Oct. 3, 1967 J. N. COLLINGE ETAL 3,344,969

ROLLERS FOR USE IN THE CONVEYANCE OF ENDLESS WEBS

Filed March 2, 1965 4 Sheets-Sheet 1

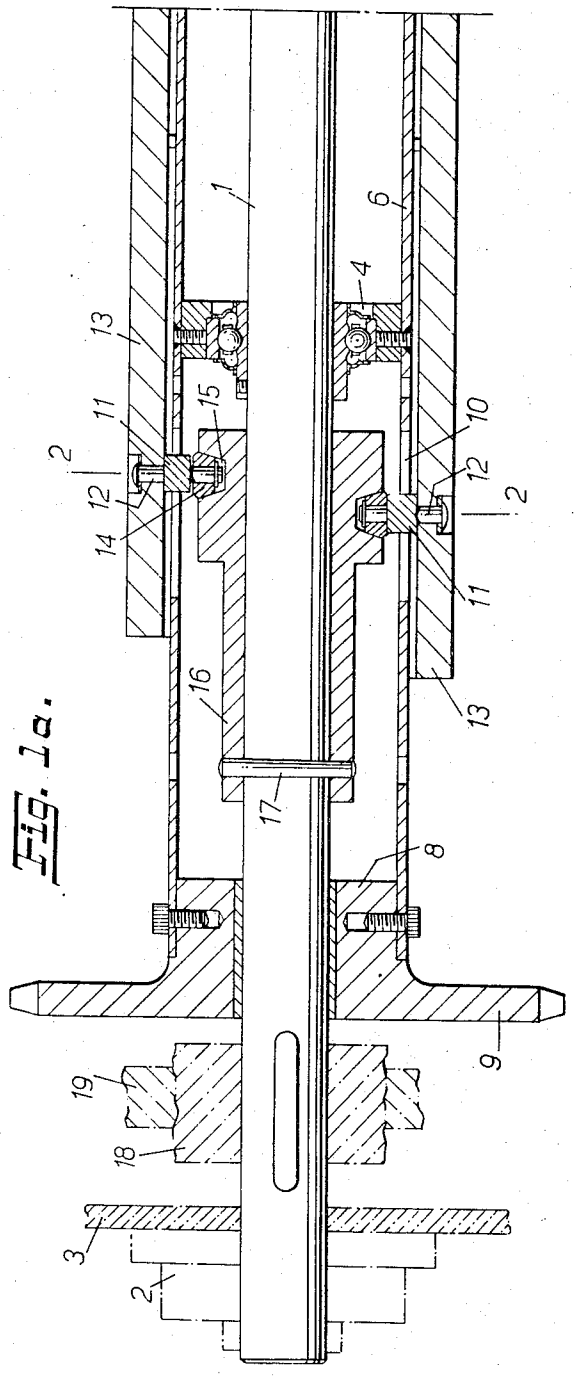

Fig. 1a.

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Fig. 1b.

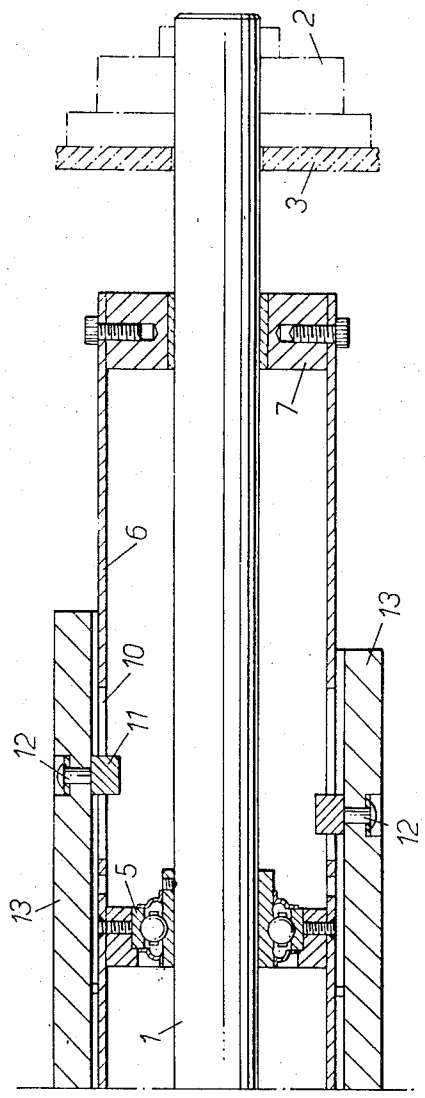

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Fig. 2a.

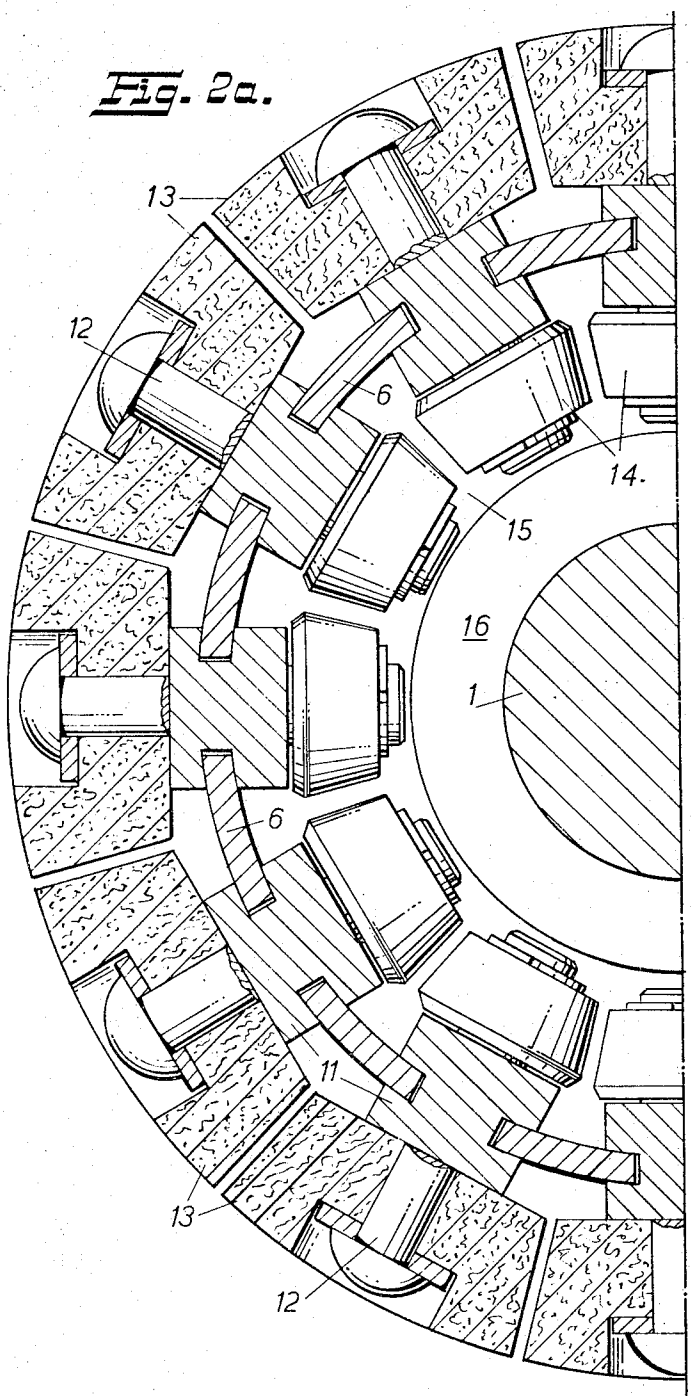

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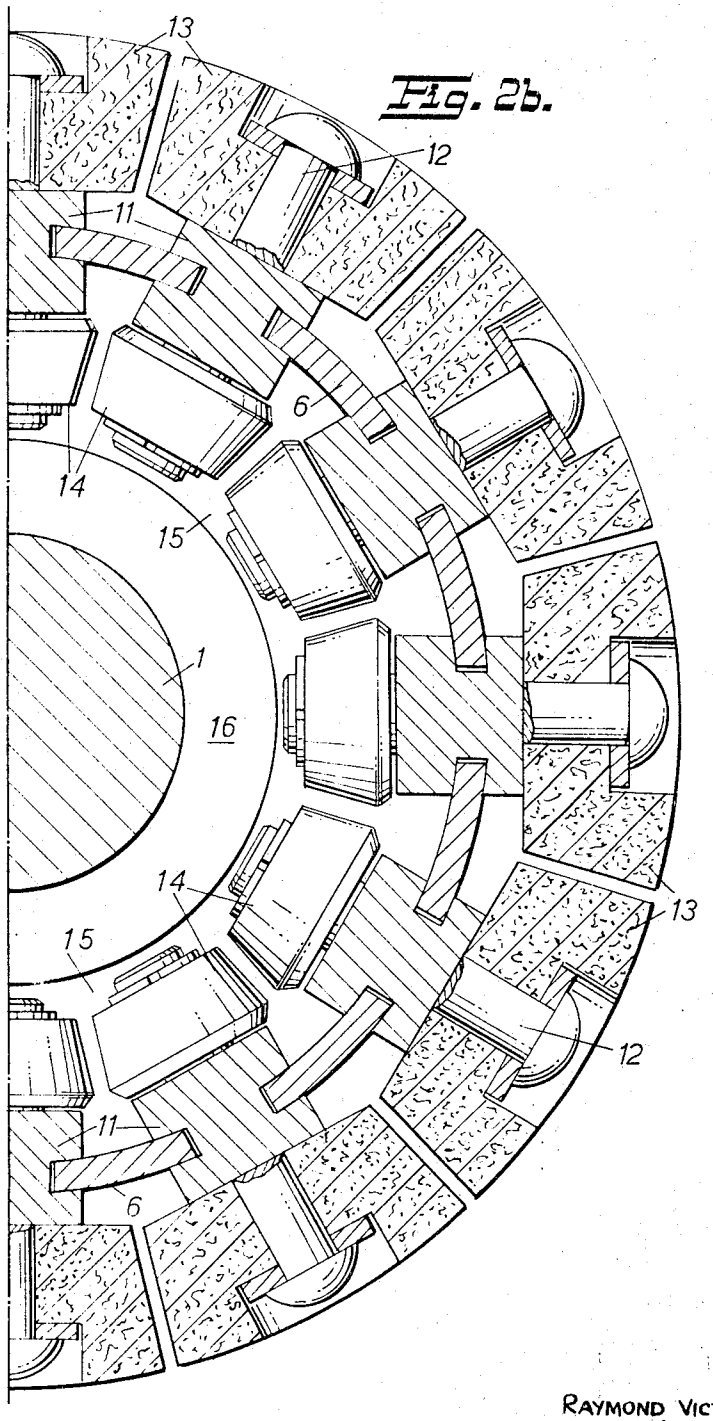
Fig. 2b.



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ROLLERS FOR USE IN THE CONVEYANCE OF ENDLESS WEBS

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8 Claims. (Cl. 226—190)

This invention is concerned with a means for guiding or tracking a moving endless web so that the longitudinal axis of the web may be kept in position relative to a central datum, say on a processing apparatus to which the web is being fed.

Various types of fabric guiding or tracking arrangements are already known but, in general, these have operated only on the edges of the fabric and this has resulted in the distortion of the web transversely and sometimes in the actual stretching of the web. This drawback is especially present when thin and/or elastic webs are being handled, for example thin P.V.C. web and they interfere with the correct processing or winding of the material in the apparatus to which it is being led, for example in the laminating of the web on to some other material.

The present invention has for its object an entirely new conception of web guiding apparatus which eliminates all the difficulties and drawbacks of the apparatus hitherto known, particularly in that any necessary transverse shift of the web is imparted to the web at all points across its width, thus avoiding distortion, deformation and/or stretching of the material.

According to this invention a web guiding apparatus includes a tracking roller the surface of which, during rotation, passes successively through zones of axial shift in one direction, no axial shift and axial shift in the other direction, and control means whereby the relative positions of the said zones and the arc of contact of the web with the roller are adjustable such that the said arc corresponds to the zone of no axial shift, or corresponds wholly or partly to a zone of axial shift.

In most cases the variation of coincidence between the web and said zones will be effected automatically by means sensing one or both edges of the web and the variation will be brought about by changing the angular position of said zones about the axis of the roller.

The angular adjustment of said zones may if desired be brought about manually but preferably it is brought about automatically, for example by means such as a light ray sensing one of the edges of the web. Sensing means of this type is known. In the present case, if a web is too far over to one side of the machine the angular position of said zones about the roller axis will be shifted in one direction, to bring the web into contact with part of the roller surface moving towards the other side of the machine, and on the other hand if the web is too far over towards such other side of the machine it is brought into contact with parts of the roller surface moving away from such other side. As the web moves back to its proper position so the said zones revert to their normal angular position about the roller axis.

According to a further feature of the invention the surface of the roller is made up of a multiplicity of slats arranged in adjacent side-by-side disposition axially of the roller, each such slat being adapted to engage a cam located co-axially with the roller, such cam being shaped so as to provide said zones of movement and non-movement, and a means is provided for rotating the cam about the roller axis to vary the relationship between said zones and the arc of contact with the web material. The

outer surface of the roller may be covered with a sleeve or sheath if desired, or it may be made up of the said side by side slats.

The angle sub-tended by the zone in which there is no axial shifting of the roller surface will depend upon the desired degree of contact between the web and the roller surface. For this reason there may be interchangeable cams which will vary the angular relationship between the zone of non-axial movement and the zones in which axial movement takes place.

In the preferred arrangement the roller comprises a supporting tube in the wall of which there are axial guideways for slide members which carry the said slats. These guideways may be of keyhole shape so that the slide members may be entered freely at one end and then the slats moved axially to another position at which they will be anchored to the tube. The tube will run on bearings on a central shaft, to which shaft the said cam is fixed, and one end of such shaft will be provided with a worm and worm-wheel drive, or like driving mechanism, under the control of automatic sensing means which by rotating the shaft will shift the cam in a direction complementary to any lateral displacement of the web so as to bring the web back to its normal position.

The tracking roller may be driven, for which purpose it will be provided with a sprocket wheel or other driving means at one end, or especially when heavier materials are being dealt with, it may be rotated merely by its frictional contact with that material. It is to be appreciated that in the event that this roller is driven, the speed may be less than, equal to or greater than the rate of progression of the material as determined by the particular requirements and characteristics of the material.

For sensing the lateral deviations of the web any known means may be employed. In one case two photo-electric cells are used, arranged in a circuit so that if one only is obstructed by the web the control means is idle, whereas if both become exposed the control means operates in one direction, and if both are obstructed the control means operates in the other direction. Various types of photo-electric control means suitable for this purpose are already known, and in themselves they form no particular part of the invention.

A representative example of the invention is illustrated in the drawings in which:

FIGS. 1*a*, 1*b* are longitudinal sections of the left and right hand ends respectively of the improved guiding or tracking roller; and

FIGS. 2*a*, 2*b* together show a transverse section on line 2—2 of FIG. 1*a*.

As shown there is a central shaft **1** mounted rotatably in bearings **2** fixed on the frame parts **3** of the machine. On the said central shaft are mounted ball bearings **4** and **5** (others will be present, dependent on the length of the roll) which carry a metal tube **6**, closed at one end by a disc **7** and closed at the other end by the hub **8** of a chain sprocket **9**. Thus tube **6** has a number of key-hole shaped slats **10** arranged in two or more annular series (two series are shown) and in each of such slots is a slotted guide member **11** mounted on a pin **12** carried by an axially-disposed elongated surface member, such as a bar or slat **13** of wood or the like. At the left hand end of the roller in FIG. 1, the pins **12** carry at their inner ends tapered rollers **14** or cam followers, which run in a cam groove **15** in a cam member **16** fixed by a cotter pin **17** to the said shaft **1**. The shape of the cam groove **15** is such that as the roller rotates the slats are moved towards one end of the roller as they pass through one arcuate zone, they are retained in their normal axial position as they pass through the next arcuate zone, and, in a third arcuate zone they are moved towards the other end

of the roller. The roller will be so mounted that normally the web being treated will lie on those slats which are in the middle zone of the three, with no axial movement. On the left hand end of the shaft **1** is a worm-wheel **18** driven by a worm **19** which will be actuated in one direction or the other, or not at all, under the influence of a photo-cell control means (not shown) as mentioned above. A reversing electric motor may be used to drive the worm **19**, the said motor preferably being equipped with a brake for quick stops, and also being provided with limit switches arranged to prevent continued rotation of the motor (and thus movement of the cam) after adjustment of the cam in an appropriate sense and by an amount corresponding to a maximum slat adjustment. Also there will be means for rotating the roller by hand, as when threading up, and means for varying the normal or neutral position according to the angles at which the material meets and leaves the roller surface. With an arc of contact of 60°, each of the zones will extend over 60°.

In operation if the web being guided is laterally aligned in its proper path, then that part of it which contacts the roller is on the slats which have no axial movement and, therefore, the alignment is preserved. If, however, the web wanders towards one end of the roller the sensing means will operate the control devices and rotate the shaft **1** and shift the cam **16** angularly so that the appropriate zone in which the slats have an axial movement in the required direction will be brought into the arc of contact with the material, and the material being supported by the slats throughout its whole width will be returned to to control position. If the web wanders in the other direction the control means will rotate the roller shaft **1** and cam **16** in the opposite direction to bring those slats into the arc of contact which have the opposite direction of axial movement and thereby return the material into proper alignment position.

It is to be appreciated that since the roller is always truly transverse to the machine and does not pivot there is no excessive tensioning of material passing thereover such as would possibly result from a pivoted roller and thus distortion of such material would not take place.

Means other than a cam and rollers may be used for shifting the slats axially. For example pneumatic cylinders or hydraulic cylinders or electro-magnetic means may be employed, the essential being that for one period of rotation there is axial movement of the slats in one direction, in a succeeding period of rotation there is no axial movement, and in the next period of rotation there is axial movement in the opposite direction, with means to bring any of these periods into the arc of contact with the material, under the control of edge-sensing means.

In a modified arrangement, instead of the cam, an harmonic motion device may be adapted for shifting the roller surface axially. In these cases the zone of no axial movement will be quite small, in fact a mere zero position of the mechanism.

What we claim is:

1. A web guiding apparatus comprising:

(a) a tracking roller having a plurality of elongated surface members,

(b) means mounting said surface members for shifting axially of said roller,

(c) means mounting said tracking roller for rotatable movement so that said surface members are in frictional engagement with a moving web through a predetermined arc of contact,

(d) first shifting means operative to axially shift said members in one direction as said members revolve through a first arcuate zone with said roller,

(e) second shifting means operative to axially shift said members in the opposite direction from said one direction as said members revolve through a second arcuate zone with said roller,

(f) means constraining said members against axial movement as said members revolve through a third arcuate zone with said roller, and

(g) control means for selectively moving said first shifting means, said second shifting means and said constraining means and their corresponding arcuate zones circumferentially and relative to said arc of contact, so that one of said arcuate zones substantially registers with said arc of contact whereby said surface members positively shift the portion of the web in the arc of contact in one direction or the other direction or constrain the web portion against axial movement.

2. The invention according to claim **1** in which said control means moves said first shifting means, said second shifting means and said constraining means as a unit relative to said arc of contact.

3. The invention according to claim **1** in which said first shifting means, said second shifting means and said constraining means comprise cam means operatively connected to said surface members, and said control means comprises means for rotatably shifting said cam means about the axis of said roller to vary the relationships between said zones and said arc of contact.

4. The invention according to claim **3** in which said roller comprises a supporting tube having an axial guideway therein for each of said surface members, a cam follower on each of said surface members slidably received in a corresponding guideway and operatively engaging said cam means.

5. The invention according to claim **3** in which said control means further comprises a worm and worm-wheel drive means for operatively shifting said cam means.

6. The invention according to claim **1** further comprising drive means for rotating said tracking roller.

7. The invention according to claim **4** in which said control means comprises a shaft extending coaxially through said tube, said cam means comprises a cam member fixed to said shaft, said cam member having circumferential cam surfaces corresponding to said arcuate zones, said cam followers operatively engaging said cam surfaces, said control means further including means for rotating said shaft to shift the position of said cam member and consequently said arcuate zones.

8. The invention according to claim **1** in which said elongated surface members comprise slat-like elements defining the effective contact surface of said tracking roller, said elements being arranged in adjacent side-by-side disposition axially of said roller.

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