United States Patent

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[33] **Germany**
[31] **P 16 11 768.3 and P 17 86 341.1**

[54] **APPARATUS FOR UNIFORMLY PULLING FORWARD INDIVIDUAL LAYERS OF A MULTILAYER WEB OF PAPER, CARDBOARD OR THE LIKE MATERIALS**
7 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **226/191**
[51] **Int. Cl.** **B65h 17/20**
[50] **Field of Search** 226/191, 190, 194, 192, 193; 29/113, 129, 125, 130

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Attorney—Burgess, Dinklage & Sprung

ABSTRACT: Apparatus for uniformly pulling forward or feeding individual layers of a multilayer web of paper, cardboard and the like materials which includes cooperative roller means that engage opposite surfaces of the web and which roller means are provided with elastic jackets and means establishing an air cushion beneath the jackets so that during pulling forward or feeding relative displacement in the feeding direction of the individual layers of the multilayer web is prevented by reason of the improved contact relationship in the feeding zone between the jackets and the opposite surfaces of the multilayer web.

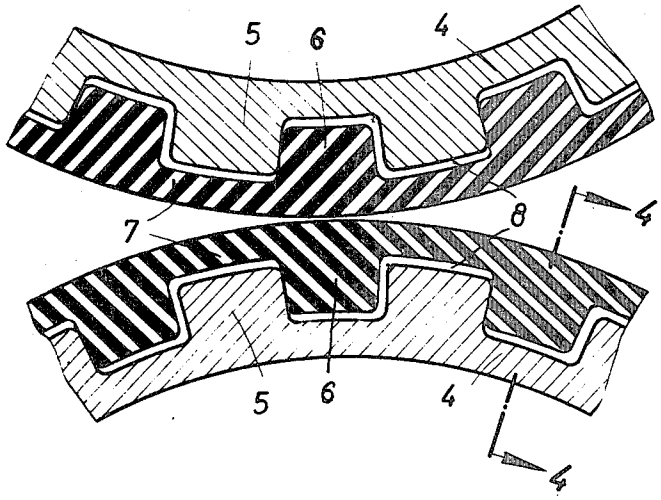


Fig. 1

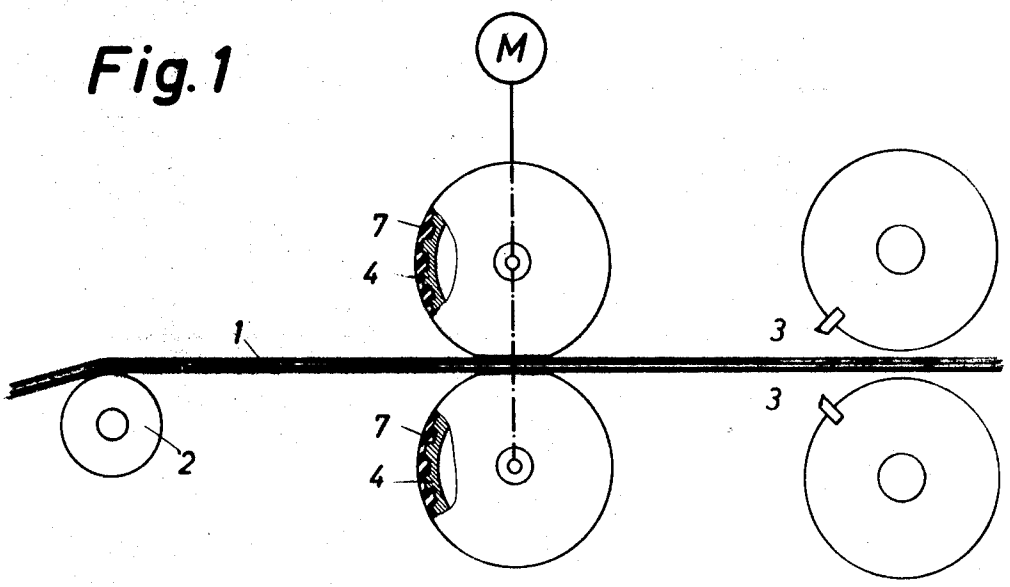


Fig. 2

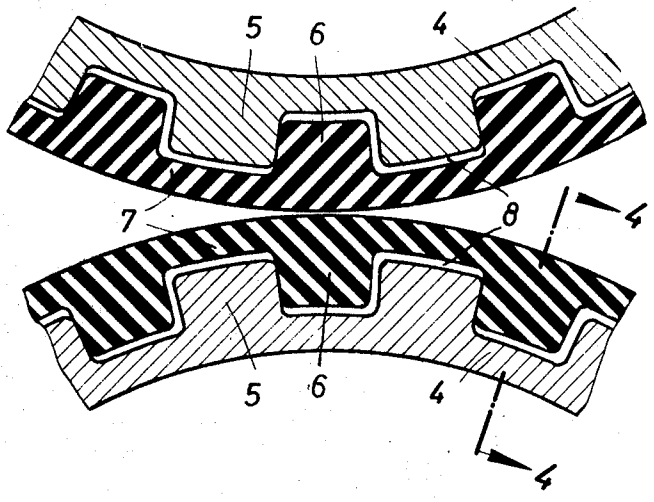
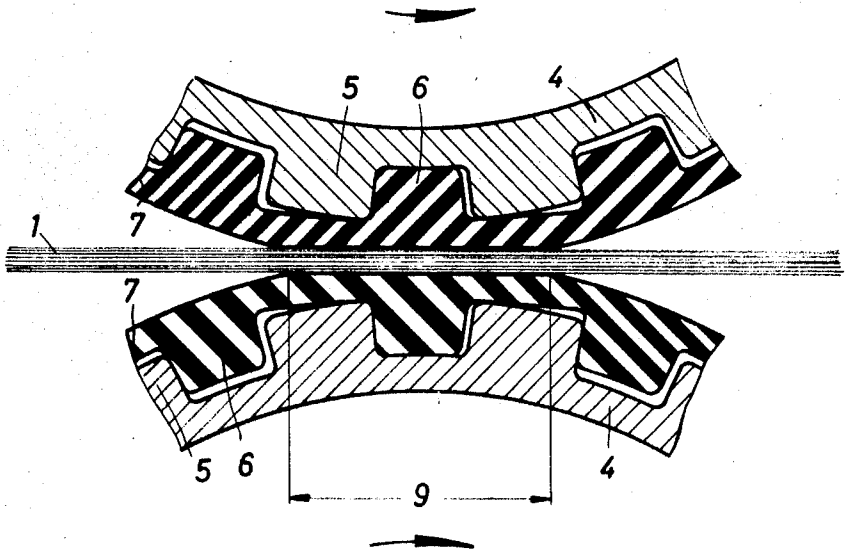


Fig. 3



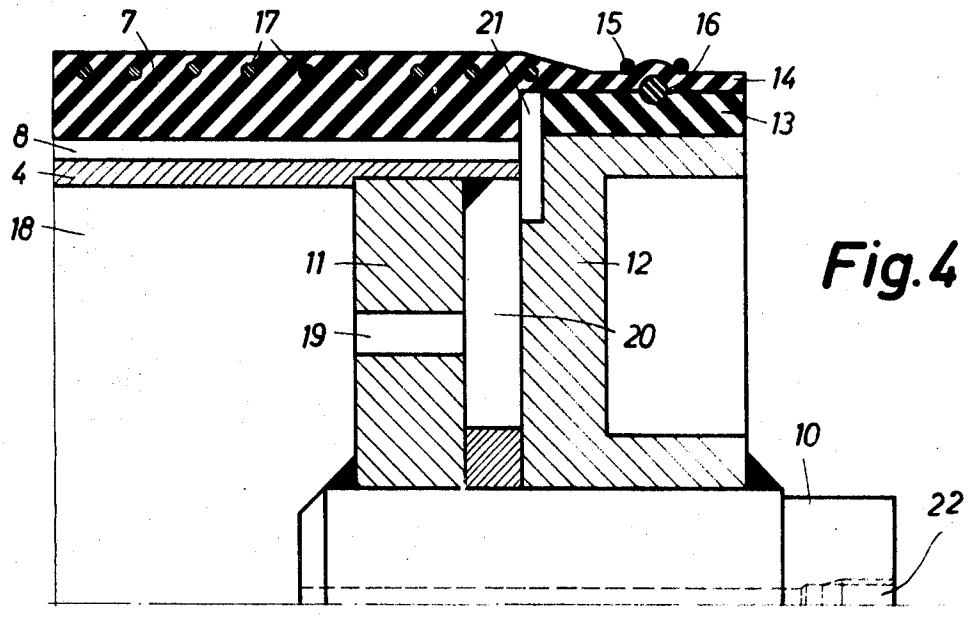
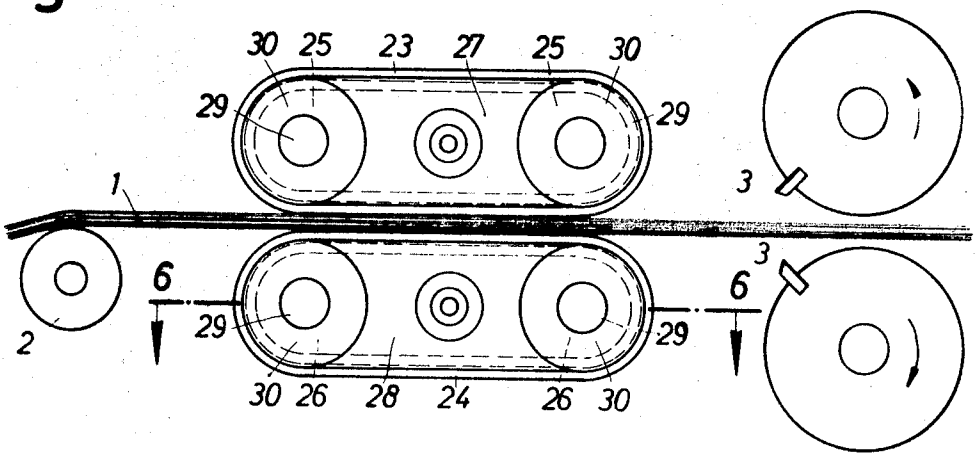


Fig. 4

Fig. 5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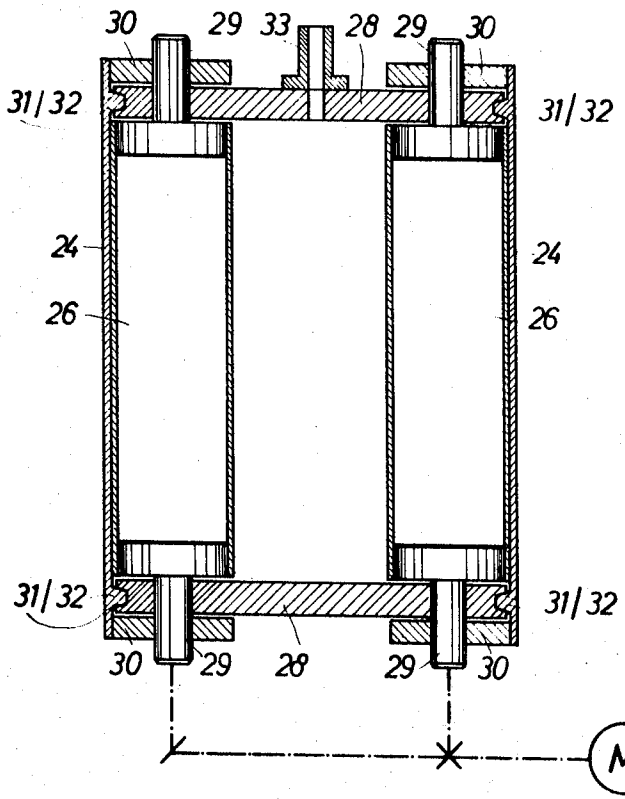
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Fig. 6

Fig. 7

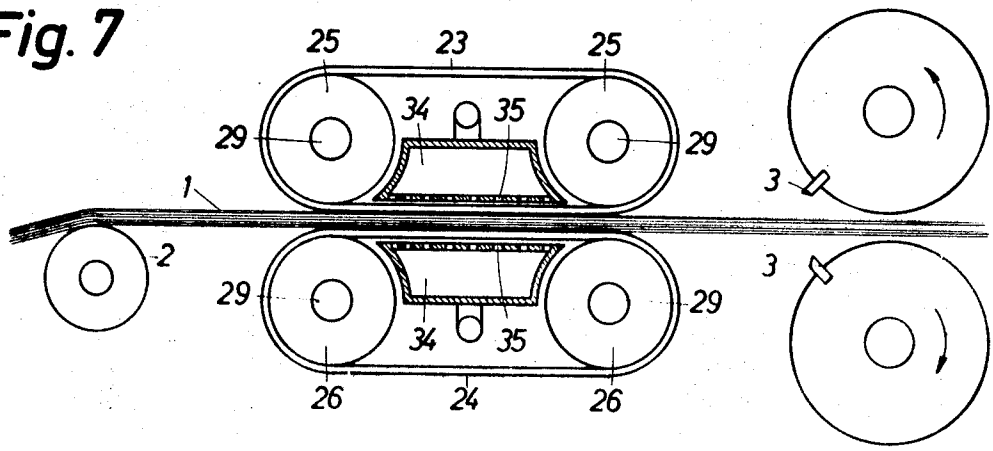


Fig. 8

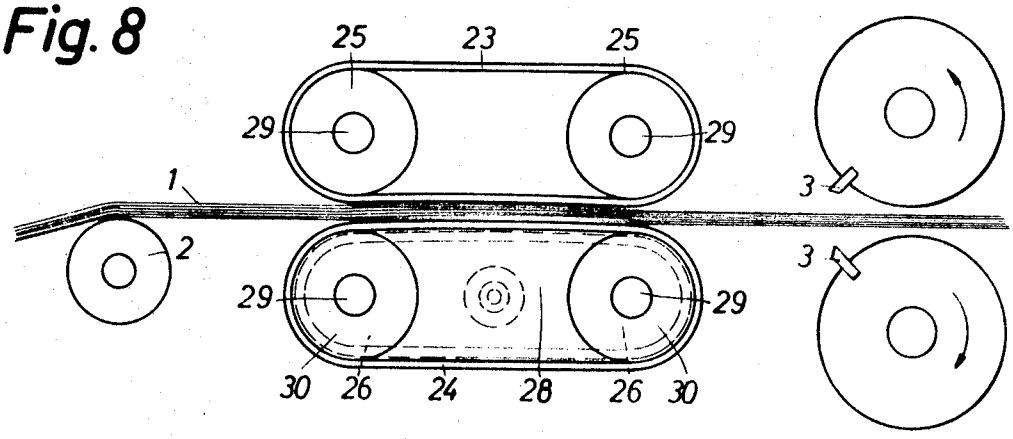
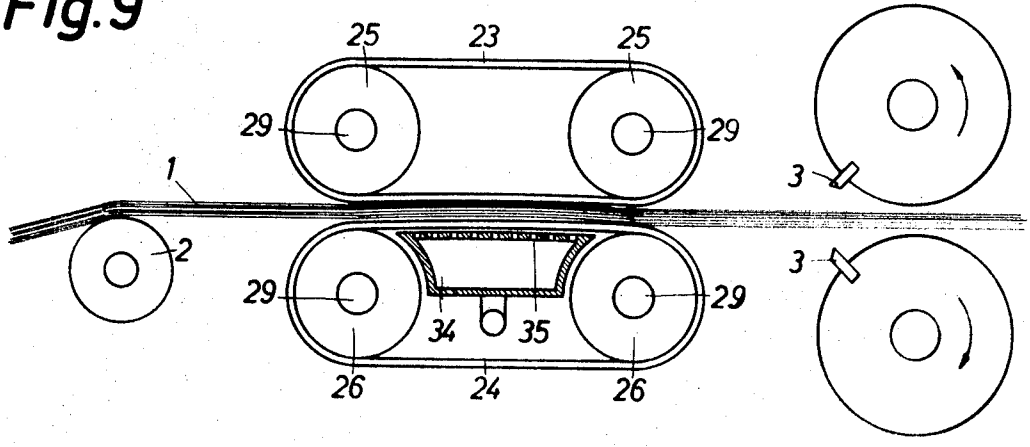


Fig. 9



APPARATUS FOR UNIFORMLY PULLING FORWARD INDIVIDUAL LAYERS OF A MULTILAYER WEB OF PAPER, CARDBOARD OR THE LIKE MATERIALS

This invention relates to an apparatus for uniformly pulling forward or feeding the individual layers of a multilayer web of paper, cardboard, and the like materials which emanate from several feeder rolls and are conveyed to a transverse cutter or some other processing machine with the aid of at least one pair of forward-pulling roller means which take up between them said multilayer web.

In conveying a plurality of webs with the aid of a forward-pulling roller partially enveloped by said webs it has been shown that the outer layers are pulled forward faster than the inner layers by virtue of their greater distance from the center of the roller. The same situation exists in pulling forward a paper web comprising several layers with the aid of a pair of forward-pulling rollers without effecting a change in direction. In this case the middle web layers are pulled forward faster than the outer web layers. In each case there takes place a reciprocal longitudinal displacement of the individual webs which causes size differences in the sheet package if the multilayer web is conducted through a transverse cutter installation following the forward-pulling installation.

To remove this drawback it has already been proposed to associate a guide and deflector roller with each individual web and to feed the combined webs to the transverse cutter installation through a pair of conveyor belts. Aside from the fact that this type of installation is expensive and space consuming, it cannot assure uniform forward travel of the individual webs since the conveyor belts provided for after said guide and deflector rollers cannot bring about uniform application of pressure and conveying action due to inevitable differences in thickness and friction wear.

In order to obtain uniform forward-pulling travel or feed of multilayer webs with the aid of forward-pulling rollers it would be theoretically conceivable to utilize rollers of infinite diameter. In that case, the distance from the central point of the rollers of all layers of the paper web to be conveyed would be equally great and the circumference of the rollers would run parallel with the web layers in its section of contact, thus assuring uniform forwardly pulled travel. This ideal situation is approximated by utilization of a roller made of elastic material or a roller having an elastic covering whereby a restricted flattening develops in the area of contact with the counter roller. However, tests directed to this type have shown that as a result of the squeeze action of the elastic material no exactly defined and straight-lined flattening effect can be obtained and uniform forwardly pulled travel or feed of the paper layers is prevented as a result thereof.

Therefore, the present invention has for an object to provide a conveyor installation distinguished by simple construction and displacement-free mode of operation due to its straight line contact area. In accomplishing this object, the invention proposes to construct the roller means of the forward-pulling pair of roller means that take up or feed the multilayer web, in such fashion that they are equipped with a covering or jacket which encloses an air cushion and that the coverings come into straight line contact with the multilayer web in their operative conveying or feeding zone.

In order to secure the relative position between the forward-pulling roller means and the covering, and also to provide for establishing a straight line area of contact between the forward-pulling roller means, the forward-pulling roller means and the covering or jackets therefor are connected in such manner that they are not displaceable toward each other in tangential direction, but are displaceable toward each other in tangential direction, but are displaceable toward each other in a radial direction. In order to secure their position in this manner, the construction is such that the facing air cushion enclosing surfaces of the forward-pulling roller means and of the associated covering or jacket are provided with intermeshing profile means. A preferred embodiment is presented when said profile means are constructed as gear teeth extending axially over the entire forward-pulling roller means. In addition to the simple manner of constructing this type of longitudinal gear, there are substantial advantages in assembling the individual parts of the forward-pulling roller means insofar as the axially provided gear makes it easy to slip the covering or jacket over the roller means.

A further advantageous feature is to be seen in the fact that the air cushion located between the forward-pulling roller and the covering is connected with a hollow interior space provided in the forward-pulling roller means. By connecting the small volume air cushion with the large volume interior spaced chamber of the roller body, said interior chamber acts as pressure storage means to equalize pressure variations and pressure losses.

Proceeding from a forward-pulling pair of conveyor belts guided by rollers, the invention proposes further to provide pairs of forward-pulling rollers which are pairwise enclosed by a cover or jacket for each pair, whereby the space enclosed on the one hand by the cover or jacket and its forward-pulling rollers and on the other hand by lateral sealing plates is formed as a hollow space which is connected to a compressed air source.

The installation can also provide for air tables on the inside of the sections of the covers or jackets conveying the plurality of webs. These air tables are equipped with a plurality of air outlets which function as support means and whereby the interior space of the air table constructed as a hollow body is connected with a source of compressed air such as an air compressor.

It is a further object to provide an installation constructed such that only one of the two sections of the coverings or jackets conveying the multilayer web is acted upon by compressed air. This results in slight arching of the section of the covering acted upon by compressed air, whereby the contact pressure of the corresponding section of the other roller results from the latter's restoring force caused by its elasticity. In employing only a one-sided compressed air action by utilizing one air table, the latter is constructed such that its operative surface is slightly arched.

Further and more specific objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings in which:

FIG. **1** is a diagrammatic side view of a conveyor installation employing one pair of forward-pulling roller means;

FIG. **2** is a fragmentary sectional view on an enlarged scale through the operative conveying zone of the forward-pulling roller means;

FIG. **3** is a view similar to FIG. **2** and illustrating the roller means during passage of a multilayer paper web;

FIG. **4** is a fragmentary longitudinal sectional view through a facing side of a forward-pulling roller means;

FIG. **5** is a diagrammatic side view of a conveyor installation employing two pairs of forward-pulling roller means;

FIG. **6** is a cross-sectional view taken along line **6—6** of FIG. **5**;

FIG. **7** is a view similar to FIG. **5** and illustrating an embodiment utilizing air tables;

FIG. **8** is a similar view illustrating a modification of the conveyor installation depicted in FIG. **5**; and

FIG. **9** is a similar view illustrating a modification of the embodiment depicted in FIG. **7**.

As can be seen particularly well in FIGS. **1** and **5**, the individual paper webs **1**, emanating from several feeder rolls not shown, are combined in the area of backing roller **2** which is mounted freely rotatable. Conveyor means described further below convey the multilayer paper web **1** to the transverse cutter installation which is equipped with revolving knives **3** and which divides the multilayer paper web into individual sheet packages.

The cross section depicted in FIG. **2** through the operative conveying section of a pair of conveyor roller means shows

that forward-pulling roller 4 which is constructed as a hollow body is provided with exterior gear teeth 5 extending axially of the roller 4. The covering or jacket 7 made of elastic material, such as rubber, plastic or the like, has internal axially extending teeth 6 that mesh with said external gear teeth 5. The diameters of roller 4 and covering or jacket 7 are selected such that an air cushion 8 is formed between gear teeth 5 of roller 4 and internal gear teeth 6 of covering or jacket 7.

FIG. 3 depicts the displacement of air cushion 8 after insertion of the multilayer paper web 1, by forming a straight-lined flattened zone 9 which determines the operative conveying zone of the pair of forward-pulling roller means. The extent of displacement of air cushion 8 is thereby such that, proceeding from the middle of flattened zone 9 and decreasing evenly toward both ends, the straight line of flattened zone 9 and uniform pressure distribution are assured in this section. The practically infinite diameter of the forward-pulling rollers in this operative conveying section is thereby determined and delimited by the contact of the tooth heads and shoulder of the internal and external gear teeth 5 and 6, said contact being caused by the displacement of air cushion 8 leaving no intervening space. Further this is enhanced by making the circumferential extent of the valleys between teeth 6 greater than the width of teeth 5.

FIG. 4 depicts the constructive features of the forward-pulling roller means in the area of their facing sides. Head ring 11 is secured to axle journal 10. Head ring 11 is rigidly connected with roller 4. Axle journal 10 also bears a terminal disc 12 which on its circumference is equipped with a flange carrying a sleeve 13 of rubber or the like. An extension 14 of covering or jacket 7 is secured with bracing wires 15 on the circumferential surface of the sleeve 13 on terminal disc 12. An O-ring 16 embedded between bracing wires 15 assures sufficient sealing. As FIG. 4 shows further, reinforcement threads 17 made of nylon are embedded in jacket 7 and extend circumferentially thereof. Air cushion 8 enclosed between roller 4 and covering sleeve or jacket 7 is connected with the internal space 18 of roller 4 through bore 19, intervening space 20 and annular chamber 21. Air is fed through bore 22 located in axle journal 10, said bore 22 being provided with a relief valve not shown. Instead of utilizing compressed air for producing the air cushion, it is also feasible to utilize another gaseous medium or also a suitable liquid. It is understood that the other end of each roller is provided with a head ring, axle journal and terminal disc.

In the embodiment depicted in FIGS 5 and 6, the conveyor installation comprises upper and lower endless coverings 23 and 24 and pairs of roller means 25 and 26 enveloped by said coverings. The spacing distance between rollers 25 and 26 has been so chosen that the distance between coverings 23 and 24 corresponds to the thickness of the multilayer paper web 1 to be conveyed. The space enclosed by coverings 23 and 24 is closed off by lateral or end sealing plates 27 and 28 in the plane of the frontal sides of rollers 25 and 26, said sealing plates at the same time serving as bearings for the axle journals 29 of rollers 25 and 26. Support discs 30 are secured to the ends of axle journals 29, said support discs bearing on their circumferential sides the outside portions of coverings 23 and 24. In order to provide effective sealing of the pressure chamber, coverings 23 and 24 are equipped with a bridgelike profile sections or ribs 31 engaging within grooves 32 of sealing plates 27 and 28. Compressed air is fed through connecting extension 33 which is connected to an air compressor not shown.

In the embodiment depicted in FIG. 7, the compressed air acting internally upon the operative sections of coverings or jackets 23 and 24 does so by means of known air tables 34 which are constructed as having the shape of flat hollow bodies and whose sides facing coverings 23 and 24 are equipped with air outlets 35. The application of pressure to operative sections of the coatings here also takes place by the compressed air cushion forming between the air table and the covering.

FIG. 8 shows a simplified version of the embodiment shown in FIGS. 5 and 6 insofar as only one of the two coverings 23 and 24 is acted upon by compressed air. The result of this measure is a slight arching of the operative sections of the coverings whereby the pressure needed for conveying the multilayer web 1 is produced by the restoring force of the section of the covering not acted upon by compressed air.

Tests have shown that the slight curvature of the operative section of the covering caused by a very great radius does not have any displacement-causing effect upon the individual paper webs. In similar manner, the embodiment depicted in FIG. 7 can likewise be simplified. As FIG. 9 shows, only one air table 34 is utilized in this case whose upper surface is slightly arched, whereby here also the pressure needed for conveying is produced by the restoring force of the section of the opposite covering.

What is claimed is:

1. Apparatus for uniformly pulling forward the individual layers of a multilayer web of paper, cardboard or the like material emanating from feeder rolls for conveyance to a cutter or other processing machine comprising at least one pair of forward-pulling roller means cooperatively arranged on opposite sides of the path of movement of and engaging said multilayer web, each said forward-pulling roller means having an elastically deformable jacket therearound, means cooperatively arranged between said roller means and jackets to provide an air cushion internally of said jackets so that in operation said jackets make straight line contact with the opposite sides of said multilayer web, and interengaging profile means connecting the jackets to the roller means, said profile means comprising interengaging external and internal gear teeth extending respectively longitudinally of said roller means and jackets throughout the operative feeding length thereof with the valleys between the teeth of one of said roller means and jackets having greater circumferential extent than the teeth accommodated in said valleys.

2. Apparatus as claimed in claim 1 in which each said roller means includes a hollow interior chamber, each jacket being sealed relative to each roller mans and the means cooperatively arranged between each roller means and jacket includes conduit means providing communication between said hollow interior chamber and the air cushion between said roller means and jackets.

3. Apparatus as claimed in claim 1 and two pairs of longitudinally spaced roller means, a jacket enclosing each pair of roller means, end plates externally of each pair of roller means, each jacket being sealed relative to the associated pair of end plates so as to define an internal chamber and means for supplying compressed air within at least one of said chambers.

4. Apparatus as claimed in claim 3 in which said last mentioned means comprises an air table within one of said chambers having an apertured side facing the associated jacket.

5. Apparatus as claimed in claim 4 in which the apertured side of said air table is slightly arched.

6. Apparatus as claimed in claim 3 in which said last mentioned means supplies compressed air within both chambers.

7. Apparatus as claimed in claim 6 in which the means supplying compressed air within both chambers comprises an air table within each chamber having an apertured side facing the associated jacket.