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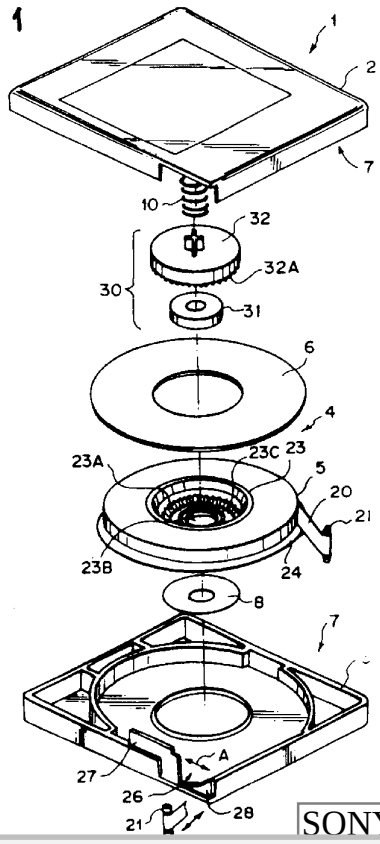
(54) Magnetic tape cartridge

(57) A magnetic tape cartridge includes a cartridge casing and a single reel which is contained in the cartridge casing for rotation. The reel has a reel hub in the form of a cylindrical member which has a bottom wall and is provided with an opening and a stopper gear formed on the bottom wall. A brake member is provided with a brake gear and is movable up and down between an operative position where the brake gear is brought into engagement with the stopper gear to prevent rotation of the reel and a retracted position where the brake gear is disengaged from the stopper gear to permit rotation of the reel. The brake member is normally urged toward the operative position and moved to the retracted position by a pusher member of a tape drive system which acts on the brake member through the opening in the reel hub when the magnetic tape cartridge is loaded in the tape drive system. A continuous wall portion is erected around the opening in the reel hub, and the brake member includes a horizontal portion and a continuous skirt portion which extends downward from the horizontal portion and is in contact with the continuous wall portion of the reel hub to close the opening together with the horizontal portion. The brake member is moved between the operative position and the retracted position with the skirt portion kept in cotact with the continuous wall portion of the reel hub.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] This invention relates to a magnetic tape cartridge, and more particularly to a magnetic tape cartridge comprising a cartridge casing and a single reel around which a magnetic tape is wound and which is contained in the cartridge casing for rotation.

Description of the Related Art

[0002] There has been known a single reel magnetic tape cartridge, comprising a cartridge casing and a single reel around which a magnetic tape is wound and which is contained in the cartridge casing for rotation, as a recording medium for an external storage for a computer and the like. Such a single reel magnetic tape cartridge is used for retaining important data of a computer or the like and accordingly is arranged so that trouble such as tape jamming does not occur and the magnetic tape is not accidentally drawn out.

[0003] The reel is provided with a cylindrical reel hub having a closed bottom and stopper gear teeth are formed in a circle and a brake member provided with a brake gear which is adapted to be brought into engagement with the stopper gear teeth is disposed to be movable in the direction of thickness of the cartridge casing along the axis of rotation of the reel. The brake member is urged, for instance, by a coiled spring toward a position where the stopper gear teeth are engaged with the break gear to prevent rotation of the reel when the magnetic tape cartridge is not used. When the magnetic tape cartridge is loaded in a recording and reproducing system, a brake release spindle of the recording and reproducing system pushes upward the brake member to disengage the stopper gear teeth from the brake gear.

[0004] However if a space is formed between the brake member and the reel hub when the brake member is moved upward, dust and dirt can enter the inside of the cartridge casing through the space.

SUMMARY OF THE INVENTION

[0005] In view of the foregoing observations and description, the primary object of the present invention is to provide a magnetic tape cartridge in which dust and dirt can be prevented from entering the inside of the cartridge casing when the brake member is moved upward to permit rotation of the reel.

[0006] In accordance with the present invention, there is provided a magnetic tape cartridge comprising a cartridge casing, a single reel around which a magnetic tape is wound and which is contained in the cartridge casing for rotation, the reel having a reel hub in the form of a cylindrical member which has a bottom wall and is provided with an opening and a stopper gear formed on the bottom wall, and a brake member which is provided with a brake gear and is movable up and down between an operative position where the brake gear is brought into engagement with the stopper gear to prevent rotation of the reel and a retracted position where the brake gear is disengaged from the stopper gear to permit rotation of the reel, the brake member being normally urged toward the operative position and moved to the retracted position by a pusher member of a tape drive system which acts on the brake member through the opening in the reel hub when the magnetic tape cartridge is loaded in the tape drive system,

wherein the improvement comprises that

a continuous wall portion is erected around the opening in the reel hub, and

the brake member comprises a horizontal portion which is disposed above the opening in the reel hub and receives force from the pusher member when the brake member is moved to the retracted position and a continuous skirt portion which extends downward from the horizontal portion and is in contact with the continuous wall portion of the reel hub, thereby closing the opening together with the horizontal portion, the brake member being moved between the operative position and the retracted position with the skirt portion kept in contact with the continuous wall portion of the reel hub.

[0007] It is preferred that the brake member comprises a first member and a second member which abuts against the first member from above and is movable up and down together with the first member, said horizontal portion and the skirt portion are formed on the first member and the brake member is urged toward the operative position by a spring means which acts on the second member.

[0008] The skirt portion may be fitted either on or in the continuous wall portion.

[0009] In the case where the brake member comprises the first and second members, it is preferred that the first and second members abut against each other by way of a projection and the first and/or second members be formed of low friction hardwearing material.

[0010] In the magnetic tape cartridge of the present invention, the skirt portion is kept in contact with the continuous wall portion on the reel hub to keep the opening closed even when the brake member is in the retracted position, entrance of dust and dirt into the cartridge casing through the opening can be prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Figure 1 is an exploded perspective view of a magnetic tape cartridge in accordance with a first em-

bodiment of the present invention,
Figure 2 is a side view of the first member of the brake member,
Figure 3 is a side view of the second member of the brake member,
Figure 4 is a fragmentary cross-sectional view showing an important part of the magnetic tape cartridge of the first embodiment,
Figure 5 is a fragmentary cross-sectional view showing a modification of the first embodiment,
Figure 6 is a view similar to Figure 5 but showing another modification of the first embodiment,
Figure 7 is a cross-sectional view of a magnetic tape cartridge in accordance with a second embodiment of the present invention in a state where the magnetic tape cartridge is not used,
Figure 8 is an exploded perspective view showing the reel stopper mechanism of the magnetic tape cartridge,
Figure 9 is a fragmentary cross-sectional showing the magnetic tape cartridge in a state where it is used,
Figure 10 is a fragmentary cross-sectional showing a modification of the magnetic tape cartridge of the second embodiment,
Figure 11 is a view similar to Figure 8 but showing the reel stopper mechanism in a magnetic tape cartridge in accordance with a third embodiment of the present invention,
Figure 12 is a cross-sectional view of a magnetic tape cartridge in accordance with a fourth embodiment of the present invention in a state where the magnetic tape cartridge is not used,
Figure 13 is an exploded perspective view showing the reel stopper mechanism of the magnetic tape cartridge,
Figure 14 is a fragmentary cross-sectional showing the magnetic tape cartridge in a state where it is used,
Figure 15 is a fragmentary cross-sectional view showing an example of the through hole and the push rod employed in the fourth embodiment,
Figures 16A and 16B are fragmentary cross-sectional views showing another example of the through hole and the push rod employed in the fourth embodiment,
Figure 17 is a fragmentary cross-sectional view showing still another example of the through hole employed in the fourth embodiment,
Figure 18 is a fragmentary cross-sectional view showing still another example of the through hole and the push rod employed in the fourth embodiment,
Figure 19 is a fragmentary cross-sectional view showing still another example of the through hole employed in the fourth embodiment,
Figures 20 and 21 show modifications of the brake release member,
Figures 22A and 22B are cross-sectional views showing modifications of the shapes of the push rod and the through hole,
Figures 23A and 23B are cross-sectional views showing modifications of the shapes of the push rod and the through hole,
Figure 24 is a cross-sectional view of a magnetic tape cartridge in accordance with a fifth embodiment of the present invention in a state where the magnetic tape cartridge is not used,
Figure 25 is an exploded perspective view showing the reel stopper mechanism of the magnetic tape cartridge,
Figure 26 is a cross-sectional view of a magnetic tape cartridge in accordance with a sixth embodiment of the present invention in a state where the magnetic tape cartridge is not used, and
Figure 27 is an exploded perspective view showing the reel stopper mechanism of the magnetic tape cartridge.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0012] In Figure 1, a magnetic tape cartridge 1 in accordance with a first embodiment of the present invention comprises a single reel 4 around which a magnetic tape 20 is wound and is contained for rotation in a cartridge casing 7. The reel 4 is formed by bonding together a lower reel half 5 and an upper reel half 6 by ultrasonic welding. The cartridge casing 7 is formed by fastening together upper and lower casing halves 2 and 3 by screws and the like.

[0013] The lower reel half 5 comprises a cylindrical hub 23 and a flange 24 which are integrally molded from synthetic resin. A reel plate 8 for magnetically connecting a drive mechanism of a recording and reproducing system is mounted on the outer bottom surface of the hub 23. Further on the inner bottom surface of the hub 23, is formed a stopper gear 23A which is brought into engagement with a brake gear 32A formed on a brake member 30 to be described later and prevents rotation of the reel 4 when the magnetic tape cartridge 1 is not used. The hub 23 is provided with an opening 23B, through which a brake release spindle in the recording and reproducing system is inserted to push upward the brake member 30. An annular groove 23C in which the brake member 30 is fitted is formed around the opening 23B.

[0014] The brake member 30 comprises a first member 31 having an annular protrusion 31A (Figure 2) which is fitted in annular groove 23C of the reel hub 23 and a second member 32 having an annular protrusion which is projected downward as shown in Figure 3. The brake gear 32A is formed on the lower end face of the annular protrusion of the second member 32. A projection 31B is formed on the upper surface of the first member 31 and the second member 32 rests on the projection 31 as shown in Figure 4. Further an exposed portion

31C which is exposed outward through the opening 23B of the reel hub 23 as shown in Figure 4 is formed on the lower surface of the first member 31. A projection 32B which is like a cross in cross-section and is normally held in a groove 2A which is like a cross in cross-section and is formed on the inner surface of the upper casing half 2 is provided on the upper surface of the second member 32.

[0015] The brake member 30 is urged downward by a coiled spring 10 fitted on the projection 32B and is positioned in the cartridge casing 8 with the annular protrusion 31A of the first member 31 received in the annular groove 32C of the reel hub 23, with the brake gear 32A and the stopper gear 23A in mesh with each other and with the projection 32B received in the groove 2A as shown in Figure 4. The height of the first member 31 (the distance between the lower end face of the annular protrusion 32A and the top of the projection 31B) is set so that the second member 32 rests on the projection 31B of the first member 31 and the brake gear 32A and the stopper gear 23A are in mesh with each other so long as the second member 32 is in a position as urged by the coiled spring 10. Further the height of the annular protrusion 31A of the first member 31 and the depth of the annular groove 23C of the reel hub 23 are set so that the annular protrusion 31A is still in the annular groove 23C even if the first member 31 is lifted to its uppermost position. The first member 31 and/or the second member 32 is formed of low friction, hardwearing material such as polyoxymethylene, resin added with molybdenum or the like.

[0016] In this state, rotation of the reel 4 is prevented by engagement between the brake gear 32A and the stopper gear 23A. When the magnetic tape cartridge 1 is loaded in the recording and reproducing system, the brake release spindle of the recording and reproducing system pushes upward the exposed portion 31C of the brake member 30, whereby the first and second members 31 and 32 of the brake member 30 are moved upward overcoming the force of the coiled spring 10 and the gears 32A and 23A are disengaged from each other to permit rotation of the reel 4. At this time, though the annular protrusion 31A of the first member 31 is moved upward relative to the annular groove 23C of the reel hub 23, the protrusion 31A is not drawn out of the groove 23C as described above.

[0017] A tape outlet opening 26 through which the magnetic tape 20 is drawn out is formed in a side wall of the cartridge casing 7. The tape outlet opening 26 is closed and opened by a slide door 27 which is slidable in the directions of double-headed arrow A and is urged in the closing position by a spring not shown.

[0018] A leader pin 21 is fixed to the leading end of the magnetic tape 20 and when the magnetic tape cartridge 1 is not used, the magnetic tape 20 is entirely wound around the reel 4 with the leader pin 21 held in a recess 28 formed near the tape outlet opening 26.

[0019] When the magnetic tape cartridge 1 is loaded in a recording and reproducing system, the gears 23A and 32A of the hub 23 and the brake member 30 are disengaged from each other to permit rotation of the reel 4 in the manner described above and the drive mechanism of the recording and reproducing system holds the reel plate 8 under magnetic force and rotates the reel 4. At the same time, the slide door 27 is opened and the leader pin 21 is brought to a predetermined position in a tape running path, thereby recording or reproduction becomes feasible. In this state, since the annular protrusion 31A of the first member 31 is still in the annular groove 23C, dust cannot enter the cartridge casing 7 through the opening 23B of the reel hub 23.

[0020] Since the annular protrusion 31A is fitted in the annular groove 23C, the first member 31 is sometimes rotated relative to the second member 32 in response to rotation of the reel 4. In this particular embodiment, since the first member 31 is in contact with only at the projection 31B, sliding resistance is small and generation of wear tailings can be reduced. Further since the first member 31 and/or the second member 32 is formed of low friction, hardwearing material such as polyoxymethylene, sliding resistance is smaller and generation of wear tailings can be more reduced.

[0021] Though, in the first embodiment described above, the groove 23C is formed in the reel hub 23 and the protrusion 31A of the first member 31 is fitted in the groove 23C, an annular wall portion 23D may be formed around the opening 23B as shown in Figure 5, and the annular protrusion 31A may be fitted on the annular wall portion 23D. Otherwise an annular wall portion 23E may be formed around the opening 23B and the annular protrusion 31A may be fitted in the annular wall portion 23E as shown in Figure 6. In this case, it is preferred that an annular flange 23F be provided to project inward from the annular wall portion 23E, thereby preventing the first member 31 from falling down through the opening 23B.

[0022] Further, though, in the first embodiment described above, the first member 31 is in abutment against the second member 32 at the projection 31B formed on the first member 31, such a projection may be formed on the second member 32 or on each of the first and second members 31 and 32.

[0023] A magnetic tape cartridge in accordance with a second embodiment of the present invention will be described with reference to Figures 7 to 9, hereinbelow.

[0024] In Figure 7, the magnetic tape cartridge 101 of the second embodiment comprises a single reel 102 around which a magnetic tape (not shown) is wound and is contained for rotation in a cartridge casing 103. The cartridge casing 103 is formed by fastening together upper and lower casing halves 131 and 132 by screws and the like. The lower casing half 132 is provided with a central opening 132a. Further the magnetic tape cartridge 101 is provided with a reel stopper means 110 which prevents rotation of the reel 102 when the magnetic tape cartridge 101 is not used and permits rotation of the reel 102 when the magnetic tape cartridge 101 is

used.

[0025] The reel 102 comprises a reel hub 121 which is a cylindrical member having a bottom wall 121a and doughnut-shaped lower and upper flanges 122 and 123 extending outward from the lower and upper ends of the reel hub 121. The reel hub 121 and the lower flange 122 are formed integrally with each other by molding of synthetic resin and the upper flange 123 is fixed to the reel hub 121, for instance, by ultrasonic welding. Gear teeth (reel gear) 124 for driving the reel 102 are formed in a circle on the lower surface of the bottom wall 121a of the reel hub 121 and an annular reel plate 125 of magnetic metal is mounted on the lower surface of the bottom wall 121a inside the reel gear 124. The reel gear 124 and the reel plate 125 are exposed outside through the central opening 132a in the cartridge casing 132. The reel 102 is urged downward by an urging member 105 to be described later.

[0026] A reel drive means 111 of a tape drive system comprises a rotary spindle 112 provided with a drive gear 113 formed on the upper end face of the rotary spindle 112 and a magnet disposed on the upper end face of the same. When the magnetic tape cartridge 101 is loaded in the tape drive system, the rotary spindle 111 is moved upward toward the magnetic tape cartridge 101 and the drive gear 113 is brought into mesh with the reel gear 124 while the magnet attracts the reel plate 125 to hold the drive gear 113 in mesh with the reel gear 124.

[0027] The reel stopper means 110 comprises a brake member 104 which is movable up and down away from and toward the reel 102, an urging member 105 which urges the brake member 104 toward the reel 102 and a brake release member 106 which moves the brake member away from the reel 102.

[0028] As shown in Figure 8, three through holes 126 are formed in the bottom wall 121a of the reel hub 121 at regular intervals on a circle to extend through the bottom wall 121a at the portion where the reel gear 124 is formed. Further three engagement projections 127 are erected from the upper surface of the bottom wall 121a at regular intervals on a circle in positions angularly spaced from the through holes 126. The number of the through holes 126 and the engagement projections 127 need not be limited to three but for or more through holes 126 and engagement projections 127 may be formed. The upper end portion of each engagement projection 127 is shaped like a gear tooth and may be shaped like a plurality of gear teeth. In Figure 8, only the bottom wall 121a of the reel hub 121 is shown as the reel 102.

[0029] The brake member 104 is a substantially disc-like member and is disposed in the reel hub 121 opposed to the bottom wall 121a of the reel hub 121. A plurality of gear teeth 141 (stopper gear) are annularly formed on the lower surface of the brake member 104 and are adapted to be brought into engagement with the engagement projections 127. A straight protrusion 142 extends upward from the upper surface of the brake member 104 and is fitted in a guide groove formed in a guide portion 131a projecting downward from the inner surface of the upper casing half 131, whereby the brake member 104 is able to be moved toward and away from the bottom wall 121a of the reel hub 121 without rotating relative to the reel hub 121. The protrusion 142 and the groove in the guide portion 131a may be like a cross in cross-section.

[0030] An urging member 105 in the form of a coiled spring compressed between the upper surface of the brake member 104 urges the brake member 104 toward the operative position where the stopper gear 141 and the engagement projections 127 are engaged with each other to prevent rotation of the reel 104.

[0031] The brake release member 106 is disposed between the brake member 104 and the bottom wall 121a of the reel hub 121 to be movable up and down. As shown in Figure 8, the brake release member 106 comprises a central disc portion 161 and three arms 162 extending radially outward from the central disc portion 161. A rectangular push rod 163 extends downward from the free end of each arm 162 and is inserted for up and down movement into one of the through holes 126 formed in the bottom wall 121a of the reel hub 121 with its lower end projected into teeth portion of the reel gear 124 on the lower surface of the reel hub 121. The engagement projections 127 are positioned between the arms 162.

[0032] In the lowermost position of the brake release member 106 shown in Figure 7, the lower end face of each push rod 163 is positioned substantially flush with the tips of the teeth of the reel gear 124 and, in response to chucking action of the rotary spindle 111 of the tape drive system for bringing the drive gear 113 into mesh with the reel gear 124, the push rods 163 are pushed upward to move upward the brake release member 106 by a predetermined amount, thereby disengaging the engagement projection 127 from the stopper gear 141 to permit rotation of the reel 102 as shown in Figure 9. Since the push rods 163 are inserted into the through holes 126 in the reel hub 121, the brake release member 106 is rotated integrally with the reel 102.

[0033] The brake member 104 is urged downward by the urging means 105 so that the lower surface thereof abuts against the upper surface of the brake release member 106. A spherical projection 164 is formed on the upper surface of the central disc portion 161 coaxially with the axis of rotation of the brake release member 106, and a recess 143 having a curved bottom is formed on the lower surface of the brake member 104 so that the tip of the spherical projection 164 abuts against the center of the recess 143. Further an annular protrusion 165 is formed on the upper surface of the brake release member 106 around the spherical projection 164 and the lower surface of the brake member 104 abuts against the upper surface of the protrusion 165. Thus the brake member 104 and the brake release member 106 contact each other over a limited area, whereby the

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