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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G11B 23/087	A1	(11) International Publication Number: WO 95/05662
		(43) International Publication Date: 23 February 1995 (23.02.95)

(21) International Application Number: PCT/US94/08756

(22) International Filing Date: 5 August 1994 (05.08.94)

(30) Priority Data:
08/106,645 16 August 1993 (16.08.93) US

(71) Applicant: GIGATEK MEMORY SYSTEMS [US/US]; 1989 Palomar Oaks Way, Carlsbad, CA 92009 (US).

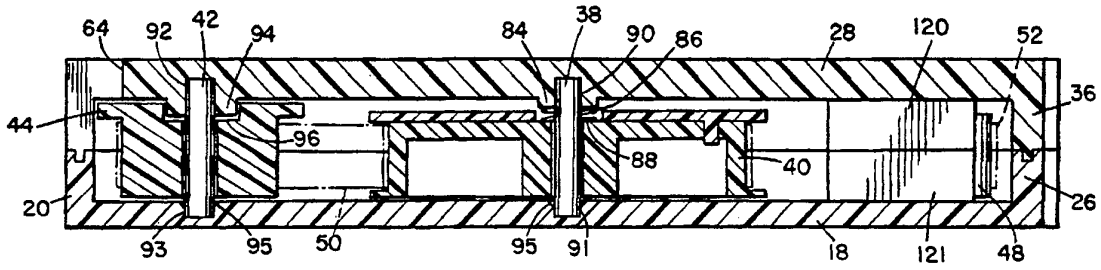
(72) Inventors: EGGEBEEN, James, A.; 7029 Westleigh Place, San Diego, CA 92126 (US). BADOUR, Leonard, C.; 4260 Pilon Point, San Diego, CA 92130 (US).

(74) Agents: HALLER, John, L. et al.; Brown, Martin, Haller & McClain, 1660 Union Street, San Diego, CA 92101-2926 (US).

(81) Designated States: AU, BR, CA, JP, KR, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: TAPE CARTRIDGE HOUSING



(57) Abstract

A belt driven, magnetic tape cartridge housing for 1/4-inch data tape is rectangular and has an upper wall, lower wall and peripheral front, side and rear walls. The housing is formed from separate base and lid members of molded plastic material. At least one of the members has peripheral front, side and rear walls forming at least part of the total height of the front, side and rear walls of the housing. The base and lid members are rigidly secured together with the peripheral edges in mating engagement. A plurality of pins including tape guide pins, tape hub pins and drive belt roller pins are press fit into aligned openings in the base and lid to secure the base to the lid.

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TAPE CARTRIDGE HOUSING

BACKGROUND OF THE INVENTION

The present invention relates generally to a tape cartridge housing, and is particularly concerned with housings for belt driven, magnetic data tape cartridges of the type used in computers and the like.

In known, ¼-inch tape cartridges for magnetic recording tape of the type used in computers, the housing typically consists of a flat metal base plate and a cover member of plastic material secured to the base plate via connecting screws or the like. A metal base plate adds to the expense of the construction, but was considered essential to add the necessary rigidity in order to reduce potential warping or bending of the various guide and roller carrying pins. Such distortions cause problems at current high recording and track densities which require precise tape positioning and transport.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a new and improved belt driven magnetic tape cartridge housing.

According to the present invention, a tape cartridge housing is provided which comprises a rectangular enclosure having an upper wall, a lower wall, and peripheral side, front and rear walls. The enclosure is made in two parts, comprising a base and cover which are both made of injection molded plastic, and which are rigidly secured together. The base comprises the lower wall of the housing and has upwardly extending side, front and rear wall portions forming part of the side, front and rear walls of the enclosure. The cover or lid comprises the upper wall

of the enclosure and has downwardly descending side, front and rear wall portions forming the remainder of the side, front and rear walls of the enclosure, with the side, front and rear wall portions of the base and lid being in engagement to form continuous wall surfaces. A securing mechanism is provided for securing the base and lid together with their side, front and rear wall portions in mating engagement.

The partial side, front and rear walls on the base and lid provide rigidity to both the upper and lower walls of the enclosure and resist distortions with minimum tolerance for a belt driven tape cartridge housing. At the same time, the housing is relatively inexpensive since it is formed entirely of plastic.

A plurality of pins extend between the upper and lower walls of the enclosure. The upper and lower walls have a series of aligned openings, each aligned with a respective one of the pins, and the pins are each press fit at opposite ends into the respective aligned openings in the upper and lower walls, forming the securing mechanism for securing the base to the lid. The pins comprise tape hub mounting pins for rotatable mounting of the two tape hubs or spools of the tape cartridge, drive roller and corner roller mounting pins for rotatable mounting of the drive belt for advancing the magnetic tape, and tape guide pins. With this arrangement, the pins have the additional function of securing the base to the lid. The pins may comprise the sole securing means between the base and lid, or the base and lid may additionally be secured together at their mating surfaces by sonic welding or the like. The base and lid may have mating tongue and groove interconnections at the mating peripheral edges of the side, front and rear wall portions for added structural rigidity.

The side, front and rear wall portions of the base and lid each form part of the complete side, front and rear walls of the enclosure. In a preferred embodiment of the invention, the base and lid each form half of the total height of the side, front and rear walls. However, different proportions may be used. The side, front and rear wall may be provided entirely on lid or base, or the wall portions on the base may be of greater height than those on the lid and vice versa, for example. Thus, for example, the ratio of the wall height on the lid and base may be 1:4.

The front wall includes the conventional opening for access by a magnetic transducer head to the tape surface, and an access opening for access by a drive motor for driving the belt drive roller.

The housing may be of any standard size for belt driven magnetic data tape cartridges, such as the standard 5¼-inch and 3½-inch mini cartridges, with the smaller cartridge having a lesser number of pins than the larger cartridge.

The belt driven magnetic tape cartridge housing of this invention is inexpensive yet provides sufficient rigidity to meet the tolerance requirements for high velocity, high density and low density tape cartridges. This makes it suitable for delivery of a program without making the overall cartridge prohibitively expensive.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be better understood from the following detailed description of a preferred embodiment of the invention, taken in conjunction with the accompanying drawings, in which like reference numerals refer to like parts, and in which:

Figure 1 is a top plan view of a complete cartridge housing according to a preferred embodiment of the invention;

Figure 2 is a front elevation view of the cartridge;

Figure 3 is a sectional view taken on line 3-3 of Figure 1;

Figure 4 is an enlarged sectional view taken on line 4-4 of Figure 1;

Figure 5 is an enlarged sectional view taken on line 5-5 of Figure 1;

Figure 6 is an enlarged sectional view taken on line 6-6 of Figure 1;

Figure 7 is an enlarged view of a portion of Figure 3, showing the edge joint of the cartridge;

Figure 8 is a similar view showing an alternative edge joint;

Figure 9 is an enlarged view of a portion of the base wall of Figure 5, illustrating a countersunk bore for receiving a pin end;

Figure 10 is a view similar to Figure 9, illustrating a modification in which a lead-in edge is provided on the pin;

Figure 11 is a section on the lines 11-11 of Figure 10;

Figures 12-15 are views similar to Figures 7 and 8 illustrating some alternative edge joints for the cartridge;

Figure 16 is a front elevational view of the rear wall of the cartridge illustrating an alignment rib structure for use with edge joints of the type illustrated in Figure 13;

Figure 17 is a section on the lines 17-17 of Figure 16; and

Figure 18 is a view similar to Figures 12-15 illustrating formation of an alternative edge joint.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The drawings illustrate a belt driven, magnetic tape cartridge 10 designed for ¼-inch data tape and having a rectangular housing or enclosure 12 according to a preferred embodiment of the present invention. The housing 12 holds various internal tape guiding and transporting components, and includes a base member 14 and cover or lid member 16 which are each made of relatively rigid, injection molded plastic material.

The base member 14 includes a lower wall 18 of the housing and upstanding partial front wall 20, side walls 22, 24, and rear wall 26. The cover member 16 includes upper wall 28 of the housing and downwardly descending partial front wall 30, side walls 32, 34 and rear wall 36. The cover and base members are secured together with their partial front, side and rear walls in mating engagement to form continuous front, side and rear walls of the enclosure, as best illustrated in Figures 2, 4 and 5. In the illustrated embodiment, the cover and base each have partial front, side and rear walls forming half of the total height of the housing. However, different proportions may be used in alternative embodiments. For example, the partial walls of the base may be taller than the partial walls of the lid, or vice versa, with the ratio between the wall height of the base and the wall height of the lid being in the range from 4:1 to 1:4. Although partial front, side and rear walls are preferably provided on both the base and lid, the entire front, side and rear walls may be provided on either the base or the lid in alternative embodiments.

As best illustrated in Figure 1, a plurality of pins extend between the upper and lower walls of the housing. These include a pair of tape hub pins 38 on which magnetic tape spools or hubs 40 are rotatably mounted, drive roller

pin 42 on which belt drive roller 44 is rotatably mounted and a pair of corner roller pins 46 on which corner rollers 48 are rotatably mounted. A conventional belt drive is provided in which an inside drive belt 50 extending around roller 44 and corner rollers 48 drives an outside ¼-inch magnetic data tape 52 between the two tape spools 40. Tape guide pins 56 guide the tape 52 in a path across the front wall 20, 30 of the housing. Tension pins 58 are also provided in the tape path. All of the pins 38, 42, 46, 56 and 58 extend between the upper and lower walls of the housing and are press fit into aligned openings in the upper and lower walls, respectively, in order to secure the base member to the cover member, as will be described in more detail below.

In the illustrated embodiment, the tape cartridge housing is of the 5¼-inch size and has a total of 11 pins extending between the upper and lower walls and press fit at opposite ends into those walls, providing a relatively rigid interconnection between the base and lid across the entire area of the cartridge. It will be understood that similar principles may be applied to other ¼-inch tape cartridges, such as the mini or 3½-inch cartridge which has 9 pins.

The front wall 20, 30 of the housing has a standard recessed tape head opening 60 which is closed when the cartridge is not in use by a door 62 pivotally secured to a front corner of the housing. An access opening 64 is also provided in the front wall to allow drive roller 44 to be driven via an external drive (not illustrated) of a conventional type. A further opening 66 is aligned with a reflective surface or prism 68 mounted on the lower wall of the housing facing opening 66. Reflective surface 68 provides the optical path required for the tape hole sensing function. The front wall also has an opening 70

for access to a rotatable write-lock-out knob 72 of a conventional type.

The pins 38, 42, 46, 56 and 58 are of different types and are captured and press-fit in the upper and lower walls of the housing in different ways. Guide pins 56 have enlarged portions 73, 74 at their upper and lower ends between which the tape is guided for alignment purposes. The enlarged portions 73, 74 of each guide pin 56 are axially extended as illustrated in Figure 3 and are press fit into corresponding aligned openings in the upper and lower walls, respectively, of the housing.

The upper wall of the housing has projecting boss portions 77, which have openings 80 in alignment with each of the straight tension pins 58, as illustrated in Figure 6. The opposite ends of each pin 58 are press fit into the respective aligned openings 82 in the lower wall. The bulking up of the upper wall in the vicinity of the pin capturing openings 80 provides added rigidity. Similarly, bosses may optionally be provided in the lower wall, if necessary.

Similar projecting bosses 84 are provided in the upper wall of the housing in alignment with each of the tape hub mounting pins 38. Each tape hub has a corresponding opposing recess 88 at its upper end for receiving the respective bosses 84, as illustrated in Figure 5. Each boss 84 and lower wall 18 have openings 90, 91 aligned with the respective mounting pins 38, and the pins 38 are press fit into the openings 90 and 91 at their opposite ends. A conventional biassing spring 86 biasses tape hub 40 towards the lower wall 18.

Similarly, pins 42 and 46 for mounting the drive roller 44 and corner rollers 48, respectively, are press fit into opposing openings 92, 93 provided in a projecting boss 94 in the upper wall and in the lower wall in alignment with the respective pins, as illustrated in

Figures 4 and 5. The roller 44 has a recess 96 for receiving the boss 94, and the rollers 48 each also have a recess 98 for receiving the boss 94. This arrangement of providing increased material at the connection between each pin and the upper wall of the housing provides greater rigidity and resistance to separation or deformation. Corresponding bosses may be provided in the lower wall, if desired for greater rigidity, although it is preferred that bosses are provided on the cover due to the greater spacing between the cover and tape. The boss preferably has a wall thickness between the inner diameter of the bore and the outer diameter of the boss equal to half the upper wall thickness, to ensure uniform cooling on manufacture. The bores extend halfway through the thickness of the upper wall for similar reasons.

Preferably, the pins and corresponding openings do not extend completely through the upper and lower wall. In the illustrated embodiment, each opening extends through approximately ⅔ of the total wall thickness of the upper or lower wall. This provides a sufficient contact area with the press fit pin to resist separation of the parts.

The press fitting of each of the pins into openings in the base and lid may secure the base to the lid with sufficient strength and rigidity without any other fastening mechanism. Preferably, the bores 82, 91 and 93 in the lower wall are all countersunk with radiused or chamfered lead-in edges 95, as illustrated in Figures 4, 5, 6 and 9, for centering purposes. Alternatively, lead-in or radiused edges 99 may be provided on the pins 38, 42 and 58, as illustrated in Figure 10, to allow the pins to be more easily press fit into the bores. The bores in the lower wall may be of hexagonal shape, as illustrated in Figure 11, with a slightly smaller radius than that of the pin. Preferably, the radius of the bore is between 0 to 0.010 inches smaller than the pin radius, for a secure

friction or press fit. In the preferred embodiment, the difference between the radius of bores 82, 91, 93 and the pins 58, 38, 42 was around 0.002 inches.

The cartridge is preferably made by first press fitting all pins into the corresponding bores in the base or lower wall. The pins are held on a jig in the appropriate positions, and sonically inserted into the plastic base providing a small amount of melting of the plastic due to vibration. The cover is then installed on top of the pins after mounting of the various components in the housing.

In the preferred embodiment of the invention illustrated in the drawings, the partial front, side and rear walls have a capturing or mating tongue and groove type engagement and may be bonded or secured together by adhesive, sonic welding, or the like. As best illustrated in Figures 4, 5 and 7, the peripheral front, side and rear wall of the lid has a downwardly projecting tongue or lip 110 of square cross-section, which engages in a corresponding, square cross-section groove 112 extending around the periphery of the front, side and rear wall of the base. In an alternative arrangement the projecting tongue may be provided around the periphery of the base while a corresponding groove is provided around the periphery of the lid. Figure 8 illustrates another alternative arrangement in which a downwardly projecting, V-shaped or pointed tongue 118 is provided around the periphery of the front, side and rear walls of the lid, while a corresponding V-shaped groove 119 is provided around the periphery of the front, side and rear walls of the base. This provides a rigid, stable interconnection between the base and lid.

Figure 12 illustrates an alternative arrangement in which the peripheral edges of the lid and base front, side and rear walls have mating lap or step formations 130, 132.

Figures 13 illustrates an alternative in which step formations 134, 135 have inclined, mating inner edges 136, 137, respectively. With this arrangement, alignment ribs 138 may be provided at spaced intervals around the periphery of the front, side and rear walls, as illustrated in Figures 16 and 17, to ensure mating engagement between the step formations on assembly. Preferably three ribs are provided on the rear wall, two on each side wall, and one on the front wall outside the tape path.

Alternatively, the peripheral mating edges of the base and lid front, side and rear walls may be flat to form a flat junction 140, as illustrated in Figure 14.

Figure 15 illustrates another alternative in which mating concave and convex faces 142, 143 are provided on the peripheral edges of the front, side and rear walls.

Finally, Figure 18 illustrates an alternative joint in which a projection 144 is provided on the peripheral edge of lid 28, while the peripheral edge 146 of base 18 is flat. Some flattening of projection 144 will tend to occur on sonic welding of this joint, so that the final structure may be similar to that of Figure 14.

In addition to the rigidity provided by the partial front, side and rear walls of the base and lid, as well as the press fit of each pin into openings in the base and lid, further structural rigidity may be provided by means of internal baffles or wall members provided inside the housing at those locations where space is available. Thus, for example, generally triangular-shaped baffles may extend upwardly from the base or downwardly from the lid, or both at a location adjacent the rear wall of the housing, as illustrated in Figures 1 and 4, partial baffles 120, 121 extend upwardly from the base and downwardly from the lid into mating engagement, at a location spaced from the drive belt and tape paths but filling up all available space outside these paths. An additional, generally triangular

baffle 122 may be provided adjacent the front corner of the housing remote from the door 62.

This arrangement provides a belt driven tape cartridge for ¼-inch magnetic tape in which both the base and lid are formed of injection molded plastic and are secured together with sufficient rigidity to meet the tolerance requirements for such cartridges even for high tape speed and track density. The cartridge is therefore simpler to manufacture and less expensive than conventional cartridges having a metal base.

Although a preferred embodiment of the invention has been described above by way of example only, it will be understood by those skilled in the field that modifications may be made to the disclosed embodiment without departing from the scope of the invention, which is defined by the appended claims.

CLAIMS

1. A belt driven magnetic tape cartridge housing for housing a magnetic data tape and tape drive belt assembly, comprising:

a rectangular outer enclosure having an upper wall, a lower wall, and peripheral side, front and rear walls;

the enclosure comprising separate base and cover members of molded plastic material;

the base member comprising the lower wall of the enclosure and having a perimeter;

the cover member comprising the upper wall of the enclosure;

at least one of the base and cover members having side, front and rear walls forming at least part of the side, front and rear walls of the enclosure; and

securing means for rigidly securing the base member to the lid member to form the enclosure.

2. The housing as claimed in Claim 1, wherein the base member has upstanding partial side, front and rear walls forming part of the side, front and rear walls of the enclosure, the lid member has downwardly depending partial side, front and rear walls forming part of the side, front and rear walls of the enclosure, and the securing means comprises means for rigidly securing the base member to the lid member with the partial side, front and rear walls of the base and lid members in mating engagement.

3. The housing as claimed in Claim 1, including a plurality of pins extending between the upper and lower walls of the enclosure, the pins including tape hub mounting pins, drive roller mounting pins and tape guide pins, the upper and lower walls having aligned openings axially aligned with each of the pins, and each pin being

a press fit in a respective pair of aligned openings in the upper and lower walls, the pins comprising at least part of said securing means.

4. The housing as claimed in Claim 3, wherein said aligned openings extend at least partially through the upper and lower walls, respectively.

5. The housing as claimed in Claim 3, wherein at least some of said pins have enlarged portions at their opposite ends, said enlarged portions being press fit into said respective openings.

6. The housing as claimed in Claim 3, wherein at least some of said pins are straight pins, and at least one of the upper and lower walls has projecting bosses aligned with each of said straight pins, said aligned openings in said one wall extending axially through said projecting bosses and said straight pins being press fit into said bosses.

7. The housing as claimed in Claim 6, wherein said projecting bosses are provided on said upper wall.

8. The housing as claimed in Claim 6, wherein said tape hub and drive roller pins comprise straight pins.

9. The housing as claimed in Claim 3, wherein said openings in said lower walls have radiused lead-in edges.

10. The housing as claimed in Claim 3, wherein said pins have a tapered lead-in edge at least at one end of each pin.

11. The housing as claimed in Claim 3, wherein said openings are of hexagonal cross-section.

12. The housing as claimed in Claim 3, wherein said openings have a smaller diameter than said pins.

13. The housing as claimed in Claim 6, further including a tape hub rotatably mounted on each of said tape hub pins and a roller rotatably mounted on each of said drive roller pins, each hub and roller having opposing faces facing the upper and lower wall, respectively, of the housing, and at least one of said opposing faces of each said hubs and rollers which faces a projecting boss having a recess for receiving said projecting boss.

14. The housing as claimed in Claim 2, wherein each partial front, side and rear wall has a peripheral edge for mating engagement with the peripheral edge of the opposing partial front, side and rear wall, one of said peripheral edges having interengageable formations for mating engagement to form continuous side, front and rear walls of said enclosure.

15. The housing as claimed in Claim 14, wherein one of said formations comprises a projecting tongue and the other formation comprises a corresponding groove for mating engagement with said tongue.

16. The housing as claimed in Claim 14, wherein said peripheral edges are bonded together.

17. The housing as claimed in Claim 14, wherein said formations comprise mating step formations.

18. The housing as claimed in Claim 17, including a series of spaced alignment ribs around the peripheral edge of one of said members.

19. The housing as claimed in Claim 14, wherein one of said formations comprises a concave depression and the other formation comprises a mating convex projection.

20. The housing as claimed in Claim 1, including baffle members projecting from at least one of the upper and lower walls in predetermined free spaces inside the housing spaced from any tape or belt paths or other components of the cartridge.

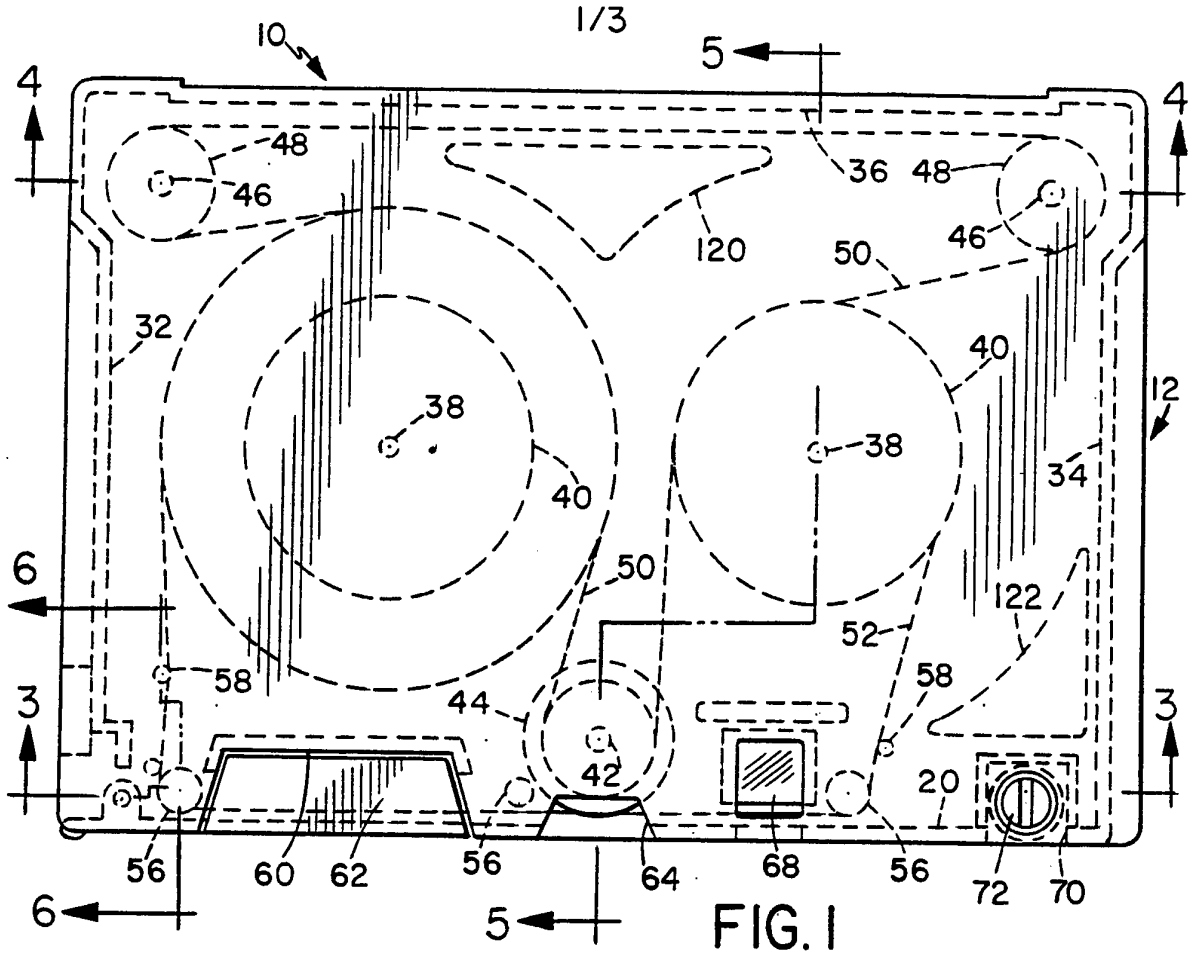


FIG. 1

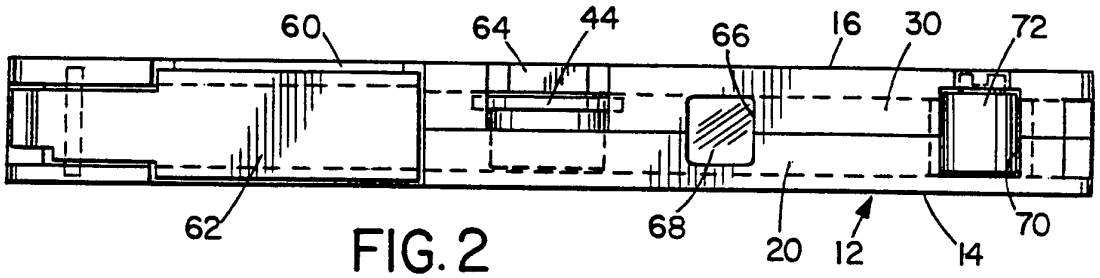


FIG. 2

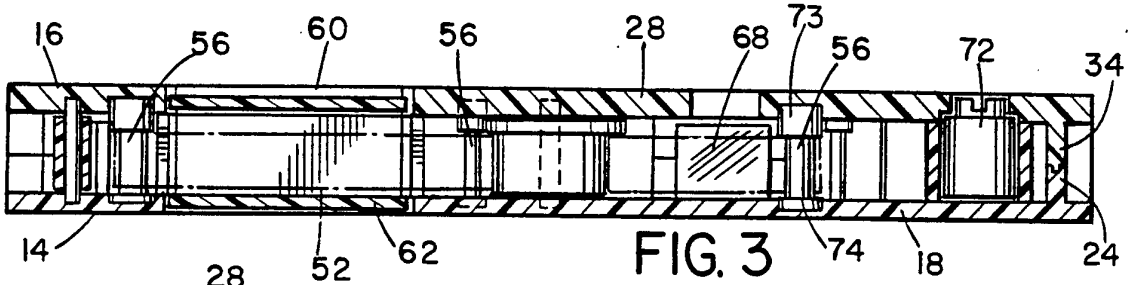


FIG. 3

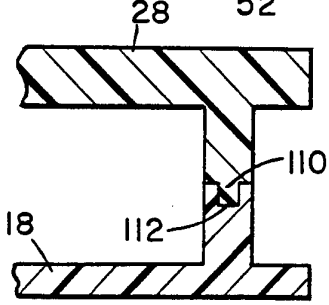


FIG. 7

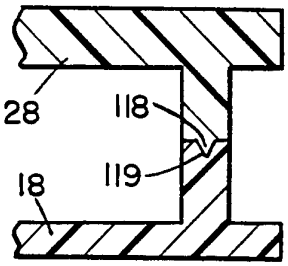


FIG. 8

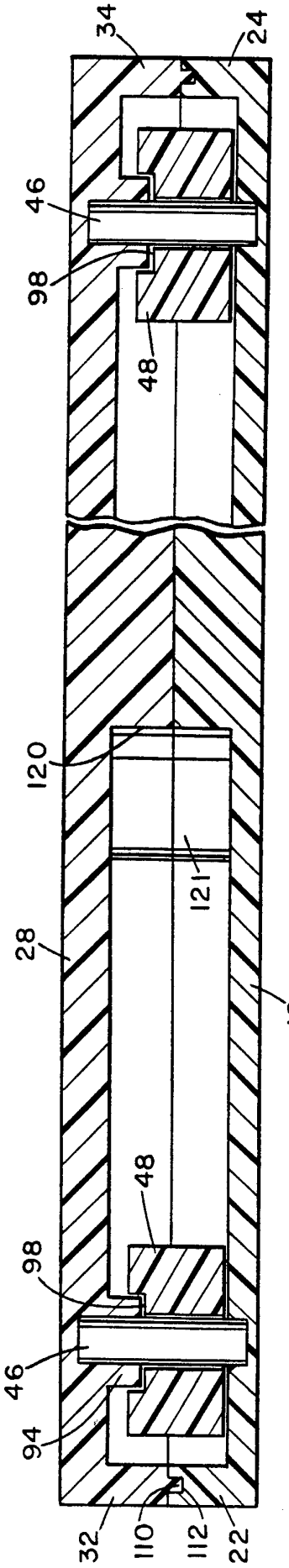


FIG. 4

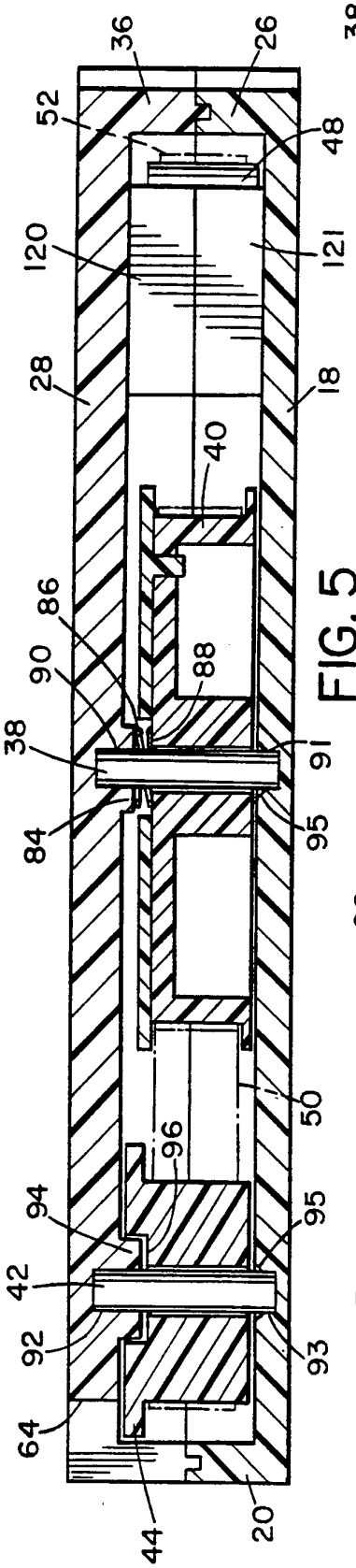


FIG. 5

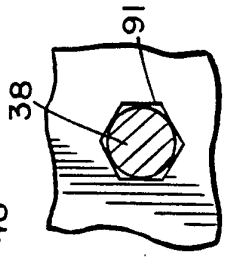


FIG. 11

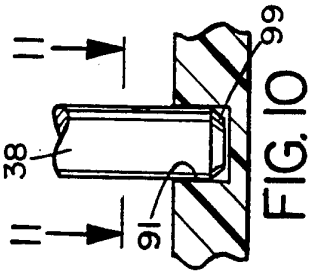


FIG. 10

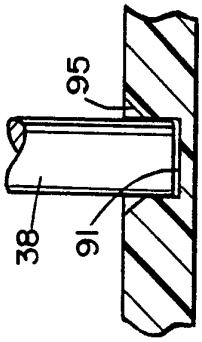


FIG. 9

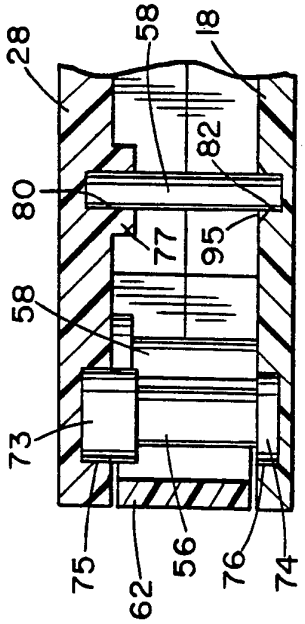


FIG. 6

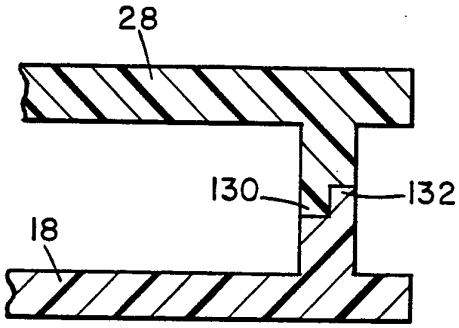


FIG. 12

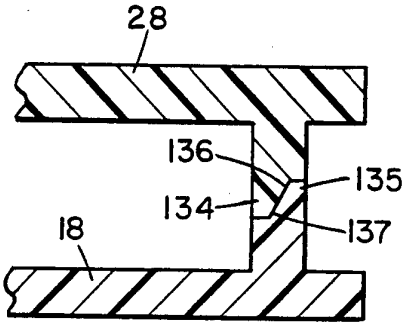


FIG. 13

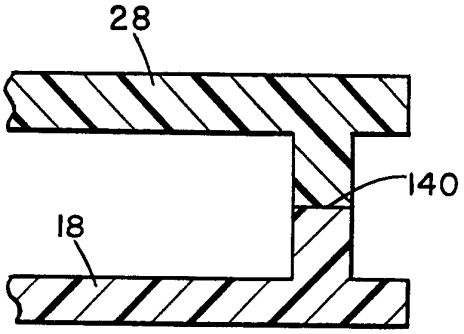


FIG. 14

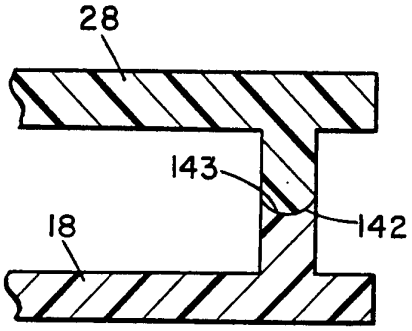


FIG. 15

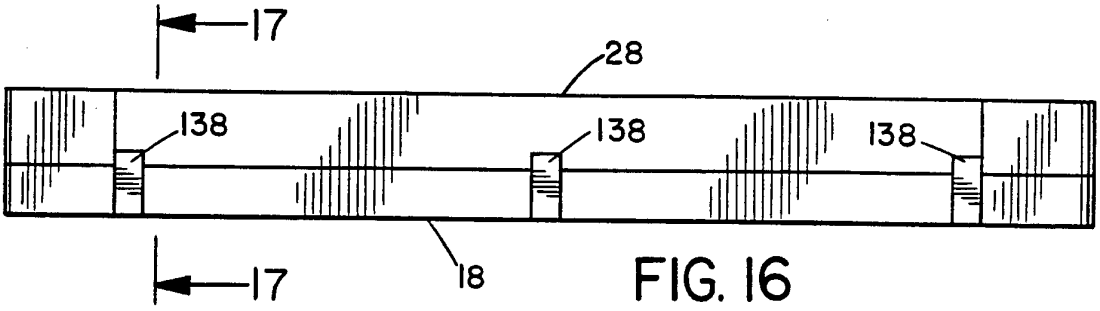


FIG. 16

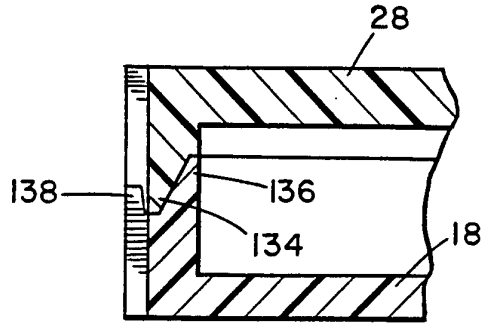


FIG. 17

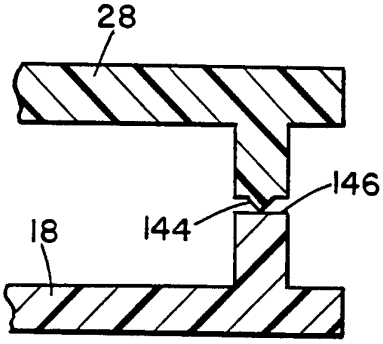


FIG. 18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 94/08756

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G11B23/087

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)
IPC 6 G11B

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 practical, 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	EP,A,0 373 884 (SONY CORPORATION) 20 June 1990 see page 5, line 9 - page 6, line 46; figures 3,4,7,8	1-12
Y	US,A,4 635 155 (GEORGENS ET AL.) 6 January 1987 see column 1, line 65 - column 2, line 24 see column 2, line 46 - column 5, line 22; figure 1	1-12
A	WO,A,91 05347 (GIGATEK MEMORY SYSTEMS) 18 April 1991 see page 5, paragraph 4 - page 7, paragraph 3	1
A	US,A,4 642 721 (GEORGENS) 10 February 1987 see column 2, line 5 - line 46	1

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"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 when the document is taken alone

"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

Date of the actual completion of the international search	Date of mailing of the international search report
8 November 1994	28. 11. 94

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+ 31-70) 340-3016	Ressenaar, J-P

Form PCT ISA 210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 94/08756

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,4 756 490 (NEWELL) 12 July 1988 see column 2, line 31 - column 3, line 36 ---	1
A	US,A,4 457 473 (MROZ ET AL.) 3 July 1984 see column 3, line 54 - column 4, line 48 -----	1

1

INTERNATIONAL SEARCH REPORT

...nformation on patent family members

International application No.
PCT/US 94/08756

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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		JP-A-	2162586	22-06-90
		US-A-	5287240	15-02-94
		US-A-	5204796	20-04-93
		US-A-	5097374	17-03-92
US-A-4635155	06-01-87	US-A-	4642721	10-02-87
WO-A-9105347	18-04-91	US-A-	4989806	05-02-91
		AU-B-	634129	11-02-93
		AU-A-	7035191	28-04-91
		EP-A-	0493536	08-07-92
		JP-T-	5504434	08-07-93
US-A-4642721	10-02-87	US-A-	4635155	06-01-87
		EP-A-	0184139	11-06-86
		JP-A-	61180973	13-08-86
US-A-4756490	12-07-88	US-A-	4624405	25-11-86
		WO-A-	8704295	16-07-87
US-A-4457473	03-07-84	NONE		