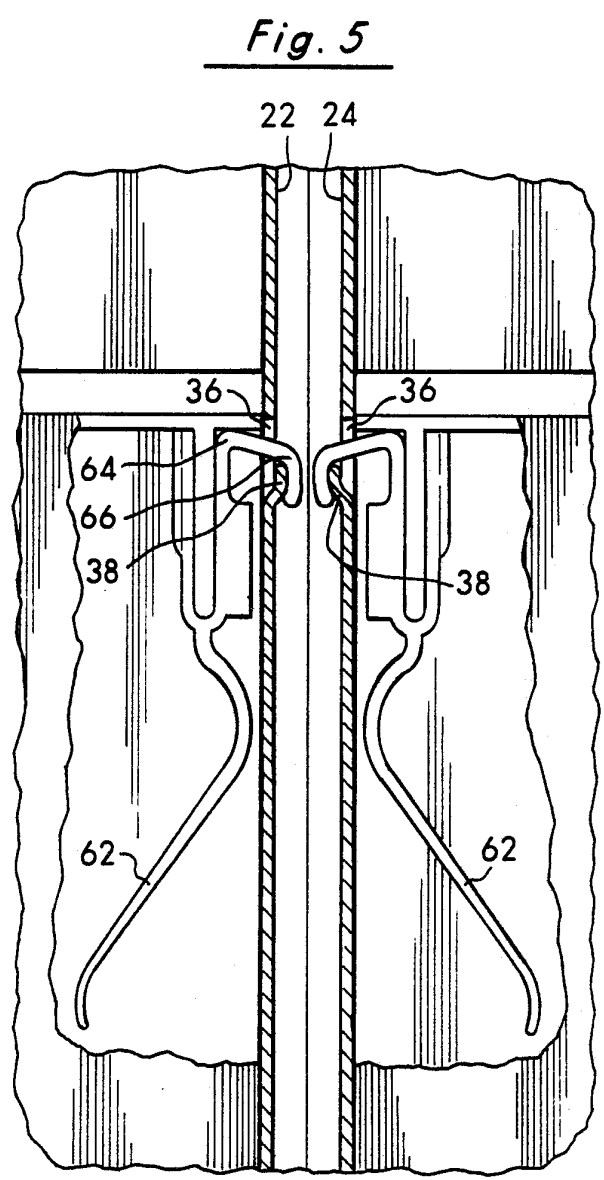
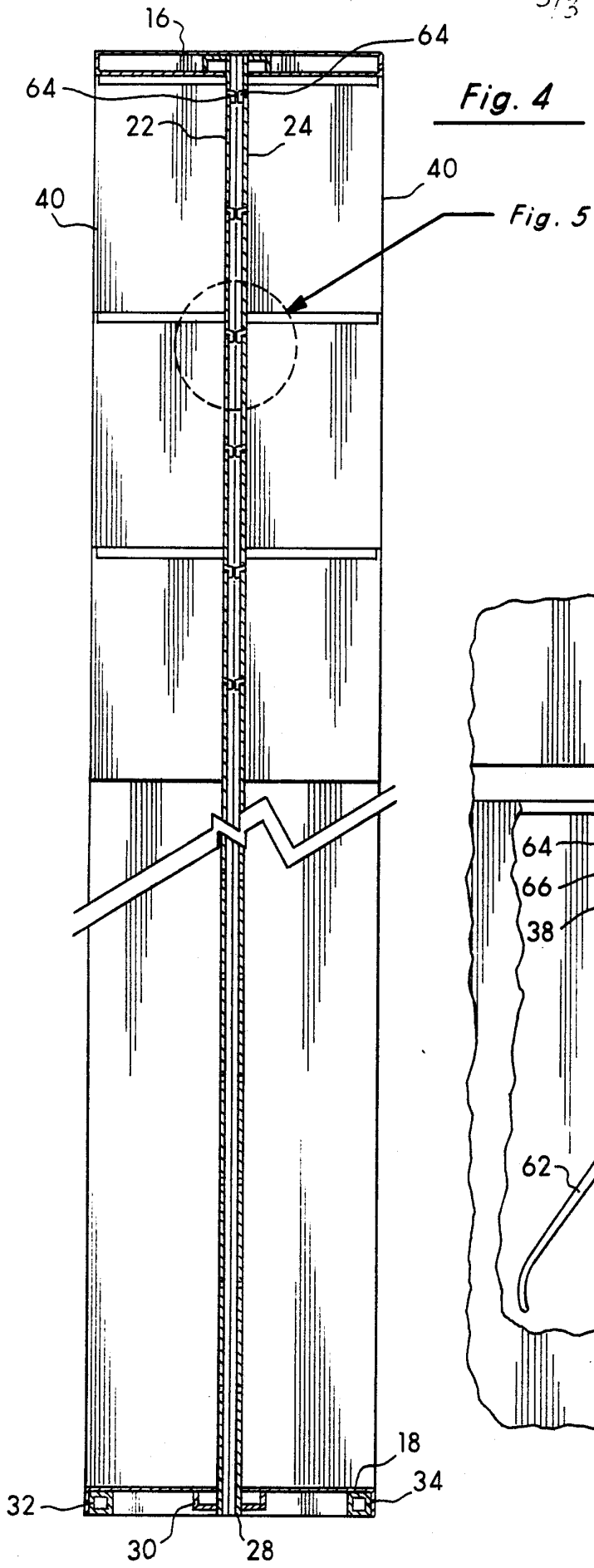


Fig. 3

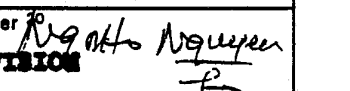


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INTERNATIONAL SEARCH REPORT

International Application No. PCT/US92/02725

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ³				
According to International Patent Classification (IPC) or to both National Classification and IPC				
IPC (5) : A47G 19/08 US CL : 211/41				
II. FIELDS SEARCHED				
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Classification System	Classification Symbols			
U.S.	211/41, 189, 208, 88, 103 190, 192 312/8, 10,12,15; 206/387; 248/221.3			
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched ⁵				
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴				
Category ⁸	Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸		
X/Y	US,A 3,666,337 (Sztorc) 30 May 1972 (See entire document)	1,2,12 / 3-11, 13-20		
Y	US,A 4,352,478 (Loew) 5 October 1982 (See entire document)	4,5,14		
Y	US,A 4,844,564 (Price, Sr. et al) 4 July 1989 (See entire document)	7-11,17,18		
Y	US,A 4,854,535 (Winter et al) 8 August 1989 (See entire document)	3 - 5 , 13 - 15,19,20		
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IV. CERTIFICATION				
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17 JUNE 1992	01 JUL 1992			
International Searching Authority ¹	Signature of Authorized Officer ²⁰			
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