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D. R. ANDREWS ET AL

2,908,495

WEB REELING SYSTEM

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Fig. 1.

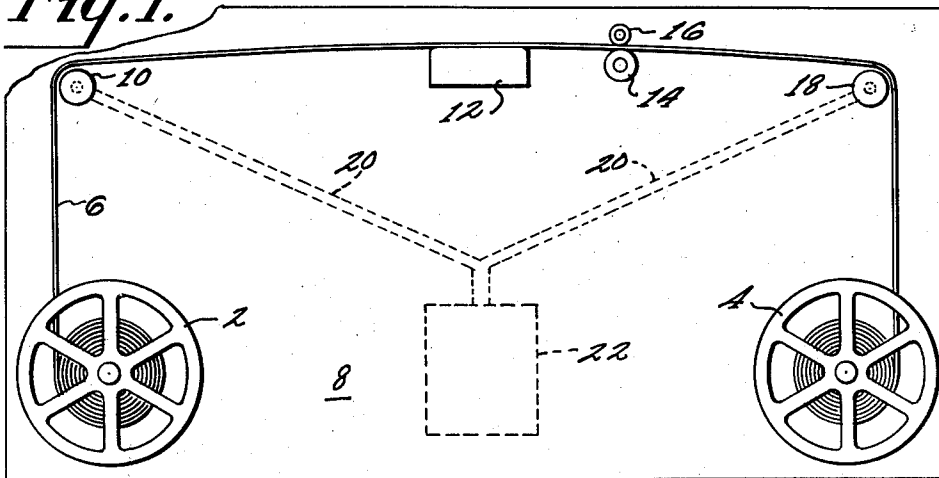


Fig. 2.

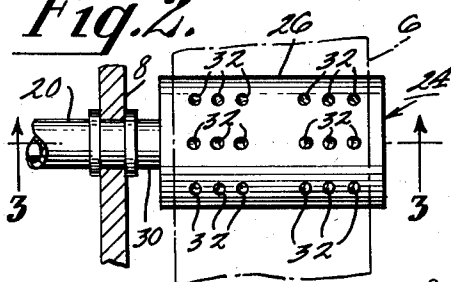


Fig. 3.

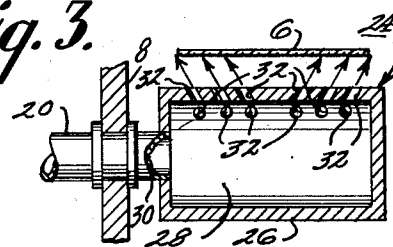


Fig. 5.

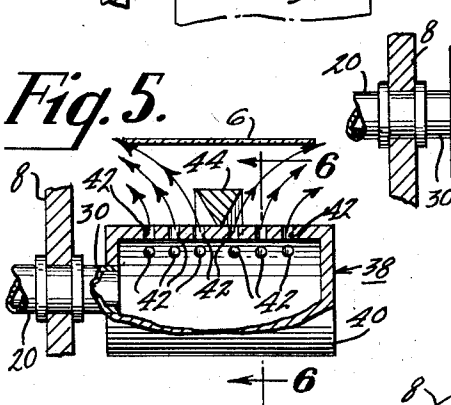


Fig. 4.

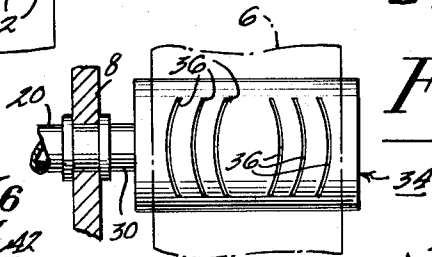


Fig. 7.

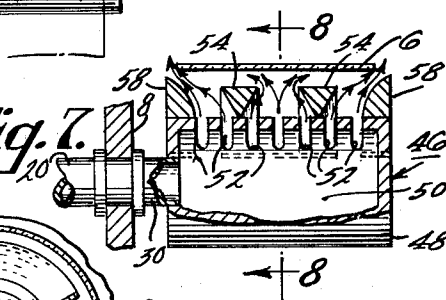


Fig. 6.

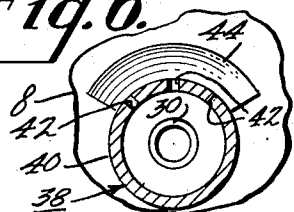
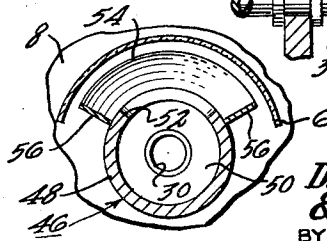


Fig. 8.



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WEB REELING SYSTEM

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3 Claims. (Cl. 271—2.6)

This invention relates to web feeding systems, and more particularly to means providing substantially frictionless web guides.

In the art of web reeling, particularly the art relating to such webs as magnetic recording tape, there has been an increasing necessity for constancy of web motion. When such guide means as flanged rollers or nonrotating posts are used for such guiding, irregularities in motion are imparted to the tape either by the rotational movement of the rollers or by the frictional engagement of the tape with the post type guides.

It is an object of the present invention to provide an improved web feeding system in which frictionless guide means are employed.

It is another object of this invention to provide an improved web feeding system as set forth wherein improved air bearing guides are used.

It is a further object of this invention to provide improved air bearing guides for a web feeding system wherein jets of air provide lateral guiding and also support the tape or web out of physical contact with the mechanical structure.

In accomplishing these and other objects, there has been provided in accordance with the present invention, a web reeling system wherein the guide elements of the reeling system comprise means for defining a trough-like air jet or stream whereby a tape member is supported both laterally and vertically.

A better understanding of the present invention may be had from the following detailed description when read in connection with the accompanying drawing in which:

Fig. 1 is a front elevational view schematically representing a web feeding system embodying the present invention;

Fig. 2 is a top view partly in section of one form of guide element according to the present invention;

Fig. 3 is a cross sectional view taken along the line 3—3 of Fig. 2 as viewed in the direction of the arrows;

Fig. 4 is a top view of a different form of structure also embodying the present invention;

Fig. 5 is a side view partly broken away showing still another form of structure also embodying the present invention;

Fig. 6 is a cross sectional view taken along the line 6—6 of Fig. 5 as viewed in the direction of the arrows;

Fig. 7 is a side view partly broken away of yet another form of structure also embodying the present invention; and

Fig. 8 is a cross sectional view taken along the line 8—8 of Fig. 7.

Referring now to the drawing in more detail, there is shown in Fig. 1 a general representation of a reeling system in which a storage reel 2 and a takeup reel 4 for a web member 6, such as a magnetic record tape, are mounted on a mounting panel 8. Suitable means (not shown) are provided for driving the reels in the appropriate direction for winding or unwinding the web or tape thereon. The web 6 is passed over a first guide element

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10 to a translating station 12. The velocity of the advancement of the web member is controlled by an appropriately driven capstan 14 operating in conjunction with a pressure roller 16. After leaving the capstan 14, the tape is fed over a second guide element 18 then to the takeup reel 4. The guide elements 10 and 18 are coupled through a suitable conduit 20 to a source of compressed air 22. The compressed air is forced from the surface of the guide elements through a plurality of orifices therein in such a manner as to form a stream of air in the configuration of a V-shaped trough. The axis of the trough runs in the same general direction as the longitudinal axis of the web member i.e., the direction of travel of the web. The stream of air thus bearing against the adjacent surface of the web member 6 supports the web member 6 in a position slightly spaced from the physical surface of the guide element. Since the stream of air supporting the web member is in the nature of a V-shaped trough, the web member supported thereby will be stabilized in a transverse or lateral direction in a position of equilibrium. Any tendency of the web to move to one side or the other will be immediately met with an unbalanced force from the air stream. The unbalance of these forces is in a direction to restore the web member to the desired lateral position. These forces which tend to maintain the web in a lateral position of equilibrium obviate the necessity for mechanical edge guides for the web member. Such mechanical edge guides could, of course, contribute sufficient frictional engagement with a guided web member to provide a measure of irregularity to the motion of the web member. It will be readily apparent that the stabilizing effect of the air guide contributes no such friction to disturb the regularity of the motion of the web member.

Several structural members are shown which will provide the desired figuration of the air stream which constitutes the web guide means. In Figs. 2 and 3, there is shown a guide element 24. The guide element 24 comprises a box-like structure which may be in the form of a hollow cylinder 26. The cylinder 26 defines and encompasses an inner chamber 28. The cylinder is supported in a mounting panel 8 by a hollow support member 30 which comprises a conduit for the conduction of the compressed air from the source 22 to the interior or chamber 28 of the cylinder 26. The surface of the cylinder adjacent the desired path of the web member is provided with a plurality of orifices in the form of tiny jet holes 32. These holes are arranged in two groups positioned on opposite sides of the central portion of the cylinder. The first group of holes 32 is slanted in such a direction that a stream of air issuing from these holes will be directed at an angle toward the end of the cylinder adjacent the mounting panel. The other group of the holes is slanted in such a direction that a stream of air issued therefrom would be directed at an angle toward the end of the cylinder remote from the mounting panel. In this manner, the two groups of holes provide means for directing the compressed air from the source 22 into a divided stream of air which forms a substantially V-shaped trough as indicated in Fig. 3. The pressure of the air bearing on the near surface of the web member 6 supports that web member out of physical contact with the surface of the guide element. Because of the trough-like nature of the air stream, the tendency will be for the tape web member to be stabilized at a position where the divided stream of air exerts substantially equal force on the two edges thereof.

In Fig. 4, there is shown a somewhat similar structure to that shown in Figs. 2 and 3 with the exception that the guide element 34 of Fig. 4 has its surface provided with two groups of orifices in the form of narrow slots 36.

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These slots are similarly slanted to provide a divided stream of air as was illustrated in Fig. 3.

In Figs. 5 and 6, there is shown still another structure which provides the divided air stream in accordance with the present invention. The guide elements 38 then comprise the box-like structure which may be in the form of a hollow cylinder 40. Again the surface of the cylinder is provided with two groups of jet holes 42. In this instance, however, the holes are not slanted but are made perpendicular to the surface of the cylinder. On the outside of the cylinder, there is provided a shoe member 44 which is substantially V-shaped in cross section and is positioned at approximately the middle of the surface of the cylinder between the two groups of holes 42. The V-shaped surface of the shoe member serves to direct and divide the air stream issuing from the jet holes 42 into a V-shaped trough which, again, supports the web member 6 in the manner heretofore described.

In Figs. 7 and 8, there is shown yet another structure which embodies the present invention. The guide element 46 again comprises a cylindrical member 48 defining an air chamber 50. The surface of the cylindrical member which is positioned to be adjacent the tape member 6 is provided with a number of straight slots 52. It is not essential that the slots be slanted and in fact the orifices may comprise a plurality of holes similar to those shown in Fig. 5. Surrounding a portion of the slotted surface of the cylindrical member 48 there is positioned a pair of spaced, parallel, V-shaped shoe members 54. The ends of the space between the two shoe members is closed by a pair of wall members 56. As before, compressed air transduced into the chamber 50 issues forth from the slots 52. The V-shaped shoes 54 cause the air issuing from the openings nearest the ends of the cylindrical member to form a substantially V-shaped trough to maintain the web member in position as hereinbefore described. A pair of outer shoes 58 placed parallel to the shoes 54 and on the extreme ends, respectively, of the cylindrical member 48 further direct and accelerate the stream of air forming the V-shaped trough. Certain of the slots open between the two shoe members 54. The air issuing from these central slots bears directly against the back of the web member where it is spread into a thin layer of air escaping at relatively high velocity between the surface of the web member and the outer surface of the shoe members 54. The operation of the central stream of air follows the Bernoulli principle in that the higher velocity of the air stream gives rise to a reduced pressure. This maintains the web in a position of equilibrium in the spacing of the web member from the surface of the shoes 54. As before indicated, the V-shaped trough of air issuing from the slots on the outer sides of the shoe members again provides for the lateral stability of the web. The central jets provide a higher degree of stability in the spacing of the web from the surface of the shoe members.

In all of the structures described, there is provided a

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divided stream of air which constitutes a V-shaped trough which supports the web member in both a lateral and a vertical direction. These structures accomplish a reliable guide means for a web feeding device which does not introduce frictional engagement with the web.

What is claimed is:

1. In a web feeding system, a web guide means comprising a web guide element for supporting and guiding a web member including a substantially cylindrical body enclosing a chamber, means for applying compressed air to said chamber, said cylindrical body having a plurality of narrow slots therethrough communicating with said chamber and through which said compressed air may issue, said slots being arranged in two groups, said slots in one of said groups being angularly disposed relative to the surface of said cylindrical body to direct air issuing from said slots angularly toward one end of said cylindrical body and said slots in the other of said groups being angularly disposed relative to said surface of said cylindrical body and to said slots in said first-mentioned group to direct air issuing from said slots in said other group angularly toward the other end of said cylindrical body, and said angularly related groups of slots constituting means for defining a V-shaped trough-like stream of air for supporting and guiding said web member.

2. In a web feeding system, a web guide means comprising a web guide element for supporting and guiding a web member including a substantially cylindrical body enclosing a chamber, means for applying compressed air to said chamber, said cylindrical body having a plurality of orifices therethrough communicating with said chamber and through which said compressed air may issue, certain of said orifices being spaced from each other longitudinally of said guide path, said orifices being arranged in three groups, a pair of shoe members mounted on the outer surface of said cylindrical body, said shoe members being substantially V-shaped in cross section, said shoe member being spaced from each other in parallel relation about said cylindrical body to form dividers between said groups of orifices, one of said groups of orifices lying between said shoe members, the other of said groups lying respectively on opposite sides of said two shoe members, and said shoe members comprising means for dividing said air issuing from said orifices into a V-shaped trough-like stream of air for supporting and guiding said web member and including a central stabilizing stream of air.

3. The invention as set forth in claim 2 characterized by the addition of a pair of accelerating shoe members mounted on said cylindrical body in spaced parallel relation to said V-shaped shoe members respectively on opposite sides thereof to provide a restrictive path to accelerate said air in said V-shaped trough-like stream.

References Cited in the file of this patent

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