

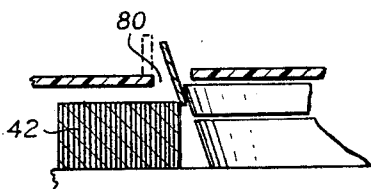
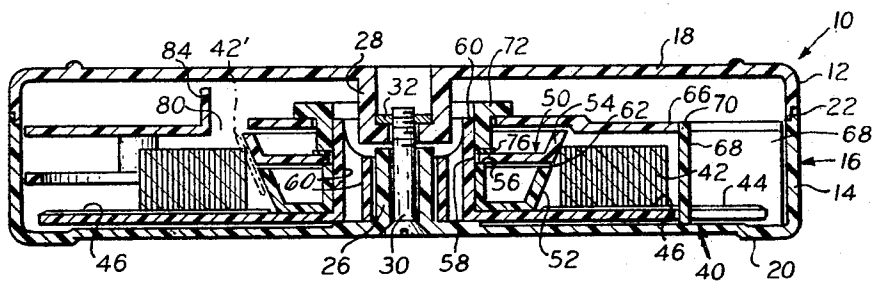
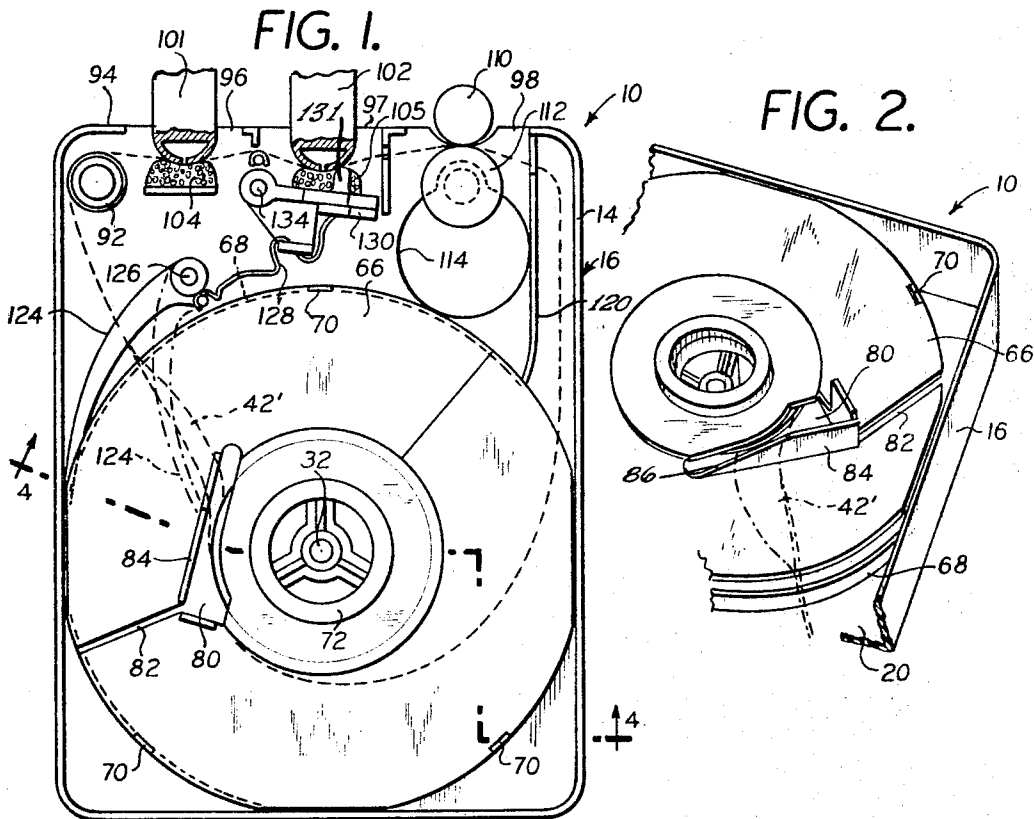
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TAPE CARTRIDGE WITH REGULATED TENSION

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TAPE CARTRIDGE WITH REGULATED TENSION
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This invention relates to coils of endless tape or film and more especially to apparatus for supplying tape progressively to a station and rewinding it as it comes from the station after use. The tape is withdrawn from the inner convolution of the coil, and the tape winds as an outside convolution as it is returned to the coil.

It is an object of the invention to provide improved apparatus for supplying tape in response to the pull of feed rolls, and for rotating the coil in response to the feed so as to rewind the returned tape.

Another object is to provide such apparatus in a unitary assembly with a housing which preferably has an opening for exposing a run of the tape to the action of feed rolls and to recording or reproducing heads or other apparatus with which the tape is used.

The apparatus will be described as applying to magnetic sound tape, but it will be understood that it can be applied also to motion-picture film or any tape or film. The expression "modulations of the tape" is used herein to designate changes in magnetism which form sound tracks or other signals; changes in transparency, as in the case of pictures or light sound tracks; contour variations, such as grooves; or any other deliberate variations in the tape along its length.

Another object is to provide an endless tape supply cartridge with means for winding the tape uniformly and for preventing over-running of the coil when the feed is stopped suddenly.

Other objects, features and advantages of the invention will appear or be pointed out as the description proceeds.

In the drawing, forming a part hereof, in which like reference characters indicate corresponding parts in all the views;

FIGURE 1 is a plan view of a cartridge, with the cover removed, showing a preferred embodiment of the invention;

FIGURE 2 is a fragmentary, perspective view showing a portion of the cartridge illustrated in FIGURE 1;

FIGURE 3 is a greatly enlarged, fragmentary, sectional view showing the correlation of slope of certain parts which are illustrated in FIGURE 2; and

FIGURE 4 is an enlarged, sectional view taken on the line 4—4 of FIGURE 1.

The cartridge shown in the drawing includes a housing 10 having an upper shell 12 and a lower shell 14. Both of these shells have side walls which fit together to form sides 16 of the cartridge. The upper shell 12 has a top wall 18. The lower shell 14 has a bottom 20. The shells are held in alignment with one another by a ridge 22 extending around at least a portion of the upper shell 12 and fitting into a complementary depression in the side wall of the lower shell 14.

There is a center stud 26 extending upwardly from the bottom 20; and there is a larger-diameter stud 28 extending downwardly from the top wall 18. A bolt 30 extends through the studs 26 and 28 to detachably secure the shells 12 and 14 together. In the preferred construction, the stud 28 is large enough to hold a nut 32 into which the bolt 30 threads. The head of the bolt 30 is countersunk into the center stud 26.

There is a reel 40 within the housing 10 for holding a coil 42 of magnetic tape or other film. The reel 40 has a bottom flange 44 which serves as a support for the coil

42; and in the preferred construction there are low ridges 46 extending upwardly from the top surface of the flange 44 and with the length of the ridges extending toward the circumference of the flange 44 either radially or along a curve or slope in a direction having a substantial radial component. This ridge 46 supports the coil 42 out of contact with the surface of the flange between the ridges. In the preferred construction there are three or more ridges 46 at angularly-spaced locations around the axis of the reel 40.

The reel 40 has a frusto-conical hub 50 which is made in two parts. It has a lower part 52 which is integral with the flange 44, and an upper part 54 which is supported on a shoulder 56 of the lower part 52.

The upper part 54 has a center opening 58 which fits over a sleeve 60 that extends upwardly at the center region of the reel 40. This sleeve 60 provides a radial bearing for the upper part 54 of the hub. This upper part 54 of the hub is free to rotate independently of the flange 44 and the lower part 52 and sleeve 60 of the hub, these elements being integral with the flange 44.

The hub 50 has a frusto-conical peripheral surface, part of which is on the lower part 52 and the remainder of which is on the upper part 54 of the hub. The surface on each of the parts 52 and 54 is a continuation of the frusto-conical surface on the other part, but preferably with a slight clearance 62 between the peripheral portions of the parts 52 and 54.

The inner convolution of the coil 42 contacts with the upper part 54 of the hub, preferably at a location about midway between the upper and lower limits of the frusto-conical surface of the upper part 54.

At the location where the tape of the inner convolution of the coil 42 is pulled out of the coil, the tape twists into the position shown in dotted lines in FIGURES 1 and 4, the tape being indicated by the reference character 42'.

Thus the tape 42' comes in contact with the frusto-conical surface of both the lower part 52 and the upper part 54 of the hub and the friction of the tape 42' against the lower part 52 causes the hub to rotate and thus turn the entire reel 40. This rotation causes the coil 42 to rotate so as to wind the returning tape on the outside of the coil. Since the average lineal velocity of the tape 42' must be the same at all points along the length of the tape, and since the lineal velocity of the flange 44 is different at different distances from its center of rotation, there is slippage between the edges of the convolutions of the coil 42 and the ridges 46 on which the coil 42 is supported. These ridges 46 reduce friction by reducing the area of contact. Before reaching the hub 50, the ridges 46 preferably terminate, since the slippage between the coil 42 and the flange 44 is much less in the vicinity of the hub 50; and the elimination of the ridges 46 near the hub 50 permits the inner convolutions to occupy a lower position with respect to the hub 50. This increases contact of the tape with the lower part 52 of the hub and makes available more force for rotating the reel 40.

The freedom of rotation of the upper part 54 of the hub, and a certain amount of slippage of the tape 42' on the lower part 52 of the hub, results in a speed of rotation of the flange 44 which determines the rate at which the coil 42 winds the returning tape on the outer convolution of the coil and the resulting pull of the returning tape as it winds on the coil.

A removable partition 66 fits over the sleeve 60 and rests on upstanding partitions 68 which are preferably integral with the bottom wall 20 of the housing. This partition 66 is keyed to the upstanding partitions 68 by keys in slots indicated generally by the reference character 70.

A friction collar 72 fits over the upper end of the sleeve 60 with a press fit. This collar 72 has a shoulder 74 for limiting its axial movement as it is pressed downwardly on the sleeve 60. A thrust bearing 76 is located between the collar 72 and the top surface of the upper part 54 of the hub. The shoulder 74 limits the collar to a position which leaves a running clearance between the hub 50, thrust bearing 76 and collar 72. The top surface of the collar 72 contacts with the partition 66 to prevent upward movement of the reel 40.

Although the apparatus is shown in FIGURE 4 with the flange 44 under the coil 42, the cartridge can be used in other positions. For example, the axis of the reel 40 can be horizontal. In such a case the weight of the coil 42 is supported by the hub 50. Because of the frusto-conical surface of the hub 50, the coil 42 tends to slide toward the flange 44 when the axis of the reel is horizontal. Thus the coil 42 contacts with the flange 44 and the ridges 46 in very much the same way as when the flange 44 is under the coil 42, as shown in FIGURE 4.

There is an opening 80 in the partition 66, and the tape 42' passes through this opening 80 as it is pulled out of the coil 42. A slot 82 extends from the periphery of the partition 66 to the opening 80 for initially placing the endless tape into the opening 80. A ridge 84 extends upwardly from the top of the partition 66. This ridge 84 has a sloping top surface at one end forming a ramp 86. This ramp 86 has the same angular slope as the frusto-conical surface of the hub 50 so that the tape is led from the sloping surface of the hub upwardly out of the coil of tape without changing the direction of tape travel as it comes across the next adjacent convolutions of the coil 42. This prevents stretching of the tape along one edge and also prevents wear of the tape such as has been encountered in other tape supply cartridges.

The slope of the ramp 86 may be described as in a direction which is a projection of the slope of the hub, from the location where the inside convolution of the coil leaves the hub, on a plane extending normal to the direction of travel of the tape away from the hub to the location where the tape first comes in contact with any guide surface. The guide surface in this case is the ramp 86.

Beyond the ramp 86, the tape 42' passes around a guide stud 92. From the guide stud 92, the tape 42' passes along the inside of a side wall 94 of the housing 10. This side wall 94 has several openings 96, 97 and 98, which provide access to the run of the tape which extends generally parallel to the wall 94. The openings 96 and 97 may be used for inserting a recording head 101 and a monitoring head 102, respectively, into the housing and into contact with the tape. There are pads 104 and 105 in position to provide a backing for holding the tape against the heads 101 and 102. These pads are representative of resilient backing means; but in the preferred construction they are made of polyurethane foam and they are of sufficient area to exert pressure against the tape for some distance beyond the gaps in the heads 101 and 102. This reduces wear on the tape and also reduces wear on the heads themselves so that they do not form a concave surface which the tape will bridge after extended use of the heads. Polyurethane foam also has the distinct advantage of providing a backing with substantial pressure but with minimum friction since polyurethane does not have the "sticky" effect encountered with other organic plastic foams.

The tape 42' is pulled past the heads 101 and 102 by feed rolls. These feed rolls include a power-driven capstan 110 which is a part of the machine with which the tape cartridge is used. The other feed roll is a backing-up roll 112 which enters the housing 10 through an opening 114 in the bottom wall when the cartridge is placed on the machine. After entering through the opening 114, the backing-up roll 112 is pushed into contact with the

tape 42' by a spring or other resilient means for maintaining friction between the tape and the capstan 110.

Beyond the feed rolls consisting of the capstan 110 and the backing-up roll 112, the tape passes behind another partition wall 120 and from there, wraps on the outside of the coil 42.

In order to hold the outer convolution against the reel 40, there is a brake 124. This brake is supported on a pivot 126 extending upwardly from the bottom wall of the housing, and there is a spring 128 tensioned between the brake 124 and a holder 130 which carries the pad 105. This spring holds the brake 124 against the outside convolution of the coil 42 and the purpose of the brake is to keep the coil intact when the cartridge is being handled and when it is in shipment and subject to random positioning in any orientation. When the cartridge is in use, however, the brake 124 is unnecessary and it would add friction to the operation of the apparatus. Automatic means are provided for releasing the brake 124 when the cartridge is in use. This automatic means consists of a correlation between the spring 128 and a button 131 secured to the pad holder 130 so that the spring connects with the brake 124 in a position to shift the brake 124 clockwise about its pivot 126 when the head 102 initially displaces the button 131 and rocks the pad holder 130 about a pivot support 134. When the head 102 is withdrawn, the tension of the spring 128 returns the brake 124 and pad holder 130 to their original positions with the brake 124 in contact with the tape coil 42. The button 131 also limits the compression of the pad 105 since the contact of the button 131 with the head 102 maintains the holder 130 at a predetermined distance from the head.

The preferred embodiment of the invention has been illustrated and described, but changes and modifications can be made and some features can be used in different combinations without departing from the invention as defined in the claims.

What is claimed is:

1. An endless tape holder assembly including a flange for contact with one side of a coil of tape, a frusto conical hub in position to be within the inner convolution of the coil of tape, the hub being in two parts including a first frustrum that turns as a unit with the flange, and a second frustrum at the larger diameter end of the first frustrum, and means mounting the second frustrum for rotation independently of the first frustrum, and guide means across which the tape is pulled from the inner convolution along a course that pulls the inner convolution into contact with both parts of the hub.

2. The assembly described in claim 1 characterized by the flange being at the smaller diameter end of the first frustrum, and a coil of tape on the hub with inner convolutions in contact with at least the second frustrum, the coil having one side resting against the flange and the coil being of a width to reach completely across the first frustrum and part way across the second frustrum.

3. The assembly described in claim 2 characterized by the guide means including a sloping surface which extends in a direction that is a projection of the slope of the hub, at the location where the inside convolution of the coil leaves the hub, on a plane extending normal to the direction of travel of the tape away from the hub and to the location of the first contact of the tape with said guide means.

4. The assembly described in claim 3 characterized by a partition above the flange hub and adjacent to the upper end of the hub for preventing the tape from being displaced axially of the hub in a direction away from the flange, the partition having a slot therein through which the tape travels away from the coil, and said guide means including a ridge on the side of the partition opposite the hub and adjacent to the slot, the ridge having a sloping surface that forms a ramp which constitutes the sloping surface of said guide means.

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5. The assembly described in claim 1 characterized by a housing in which all other elements of the assembly are contained, the housing having a wall along which the tape is led in a path defined by the guide means, and said wall having openings in it for access of a modulation-responsive head to the tape, and for the access of feed rolls to the tape.

6. The assembly described in claim 5 characterized by a pressure element in the housing behind the path of the tape and in position to urge the tape against a modulation-responsive head at one of the openings in the housing.

7. The assembly described in claim 2 characterized by a retainer pressing the outer convolutions of the coil against the other convolutions, and means operated by a pressure pad located along a working run of the tape for releasing the retainer when the coil is in use.

8. An endless tape assembly including a cartridge having a housing with walls, at least a portion of which includes an opening, an endless coil of tape in the housing, a stud within the housing and integral with one wall of the housing, a sleeve that rotates on the stud as a bearing, a flange extending radially outward from the sleeve and integral therewith, said flange extending across most of the width of the housing, the endless coil of tape having one side of the coil in contact with a side of the flange, a frusto conical hub within the inner convolutions of the coil, the hub being in two parts including a first frustrum that turns as a unit with the flange, and a second frustrum at the larger diameter end of the first frustrum, means mounting the second frustrum for rotation independently of the first frustrum, guide means across which the tape is pulled from the inner convolution along a course that pulls the inner convolution

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into contact with both parts of the hub and along a course which extends under the opening of the housing wall, partitions extending inward from at least one of the walls of the housing, some of said partitions constituting part of the guide means, a removable partition overlapping the flange, hub and tape in position to prevent axial displacement of the tape on the hub in a direction away from the flange, key means on the removable partition and others of the partitions for holding the removable partition in a predetermined orientation with respect to the guide means, the removable partition having a slot therein through which the tape travels away from the inner convolution of the coil, the guide means including a sloping surface which extends in a direction that is a projection of the slope of the hub, at the location where the inside convolution of the coil leaves the hub, on a plane extending normal to the direction of travel of the tape away from the hub, and a ridge on the side of the removable partition opposite the hub and adjacent to the slot, the ridge having a sloping surface that forms a ramp which constitutes the sloping surface of said guide means.

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