CAPSULE REEL ASSEMBLY FOR TAPES
14 Claims, 8 Drawing Figs.

ABSTRACT: A capsule reel assembly for tapes having a pair of flanges rotatably mounted with respect to each other in spaced-apart parallel relationship, a hub extending between said flanges for supporting a length of tape trained therearound, and a spool disposed about the hub for winding a length of tape into the space between the flanges for storage.
CAPSULE REEL ASSEMBLY FOR TAPES

RELATED APPLICATION

The present application discloses an improvement of the capsule reel assembly disclosed in my copending application, Ser. No. 689,540, filed Dec. 11, 1967, entitled Reels and Reel-and-Ribbon Assemblies.

BACKGROUND OF THE INVENTION

My copending application, mentioned above, discloses a capsule reel assembly comprising, in general, pair of reel flanges which are maintained in spaced-apart parallel relationship by hub means which support one flange for rotary movement with respect to the other. Pin means are carried by the rotating flange for facilitating the winding of an endless ribbon into the space between the flanges; and, in the preferred embodiment, this space is enclosed by an endless sidewall carried by the nonrotating flange and extending between the outer peripheral edges of the two flanges.

With the structure of the assembly disclosed in my copending application, the endless ribbon or tape, which may be a magnetic tape, punched tape, film or the like, is trained about the hub means and, when in use, the ribbon extends outwardly of the reel assembly in the form of a closed loop. In this condition, without any further preparation, the tape or ribbon may be fed though the tape-advancing rollers on the sound head of a conventional recording-playback instrument. When not in use, the tape may be conveniently wound back into the reel assembly for storage simply by rotating the rotatable flange with the finger. This rotational movement causes the tape to be engaged by the pin members carried by the rotating flange at a point spaced from the hub; and upon rotation of the pins about the hub, the tape is caused to wind up into the internal space between the flanges of the assembly.

With the capsule reel assembly disclosed in my copending application, there are certain features which may present problems if the assembly is not handled and used properly. In my prior reel assembly, the rotating flange is held in place on the hub of the assembly by a separate snap ring, a removable plastic cap or similar means. The use of a multiple-part hub and flange-retaining means adds to the cost of manufacture of the reel assembly and the separate retainer may be lost when the assembly is taken apart.

Also, with the construction disclosed in my copending application, the rotating flange is supported on the upper edge surface of the sidewall of the assembly. This edge surface is flat and the bottom peripheral surface of the rotating flange is likewise flat. With these two surfaces facing each other, a slit is formed between the sidewall and upper flange; and this slit provides an opening through which the tape may pass upon mishandling of the assembly.

Another characteristic of the capsule disclosed in my copending application relates to the use of the pin members for winding the tape onto the assembly. The use of one or more pin members for effecting this winding provides a rather short turn about which the tape is wound; and if the user of the assembly improperly winds the tape too tightly, this could cause the formation of crease marks in the tape. Of course, such crease marks would not be formed if the winding of the tape were properly done to form a rather loose coil.

SUMMARY OF THE INVENTION

In accordance with the teachings of the present invention, an improved capsule assembly is provided. Generally, the assembly is made of Plexiglas or similar material and includes a hub and retaining means requiring no separate element for retaining the flange in place. The hub of the assembly includes a split shank member onto which the flange may be assembled by simply pressing it on with a snap action; with the flange being retained in place by an enlarged end portion of the shank. The hub means also includes a rotatable bearing support for the tape to be wound thereon; and this bearing support is mounted for rotation independently of the rotating flange of the assembly.

For winding the tape into the capsule assembly, the pin structure disclosed in my prior application is replaced by a circular spool providing a smooth winding surface for the tape. This spool is disposed about the hub of the assembly and is formed with an opening for permitting the tape, which is trained about the hub, to pass outwardly of the spool and outwardly of the capsule assembly for feeding through the recording-playback instrument.

In addition to the above, the sidewall of the capsule assembly of the present invention is constructed to facilitate initial winding of the tape about the hub of the assembly without necessitating removal of the rotating flange. Also, the surface of the sidewall facing the rotating flange is constructed with an irregular stepped surface for mating with a similar surface on the flange. This construction provides a tightly closed capsule preventing passing of tape therethrough.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of the capsule reel assembly of the present invention;
FIG. 2 is a cross-sectional view of the assembly taken along lines 2--2 of FIG. 1;
FIG. 3 is a top plan view of the capsule assembly of the present invention showing a modified hub construction and the endless tape in stored condition;
FIG. 4 is a top plan view of the capsule assembly of FIG. 3 showing the tape in playing position;
FIG. 5 is a cross-sectional view of the capsule assembly showing another modified embodiment of the hub means;
FIG. 6 is an enlarged partial cross-sectional view of the area around the openings in the sidewall of the capsule assembly shown in FIGS. 1--4;
FIG. 7 is a partial cross-sectional view of the capsule assembly showing an alternative embodiment of the flange and sidewall connection; and
FIG. 8 is a partial cross-sectional view showing still another embodiment of the flange and sidewall connection.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIGS. 1 and 2, the reel assembly of the present invention generally includes a base flange 1, a top flange 2, and hub means 3 for rotatably connecting the flanges together. The assembly also includes a sidewall 4 formed integrally with the base flange and extending upwardly towards a top flange. Finally, extending downwardly from the top flange is a circular shape spool means 5 about which a continuous length of tape is adapted to be wound for storage in the area between the spool means and the outer sidewall of the assembly.

The hub means 3 is disposed centrally between the top and base flanges and is constructed to support the top flange for rotary movement with respect to the base flange. The hub means comprises a shank 6 of generally circular cross section formed integrally with the base flange and having an enlarged free end 7 extending outwardly through a centrally disposed aperture 8 in the top flange 2. In the embodiment shown in FIGS. 1 and 2, the shank 6 is split as shown at 9 so as to provide two prongs 10. Due to the physical properties of Plexiglas from which the entire assembly is made and due to the cross-sectional size of the prongs, they are bendable to the extent necessary to permit attachment of the flange thereon.

As an alternative to the split shank construction shown in FIGS. 1 and 2, the shank may, as shown in FIGS. 3 and 4, be split three ways to thereby form three resilient prongs 11. With the split shank construction, the upper flange may be easily secured about the shank 6 in the manner indicated in FIG. 2 simply by snapping it into place thereon. Since the enlarged head extends appreciably above the outer face of the top flange 2, it may be grasped within the fingers and squeezed together to permit removal of the top flange 2 and access to the interior of the assembly.
In the embodiments shown in FIGS. 1-4, the top flange is supported and maintained in spaced relationship to the base flange 1 by a flange-supporting means comprising a sleeve 12 which is disposed about the shank 6 in underlying relation to its enlarged head 7. Since the sleeve is intended to provide a double-bearing-surface, as will hereinafter be described, it is advantageously made of a material having a low coefficient of friction, such as that sold under the trade name Teflon.

Disposed about the sleeve 12 in contacting rotational engagement therewith is a hollow roller 13. The axial length of the roller is approximately equal to the width of the tape to be stored between the flanges but slightly less than the axial length of the sleeve 12. With this arrangement, the roller 13 can rotate about the sleeve 12 independently of the top flange; and conversely, the top flange 2 can rotate about the shank 6 on sleeve 12 independently of roller 13.

The mounting of the roller 13 for rotation independently of the flange is of advantage when the tape from the capsule assembly is being fed through the recording-playback instrument. During this use of the capsule assembly, the tape takes on the position shown in FIG. 4; and by providing the freely rotating roller 13, movement of the tape through the capsule assembly can be accomplished with a minimum amount of frictional drag.

For the above description of the hub means, it will be recognized that the sleeve 12 serves as a bearing surface for both the top flange 2 and the roller 13, the former being supported by and rotating in contact with the upper end of the sleeve and the latter rotating in contact with its cylindrical outer surface.

In the embodiment of the invention shown in FIG. 5, the flange-supporting means for the flange 2 is constructed as an integral part of the shank portion of the hub means. As shown in FIG. 5, the shank is provided with a radially outwardly extending land 14 underlying the enlarged head 7 of the shank. The land together with the facing surface of the enlarged head of the shank provide a bearing recessed support for the rotating flange 2. The height of the supporting land for the flange is slightly greater than the height of roller 13 so that the latter may rotate independently of the flange. In the construction shown in FIG. 5, it is of advantage to include a thin bearing washer 15 made of suitable material such as Teflon for axially supporting the flange.

The hub constructions described above, either the sleeve 12 and/or the roller 13 provides a suitable way by which a label containing information pertaining to the recording on the tape may be attached to the assembly. In the construction shown in FIG. 2, such a label H having central apertures for receiving the prongs of the shank of the hub therethrough may be positioned on the upper surface of the base flange 1 and held firmly in place by the sleeve 12. In the construction of FIG. 5, the roller 13 alone is used to hold the label on the flange. With the capsule assembly being made of transparent Plexiglas, the information on the label may be conveniently read through the opposite flanges.

In accordance with the teachings of the present invention, the capsule assembly is provided with a spool means which provides for winding of the tape into a coil without subjecting it to sharp bending that might cause creasing. As shown in the drawings, the spool means 5 of the assembly of the present invention is mounted on the top flange 2 and extends downwardly along the hub means. In the preferred embodiment, the spool means comprises a circular collar formed of a major wall portion 16 and a minor wall portion 16' positioned in concentric fully spaced relationship to the hub means. As shown in FIG. 2, the collar extends into the space between the top and base flanges and terminates at a point slightly above the upper surface of the base flange. The height of the collar is chosen so that it corresponds approximately to the width of the tape used. The collar is formed with two slits 17 between the major and minor wall portions which extend transversely of the collar for receiving portions of the endless tape to be trained around the roller 13 in the manner indicated in FIG. 4. The angular distance between these slits depends on the direction at which the tape is to enter into and issue from the capsule when in use. This angular distance may vary between about 30° and 150°. However, experience has indicated that an angular distance of about 50° is best suited for most applications.

For cooperating with the slits 17 of the collar, the sidewall of the assembly is provided with two slits 18. These slits provide for free entry and exit of portions of the endless tape into the area between the collar and sidewall. This area defines a storage area for containing the wound tape as shown in FIG. 3. The angular distance between the slits 18 corresponds approximately to the angular distance between the slits 17 of the collar so that the slits of the collar and the sidewall are radially aligned with respect to a common center along two straight lines extending tangentially of the opposite side surfaces of the roller 13. As shown in FIG. 4, these two straight lines, indicated by the broken lines 19, meet at a common center point 20. With this construction, the tape can be fed around the roller 13 and through the capsule during use in a recording-playback instrument without rubbing against the nonbearing surface which form the slits 17 and 18.

As shown in FIGS. 3 and 4, and more clearly in the enlarged view of FIG. 6, the sidewall of the capsule assembly is comprised of a major wall portion 21 and a minor wall portion 22, the minor wall portion being disposed in spaced relation between the ends of the major wall portion to define the slits 18. For purposes of facilitating loading of the capsule assembly, the ends of the major wall portion 21 are constructed with tapered surfaces 23 facing radially inwardly of the assembly while the ends of the minor wall portion 22 are constructed with tapered surfaces 24 facing radially outwardly of the assembly.

With this construction, the top flange may be rotated to align the slits of the collar with the slits of the sidewall of the assembly; and then, a length of tape may be inserted through one radially aligned pair of slits 18, 17, trained around the hub means 3 and directed back to the outside of the assembly through the slits 17, 18. The loading of the capsule assembly without requiring removal of the flange 2 is possible since the surfaces of the collar and sidewall of the assembly assist in properly directing the tape through the slits 17, 18. More particularly, the leading end of the tape as it is fed into the area defined by the collar will be directed about an engagement with the inner surface of the major wall portion 16 of the collar; and as the leading end approaches the open slit 17 it will pass outwardly of the collar. It is then simply a matter of feeding more tape into the capsule until the leading end engages the inner surface of the major wall portion 21 of the sidewall. Such engagement may be facilitated by rotating the flange in a counterclockwise direction from the position shown in FIG. 4. As more tape is fed into the capsule, its leading end will then run along the inner surface of the major wall portion 21 until it reaches the open slit 18; and due to the tapered surfaces 23, 24, this leading end of the tape will be directed outwardly through the slit.

After the leading end of the tape can be grasped outside of the capsule, it may then be spliced to the other end of the tape to form a continuous loop which can then be wound into the capsule assembly by rotating the top flange 2. Since the outer loop of the endless tape lies tautly about the wall portion 22 of the sidewall 2 between the slits 18 when in woundup condition, a small protrusion 25 is provided on the outer surface of this wall portion. With this, the tape may be easily grasped and pulled out of the capsule when desired.

Attention is now drawn to the construction of the joint between the top flange 2 and the sidewall 4 of the capsule assembly. Referring in particular to FIGS. 2, 7 and 8, it will be seen that the sidewall 4 is provided with a stepped-shaped surface 26 formed along its upper free edge. A corresponding stepped-shaped configuration 27 is cut into the periphery of
the top flange 2. Thus, when assembled, the sidewall 4 and top flange 2 bear against one another on graduated or stepped surfaces. The double bend formed by the stepped-shaped joint between the sidewall and top flange prevents jamming or snarling of the tape between these two parts.

As shown in FIG. 7, the stepped surface 26 of the sidewall of the capsule assembly is formed inwardly of the outer surface of the sidewall. Thus, the top flange 2 is entirely enclosed by the sidewall 4 with the upper surface of the top flange disposed substantially level to the upper surface of the sidewall 4. With this arrangement, the flange 2 may be easily rotated when the capsule assembly is held in one's hand without worry that the user's fingers will grasp the edge of the rotating flange.

In the embodiment of the invention shown in FIG. 8, the stepped surface 26 of the sidewall is again formed inwardly of the outer edge of the sidewall. In this embodiment, however, the upper edge of the sidewall which is disposed radially outwardly of the flange 2 extends above the flange and to a location level with the uppermost extremity with the hub means. This construction facilitates stacking of the capsule assemblies.

The operation of the capsule assembly is described as follows. An endless tape is disposed about the roller 13 as shown in FIG. 4 with opposed portions of the endless tape extending through the slits 17 of the collar and the slits 18 of the sidewall. In this condition, the tape can be fed through the tape advancing rollers of a recording-playback instrument when the latter is placed in a vertical position on a shelf or other supporting structure. The tape together with the capsule assembly simply hangs down as the tape is fed through the recording-playback instrument. The assembly remains stationary in its suspended condition with the roller 13 seated within the lower end of the hoop of tape. The weight of the capsule assembly is selected so that the moving tape remains under a light tension during feeding through the recording-playback instrument.

It is also possible with the tape capsule assembly of this invention to feed the tape through the feed rollers of a horizontally positioned recorder. For this purpose, an axial bore is provided in the shank 6 of the hub so that the assembly can be supported on an upstanding pin which extends freely through the bore.

When playing of the tape has been completed and it is desired to store the tape within the capsule the top flange 2 is rotated in either a clockwise or counterclockwise direction thereby causing the tape to be wound into the capsule around the circular spool 5. For example, if as shown in FIG. 3, the upper flange 2 is rotated in the direction of the arrow, the tape will become engaged by counterclockwise facing end portions of the major and minor wall portions of the collar; and upon continued turning of the top flange 2, the tape will become wound about the collar in which condition it may be stored.

1. A capsule reel assembly for holding a ribbon of flexible tape material comprising:
   a. first and second flanges disposed in spaced-apart parallel relationship at a distance least equal to the width of the ribbon so that the latter may be stored therebetween;
   b. hub means extending between said flanges for supporting said ribbon therein;
   c. means for supporting said flanges for rotary movement with respect to each other;
   d. spool means carried by said first flange for winding said ribbon into the space between said flanges, said spool means including a substantially circular collar disposed in spaced relation about said hub means and between said flanges and having at least one opening therethrough through which said ribbon extends from about said hub means; and
   e. a peripheral sidewall carried by said second flange and extending toward said first flange defining an enclosed ribbon storage space outwardly of said spool means, said sidewall being formed with a pair of slits extending transversely of said sidewall between said flanges for passage of said ribbon; said slits being in radial alignment with respect to a common center along two straight lines extending tangentially of opposite side surfaces of said hub means said two straight lines both extending through said at least one opening in at least one relative position of rotation of said flanges.

2. A capsule reel assembly according to claim 1 wherein said at least one opening comprises two slits in radial alignment with said pair of slits along said two straight lines in said at least one relative position of rotation.

3. The combination according to claim 1 wherein:
   a. said sidewall is constructed of a major wall portion extending a major portion of the distance around said flanges and a minor wall portion disposed between the ends of said major wall portions, the ends of said major wall portion having tapered surfaces facing radially inwardly thereof.
   b. a capsule reel assembly for holding an endless ribbon of flexible tape material comprising:
      a. first and second circular flanges; and
      b. hub means extending between said flanges and operatively connected thereto for holding said flanges in spaced-apart parallel relationship at a distance least equal to the width of the ribbon so that the latter may be stored between said flanges while turned around said hub means, said hub means supporting said first flange for free rotary movement with respect to said second flange and comprising:
         1. an inner axially split shank formed integrally with said second flange and having an enlarged free end extending through a central opening in said first flange for holding the latter thereon with a snap action,
         2. flange-supporting means disposed about said shank for supporting said first flange under the enlarged end of said inner shank,
         3. a roller rotatably mounted about said flange-supporting means for supporting said ribbon therein, said roller having an axial length about equal to the width of an endless ribbon and slightly less than the axial length of said flange-supporting means for rotation in bearing engagement therewith independently of said first flange.

5. A capsule reel assembly for holding an endless ribbon of flexible tape material comprising:
   a. first and second circular flanges; and
   b. hub means extending between said flanges and operatively connected thereto for holding said flanges in spaced-apart parallel relationship at a distance at least equal to the width of the ribbon so that the latter may be stored between said flanges while turned around said hub means, said hub means supporting said first flange for free rotary movement with respect to said second flange and comprising:
      1. an inner axially split shank formed integrally with said second flange and having an enlarged free end extending through a central opening in said first flange for holding the latter thereon with a snap action,
      2. flange-supporting means disposed about said shank for supporting said first flange under the enlarged end of said inner shank,
      3. a roller rotatably mounted about said flange-supporting means for supporting said ribbon therein, said roller having an axial length about equal to the width of an endless ribbon and slightly less than the axial length of said flange-supporting means for rotation in bearing engagement therewith independently of said first flange.

6. The combination according to claim 5 wherein:
   a. said flange-supporting means comprises a separate sleeve member disposed about said shank in underlying relation to its enlarged end.
   b. a capsule reel assembly for holding an endless ribbon of flexible tape material comprising:
      a. first and second circular flanges; and
      b. hub means extending between said flanges and operatively connected thereto for holding said flanges in spaced-apart parallel relationship at a distance least equal to the width of the ribbon so that the latter may be stored between said flanges while turned around said hub means, said hub means supporting said first flange for free rotary movement with respect to said second flange and comprising:
         1. an inner axially split shank formed integrally with said second flange and having an enlarged free end extending through a central opening in said first flange for holding the latter thereon with a snap action,
         2. flange-supporting means disposed about said shank for supporting said first flange under the enlarged end of said inner shank,
         3. a roller rotatably mounted about said flange-supporting means for supporting said ribbon therein, said roller having an axial length about equal to the width of an endless ribbon and slightly less than the axial length of said flange-supporting means for rotation in bearing engagement therewith independently of said first flange.

7. The combination according to claim 5 wherein:
   a. said flange-supporting means includes a radially outwardly extending supporting land formed integrally with said inner shank.
   b. The combination according to claim 7 wherein:
      a. said flange-supporting means further includes a bearing washer seated on said land.
   c. The combination according to claim 5 further including:
      a. spool means carried by said first flange in at least partially spaced relation about said hub means for winding the endless ribbon into the space between said flanges, and
      b. sidewall means extending from said second flange toward said first flange for defining an enclosed storage area outwardly of said spool means, said sidewall being formed with at least one opening through which the endless ribbon can extend from said space storage area.

8. The combination according to claim 9 wherein:
   a. said sidewall includes a stepped-shaped bearing support surface formed along its upper free edge facing said first flange; and
   b. said first flange includes a mating, stepped-shaped surface along the periphery thereof.

9. The combination according to claim 9 wherein:
a. the first flange is seated wholly within the boundary of said sidewall.

12. The combination according to claim 11 wherein:
   a. the upper free edge of said sidewall extends beyond said first flange to a location substantially level with the uppermost extremity of said hub means.
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   b. means for supporting said flanges for rotary movement with respect to each other, said means including:
      1. a stepped-shaped bearing support surface formed along the upper free edge of said sidewall facing said first flange, and
      2. a mating, stepped-shaped surface along the periphery of said first flange whereby said first flange is seated wholly within the boundary of said sidewall.
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   c. means within which said ribbon can be stored, said sidewall being formed with at least one opening through which said ribbon can extend from said storage space; and
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e. means for supporting said flanges for rotary movement with respect to each other, said means including:
      1. a stepped-shaped bearing support surface formed along the upper free edge of said sidewall facing said first flange, and
      2. a mating, stepped-shaped surface along the periphery of said first flange whereby said first flange is seated wholly within the boundary of said sidewall.
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