July 23, 1968 H. E. HASS 3,393,849

TAPE HANDLING ELEMENT

Filed March 11, 1966

FIG. 2

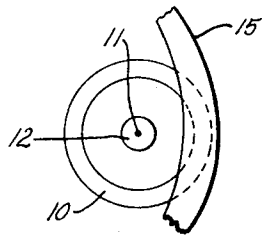


FIG. 1

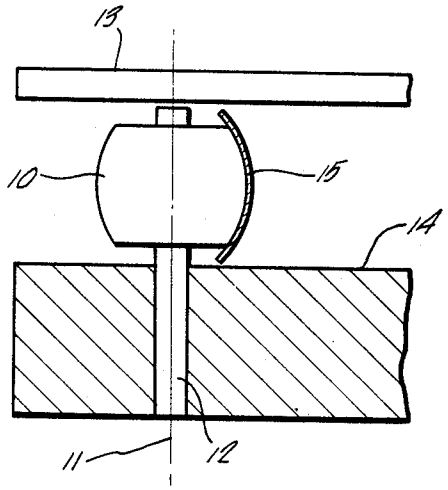
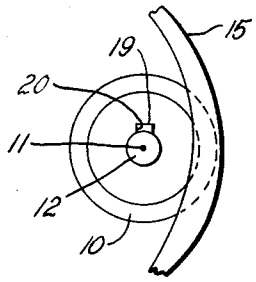


FIG. 3



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TAPE HANDLING ELEMENT

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ABSTRACT OF THE DISCLOSURE

A crown-shaped member supported by a shaft to permit axial movement. As tape that has separate guide means to control its position transverse to the direction of tape travel passes over the surface of the crown-shaped member, the axial position of the crown-shaped member is automatically adjusted to support the tape passing over it so the tension on both edges of the tape is balanced.

This invention relates to elements used in handling strips of flexible material, such as tape, and more particularly, to a member used in controlling the direction of travel of tape.

In tape handling systems, roller and post members with axes transverse to the direction of travel of the tape are used to control the direction of tape travel. When unsprocketed tape is being handled, separate guide members, not the rollers and posts, generally control the position of the tape transverse to its direction of travel.

Rollers and posts of cylindrical shape with a surface lying parallel to the cylindrical axis within some close tolerance are conventionally provided. It is, however, virtually impossible to mill a roller or post whose surface is absolutely parallel to the cylindrical axis, i.e., without taper. The taper forces unsprocketed tape passing over the roller or post to move transverse to the direction of tape travel, thus pressing against one of the tape guide members. This causes undue wear upon one edge of the tape.

As a reaction to the transverse force on the tape, a force in the direction opposite to the force on the tape is exerted upon the roller or post. In the case of a roller, this reaction slows down rotation, much as a disc brake does, and causes wear on the tape surface due to slippage of the tape over the roller surface. This is in some measure self-defeating of the purpose of using rollers, which is to reduce wear on the tape surface.

These problems are overcome according to the present invention by providing a crown-shaped member, i.e., a roller or post, to control the direction of travel of tape in a system having separate guide means to control the position of the tape transverse to its direction of travel. The crown-shaped member has an axis transverse to the direction of tape travel and is supported, as for example by a shaft, to permit movement along its axis. As a result, the axial position of the crown-shaped member is automatically adjusted to support the tape passing over it such that the tension on both edges of the tape is balanced. Thus neither edge of the tape presses unduly against the guide means.

Crown pulleys used to drive and control the position of endless conveyor and power transmission belts are already well-known. These crown pulleys are fixed in their axial position and therefore function to guide the position of the belt transverse to its direction of travel. The present invention distinguishes from the well-known crown pulley in that the crown-shaped member is, according to the invention, translatable along its axis and the transverse position of the tape is controlled by independent guide means. The tape in turn functions to guide the axial position of the crown-shaped member.

The above and other features of the invention are considered further in the following detailed description of the invention taken in conjunction with the drawing, in which:

FIG. 1 is a side elevation view partially in section of a crown-shaped roller or post illustrating the principles of the invention;

FIG. 2 is a sectional view of a crown-shaped roller according to the invention; and

FIG. 3 is a sectional view of a crown-shaped post according to the invention.

In the drawing a crown-shaped member **10** is shown mounted upon a fixed shaft **12**. Member **10** is shown in FIG. 2 as a roller that is freely rotatable about and translatable along its axis **11**. Spaced parallel surfaces **13** and **14** are provided as guide members to control the position of tape **15** transverse to its direction of travel. When tape **15** passes across the surface of crown-shaped roller **10** the axial position of roller **10** shifts as the total transverse tension on the tape **15** changes to maintain an equal transverse tension on both edges of the tape in contact with roller **10**. As a result, tape **15** does not press unduly against one or the other of guiding members **13** and **14**. It is important to the operation of the invention that roller **10** has enough axial latitude to "find" the position on the tape that balances the transverse tension on the edges of the tape, thus minimizing tape wear.

The height of the crown of roller **10** (i.e., the distance perpendicular to axis **11** between the peak of the crown and the edge of roller **10**) is exaggerated in the drawing for purposes of illustration. The height of the crown and the height of roller **10** (i.e., the axial dimension) with respect to the width of the tape and the distance between guide members **13** and **14** can vary quite a bit. What is important is that the roller dimensions be maintained so that the described balancing action of the tension on tape **15** occurs. The exact dimensions of the crown depend upon the particular application at hand. Generally speaking, the higher the crown, the more transverse tension is exerted upon the tape by the member, but the more capable the member is of balancing transverse tension in the tape. By way of example, suitable dimensions for the crown of a member used in a magnetic tape transport system are a crown height of .005 inch, a crown surface formed by revolution of the arc of a circle with a 4 inch radius, and a roller height of ½ inch.

By way of example, crown-shaped roller **10** could be made of Teflon (polytetrafluoroethylene) and shaft **12** could be made of stainless steel. In this case, the bore of crown-shaped roller **10** could provide its own bearing surface.

The crown-shaped roller arrangement shown in the figure is particularly well adapted for use in the newest tape transport systems employing such things as vacuum columns, like that described in an application, Ser. No. 459,625, of Harry F. Rayfield, filed May 28, 1965, now Patent No. 3,345,007 and entitled "Tape Apparatus." The roller in the Rayfield application designated **32** could, for example, be of the crown-shaped type, according to the present invention. Guide surface **13** could be formed by the cover of the vacuum column and guide surface **14** by the deck of the tape transport apparatus.

It is not necessary that roller **10** be between tape guide members **13** and **14**, so long as tape guide means are provided somewhere in the system to control the transverse position of tape **15**. If roller **10** were not provided between guide members **13** and **14**, it might be found desirable to employ stops on shaft **12** to limit the translation of roller **10**. When roller **10** is located between guide members **13** and **14**, as shown in the drawing, the height of roller **10** must be smaller than the distance

between guide members **13** and **14** to permit axial movement of roller **10** along shaft **12** sufficient to result in a balance of transverse tape tension.

The invention is also applicable to crown-shaped posts, members which do not rotate. Member **10** is shown in FIG. 3 as a post having an axial keyway **20** that engages with an axial key **19** formed in the surface of fixed shaft **12**. This permits translation of post member **10** without rotation.

It is to be understood that under the term tape employed in the present application all types of strips of flexible material, are encompassed such as punched paper strips and photographic film.

What is claimed is:

1. In a system for transporting strips of flexible material, the combination comprising means for controlling the position of strips of flexible material transverse to the direction of transport of the strips, a crown-shaped member with an axis lying substantially transverse to the direction of transport, and means for supporting the crown-shaped member such that the member is axially moveable so as to adjust during transport to balance transverse tension on the edges of a strip passing over the member.

2. The combination of claim **1** in which the crown-shaped member is a roller and the supporting means permits rotation of the roller.

3. The combination of claim **1** in which the crown-shaped member is a post and the supporting means prevents rotation of the post.

4. In a system for handling strips of flexible material the combination comprising a strip of flexible material constrained in position transverse to its length, a crown-shaped member for controlling the direction of travel of the strip, the member having an axis substantially transverse to the direction of travel, and a shaft upon which the crown-shaped member is mounted such that the member is axially moveable, so as to be guided by the strip as the strip moves across the surface of the member.

5. The combination of claim **4** in which the crown-shaped member is a roller and the roller is mounted upon the shaft such that the roller rotates.

6. The combination of claim **4** in which the crown-shaped member is a post and the post is mounted on the shaft such that the post is rotationally fixed.

7. In a tape-handling system, the combination comprising two spaced, substantially parallel surfaces to control the transverse position of tape, a shaft standing substantially perpendicular to and between the two surfaces, and a crown-shaped roller mounted upon the shaft so as to permit rotation and axial movement of the roller, the height of the roller being smaller than the distance between the two surfaces so that the axial position of the roller is automatically adjusted to support tape coming in contact with it to balance the transverse tension on the edges of the tape.

8. The combination of claim **7** in which the height of the roller is ½ inch, the crown height is .005 inch, and the crown surface is formed by revolution of the arc of a circle with a 4 inch radius.

9. The combination of claim **7** in which the roller is made of Teflon.

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ALLEN N. KNOWLES, *Primary Examiner.*