United States Patent

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[54] **TURNING DEVICE FOR DEFLECTING MOVING FLEXIBLE WEBS OF PAPER OF PLASTIC FILM**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.**.....**226/197**
[51] **Int. Cl.**.....**B65h 23/32**
[58] **Field of Search**.....226/197

[56] **References Cited**

UNITED STATES PATENTS

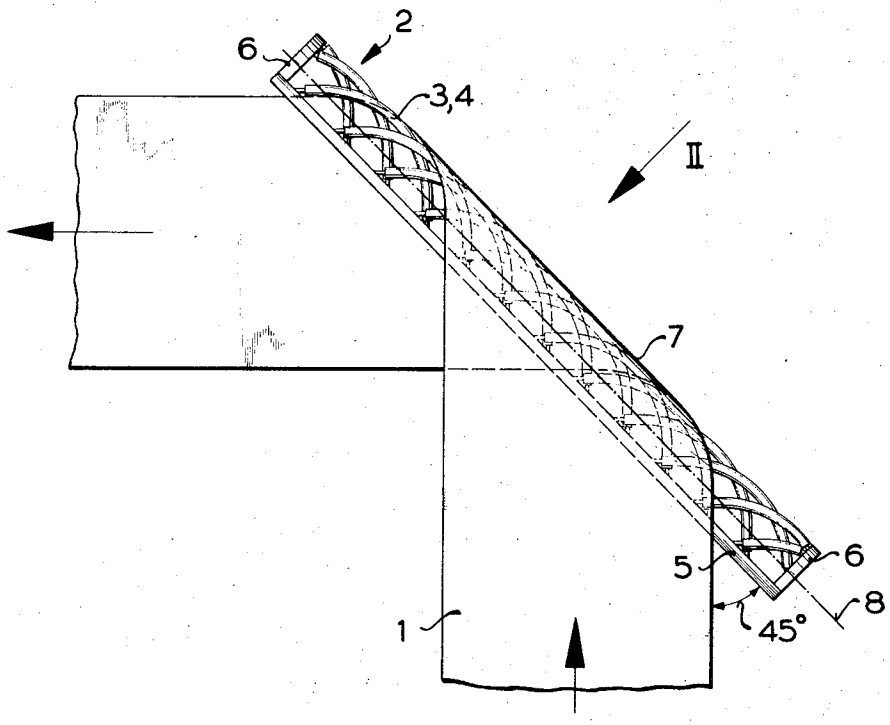
3,583,621	6/1971	Bryant	226/197 X
1,273,926	7/1918	Roesen	226/197 X

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Assistant Examiner—Gene A. Church
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[57] **ABSTRACT**

According to the invention, a turning device for deflecting moving flexible webs comprises a curved surface about which the web can be passed and which is defined by a plurality of individual supporting elements formed from curved shafts having a rotatable covering of which the web-supporting portions are movable at the same speed as and in the same direction as the web. In this way, the web can be passed over the supporting elements along a helical line corresponding to the required deflection angle without having to slide over the curved surface defined by the supporting elements. Positive guiding of the individual supporting elements is not necessary and therefore there will be no appreciable wear and the device will not give rise to frequent interruptions in production.

12 Claims, 5 Drawing Figures



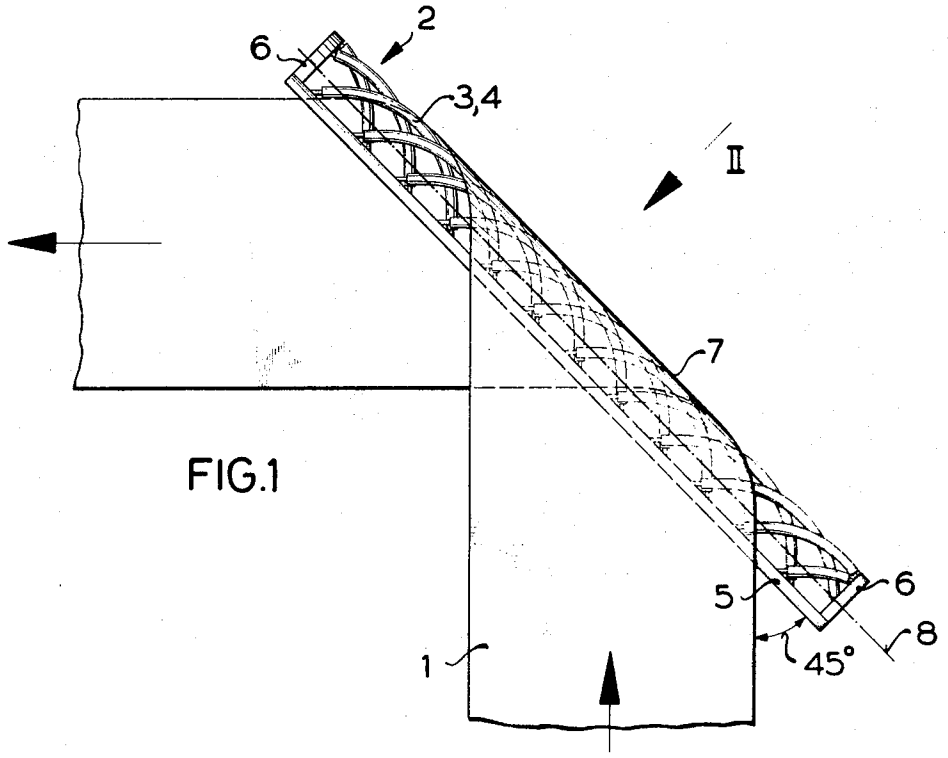


FIG.1

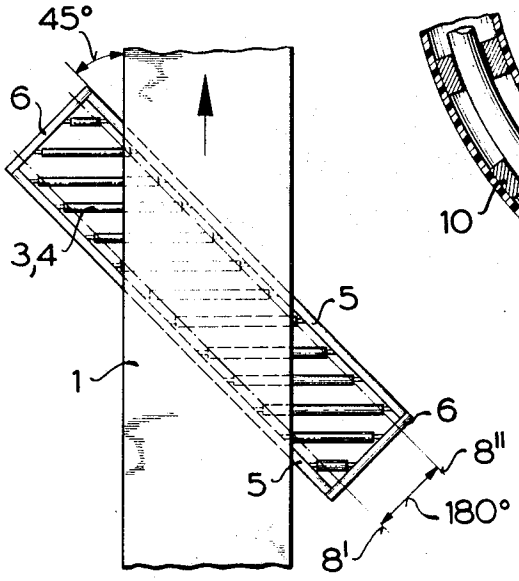


FIG.2

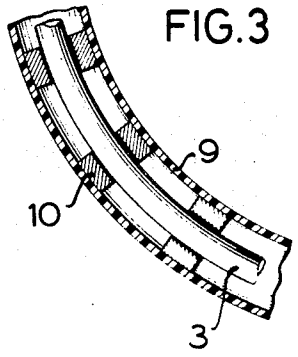


FIG.3

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FIG. 4

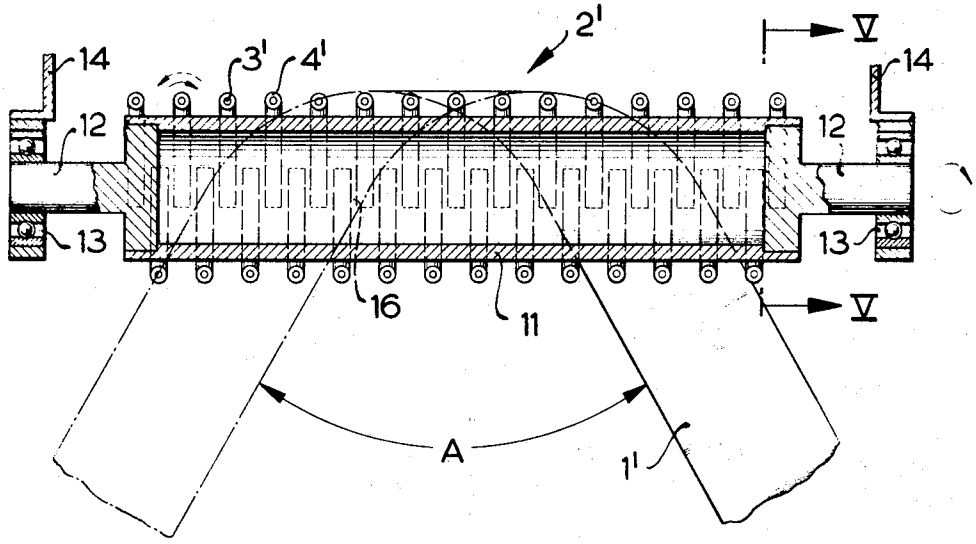
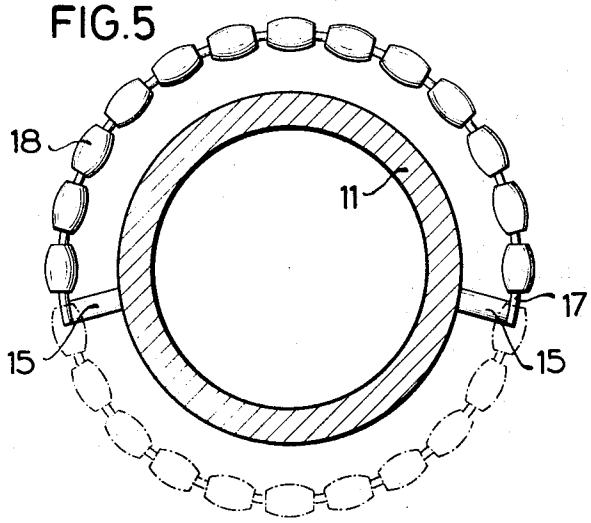


FIG. 5



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TURNING DEVICE FOR DEFLECTING MOVING FLEXIBLE WEBS OF PAPER OF PLASTIC FILM

The invention relates to a turning device for deflecting moving flexible webs of paper or plastics film.

In the processing of such a web, it is often required that the web should be diverted to one side without the creation of folds or creases. For this purpose, the web may be passed over a substantially cylindrical turning surface of which the longitudinal axis is inclined to the direction of web feed at an angle which is appropriate to achieve the desired amount of web deflection. In the processing of paper webs, a polished metal surface of a cylindrical turning rod will exhibit a sufficiently low coefficient of friction to avoid excessive stresses in the web. The conditions are however not so favorable when processing thin flattened tubes or single layers of thermoplastic film or like materials. To reduce the coefficient of friction at the turning rod to an acceptable minimum, compressed air could be introduced through small perforations beneath the web to form a supporting air cushion. It is also possible to provide the turning rod with a coating of low-friction material such as polytetrafluoroethylene. The introduction of compressed air involves a constant uneconomical consumption of compressed air while a low-friction slide layer on the turning rod needs to be frequently renewed because of unavoidable wear, with consequent interruptions in production. For the purpose of deflecting paper webs, it has also already been suggested to use turning rods of which the surfaces comprise a plurality of parallel bars which are mounted for displacement parallel to the bar axes so that they can follow the path of the web about the turning rod by executing a longitudinal displacement and then be returned to their original position. To achieve the reciprocating movement of the bars, the latter are positively guided in stationary cam tracks. This arrangement has the disadvantage that considerable inertia and frictional forces have to be overcome at high web speeds, resulting in intensive wear of the guiding elements for the bars and making these susceptible to faults.

The invention aims to provide a turning device between which and the web there will be practically negligible friction, for the operation of which it is not necessary to use compressed air or the like but which will nevertheless not be subject to appreciable wear.

The shafts may be helically curved and mounted so as to extend transversely to the direction of web movement where the web passes thereabout. This avoids the need for rotating the turning device because no appreciable increase in web tension is caused if the rotatable coverings revolve under the action of the web that passes over them.

In another form of the invention, the shafts are substantially arcuately curved and mounted on a rotatable cylinder to extend circumferentially thereto. Since the rotatable coverings turn about their own axes or rather about the arcuately curved axes of the shafts and also circulate about the rotary axis of the cylinder, such a combination of movement permits the web-supporting portions of the coverings to follow the movement of the web in any desired direction without giving rise to substantial friction. Deflection of the web is therefore brought about without effort and through almost any desired angle. In this form of the invention, assembly of the shafts can be simplified if the latter are curved to

substantially semi-circular shape and alternately arranged on opposite sides of the cylinder.

In any form of the invention, each rotatable covering may comprise a flexible tube which is supported on the associated shaft by individual rollers. Alternatively, each covering may be formed by individual juxtaposed rollers which are preferably barrel-shaped.

Examples of the invention are illustrated in the accompanying drawings, wherein:

FIG. **1** is a side elevation of a turning device showing a web of plastics material passed thereabout and deflected thereby;

FIG. **2** is a plan view taken in the direction of the arrow II in FIG. **1** but with the device and web developed into a single plane;

FIG. **3** is a fragmentary enlarged longitudinal section through one of the supporting elements of the FIG. **1** device;

FIG. **4** is a longitudinal section through a second form of turning device, and

FIG. **5** is a section on the line V—V in FIG. **4**.

Referring to the FIGS. **1** to **3** embodiment, a web **1** of plastics material is deflected through 90° by a turning device which is generally indicated at **2**. The turning device comprises helically curved supporting elements each of which is formed by a shaft **3** having a rotatable covering **4**. The supporting elements are mounted in a frame **5** having semi-circular end pieces **6**, the manner of mounting the supporting elements being such that wherever they are enveloped by the web **1** they extend transversely to the direction of movement of the web. The ideal longitudinal axis of a semi-cylindrical web-supporting surface **7** defined by the supporting elements is indicated at **8**. The rotatable covering **4** for each shaft **3** may comprise a flexible tube **9** supported on the shaft by individual supporting rollers **10** as shown in FIG. **3**. Alternatively, each rotatable covering may be formed by a plurality of closely juxtaposed narrow rolls **18** (see FIG. **5**) which are convexly shaped so as to conform to the supporting surface **7**. When processing extremely thin films, the spacing between the individual shafts **3** can be selected to be quite narrow but for films of heavier gauge a larger spacing is possible.

The turning device may be designed for deflecting the web through angles other than 90°. Also, two turning devices may be arranged at an acute angle to one another so as to fold the web to double thickness. Of course in this case the angle of approach of the web **1** to the first turning device will be other than the 45° indicated in FIG. **1** and the sector angle by which each device is enveloped by the web **1** will be other than 180°; the arrangement of the supporting elements **3**, **4** will then have to be appropriately modified.

In the embodiment of FIGS. **4** and **5**, a turning device **2'** comprises a cylinder **11** provided with trunnions **12** which are rotatable in bearings **13** secured to mountings **14**. Arranged on alternately opposite sides of the cylinder **11** there are substantially semi-circular supporting elements each comprising a shaft **3'** having a readily rotatable covering **4'**. The shafts extend circumferentially of the cylinder **11** and are mounted thereon by means of holders **15**. The spacing between adjacent supporting elements on the same side of the cylinder **11** should be somewhat greater than the

diameter of the rotatable coverings 4' so that, if the supporting elements overlap circumferentially of the cylinder as shown at 16 in FIG. 4, the overlapping portions will not interfere with rotation of the coverings 4'. The amount of circumferential overlap need be no more than a few centimeters. The arrangement as a whole will result in a very good cylindrical supporting surface being defined without any interruptions that would be potentially dangerous for the web 1' that is slung thereabout. The FIGS. 4 and 5 embodiment permits a particularly free-running deflection of the web 1' through any desired angle A which is 60° in the illustrated case. There will be no appreciable braking during deflection of the web, even if the latter is of flimsy flexible plastics material.

The embodiments of the invention are possible in which the individual supporting elements are other than substantially semi-circular. For example, the shafts and rotatable coverings may describe complete circles, except that the coverings would have to be interrupted at positions where the shafts are secured to the cylinder by means such as the holders 15 in FIG. 5. Supporting elements extending along only one third or one quarter of the cylinder circumference are also conceivable. Further, it is possible for the shaft 3' to extend as an endless helix so that the spacings between the individual helical convolutions are approximately equal to the diameter of the rotatable covering 4', individual holders 15 being necessary for each convolution. In this case, however, the assembly and alignment of the shaft and of the rotatable covering is more difficult and the pitch of the helix could possibly exert a certain steering effect on the web.

As shown in FIG. 5, each supporting element may comprise a shaft of wire 17 and a rotatable covering in the form of separately rotatable convex rolls 18 mounted on the wire, the rolls preferably being of barrel shape. However, the FIG. 4 embodiment may make use of a rotatable covering in the form of a flexible tube supported on individual supporting rolls as hereinbefore described with reference to FIG. 3.

By reason of the rotatability of the covering 4' about its own axis, i.e. about the axis of the associated shaft 3' and the simultaneous rotation of the shafts and coverings about the rotary axis of the cylinder 11, the supporting surface defined by the rolls or tube as the case may be can follow the movement of the web thereabout in any desired direction.

I claim:

1. A turning device for deflecting moving flexible webs, comprising a curved surface having web-supporting portions about which the web can be passed, said curved surface comprising a plurality of individual supporting elements, each of said supporting elements comprising a shaft having a curved axis and a covering arranged to rotate round said axis, said web-supporting portions being movable at the same speed as and in the same direction as the web.

2. A device according to claim 1, wherein the shafts are helically curved and mounted so as to extend transversely to the direction of web movement where the web passes thereabout.

3. A device according to claim 1, further including a rotatable cylinder and wherein the shafts are substantially arcuately curved and mounted on said rotatable cylinder to extend circumferentially thereto.

4. A device according to claim 3, wherein the shafts are curved to substantially semi-circular shape and alternately arranged on opposite sides of the cylinder.

5. A device according to claim 1, further including individual rollers and wherein each rotatable covering comprises a flexible tube supported on the associated shaft by individual ones of said rollers.

6. A device according to claim 1, wherein the rotatable covering comprises individual rollers.

7. A device according to claim 6, wherein the rollers are barrel-shaped.

8. A turning device for deflecting moving flexible webs, comprising a curved surface about which the web can be passed and which is defined by a plurality of individual supporting elements formed from curved shafts having a rotatable covering of which the web-supporting portions are movable at the same speed as and in the same direction as the web, said shafts being substantially arcuately curved and mounted on said rotatable cylinder to extend circumferentially thereto.

9. A device according to claim 8, wherein the shafts are curved to substantially semi-circular shape and alternately arranged on opposite sides of the cylinder.

10. A device according to claim 8, further including individual rollers and wherein each rotatable covering comprises a flexible tube supported on the associated shaft by individual ones of said rollers.

11. A device according to claim 8, wherein the rotatable covering comprises individual rollers.

12. A device according to claim 11, wherein the rollers are barrel-shaped.

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