Aug. 18, 1970 M. FURST ET AL 3,524,607

CAPSTAN CONSTRUCTION

Original Filed Feb. 9, 1967

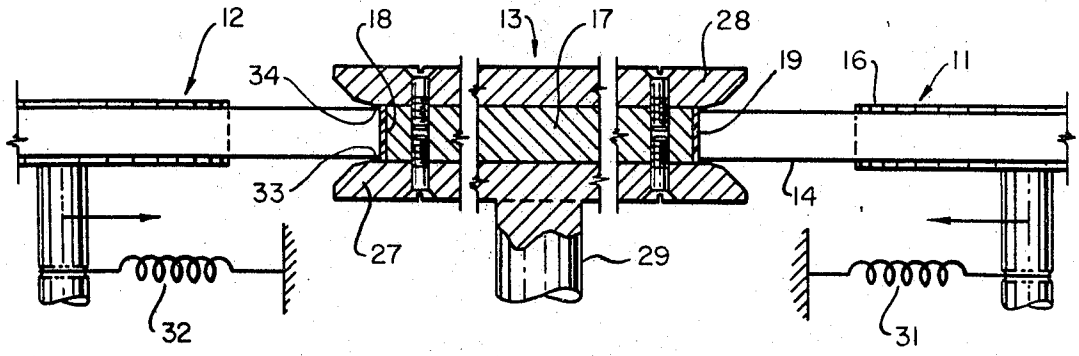


FIG. 1

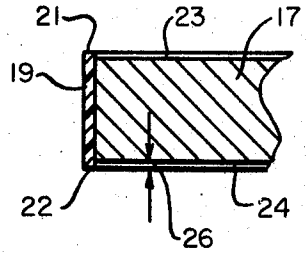


FIG. 2

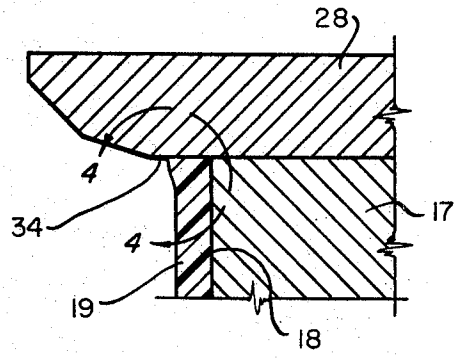


FIG. 3

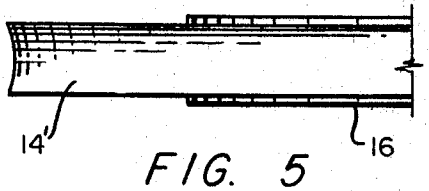


FIG. 5

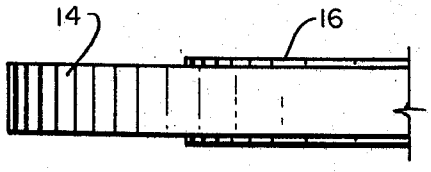


FIG. 6

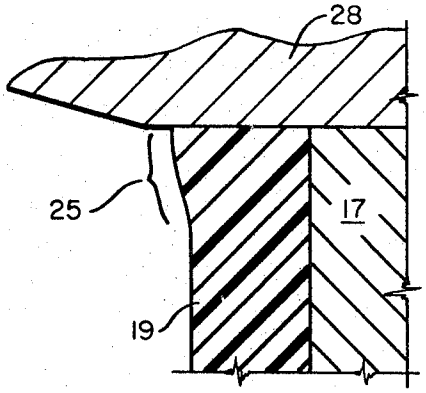


FIG. 4

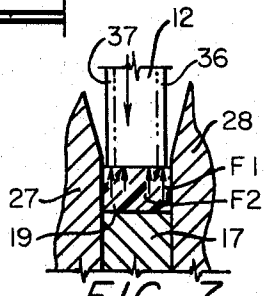


FIG. 7

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CAPSTAN CONSTRUCTION

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Int. Cl. G11b *15/32*; B65h *17/20*

U.S. Cl. 242—192 3 Claims

ABSTRACT OF THE DISCLOSURE

Tape roll drive capstan having a periphery wherein the outer margins are harder than intermediate portions so as to eliminate "cupping" of tape rolls.

CROSS REFERENCE TO RELATED APPLICATION

This application is a division of application Ser. No. 614,967, filed Feb. 9, 1967, entitled "Capstan Construction and Method of Manufacture," now Pat. No. 3,441,998.

BACKGROUND OF THE INVENTION

This invention relates to tape transport apparatus, and more particularly to a capstan construction of a type for driving supply and take-up rolls of tape to transfer a length of tape from the former to the latter.

In apparatus for feeding magnetic recording tape, a common problem which is frequently encountered is "cupping" of the rolls of tape. Briefly, this problem refers to the phenomenon whereby after tape has been fed between supply and take-up rolls a number of times, the "rim" or edge of the roll becomes somewhat concave as distinguished from the desired rectilinear configuration which it had upon being initially employed. Thus, where the edge of a roll has become concave, "cupping" exists and introduces deleterious effects to the tape itself as well as serving to introduce well-known problems with respect to the transducing of signals to and from the tape.

Accordingly, it is readily evident that apparatus for feeding tape from a supply to a take-up roll wherein "cupping" can be minimized or eliminated becomes highly desirable.

OBJECTS OF THE INVENTION

It is a general object of the present invention to provide a capstan construction whereby in the feeding of tape from a supply to a take-up roll "cupping" of tape rolls is essentially eliminated.

Other objects of the invention will become readily apparent from the following detailed description of a preferred embodiment.

As used herein, the term "edge" driven refers to the edge of the rolls as distinguished from the edges of the tape. Another term for the present arrangement might be "rim-driven" rolls, but it is readily apparent that the rolls have no "rim."

SUMMARY OF THE INVENTION

Briefly stated, in the capstan construction disclosed herein, there is provided an annular rotating body adapted to be mounted for rotation. The periphery around the body is adapted to engage and press against the edge of a roll of tape so as to develop reactive forces in the periphery such that these reactive forces act radially outwardly thereof. The capstan construction herein is characterized by the fact that those reactive forces disposed

to oppose the longitudinal outer margins of the engaged roll of tape are at least as great as those reactive forces developed in between. According to the method of manufacture disclosed herein, a uniformly homogeneous material can be employed to form the periphery of the capstan.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view partially in elevation cross-section showing a capstan construction according to the invention and schematically disposed in conjunction with supply and take-up rolls;

FIG. 2 is an enlarged detail view, in section, of a portion of the capstan construction shown in FIG. 1 prior to the attachment of flanges thereto;

FIG. 3 is an enlarged detail view, in section, similar to FIG. 2 after attachment of flanges thereto;

FIG. 4 is a further enlarged detail view, in section, of that portion of FIG. 3 taken along the lines 4—4 thereof;

FIGS. 5 and 6 respectively show rolls of tape with and without the problem of "cupping"; and

FIG. 7 is a diagram of the invention showing a detailed portion of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

There has been provided herein a capstan construction of a type for edge-driving supply and take-up rolls of tape for transferring a length of tape from the former to the latter. Thus, the edges of the rolls are engaged by the capstan periphery. The cylindrical capstan periphery includes a resilient driving surface bounded at the cylindrical end edges to preclude expansion laterally of the driving surface. The back side of the resilient driving surface is supported by a homogeneous body as provided, for example, by a metal hub.

Thus, the capstan construction generally comprises a rigid annular hub adapted to be mounted for rotation. A relatively thin layer of resilient material encircles the hub and is adapted for edge-driving engagement with rolls of tape. A pair of flanges are carried by the ends of the hub and extend radially outwardly across the end edges of the driving layer. The flanges serve to compress the ends of the layer so as to support the layer against any endwise expansion of the layer under applied compression experienced during an edge-driving transfer of tape.

More particularly, referring to the drawings, a supply roll **11** and take-up roll **12** are arranged whereby a capstan assembly **13** can be rotated to transfer tape **14** from hub **16** to take-up roll **12**.

Capstan assembly **13** comprises an annular, generally cylindrical, hub **17** of a rigid material, such as cast aluminum. Hub **17** includes a cylindrical periphery **18** having an axial extent essentially co-extensive with the width of tape **14**.

Periphery **18** carries a relatively thin layer **19** of resilient material, preferably polyurethane. The material of layer **19** should be virtually completely free of any bubbles or pockets of porosity whereby uniform density of the material and support of tape is assured.

In the process of manufacturing capstan assembly **13**, layer **19** is applied to hub **17**, preferably by molding to form a structure as shown in FIG. 2. Layer **19** is disposed and dimensioned to provide end edges **21, 22**. The edges are then reduced down to a point where they overhang the ends **23, 24** of hub **17** only slightly. This is preferably accomplished by grinding edges **21, 22** until the plane of ends **23, 24** is reached. When the grinding tool is removed, the resilience of the material of layer **19** causes edges **21, 22** to spring back an amount suitable for providing the advantageous anti-cupping property to the capstan. The extent to which edges **21, 22** then extend beyond ends **23, 24** has been found, in the case of a quarter-inch

wide periphery **18**, of polyurethane, to run on the order of 0.001 inch.

By securing flanges **27, 28** to the ends of hub **17**, a bulge **25** is thus formed on the driving surface of layer **19** by the axial compression of the flanges acting on the overhanging portion **26** of layer **19**. This step of axially compressing the overhanging portion **26**, therefore, serves to form bulge **25**. Thereafter, flanges **27, 28** are coupled, as by screws, to the respective ends **23, 24** of hub **17**.

Thus, the bounding surface of a side wall member, such as flanges **27, 28** bears against each of the end edges **21, 22** of layer **19** and compresses them in a direction axially of hub **17** so as to form bulge **25** along the edge margins of layer **19**.

A capstan construction, as described above, is adapted to be driven by a spindle **29** and mounted for rotation in edge-driving relation to supply and take-up rolls **11, 12**. In a particularly preferred embodiment, supply and take-up rolls **11, 12** may be resiliently urged, as by springs **31, 32** toward capstan **13**. In this manner compression is applied to the face of layer **19**.

A particularly preferred construction of the above arrangement has been built and successfully operated to eliminate "cupping" (as shown in FIG. 5) for a one-quarter inch width of magnetic recording tape wherein the thickness of layer **19** ran on the order of 0.0625 to 0.125 inch. It was found that the former dimension may be somewhat too thin to successfully accommodate splices in the tape and "run-out" found in the roll of tape and therefore represents a minimum thickness.

It has been observed (FIG. 7) that the reactive forces F_1 must be at least as great as forces F_2 to overcome the "cupping" problem completely. Whereas a thickness on the above order represents something of a minimum, there appears to be no particular maximum so long as the reactive forces along the outer margins **36, 37** equal or exceed forces F_2.

The material of layer **19** preferably, as noted above, consists essentially of polyurethane and preferably has a hardness within a range on the order of 40–60 durometer (Shore A). Using fixed flanges as shown in the drawings, the tape edges of rolls **11, 12** preferably provide a closely spaced fit with the bounding surfaces **33, 34** of flanges **27, 28**. Thus, a slight positive spacing between surfaces **33, 34** preferably runs on the order of (+) 0.001 to (+) 0.002 inch relative to the width of tape **14**. Accordingly, the axial extent of periphery **18** is substantially coextensive with the width of tape **14**.

Whereas in the foregoing preferred embodiment the construction entails a capstan of a type for drivably moving the edge of a roll of tape, it is to be understood that the term "capstan construction of a type for edge driving" as used herein and as appearing in the claims shall be deemed to include other annular rotating bodies of a type, for example, such as idler rolls and tape roll followers or other arcuate tape guides such as employed, for example, in the spooling of tape or otherwise.

What is claimed is:

1. A capstan construction of a type for edge-driving supply and take-up rolls of tape to transfer a length of tape from the former to the latter, said construction comprising an annular hub adapted to be mounted for rotation, a layer of resilient material encircling the hub and adapted for edge-driving engagement with rolls of tape, a pair of flanges carried by the ends of the hub and extending radially outwardly across the end edges of said layer, said flanges serving normally to compress the ends of said layer and further to support same against endwise expansion of the layer when under compression applied during said edge-driving engagement.

2. In a capstan construction of a type for engaging the edge of a roll of tape, said construction having an annular rotating body adapted to be mounted for rotation, and a periphery around said body adapted to engage and press against the edge of a roll to develop reactive forces in said periphery acting radially outwardly thereof, said periphery acting radially outwardly thereof, said periphery when so engaged being characterized by those of said reactive forces disposed in that portion of said periphery opposing the longitudinal margins of the engaged tape being greater than those of said reactive forces disposed laterally therebetween.

3. A capstan construction as defined in claim **2** wherein the material of said periphery is uniformly homogeneous.

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GEORGE F. MAUTZ, Primary Examiner

U.S. Cl. X.R.

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