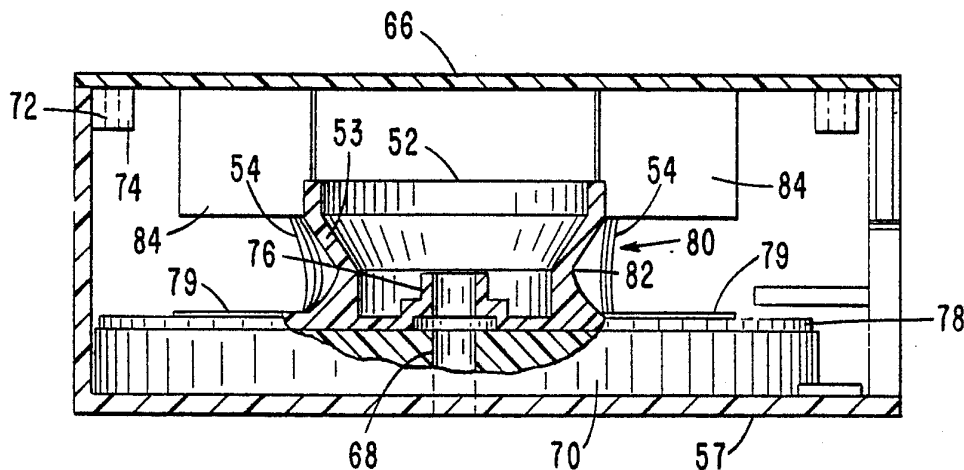




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(54) Title: RIBBON CASSETTE



(57) Abstract

A cassette for an endless thermal ribbon is utilized in a thermal printer with the ribbon being unwound from the inside of a coil (54) thereof which is supported by a spool (52) and rewound on the outside of the coil. A plurality of guide plates (84) are disposed in radial manner to guide the ribbon in its winding and hold the ribbon coil (54) in position.

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RIBBON CASSETTETechnical Field

The present invention relates to ribbon cassettes. More particularly, the invention is directed to a thermal transfer ribbon cassette for use in a printer with a print head carriage that travels back and forth across the printer and supports a thermal print head for printing on paper which is directed in a path past a platen.

Background Art

In the field of ink ribbons for printers, a ribbon supply spool and a ribbon take-up spool have been provided on opposite sides of a typing or printing station, together with means for reversing the direction of travel of the ribbon for repeated use thereof in an arrangement for the purpose of obtaining longer ribbon life. Also, the ink ribbon has been made to travel along a line of printing wherein the spools are positioned beyond the ends of the printing line and the ribbon is caused to travel at an angle relative to the print line to utilize a greater portion of the ribbon width. However, in the case of certain high-speed printers, a ribbon substantially as wide as the line of printing may be used and caused to travel in a direction normal to the print line and along with the record media. Additionally, it has been common to provide ink carrying or containing means operably associated with the ribbon for maintaining or replenishing a supply of ink therein for proper and extended-life printing operations.

In present day printers, it is also common practice to provide and use a ribbon cassette carrying an endless ribbon which is caused to be driven past a printing station, and wherein the printing ribbon is either a pre-inked and disposable ribbon or a ribbon

which is to be continuously or frequently re-inked during the printing operation. The ribbon cassette itself may be of the stuffing-box type wherein the ribbon is contained within the cassette in random manner and such ribbon is unfolded at the cassette exit and caused to be driven past the printing station and then guided back into the cassette to be folded again in random manner therein. Additionally, a ribbon may be utilized in a Mobius loop configuration within the cassette, the ribbon may be maintained in substantially continuous contact with an inking core or like member, or the ribbon may have a plurality of coils thereof around a central core for controlled inking or re-inking of the ribbon.

More recently, development work in thermal printers has included a shuttling-type print head having approximately 20% of the number of print elements as compared to the number of elements on a fixed or stationary head. A ribbon associated with such a print head and used for transferring material from the ribbon and onto plain paper may be of the thermal transfer type or of the magnetic thermal transfer type, dependent upon the particular application.

One of the problems encountered with a shuttling print head of a thermal printer that utilizes the thermal ribbon for transferring material from the ribbon onto the plain paper is that the printing cycle needs to accommodate the moving print head and the moving ribbon in timed relationship so as to effect a complete transfer of the material to the paper. While thermal transfer ribbons have been used both in impact and in non-impact printers, it is important that the ribbon be contained and controlled in a manner to effect sharp and well-defined printed characters.

US-A-3981387 describes a ribbon cassette which includes a single rotatable reel having a flange to support a ribbon and a core on which the ribbon is wound. The ribbon is unwound from its innermost turn, driven past a printing station and rewound as an outermost turn.

It is the object of the present invention, to provide a ribbon cassette of the above type which ensures better control of the winding of the ribbon.

Thus, according to the invention, there is provided a ribbon cassette for an endless printing ribbon to be unwound from the inside of a coil thereof, driven past a printing station and then rewound on the outside of said coil, said cassette including a housing and a cover therefor, and a rotatable spool means within said housing and having a first portion for supporting one edge of the coil of ribbon, and a second portion around which the coil of ribbon is positioned, characterized by guide means engaging the other edge of the coil or ribbon to hold said coil of ribbon in position, and extending generally radially with respect to the axis of rotation of said spool means.

Brief Description of the Drawings

One embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a side elevational view of a portion of a printer carrying a ribbon cassette according to the present invention;

Fig. 2 is a perspective view of the ribbon cassette;

Fig. 3 is a top plan view of the ribbon cassette showing the orientation of ribbon guide means;

Fig. 4 is a side elevational view, partly in section, of the ribbon cassette with portions of the cassette removed to show certain of the interior parts, such view being taken along the line 4-4 of Fig. 3; and

Fig. 5 is a front elevational view, partly in section, of the ribbon cassette, taken along the line 5-5 of Fig. 3.

Best Mode for Carrying Out the Invention

Referring now to the drawing, Fig. 1 shows a portion of a thermal printer 10 that includes a platen 12 suitably supported from a printer frame. A thermal print head 14 of well-known design and structure is supported from and carried by a print head carriage 16 that is caused to be shuttled or moved in reciprocating manner by appropriate mechanism in the direction of viewing by the observer in Fig. 1. The carriage 16 is pivotally supported on a shaft 18 journaled in the frame of the printer and such carriage includes an upstanding plate portion 20 and a generally horizontal plate portion 22 with gusset means 24 bridging the two portions at appropriate locations.

A plate-like cam 30 of circular configuration is positioned to be rotatably driven by drive means coupled to the shaft of a motor suitably positioned at the left and downwardly from the plate cam. The plate cam 30 is suitably supported by bearing means 38 which, in turn, is supported by a carriage drive plate (not shown).

The horizontal plate portion 22 of the print head carriage 16 includes cam follower mechanism 42, operative to urge or bias the print head against the record medium and the platen when the print head is moved in the printing direction. When the print head is moved in the opposite or return direction, the

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carriage and the print head assembly are pivoted away from the record medium at which time the ribbon and the record medium are advanced past the printing station.

A ribbon cassette 50 is provided and is supported on the frame 51 of the printer. A ribbon 54 is provided in coiled form within the cassette and is trained at an angle in a path between the print head 14 and record media, such as paper 56, such paper being caused to be transported by suitable drive means including a drive roller 58. The ribbon 54 and the paper 56 are driven in well-known incremental manner past the print station in the printing cycle of operation.

Referring now to Figs. 2-5 of the drawing, there is shown the container or enclosure in the manner and form of a cassette, designated as 50, made of a durable plastic material, such as polystyrene, and generally square shaped in a box-like design to contain and enclose a spool or reel 52 for carrying the endless ribbon 54. The cassette 50 includes a bottom portion 57 (Figs. 4 and 5), side wall portions 59 and 60 (Figs. 2 and 5), a front wall 62, an irregular-shaped rear wall 64 (Fig. 3), and a cover 66. The spool 52 is journaled on an upstanding bearing member 68 (Fig. 4) fashioned as a part of the cassette 50 and supported by the bottom portion 57, the spool 52 being carried on and supported from a washer-like plate member or element 70 (Fig. 4), also supported by the bottom portion 57 and providing for a separation in elevation between the bottom portion 57 and the spool 52 for free rotation thereof. The top or cover 66 is placed on the cassette 50 and is suitably secured thereto by means of fingers 72 engaging with and held in upstanding posts 74, also an integral part of the several wall portions, to provide a substantially total enclosure for the spool 52 and

the ribbon 54 except for providing an opening at the rear of the cassette for ingress and egress of the ribbon. It should be stated that the directional terms herein used refer to the cassette 50 as being placed on a surface as seen in Fig. 1, however, the orientation of the cassette may be different in an actual installation.

A hub 76 encircles the bearing member 68 to be rotatable thereon, the ribbon 54 being trained around the spool 52 in at least one or a plurality of coils and carried edge-wise on an extended diametral portion 78 of the spool 52, the portion 78 including a plurality of ribs or ridge portions 79 as an integral part thereof. The spool 52 includes an upstanding circular portion 80 (Fig. 4) which may be formed to provide a surface with which the inner coil of the ribbon 54 is in contact during its travel around the spool. The upstanding portion 80 presents a peripheral surface which is substantially concave-shaped or inclined and exhibits a smaller diameter central portion 82 of the spool 52 than the upper or lower edges of the side of the portion 80, so as to maintain the ribbon in a condition to be in such edge-wise contact with the extended diametral base portion 78 of the spool 52. In this respect, the coil or coils of the ribbon 54 are made to be contained in a precise path around the circumference of the spool portion 82. Additionally, the cover 66 includes a plurality of rib or guide plates or like members 84 (Figs. 3, 4 and 5) integral therewith which extend radially with respect to the axis of rotation of the spool 52 over substantially the whole of the radial extent of the ribbon coil 54 for generally guiding the ribbon into and out of the cassette and for providing limits to prevent the coils of ribbon from climbing out of their edge-wise attitude and over other coils. There are provided six of the ribbon support ribs 79

substantially equally spaced around the spool 52 and there are provided five of the rectangular-shaped guide members 84 (Fig. 3) around the spool in alignment with respective ribs 79. The guide member 84 at the right side of Fig. 3 is longer and extends further from the spool 52 than do the other four guide members. It is seen in Fig. 5 that the ribs 79 support and carry the ribbon 54 in edge-wise manner thereon and provide a certain amount of drag or friction on the ribbon to enable sure and precise winding of the ribbon on the spool 52. If the distance between the guide plates 84 and the ribs 79 is smaller than the width of the ribbon, the ribbon is directed into a precise attitude for substantially holding thereof to the concave shape or contour of the spool 52 in rewinding of the ribbon.

As seen in Fig. 2 of the drawing, the ribbon 54 travels in a generally circular path as indicated by the arrow 86 upon rotation of the spool 52 in a clockwise direction, the ribbon 54 being wound or wrapped on the outside of the coils, as indicated on the right side of the spool 52, and such ribbon being unwound or unwrapped from the inside of the coils thereof, as indicated on the left side of the spool 52. In other words, the rewind wrap is on the outside of the coils of ribbon 54 and the unwind wrap is from the inside of the coils. It should be here noted that the concave shape of the spool 52 enables the ribbon 54 to be directed from the inside coil and guides the ribbon at an angle or slant upwardly and over the coils of ribbon as the ribbon emerges from the spool. The ribbon 54 is shown in diagrammatic form in Fig. 4 on either side of the spool 52 and assumes a slanted attitude as shown at the left side thereof, by reason of the portion 53 of the spool, as such portion causes the ribbon to move in a path up and over the coils when unwinding from the spool. Suffice it to say that

the number of coils around the spool 52 may depend upon the particular application of the endless ribbon 54, certain parameters of design being the length of the ribbon loop, and the type of thermal coating means being utilized on the ribbon. It is also desirable to state that a preferred design is to provide at least one complete coil of the ribbon 54 around the spool 52 for purposes of control and tension of the ribbon.

Drive means for the ribbon 54 is from mechanism generally positioned interior of the rear wall 64 of the enclosure 50 and may be contained in a separate package or in an extension of the enclosure. The drive means per se for the ribbon 54 forms no part of the present invention, but a showing is made of a drive element or roller 90 which may have a knurled or serrated surface engageable with the ribbon for driving thereof, there being an adjacent roller 92 which also may have a knurled surface thereon and which is biased by means of a spring 94 connected with an arm portion 96 of a pivot member 98 and arranged to place pressure on the roller 92 and against the ribbon 54 and toward the drive element 90 to provide precise engagement of the ribbon 54 with the roller 90 and the roller 92.

Travel of the ribbon in a path in unwinding thereof from the spool 52 is across a guide member 94 (Fig. 2) supported from side wall portion 60 and from an ear 96 on the rear wall 64, the ribbon being guided upwardly at an angle from the spool 52 (see also Fig. 5). The ribbon 54 then travels around a post or like member 98 at the left rear corner of the cassette 50 which acts as a guide to direct the ribbon 54 downwardly at a proper attitude or angle of about 10 degrees in a path toward and past a printing station, generally designated as 100 (Fig. 1), the ribbon 54 then being trained around a corner post or like member 102 (Fig. 2), and the ribbon again being changed in

its attitude to that coinciding with the coils around the spool 52, in effect taking a one-quarter turn around such guide post 102 in traveling in a path past the printing station, past the drive element 90 and roller 92 to engage with one of the guide elements 84 positioned to guide and contain the ribbon 54, and into the attitude for winding onto the spool 52 and coiling therearound.

CLAIMS:

1. A ribbon cassette for an endless printing ribbon to be unwound from the inside of a coil (54) thereof, driven past a printing station and then rewound on the outside of said coil (54), said cassette including a housing (57, 59, 60, 62) and a cover (66) therefor, and a rotatable spool means (52) within said housing (57, 59, 60, 62) and having a first portion (78) for supporting one edge of the coil (54) of ribbon, and a second portion (80) around which the coil (54) of ribbon is positioned, characterized by guide means (84) engaging the other edge of the coil (54) of ribbon to hold said coil (54) of ribbon in position, and extending generally radially with respect to the axis of rotation of said spool means (52).

2. A ribbon cassette according to claim 1, characterized in that said guide means (84) are formed integrally with said cover (66).

3. A ribbon cassette according to either claim 1 or claim 2, characterized in that said guide means (84) include a plurality of guide members extending radially with respect to said axis of rotation and spaced around said spool means (52).

4. A ribbon cassette according to claim 3, characterized in that said guide members (84) each extend over substantially the whole of the radial extent of said coil (54).

5. A ribbon cassette according to either claim 3 or claim 4, characterized in that said guide members (84) are rectangular plates disposed perpendicularly to said cover (66) of said housing (57, 59, 60, 62).

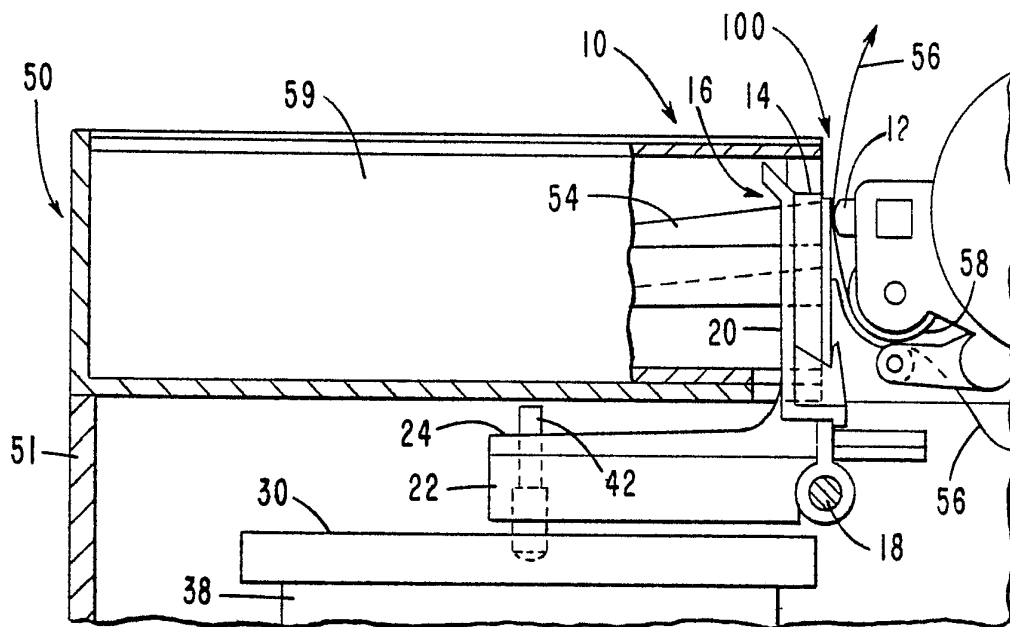
6. A ribbon cassette according to any one of claims 3 to 5, characterized in that said first portion (78) of said spool means (52) in a circular plate having radially extending ribs (79) thereon for supporting said one edge of said coil (54) of ribbon.

7. A ribbon cassette according to claim 6, characterized in that said guide members (84) are respectively disposed in alignment with corresponding ones of said ribs (79).

8. A ribbon cassette according to any one of the preceding claims, characterized in that said second portion (80) of said spool means (52) defines a substantially concave surface.

9. A ribbon cassette according to claim 8, characterized in that the distance between said first portion (78) of said spool means (52) and said guide means (84) is smaller than the width of the ribbon, whereby the ribbon is caused to assume a concave configuration corresponding to the concave surface contour of said second portion (80) of said spool means (52).

FIG. 1



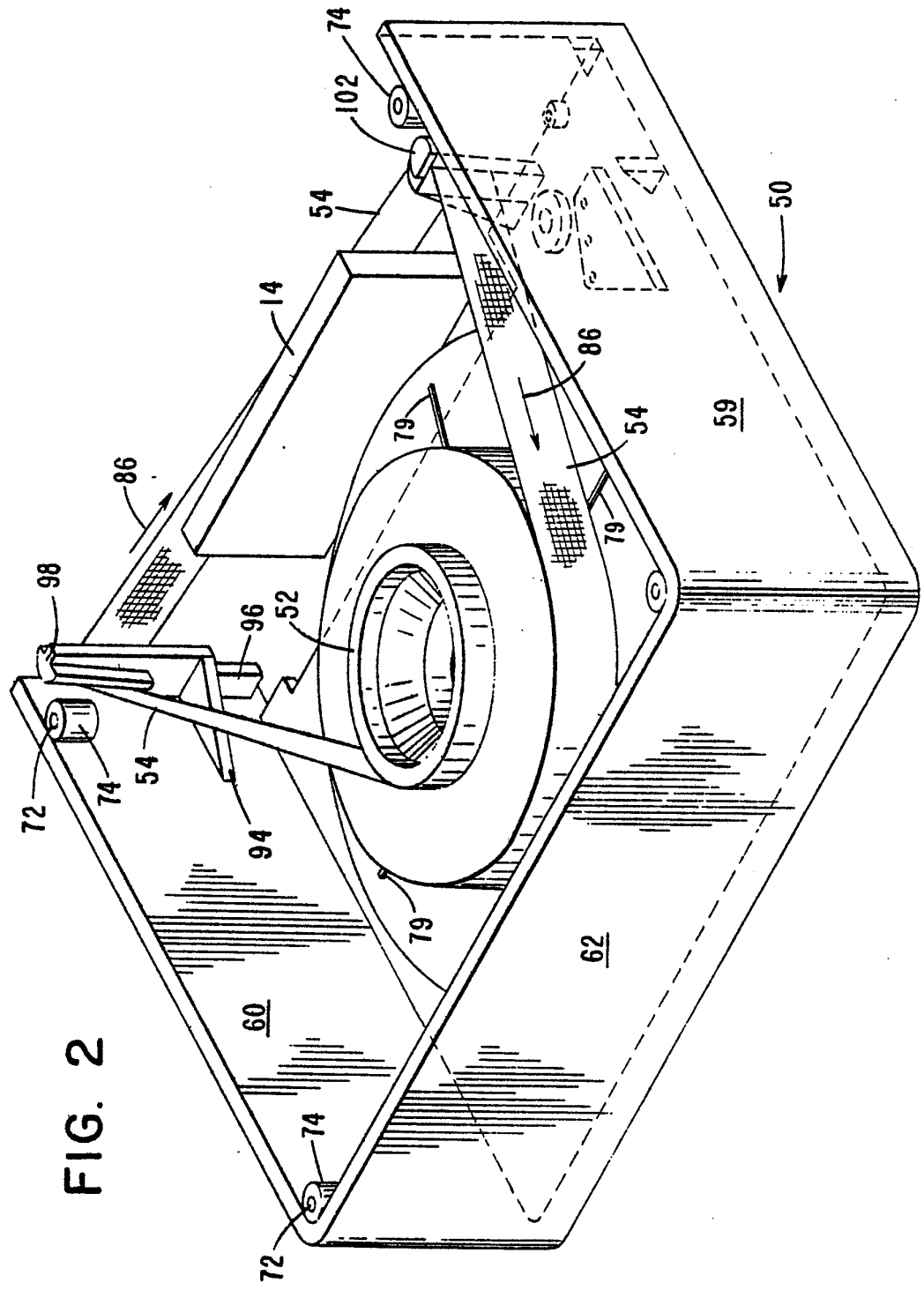


FIG. 2

FIG. 3

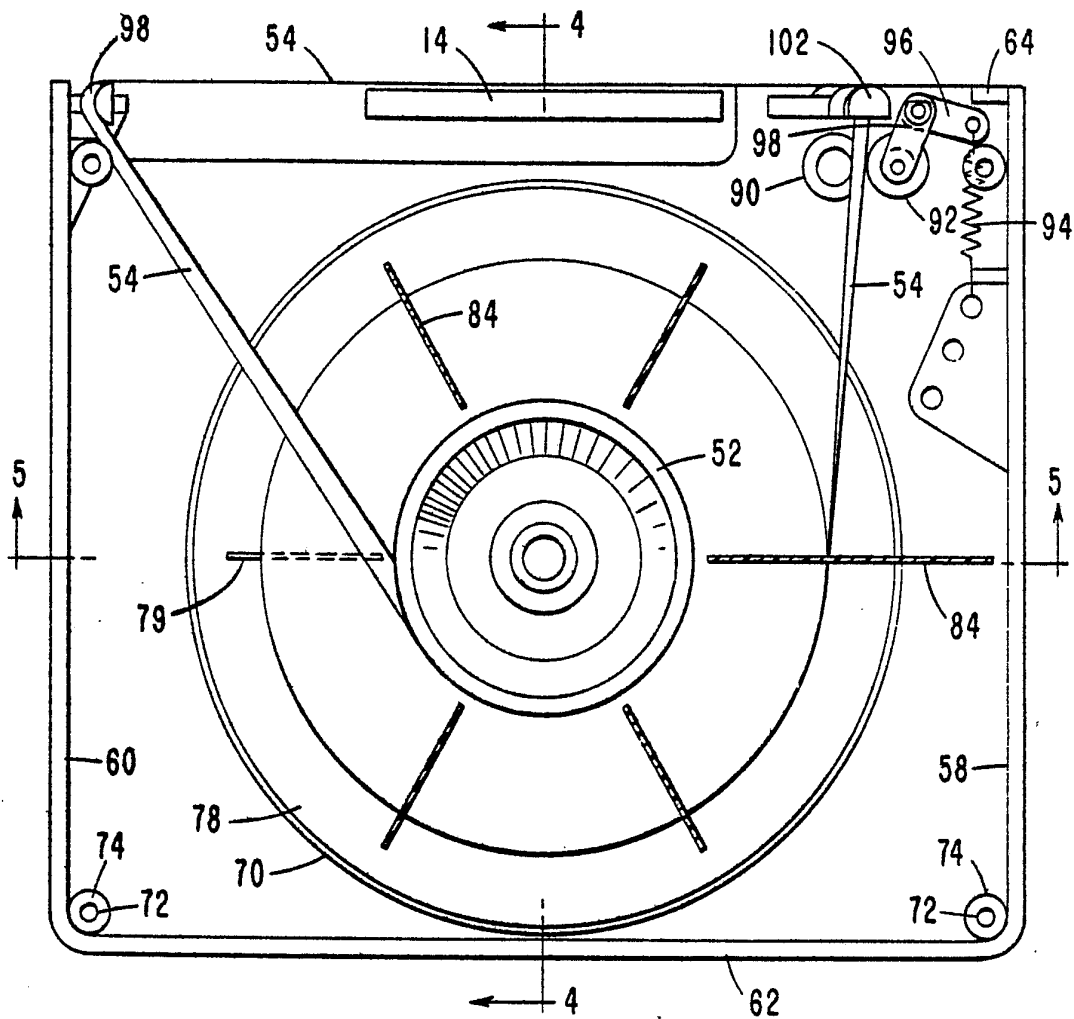


FIG. 4

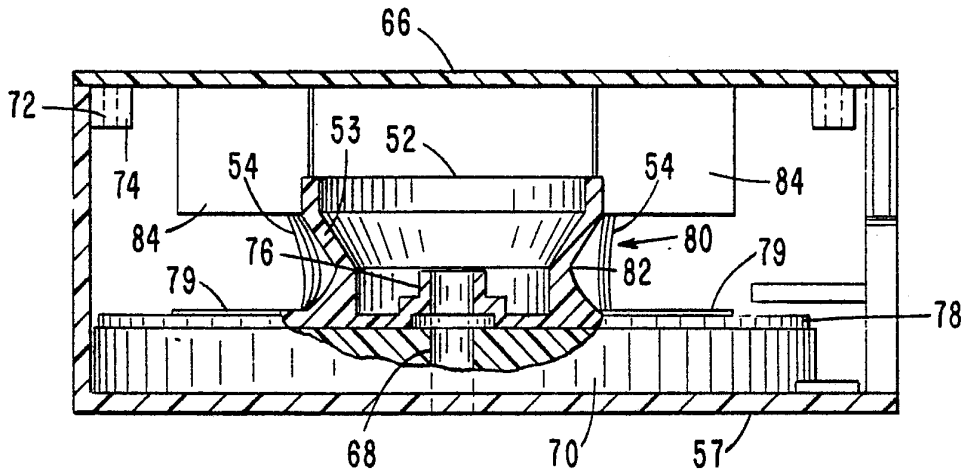
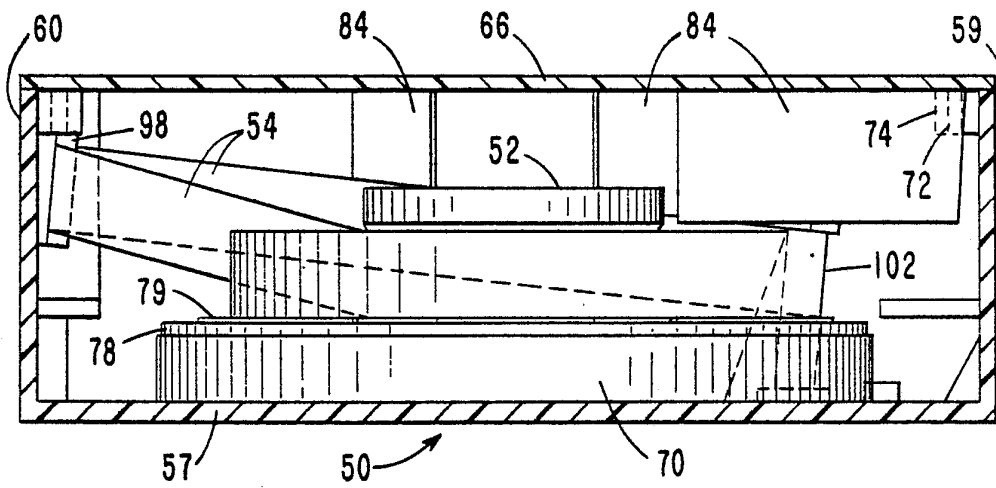



FIG. 5



INTERNATIONAL SEARCH REPORT

International Application No PCT/US 87/01034

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ⁴ : B 41 J 32/02; B 41 J 33/10		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC ⁴	B 41 J	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched *		
III. DOCUMENTS CONSIDERED TO BE RELEVANT *		
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	EP, A, 0141412 (KROY INC.) 15 May 1985 see figure 1a; page 6, lines 13-17 --	1-5
A	US, A, 4051944 (STARR D.G.) 4 October 1977 see figure 5; column 7, lines 35-37 --	1-4
A	GB, A, 1499152 (XEROX CORP.) 25 January 1978 see figures 10,11; page 6, line 127 - page 7, line 7 --	8
A	EP, A, 0013339 (IBM CORP.) 23 July 1980 see figures 1,5; page 3, lines 2-24 -----	8
<p>* Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
24th August 1987	24 SEP 1987	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	L. ROSSI 	

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/US 87/01034 (SA 17322)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 08/09/87

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A- 0141412	15/05/85	AU-A- 3497284 JP-A- 60176791 US-A- 4557617 US-A- 4678353	16/05/85 10/09/85 10/12/85 07/07/87
US-A- 4051944	04/10/77	DE-A- 2720552	01/12/77
GB-A- 1499152	25/01/78	None	
EP-A- 0013339	23/07/80	US-A- 4236678 JP-A- 55093752 CA-A- 1109045	02/12/80 16/07/80 15/09/81

For more details about this annex :
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