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3,134,324

ROLLER PRINTING APPARATUS

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2 Sheets-Sheet 1

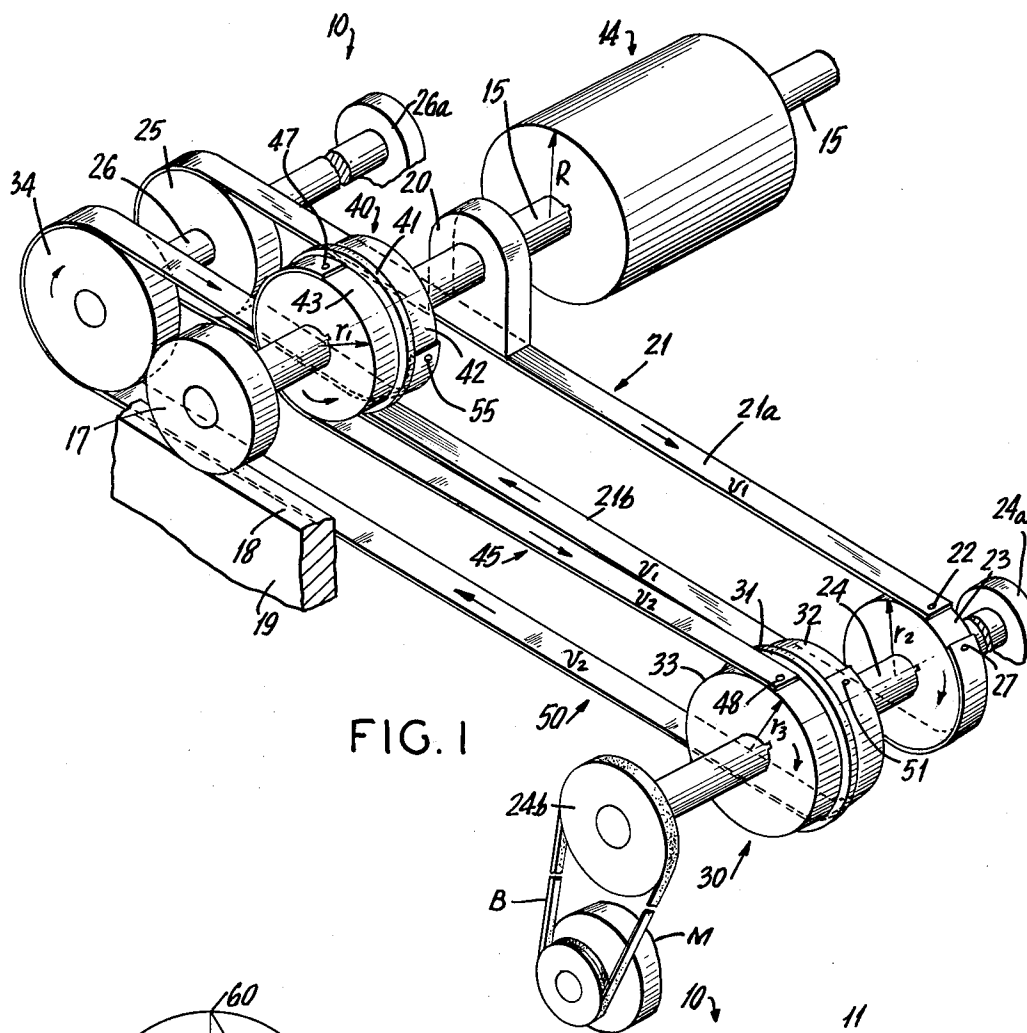


FIG. 1

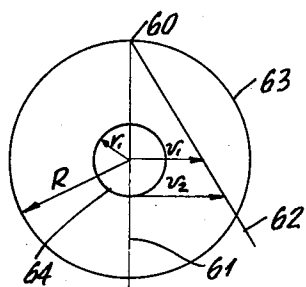


FIG. 2

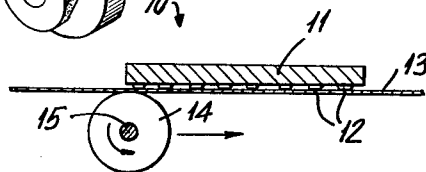


FIG. 3

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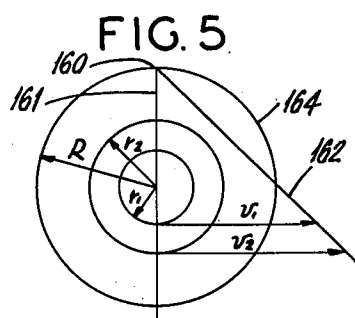
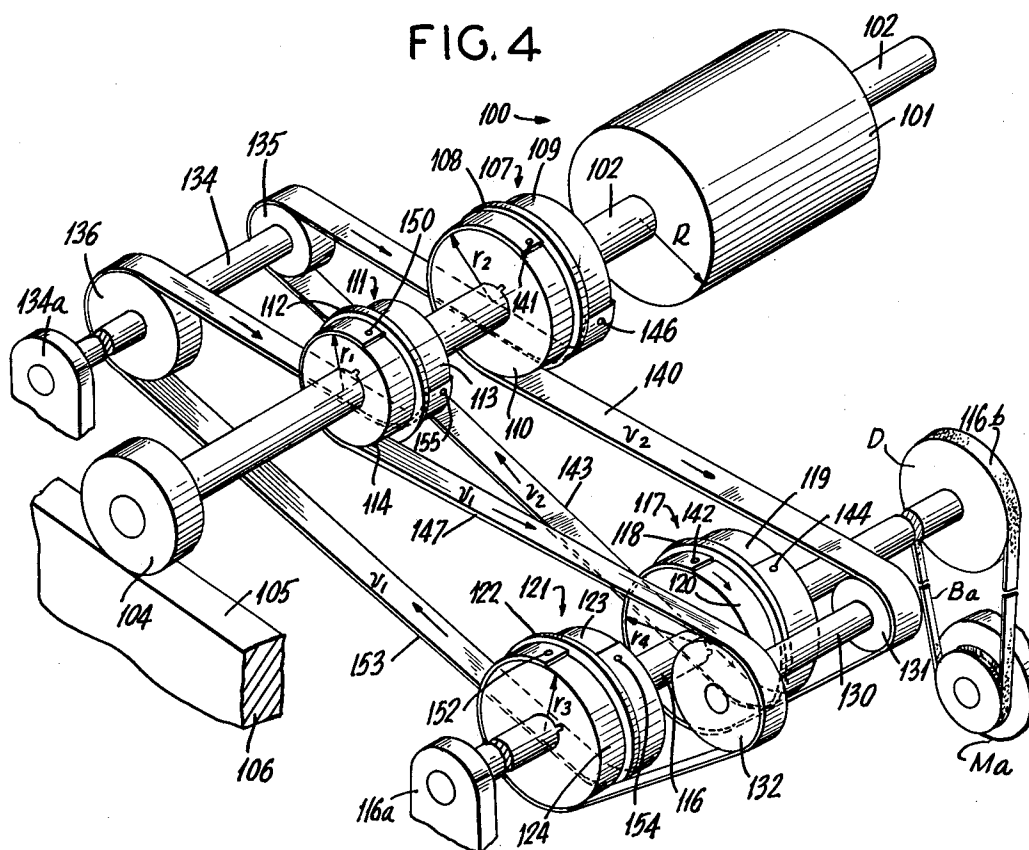
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ROLLER PRINTING APPARATUS

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This invention relates to roller printing apparatus. It is particularly directed to apparatus in which a sheet is held against a flat printing platen and a roller rolls against the sheet to press the sheet against the printing platen for the printing operation.

In such apparatus, as heretofore constructed, when a shaft on which the roller is rotatably mounted, is given a forward motion, the roller will roll against the sheet and press it against the printing type, but it has been found that with such apparatus, the roller often also pulls the paper along with it and causes it to slip across the printing type. It is therefore an object of the present invention to provide apparatus of the character described, which will roll the roller in such a way that there is no tendency for velocity at the line of contact of the roller and sheet.

Another object of the present invention is to provide apparatus of the character described, in which there is no driving mechanism at or above the surface of the sheet to be printed, so that the sheet can be large and overlie the apparatus, and no part of the apparatus or mechanism will be in the way of the sheet or interfere therewith.

Still another object of this invention is to provide a strong, rugged and durable apparatus of the character described, which will be relatively inexpensive to manufacture, which shall be sure and positive in operation, and which shall yet be practical and efficient to a high degree in use.

Other objects and advantages of this invention will in part be obvious and in part hereinafter pointed out.

The invention accordingly consists in the features of construction, combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter described, and of which the scope of invention will be indicated in the following claims.

In the accompanying drawings, in which is shown an illustrative embodiment of the present invention,

FIG. 1 is a perspective view of apparatus embodying the invention;

FIG. 2 is a diagram illustrating the relation between the velocities and radii of different parts of the apparatus;

FIG. 3 is a diagrammatic view illustrating the relationship between the rollers, the printing type and the sheet to be printed;

FIG. 4 is a view similar to FIG. 1, but illustrating a modified construction; and

FIG. 5 is a view similar to FIG. 2, but relating to the apparatus of FIG. 4.

Referring now in detail to the drawings, and particularly to FIGS. 1, 2 and 3 thereof, 10 designates one form of apparatus embodying the invention. The same comprises a horizontal fixed platen 11 provided at its underside with printing type 12. Placed against the underside of the type 12 is a sheet 13 to be printed at its upper surface. Said sheet may be held against its platen in any suitable manner. For pressing the sheet 13 against the type 12 to cause a print therein, there is provided a roller 14 fixed to a horizontal axial shaft 15. The printing roller may be made of rubber, plastic or any other suitable material. The shaft 15 extends to opposite sides of the printing roller 14, as shown in FIG. 1. Means is provided on opposite sides of the roller 14 to rotate and concurrently advance the shaft 15. Only the apparatus on one side of the roller is shown, it being understood

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that similar apparatus is symmetrically disposed on the opposite side of the roller. At the outer end of shaft 15 is a ball bearing 17 which may roll on the top edge 18 of a fixed horizontal support 19 which takes the load and extends at right angles to said shaft. The shaft 15 passes through a bearing block 20 mounted on a tape 21, which may be made of nylon or other suitable material. Tape 21 has an upper horizontal run 21a at right angles to shaft 15. One end of the tape run 21a is fixed as at 22 to an annular disc 23 keyed to a horizontal shaft 24 which is parallel to shaft 15 and rotates in a fixed bearing 24a and is power-driven by any suitable motive means 24b. The tape 21 passes around an opposed annular disc or pulley 25 idling on a fixed-axis shaft 26 (in bearing 26a) parallel to shaft 24, and has a lower run 21b extending forwardly beneath run 21a. Run 21b of the tape 21 then passes around and beneath the annular disc 23 and is fixed thereto as at 27. Thus rotation of shaft 24 by motor M through belt B, will cause the tape 21 to move and hence will advance the shaft 15 in a direction at right angles to its axis, at the longitudinal speed of the tape. Obviously the motor M would of necessity be a reversible, synchronous motor since bearing block 20 can only reciprocate. Any usual reversible synchronous motor provided with suitable reversing switches may be employed, for example such as manufactured by Haydon Division of General Time Corporation of Torrington, Connecticut.

Also it is clear that the belt 21 itself can be moved back and forth manually to effect the reciprocation of the rocker shaft 15 for causing a printing operation for which this apparatus is suitable as stated above. Obviously the shaft 15 must be reciprocated for printing.

Fixed to the shaft 24 is an annular disc 30 formed with a central annular rib 31 dividing the disc into spaced portions 32 and 33 of equal diameter. Idling on shaft 26 is an annular disc or pulley 34. Fixed to the shaft 15 and located between the bearing block 20 and the bearing 17, is an annular disc 40 formed with a central annular rib 41 dividing said disc into spaced portions 42 and 43 of equal diameter. The relationship of the radii of discs 23, 30, 40 and roller 14 is

$$\frac{R+r_1}{R} = \frac{r_3}{r_2}$$

where R is radius of the roller 14; r_1 is radius of disc 40; r_2 is radius of disc 23, and r_3 is radius of disc 30. A tape 45, which may likewise be made of nylon, extends around the underside of disc portion 43 and is attached thereto as at 47. Said tape 45 extends forwardly and over the disc portion 33 and is attached thereto as at 48.

Another tape 50 extends around the underside of disc portion 32 and is fixed thereto as at 51. Said tape 50 then extends rearwardly and around the pulley 34 and then forwardly and around and beneath the disc portion 42, and is attached thereto as at 55.

With such construction, the velocity at the point of contact at the printing roller 14 with the paper, will be zero. Assuming that the velocity of the tape 21 is V_1 and the velocity of tapes 45 and 50 is V_2 , then

$$\frac{V_2}{V_1} = \frac{R+r_1}{R} = \frac{r_3}{r_2}$$

Obviously, the velocities of the tapes 21 and 45, 50 will be in proportion to the radii of discs 23 and 30. The formula,

$$\frac{V_2}{V_1} = \frac{R+r_1}{R}$$

is illustrated in FIG. 2 of the drawing. In said figure 60 designates the point of contact of roller 14 with the sheet to be printed. Numeral 61 designates a vertical plane

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through the axis of the roller and line 62 designates an inclined line extending from point 60 and touching the outer ends of horizontal lines representing V_1 , extending from the center of the circle 63 whose radius is R , and V_2 tangent to circle 64 whose radius is r_1 .

It will now be observed that the velocity at the point of contact or at the top of the roller where the roller contacts the paper, is zero. The velocity at any point in plane 61 is equal to the length of the horizontal base of the right angle triangle whose apex is at 60, and having a vertical side 61 and an inclined side 62. Thus at the point 60 the base is zero so that at the point of contact, the roller does not move longitudinally of the paper or longitudinally of the platen 11, and therefore there will be no slippage between the roller and the platen.

It will now be observed also that the entire apparatus is located below the top of the printing roller. It will also be understood that the apparatus shown on one side of the roller 14 in FIG. 1 is repeated at its opposite side in symmetry with the illustrated apparatus, so that there is a balanced drive for the shaft 15 at opposite sides of the roller.

In FIG. 4 there is shown apparatus 100 embodying a modified form of the invention. The apparatus 100 comprises a printing roller 101 similar to printing roller 14, and fixed to a shaft 102. Roller 101 may also be used to press a sheet 13 against type 12 on a platen 11. Means are provided for concurrently rotating and advancing the shaft 102. Only the apparatus on one side of the roller is illustrated in FIG. 4, it being understood that a similar, symmetrically disposed apparatus is located at the opposite side of the roller. Shaft 102 extends to a ball bearing 104 rotating on the upper edge 105 of a fixed horizontal abutment 106, disposed at right angles to said shaft. Fixed to shaft 102 is an annular disc 107 formed with a central annular rib 108 dividing said disc into portions 109 and 110 of equal diameter. Also fixed to shaft 102 and between the disc 102 and ball bearing 104, is a second disc 111 provided with a central annular rib 112 dividing said disc into disc portions 113 and 114, of similar outer diameter.

Rotatably mounted in any suitable fixed bearings 116a is a shaft 116 which may be rotated by any suitable motive means 116b. Motive means 116b may comprise motor M^a belted by belt B^a to a disc D on shaft 116. On said shaft is an annular disc 117 provided with a central annular rib 118 dividing said disc into said disc portions 119, 120 of equal diameter. Also fixed to said shaft 116 is another disc 121 formed with a central annular rib 122 dividing said disc into disc portions 123, 124 of equal diameter. Mounted on a fixed bearing is a shaft 130 parallel and adjacent to shaft 116 and carrying a pair of idler pulleys 131 and 132. There is also provided a shaft 134 parallel to shaft 130 and supported by any suitable fixed bearings 134a and carrying idler pulleys 135 and 136. Shaft 102 is located between shafts 116 and 134.

A tape 140 has one end extending beneath and rearwardly around the disc portion 110 and fixed thereto as at 141. Said tape 140 then extends forwardly horizontally and around and over the idler 131, then down, under and around the disc portion 120, and is attached thereto as at 142. A second tape 143 has one end extending forwardly around and beneath the disc portion 119 and is fixed thereto as at 144. Said tape 143 extends rearwardly, around and over the idler 135, and then forwardly and beneath the disc portion 109, and is attached thereto as at 146.

Another tape 147 has one end extending rearwardly around and beneath the disc portion 114 and is attached thereto as at 150. Said tape 147 extends forwardly and over and around the idler 132 and then down and rearwardly around the disc portion 124 and is attached thereto as at 152. Still another tape 153 has one end thereof extending forwardly around and beneath the disc portion

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123 and is attached thereto as at 154. Said tape 153 then extends rearwardly and around the pulley 136, then forwardly and around and forwardly beneath the disc portion 113, and is attached thereto as at 155.

Assuming that the velocity of tapes 140 and 143 is V_2 and the velocities of tapes 147 and 153 is V_1 , the radius of the roller 101 is R , the radius of disc portions 109 and 110 is r_2 , the radius of disc portions 113 and 114 is r_1 , and the radius of disc portions 123, 124 is r_3 , and the radius of disc portions 119, 120 is r_4 , then

$$\frac{V_1}{V_2} = \frac{R + r_1}{R + r_2} = \frac{r_3}{r_4}$$

The above formula is illustrated in FIG. 5 of the drawing. In said drawing 160 is the apex of a triangle having a vertical side 161 and an inclined line 162 passing through the outer ends of lines r_1 and r_2 tangent to circles whose radii are r_1 and r_2 . In the drawing R is radius of circle 164. The velocities of the tapes 140 and 143 are equal, the velocities of the tapes 147, 153 are equal. The velocity of the point of contact of roller 101 with the sheet to be printed, is zero. The diagrams of FIGS. 2 and 5 illustrate the velocity of every point in the roller in a vertical, longitudinal plane passing through the axis of the roller. The velocity increases in accordance with the distance from the point of contact downwardly.

It will thus be seen that there is provided roller printing apparatus in which the several objects of the present invention are achieved and which is well adapted to meet the conditions of practical use.

As possible embodiments might be made of the above invention, and as various changes might be made in the embodiment above set forth, it is to be understood that all subject-matter herein set forth or shown in the accompanying drawing, is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In combination, a horizontal shaft, a roller fixed to said shaft for rotation therewith, a fixed longitudinal horizontal surface at right angles to said shaft, means on said shaft having rolling engagement with said surface, a second shaft parallel to the first shaft and located on one side thereof and journaled in a fixed bearing, a third shaft parallel to the second shaft and located on the other side of the first shaft, a pair of annular discs fixed to the second shaft for rotation therewith, a pair of idler pulleys on the third shaft, means including a tape connected to one annular disc on said second shaft and passing over one idler pulley on the third shaft, for advancing the first shaft in a direction at right angles to its axis, and including a tape connected to the other annular disc on the second shaft and passing over the other idler pulley on the third shaft, for rotating the first shaft, at such velocities that the velocity of points in a vertical plane passing through the axis of the roller are proportional to the distances of such points from the line of contact of a horizontal plane tangent to the top of the roller.

2. In combination, a horizontal printing platen having printing means at its underside against which a sheet to be printed may be located, a roller pressing said sheet against said printing means, an axial shaft for said roller movable therewith, a horizontal fixed surface, means on said shaft having rolling engagement with said surface, means to advance said shaft and roller in a direction at right angles to said shaft and in a plane parallel to said surface and to rotate said shaft and roller as said shaft is advanced, at such velocities that there is no longitudinal movement of the outer surface of said roller relative to the sheet in said direction at the line of contact of said roller with said sheet, said last means comprising an annular disc fixed on said shaft for rotation therewith, provided with a pair of disc portions of equal diameter, tapes fixed to and extending around said disc portions from opposite sides, respectively, and extending in opposite directions, means to move said tapes in the same direction, and at the same

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speed, and means to move said shaft at right angles to its axis, with the ratio of the velocities of the tapes and shaft being

$$\frac{R+r_1}{R}$$

where the radius of the roller is R and the radius of said disc portions is r_1 .

3. In combination, a shaft, a printing roller on the shaft rotating therewith, an annular disc, a second disc coaxial with the first disc and fixed for rotation therewith about a fixed axis parallel to said shaft, a second shaft parallel to said axis of rotation, a pair of idler pulleys on said second shaft, a tape fixed at one end to the first disc and extending around one of said idler pulleys and having its other end extending around said first disc and fixed thereto, a bearing block on said tape through which the first shaft is journaled, said second disc having a pair of spaced bearing portions of equal diameter, side by side, a third disc on the first shaft and having a pair of spaced disc portions of equal diameter, a tape fixed to one of the disc portions of the third disc and extending around said other pulley and around one bearing portion of the second disc and attached thereto, and another tape having one end fixed to the other disc portion of the second disc and extending around the other disc portion of the third disc and attached thereto, and the relationship of the radii of said roller, and said first, second and third discs being in accordance with the formula,

$$\frac{R+r_1}{R} = \frac{r_3}{r_2}$$

where R is the radius of the roller, r_1 is the radius of the third disc, r_2 is the radius of the first disc, and r_3 is the radius of the second disc.

4. The combination of claim 3, a fixed abutment having a horizontal surface extending at right angles to the first shaft and means on said first shaft having rolling engagement with said abutment.

5. The combination of claim 4, in combination with a horizontal printing platen above said roller having printing means on its underside so located that a sheet to be printed and placed against the printing means will be pressed by said roller against said printing means.

6. In combination, a first shaft carrying a printing roller rotating therewith, a first annular disc on said shaft and having a pair of annular disc portions of equal diameter side by side, a second shaft on a fixed bearing, second and third annular discs thereon each having a pair of annular disc portions of equal diameter, side by side, a third shaft parallel to and adjacent the second shaft and carrying a pair of idler pulleys, a fourth shaft parallel to the first shaft and carrying a pair of idler pulleys, a fourth annular disc on the first shaft and having a pair of annular disc portions of equal diameter side by side, a tape fixed to one disc portion of the first annular disc and extending around an idler pulley of the third shaft and around an annular disc portion of the second disc on the second shaft and fixed thereto, a second tape extending around the other annular disc portion of the second disc and extending around an idler pulley on the fourth shaft

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and beneath the other disc portion of the first disc and fixed thereto, another tape extending around one of the disc portions of the fourth annular disc and around the other idler pulley on the third shaft and around one of the disc portions of the third disc and fixed thereto, and still another tape fixed to the other disc portion of the third annular disc and extending around the other idler pulley of the fourth shaft and then around the other disc portion of the fourth annular disc and fixed thereto.

7. In the combination of claim 6, the ratio of the radii of the roller and the first, second, third and fourth annular discs following the formula,

$$\frac{R+r_1}{R+r_2} = \frac{r_3}{r_4}$$

where R is the radius of the roller, r_1 is the radius of the fourth disc, r_2 is the radius of the first disc, r_3 is the radius of the third disc, and r_4 is the radius of the second disc.

8. The combination of claim 7, in combination with a fixed horizontal platen above the printing roller and having printing means at its underside so located that a sheet to be printed and held against the printing means will be pressed against said printing means by said roller.

9. In the combination of claim 8, a fixed horizontal abutment having a horizontal surface extending at right angles at the axis of the first shaft, and bearing means on the first rolling on said surface.

10. In combination, a roller having a cylindrical outer surface, means having a fixed flat surface in a plane parallel to the axis of said roller, means to mount said roller for movement of its axis in a direction perpendicular to said axis and in a plane parallel to said surface, and means to move the axis of said roller in said direction and to rotate said roller as its axis is so moved, at such velocities that there is no relative movement between a line of tangency of the outer surface of said roller in said direction, with a plane parallel to said surface and tangent to the outer surface of said roller, and such plane, said last means comprising a pair of disc portions of equal diameter coaxial with said roller and fixed to move therewith, tapes fixed to and extending around said disc portions from opposite sides, and extending in opposite directions, respectively, means to move said tapes in said direction of movement and at the same speed, and means to move the axis of said roller in said direction of movement, with the ratio of the velocities of the tapes and axis of roller being

$$\frac{R+r_1}{R}$$

where the radius of the roller is R and the radius of said disc portions is r_1 .

11. The combination of claim 10, said last means further including means fixed to move with said roller and having rolling contact with said fixed surface.

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