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Kuckhermann

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[54] **TEAR-OFF APPARATUS FOR SUCCESSIVELY TEARING OFF A LENGTH FROM THE LEADING END OF A MOVING FLATTENED TUBULAR WEB OF MATERIAL**

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[58] **Field of Search**.....225/100, 4, 5

[56] **References Cited**

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[57] **ABSTRACT**

A tear-off apparatus for lengths of flattened tube from a transversely scored or perforated single or multi-ply paper or plastic moving tubular web including a pair of holding rolls adapted to turn at no more than the web feeding speed, a pair of tear-off rolls downstream of the holding rolls and adapted to turn faster than the web feeding speed and at least two rows of deflector rollers for the web extending transversely of the web downstream from the holding rolls and upstream of the tear-off rolls, said rollers being adapted to make substantially point contact with the web.

5 Claims, 2 Drawing Figures

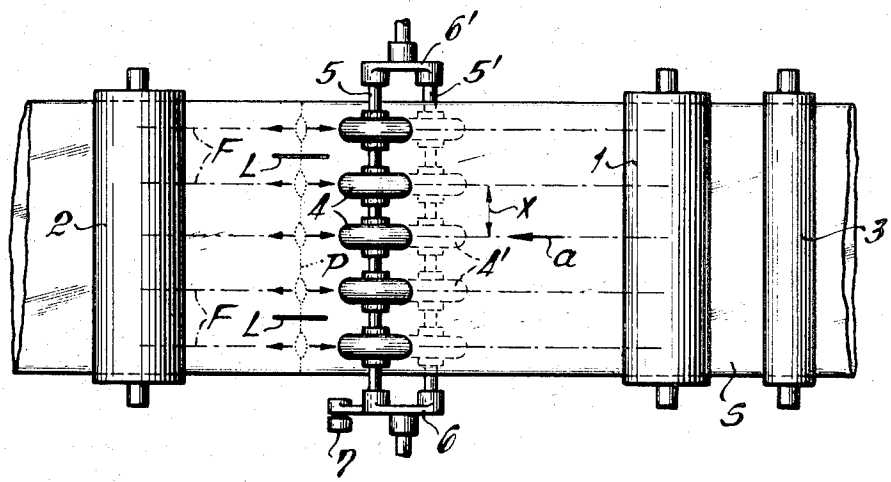


FIG. 1

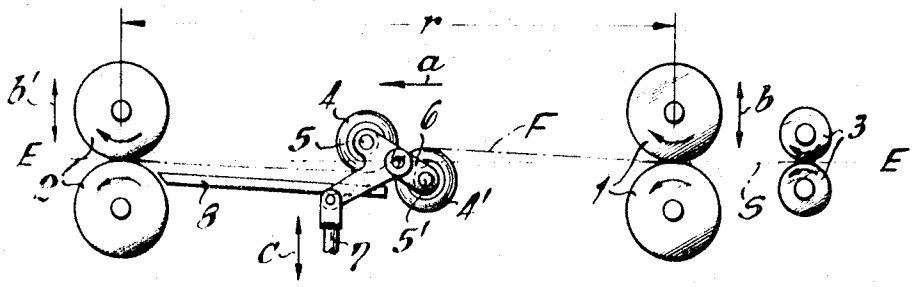
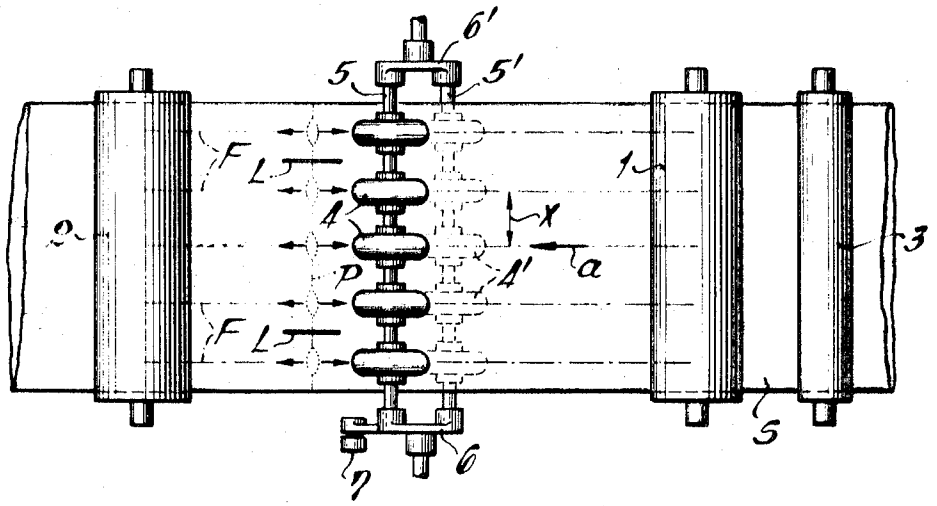


FIG. 2



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TEAR-OFF APPARATUS FOR SUCCESSIVELY TEARING OFF A LENGTH FROM THE LEADING END OF A MOVING FLATTENED TUBULAR WEB OF MATERIAL

The invention relates to tear-off apparatus for successively tearing off a length from the leading end of a moving flattened tubular web of material.

When making paper bags on a machine, it is usual first of all to form the paper into single or multi-ply tubular webs (which may be slit along one longitudinal edge) and then to sever therefrom lengths of a size sufficient to form each bag. For making multi-ply paper bags, it is of advantage if the individual plies are offset from one another both longitudinally and transversely so that each ply can be furnished with a separate longitudinal seam and, in the vicinity of where base folds are to be provided for the bag, with adhesive that is independent from the adhesive applied to the other ply or plies. However, offsetting or staggering of the individual plies in the longitudinal direction makes it impossible to sever each tube length by means of a single cut. The practice is therefore to provide the material for the individual plies with transverse scorelines or perforations at the required intervals and then to fom them into a tubular web with the scorelines or perforation offset from one another, whereupon the lengths of tube with offset plies are successively torn from the web along the offset scorelines or perforations by means of a tear-off apparatus.

Such a tear-off apparatus comprises a pair of holding rolls for the web and a pair of tear-off rolls downstream of the holding rolls as veiwed in the direction of web movement, the web passing between both pairs of rolls. The tear-off rolls turn at a higher peripheral speed than the holding rolls. One of the tear-off rolls can be lifted off the web in sequence with the operating cycle of the tube-making machine and moved back again so that it is momentarily applied to the web as soon as the offset transverse scorelines or perforations are located in a tear-off path which is the distance between the holding rolls and the tear-off rolls. The higher peripheral speed of the tear-off rolls relatively to the holding rolls causes that part of the web located along the tear-off path to be set under a sufficiently high tension to tear the leading length of web that is engaged by the tear-off rolls along the offset transverse scorelines or perforations. The tub on the web during tearing is all the greater if the speed of the web is high and the tensile force that has to be applied increases with an increase in the number of plies of the web and/or increased strength of the web material. It is extremely difficult to ensure that a uniform tensile force will be applied along the scorelines or perforations but on the other hand a uniform tensile force is desirable to facilitate trouble-free sudden tearing across the entire width of the web. When using sensitive paper such as waterproof and bitumen paper, the sudden tug of the tear-off rolls can easily give rise to rents transversely to the scoreline or perforations with the result that large ragged pieces are unintentionally torn from the web and there will be considerable wastage. Tubes which are particularly subjected to this danger are those having offset plies with short preformed longitudinal incisions which are provided to facilitate the formation of corner folds and side folds in the base of the bag to be subsequently made from the severed tube length. These incisions

unintentionally increase in length or spread uncontrollably across the web under the tug exerted to the web by the tear-off rolls, the damaged tube lengths being unusable and therefore wasted.

In our German specification No. 877,403 we have suggested that the performations adjacent the longitudinal edges of the flattened tubular web be weakened so as to avoid premature tearing off by providing rotary tensile elements upstream of the main tear-off equipment and turning at a higher peripheral speed than the latter so as to tear into the web at the longitudinal edges before the web is engaged by the main tear-off rolls. The rotary tensile elements for tearing into the longitudinal edges of the web may be segments co-operating with a backing roll or they may be in the form of rotary tearing thumbs. However, practical experience with such auxiliary tearing apparatus has shown that there is still every danger of the web tearing transversely to the perforations and the web is often damaged at the edges by reason of local stress concentrations. The cause for this is the sudden tension exerted exclusively at the longitudinal edges of the web by the auxiliary tearing apparatus and this tension, in order to fulfil its purpose, must be much higher than the tension exerted by the main tearing apparatus. Since the tension applied at the edges of the web is of course not transmitted exclusively in the longitudinal direction of the web, an uncontrollable oblique tensile force is exerted on the central portion of the perforations which are only later torn by the main tearing apparatus and this oblique tensile force gives rise to the aforementioned ragged tears and other difficulties.

Even if there is no danger of incorrect tearing of the perforations or scorelines, the high pressure that needs to be exerted by the tear-off rolls to subject the web to the necessary tension and tear the web along the entire scoreline or perforations may prove disadvantageous. For example, in the case of webs having a large number of offset plies the pressure of the tear-off and holding rolls must of course be very high so that the innermost plies are also engaged and torn apart. Even so, some slipping of the web during tearing is inevitable. If the pressure between the rolls is high then slide marks are formed on the web which not only detract from its appearance but could also influence the strength of the bags to be made from the web. If the outer ply of the web is provided with a coating such as a sealing layer, the roll pressure may damage the coating and detrimentally affect the desired sealing effect. With stretchable paper, the roll pressure may distort the web and make subsequent operations more difficult. With paper having a rough surface, for example crepe paper, the surface structure is rolled flat wherever the web is engaged by the holding and tear-off rolls and this affects the appearance of the finished bags. Particularly grave difficulties are encountered with multi-ply webs in which one of the outer plies is provided with an internal smooth lining such as of bitumen. The smoothness of this internal lining causes the respective ply to slip along the subjacent ply and therefore all the plies will not be cleanly torn off unless the pressure of the rolls is extraordinarily high which, in turn, aggrevates the aforementioned other problems occasioned by high roll pressures.

The invention aims to provide a tear-off apparatus which will function efficiently on single or multi-ply webs without an undesirably high roll pressure, thereby reducing the power required to drive the rolls and the danger of damage to the web even if the latter is of sensitive materials.

According to the invention, there is provided a tear-off apparatus for lengths of flattened tube from a transversely scored or perforated single or multi-ply paper or plastics moving tubular web, comprising a pair of holding rolls for the web turning at no more than the web feeding speed, a pair of tear-off rolls downstream of the holding rolls and turning faster than same for momentarily engaging the leading web end between each other, and a plurality of deflectors for the web disposed at a spacing from one another in a row transversely of the web downstream of the holding rolls and upstream of the tear-off rolls, the deflectors projecting through a plane that passes through the nips of the holding and tear-off rolls and being adapted to make substantially point contact with the web.

In contrast with the apparatus disclosed in our aforementioned German specification, the apparatus of the present invention does not effect tearing in two distinct stages. Instead, the tension applied by the tear-off rolls becomes effective at several points distributed across the width of the web sooner than at other portions of the web. Whilst the web is not engaged by the tear-off rolls, it moves along a deflected path which is predetermined by the deflectors and which differs slightly from the shortest path between the nips of the pairs of rolls. As soon as the tear-off rolls have engaged the leading end of the web and accelerated same, the web is firstly pulled taut at the points where the web is engaged by the deflectors and subjected to the tensile force that is necessary for tearing off the leading end of the web. Since this tensile force is initially applied at a few selected points distributed across the width of the web, a much lower force is required than if the web were to be torn with a tug simultaneously along all parts of the transverse scoreline or perforations. After tears have started to form at the locations of the deflectors, these will rapidly extend to both sides along the scoreline or perforations because the tear-off rolls will continue to turn at a higher speed than the holding rolls. Thus, although the web is completely torn whilst still in the vicinity of the deflectors, the tearing-off operation takes slightly longer than hitherto and of course is introduced at predetermined points. This avoids the danger of undesired rents or other damage to the web and, since the required tensile forces are lower, they will be transmitted to the innermost ply of multiply webs even if one of the outer plies has a smooth internal coating.

The deflectors may comprise rollers having a convex periphery so that frictional forces are kept to a minimum or virtually completely avoided if, as is preferred, the deflecting rolls are turned at the same speed as the conveying speed of the web.

In one form of the invention, two or more closely juxtaposed rows of deflectors are provided transversely of the web, the deflectors of one row projecting through the aforesaid plane in a direction opposite to that in which the deflectors of the adjacent row project. This brings about a comparatively large local increase in the path travelled by the web without having to deflect the web to a large extent. The tear-off rolls are in this case set so that for each operating cycle of the machine they engage the web when the transverse scoreline or line of perforations has reached the last row of deflectors. The deflectors may be movable to and from the web in sequence with the operating cycle of the tear-off rolls so that they deflect the web only during the tearing-off operation but remains out of contact with the web at other times. If the apparatus is provided with two or a multiple of two rows of delfectors in the form of rollers, the rollers of each row may be mounted on a common shaft extending across and beyond the entire width of the web and the ends of the shafts of the two rows or every two adjacent rows may be carried by the arms of two-armed pivotable levers disposed adjacent the longitudinal edges of the web, the pivotal axes of the levers lying in the plane of the web and the levers being pivotable to and fro in sequence with the operating cycle of the machine.

The spacing of the deflectors of the or each row may be adjustable. This is particularly desirable in cases where the web is preformed with short longitudinal incisions. The deflectors are then set so that they are as far removed as possible from such preformed incisions.

An example of the invention will now be described with reference to the accompanying drawings wherein:

FIG. 1 is a diagrammatic side elevation of a tear-off apparatus provided with two rows of deflecting rolls, and

FIG. 2 is a diagrammatic plan view of the FIG. 1 apparatus.

The illustrated tear-off apparatus comprises a pair of holding rolls 1 and a pair of tear-off rolls 2 downstream of the rolls 1 as viewed in the direction *a* of movement of a flattened tubular web S. The spacing *r* between the pairs of rolls constitutes a tear-off path at which leading lengths of the web are successively torn off along preformed transverse perforations P. The spacing *r* should therefore be less than the intervals, lengthwise of the web S, of the lines of perforations P so that only one line of transverse perforations will be located along the tear-off path at any one time. For the sake of clarity, only a single line of transverse perforations P is shown in FIG. 2 of the drawings. If the web S is made of a plurality of plies which are offset from one another, there would of course be a corresponding number of offset lines of perforations in the vicinity of the single illustrated line.

The individual rolls 1 and 2 are alternately pressed against one another and lifted off the web in the sequence of the operating cycle of the tube-making machine or rather of the operating cycle of a perforating apparatus (not shown) for the web. The control mechanism for the individual rolls does not form part of the present invention and the reciprocatability of the rolls is therefore only diagrammatically indicated by the arrows *b*, *b'*. The peripheral speed of the holding rolls 1 is approximately one-half percent less than the feeding speed imparted to the web S by a pair of feed rolls 3. The peripheral speed of the tear-off rolls 2 is approximately 12 percent higher than the feeding speed of the web.

The web S is continuously fed by the rolls 3 whilst the pairs of holding rolls 1 and tear-off rolls 2 are

separated. As soon as a line of transverse perforations has arrived between these pairs of rolls along the tear-off path 3, the rolls 1 and 2 are pressed against one another to engage the web and impart thereto the speed at which they are turning. This causes the web to be increasingly tensioned by the more rapidly turning tear-off rolls until the leading end of the web is torn along the perforations, this taking place within a very short time after the upper tear-off roll has been applied to the lower tear-off roll. Downstream of the tearoff rolls, the severed length of tube is moved away at an accelerated speed by a conveyor (not shown).

To avoid the aforementioned disadvantages that have hitherto been encountered when tearing off the leading end of web, a row of spaced deflectors 4 is provided in the tear-off path *r* transversely to the length of the web in a manner resembling the teeth of a comb. In the illustrated example, each deflector 4 is in the form of a roller which is convexly curved at its periphery and a second row of such roller deflectors is provided as indicated at 4'. The rollers 4, 4' are seated on respective shafts 5, 5' and are offset from one another lengthwise of the web S as well as in a vertical direction. The ends of the shafts 5, 5' are mounted in two-armed levers 6, 6' so that the row of rollers 4 projects from above through a plane E-E that joins the nips of the pairs of rolls 1, 2 whilst the rollers 4' project through this plane from below. The levers 6, 6' at each side of the web are pivotable about a common axis by means of a rod 7 which can be reciprocated in the direction of the arrows *c* so that the degree by which the web is deflected out of the plane E—E to assume the path F may be adjusted. If a crank drive (not shown) is provided for the rod 7, the deflecting rollers 4, 4' may be moved towards and away from the web in the sequence of the operating cycle of the tear-off rolls 2, in which case the rollers 4, 4' will cause the web to be deflected only whilst the respective rolls 1 and 2 are engaged with the web and they will remain out of contact with the web when only a pair of feed rolls 3 is effective to feed the web. The spacing *x* of the deflecting rollers along the shafts 5, 5' is adjustable. The convexly curved contour at the periphery ensures that the deflecting rollers will make substantially point contact with the web.

When the web is tensioned along the path *r* between the holding rolls 1 and tear-off rolls 2, the web is firstly pressed under the action of this tension with increasing pressure against the deflecting rollers 4, 4' In this way the longitudinal fibres F of the web which pass over the deflecting rollers are tensioned to a greater extent than the fibres located between the adjacent deflecting rollers. As soon as the tension of the fibres F exceeds the tensile strnegth of the perforations P, the latter begin to tear at those places where they lie against the deflecting rollers 4. Since the speed difference between the rolls 1 and 2 is maintained, the initial tears are immediately extended in both directions so that within a fraction of a second the entire web will be torn along the line of perforations P. However, since the tensile force is at no time larger than that necessary to bring about the initial tears at the web portions lying against the deflecting rollers 4, the required tensile force is only a fraction of that hitherto required for simultaneously tearing the web across the entire line of perforations.

For clarity, the only illustrated line of perforations P is shown to the left of the deflecting rollers 4 in FIG. 2 but it should be emphasized that tearing off is already completed within a fraction of a second in the vicinty of the deflecting rollers. Subsequently, whilst the torn off length is carried away at an accelerated speed, the new leading end of the web passes along a guide plate 8 which leads it into the nip of the tear-off rolls 2.

If, as is indicated at L in FIG. 2, the web is provided with preformed longitudinal incisions to facilitate subsequent base folding of each bag, the deflecting rollers 4 are distributed across the web so that the incisions L pass between two adjacent deflecting rollers where the tensile force on the web becomes effective only after initial tearing-off has commenced. This protects the incisions L from extending uncontrollably.

I claim:

1. A tear-off apparatus for lengths of flattened tube from a transversely scored or perforated single or multi-ply paper or plastics moving tubular web, comprising a pair of holding rolls for the web adapted to turn at no more than the web feeding speed, a pair of tear-off rolls downstream of the holding rolls adapted to turn faster than the web feeding speed for momentarily engaging the leading end of the web between each other, and two rows of deflector rollers for the web, the rows extending transversely of the web downstream from said holding rolls and upstream from said tear-off rolls, said rollers being adapted to make substantially point contact with the web, the rollers of each row being spaced from one another, said two rows being closely juxtaposed, the periphery of the deflector rollers of one of said rows projecting through a plane passing through the nips of said holding and tear-off rolls from one side of said plane and the periphery of the deflector rollers of the other of said rows projecting through said plane from the other side of said plane and in a direction opposite to that in which the deflector rollers of said one row project.

2. Apparatus according to claim 1, wherein the deflector rollers have a convex periphery.

3. Apparatus according to claim 1, wherein the deflector rollers are movable to and from the web in sequence with the operating cycle of the tear-off rolls.

4. Apparatus according to claim 1 comprising wherein the rollers of each row of deflector rollers are mounted on a common shaft extending across and beyond the entire width of the web and the ends of the shafts of the two rows are carried by the rms of two-armed pivotable levers disposed adjacent the longitudinal edges of the web, the pivotal axes of th levers lying in the plane of the web and the levers being pivotable to and fro in sequence with the operating cycle of the machine.

5. Apparatus according to claim 1, wherein the said spacing of the deflectors of each row is adjustable.

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