

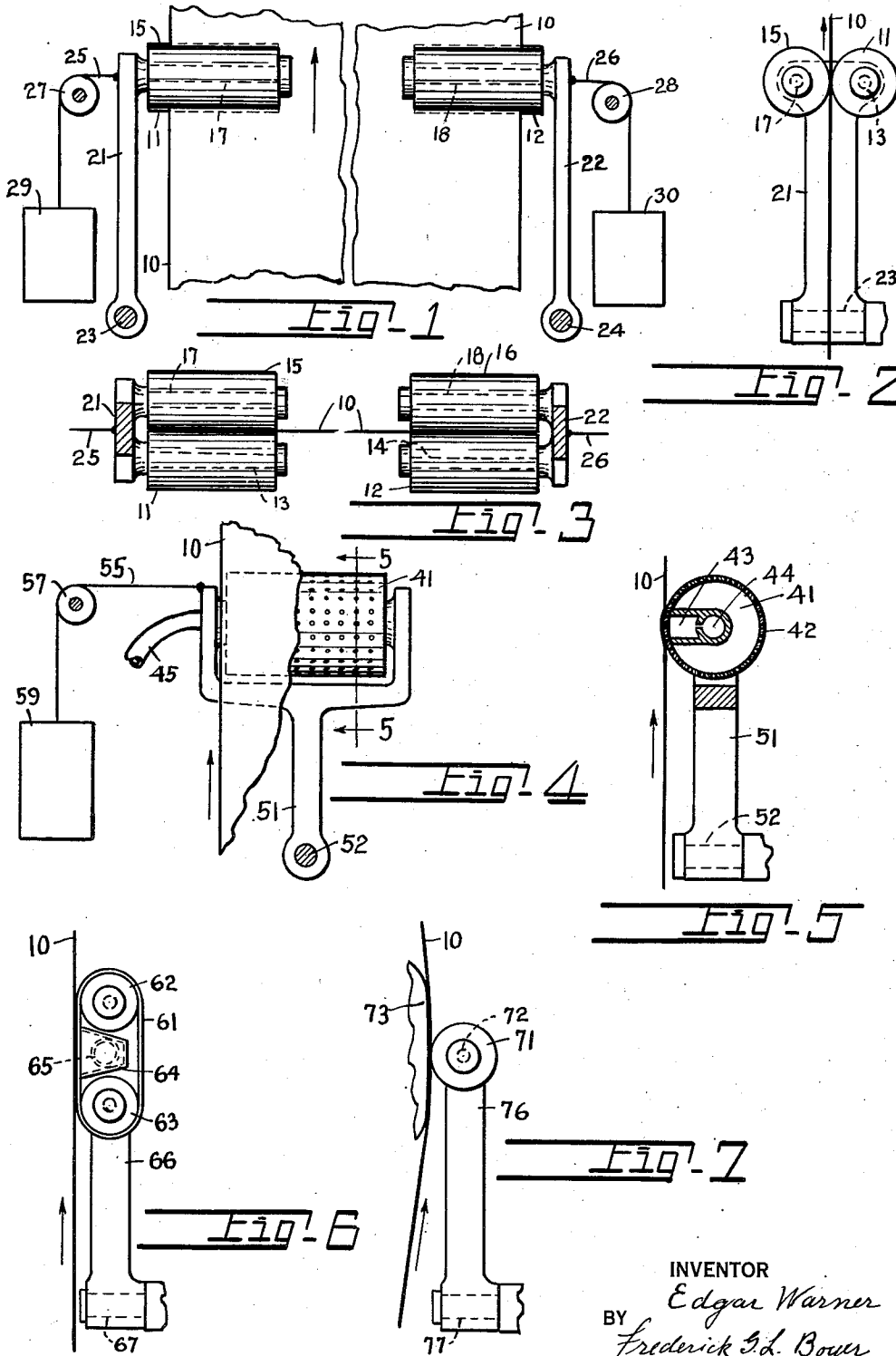
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WEB SPREADER

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WEB SPREADER

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This invention relates to the handling of paper or other material in web form, whether in machines for fabricating, treating, rewinding, processing, or using such material. In passing into or through such machines the webs often exhibit a tendency to be drawn into longitudinal wrinkles which frequently interfere with the processing of the web or become pressed into damaging creases which may even split the web in places.

In the effort to prevent the formation of injurious wrinkles, various expedients have in the past been used either alone or in combination. Rollers over which the webs pass have often been placed closer together than otherwise necessary in order to shorten the "draw" or unsupported length of web between rollers. The rollers have frequently been provided with a "crown" or enlarged diameter in the central portion, and sometimes with herringbone ridges which tend to work the wrinkles that form, outward to the edges of the web, but in spite of all known expedients, trouble with wrinkles still persists.

The present invention has for its primary object to provide a simple, novel, and more effective means of maintaining travelling webs in a wrinkle-free condition. Other and more detailed objects of the invention will become apparent in the course of the following description.

I have discovered that when a freely rotating roller means frictionally engages the surface of a moving web, if allowed to orient itself by swinging around a pivotal axis substantially perpendicular to the surface of the web (and spaced from the roller means in a direction such that the moving web passes said axis before passing said roller means), the roller means will assume a position in which the axis of roller rotation is perpendicular to the direction of travel of the web. I have further discovered that when the roller means has assumed the position described it will resist with considerable force any effort to displace it therefrom. On the basis of these discoveries, I have found that if such a roller means is provided at each edge of a moving web and forces are applied thereto, tending to pull them outwardly off of the edges of the web, these forces will be transmitted to the web, causing a lateral tension therein which serves to pull out the wrinkles and flatten the web without causing any injury thereto. It is necessary that the engagement between the roller means and the web be frictional, and to that end the roller means is advantageously, though not necessarily, made of or surfaced with a frictional material such as rubber, cork, felt, etc. In order that the

required friction be developed there must be pressure between the web and the roller means. This pressure can be obtained from the tension in the web, if the web is caused to wrap around the roller means. Any material degree of wrap is, however, disadvantageous when, as here, the roller means does not extend across the full width of the web. I therefore find it convenient to secure the needed pressure by the use of a pressure member in connection with the roller means, or by suction from within a pervious surfaced roller means.

The invention will be further described with reference to the accompanying drawing, in which:

Fig. 1 is a somewhat diagrammatic view showing a part of a web with the spreading devices of the present invention applied thereto.

Fig. 2 is a view as seen from the right hand side of Fig. 1, of the devices shown therein, except that the roller means on the right hand side of Fig. 1 has been removed in order to more clearly show that on the left.

Fig. 3 is an end view of the web passing through the devices illustrated in Figs. 1 and 2.

Fig. 4 is a fragmentary view showing an alternative type of roller means on the left hand edge of a web.

Fig. 5 is a sectional view of the roller means shown in Fig. 4 and taken on line 5-5 of Fig. 4.

Fig. 6 is a view of another alternative type of roller means, as seen from the same viewpoint as is that shown in Fig. 2.

Fig. 7 is a view of still another alternative form as seen from the same point of view.

Referring first to Figs. 1, 2 and 3, the web 10 is shown moving in the direction of the arrows. The rollers 11 and 12, which are narrow relative to the width of the web, are in frictional engagement with the right and left hand edges of the web, respectively. These rollers are advantageously covered with rubber or other resilient frictional covers, and are mounted to rotate freely on their respective axes 13 and 14. The frictional contact of the web with these rollers is maintained, in the embodiment illustrated in Figs. 1, 2 and 3, by means of similar rollers 15 and 16 (which, though they may conveniently be of the same diameter as rollers 11 and 12, are illustrated in Fig. 1 as slightly smaller, in order that rollers 11 and 12 may not be completely concealed thereby). In general the resiliency of the coverings of rollers 11, 12, 15 and 16 serves to provide the pressure necessary to give the required frictional contact with the web. If sufficiently re-

silient roller coverings are not used, resilient or spring mountings of known types may be provided for causing the necessary pressure of rollers 15 and 16 against rollers 11 and 12 respectively.

The roller pairs 11, 15 and 12, 16 are rigidly mounted on arms 21 and 22, respectively, which are adapted to swing freely on their respective fixed pivots 23 and 24. The pivots 23 and 24 are so disposed with reference to the roller pairs 11, 15 and 12, 16 that the moving web passes the pivots before passing the rollers, or in other words the rollers are mounted in the general direction of movement of the web from their respective pivots. The pivots are conveniently, though not necessarily, located beyond the edges of the web, as illustrated in Figs. 1, 2 and 3. The spreading forces are applied to roller pairs 11, 15 and 12, 16 by any suitable means. Advantageously, flexible cords 25 and 26 are attached to arms 21 and 22, thence pass over pulleys 27 and 28 and carry weights 29 and 30, respectively, which tend to pull the rollers off of the edges of the web. As has already been noted, the motion of the web creates a strong tendency for the rollers to swing on their pivots and assume the position shown in the drawing, wherein their axes of rotation are perpendicular to the direction of travel of the web. They strongly resist displacement by forces such as those exerted by weights 29 and 30 through cords 25 and 26, and these forces thus create a lateral tension in the web which tension removes, or prevents the formation of, the troublesome longitudinal wrinkles. The weights 29 and 30, or any alternative force-exerting means which may be used, are advantageously adjustable to permit adjustment of the tension to the degree required to maintain the travelling web in an unwrinkled condition. The weights on the opposite sides are, however, advantageously equal, as the web is thereby tensioned and spread equally. This serves to automatically compensate for any differences in the hardness, resiliency, or slippage of the rolls on opposite sides, which might otherwise cause an unequal pull and actually draw wrinkles into the web instead of preventing their formation.

When the web 10 comes to an end, the weights 29 and 30 swing arms 21 and 22 outward to the limits of their motion, advantageously carrying the roller pairs 11, 15 and 12, 16 out of the path of the web 10. A new web can therefore be threaded through without interference from the rollers. It is then only necessary to push them inward manually until they engage the edge of the moving web and they will automatically travel inward to their working positions.

Figs. 4 and 5 illustrate a modified form of the devices of the present invention, designed to adapt it for use with webs which have been freshly coated, printed, etc. on one side and which therefore must not be passed between press rolls such as illustrated in Figs. 1, 2 and 3. Only the roller means 41 on one edge of the web is illustrated, that on the other edge of the web being constructed in the same manner but oppositely mounted. Instead of a press roll to insure frictional engagement of the web with the roll, the roll 41 is provided with a perforate or pervious outer rotating shell 42 and a stationary internal suction box 43 which communicates by means of a hollow shaft 44 and flexible conduit 45 with any suitable suction device of known type, not shown. Suction rolls of this type are well known in the art and will not be further described. This roll is mounted on arm 51 which is adapted to

swing freely on fixed pivot 52. Since this device is all on one side of the web, the pivot 52 need not be located beyond the edge of the web but, if desired, may readily be located within the width of the web, as shown. It may or may not be opposite the middle of the roller but must, as before described, be so disposed with reference to the roller 41 that the moving web passes the pivot 52 before reaching roller 41. Force tending to pull the roller means away from the edge of the web is applied as before, conveniently by means of cord 55 passing over pulley 57 and supporting weight 59. The device functions in the same manner as that illustrated in Figs. 1, 2 and 3 to apply lateral tension to the travelling web and thereby maintain it in a wrinkle-free condition. It is further possible with this modification to limit the swing, by conventional means not shown, sufficiently to prevent the rollers from being pulled beyond the edges of the path of the web, since the rollers, being on one side only of the web, cannot interfere with threading. Immediately after threading, movement of the web will automatically draw the arms with the rollers into their operating positions.

Fig. 6 shows another modified structure. This, like that just described, depends upon suction to insure frictional engagement between the roller means and the web, so that it may operate on a web, one side of which carries wet ink, coating, or other matter which may not contact a solid surface. In order to give a longer arc of contact with the web than is obtained with the suction roll shown in Figs. 4 and 5, the roller means is here made in the form of a known type of "suction apron" or "suction belt"—an endless pervious or perforate band 61, which passes around freely turning rollers 62, 63 and over a suction box 64 wherein a partial vacuum is maintained by exhaust through flexible conduit 65. This constitutes the element of difference from the previously described structure. The supporting arm 66 and fixed pivot 67 are essentially the same in all cases. The same is true of the flexible cord 55 and weight 59, not shown in Fig. 6. The principles and mode of operation are also essentially the same as in the other modifications and will not be further described.

Fig. 7 shows a further modified structure. This structure, like that shown in Figs. 1, 2 and 3, depends on a pressure member on the opposite side of the web to assure the necessary frictional engagement of the web with the roller means. The roller means 71 is provided with a frictional, advantageously resilient surface, and rotates freely on axis 72. The opposite surface of web 10 is supported on a rigid, smooth, advantageously polished metallic surface 73 which preferably extends across the full width of the web. This surface may be flat, convex, or the surface of a relatively large diameter roll. The pressure necessary for the required frictional engagement may be provided by the resilience of the roll 71, or separate spring means of known type may be used if desired. The roller means is carried on arm 76 which swings freely on pivot 77 in response to the action of the moving web and of the weight 29 acting through cord 25 (not shown in Fig. 7). The device functions in the manner described with reference to the other figures, and the description will therefore not be repeated here.

The present invention is thus seen to offer a simple, reliable, easily controlled, and effective

method of maintaining travelling webs in a smooth and wrinkle-free condition. It is of particular value where webs of paper, fabric, etc. are drawn under tension into press rolls, calender rolls, roll winding devices, coating or printing devices, or the like, where wrinkles become pressed into creases or cuts, spoil the printing surface, damage printing plates, or otherwise cause serious difficulties with the process or defects in the product.

I claim:

1. In a device for applying lateral tension to a moving web of paper: a pair of resiliently surfaced, freely rotating, pressure rollers frictionally engaging opposite sides of the web for a small part of its width, near one edge thereof; a second and similar pair of rollers oppositely mounted and similarly engaging the web near the opposite edge thereof; each of said pairs of rollers being mounted and adapted to swing freely on a pivot located at a material distance, in the direction from which the web is travelling, from the axes of roller rotation, said pivot being substantially perpendicular to the plane of the web, whereby said rollers tend, by virtue of their engagement with the moving web, to orient themselves by swinging on their respective pivots, and thereafter to maintain their axes of rotation at right angles to the direction of travel of the web; and means for exerting oppositely directed and substantially equal forces on each of said pairs of rollers, in directions tending to pull them off of the edges of the web.

2. In a device for applying lateral tension to a travelling web: a pair of rollers engaging the web for a short distance inward from one edge thereof; a second pair of rollers engaging the web for a short distance inward from the opposite edge thereof; each of said pairs of rollers being mounted and adapted to swing freely on a pivot located at a material distance, in the direction from which the web is travelling, from the axes of roller rotation, said pivot being substantially perpendicular to the plane of the web, whereby said rollers tend, by virtue of their engagement with the moving web, to maintain their axes of rotation at right angles to the direction of travel of the web; and means for exerting forces on said pairs of rollers, in directions tending to pull them off of the edges of the web.

3. In a device for applying lateral tension to a travelling web: roller means frictionally engaging one edge thereof; separate roller means frictionally engaging the opposite edge thereof; both of said roller means being narrow relative to the width of the web, having axes of rotation approximately parallel to the plane of the web, and each being mounted to swing freely around a pivot substantially normal to the plane of the web and at a material distance, in the direction from which the web is travelling, from the axes of the roller means; and means for exerting forces on each of said roller means tending to swing said roller means about their respective pivots in directions away from the center line of the web.

4. In a device for applying lateral tension to a travelling web: roller means frictionally engaging the web near one edge thereof, said roller means being narrow relative to the width of the web, having an axis of rotation approximately parallel to the plane of the web, and being mounted to swing freely around a pivot substantially normal to the plane of the web, and spaced a material distance, in the direction from

which the web is travelling, from the axis of rotation of said roller means; and means for exerting force on said roller means tending to swing said roller means around said pivot and off of the edge of the web.

5. A device for providing lateral tension in a moving web, comprising: separate roller means engaging opposite edges of the web; means for holding the web in frictional engagement with said roller means; separate pivots, substantially normal to the plane of the web, on which said roller means are separately mounted, and about which they may swing freely, said roller means being disposed in the general direction of movement of the web from their respective pivots; and means for applying forces to said roller means tending to swing them, around their respective pivots, in directions away from the axis of the web.

6. A device for providing lateral tension in a moving web, comprising: separate roller means engaging opposite edges of the web; a pressure member, engaging the opposite side of the web, for holding the web in frictional engagement with said roller means; separate pivots, substantially normal to the plane of the web, on which said roller means are separately mounted, and about which they may swing freely, said roller means being disposed in the general direction of movement of the web from their respective pivots; and means for applying forces to said roller means tending to swing them, around their respective pivots, in directions away from the axis of the web.

7. A device for providing lateral tension in a moving web, comprising: separate roller means engaging opposite edges of the web, each of said roller means being provided with a pervious web-engaging surface; means for maintaining a partial vacuum inside the pervious surface engaging the web, on each of said roller means, whereby the web is held, by suction, in frictional engagement with said roller means; separate pivots, substantially normal to the plane of the web, on which said roller means are separately mounted, and about which they may swing freely, said roller means being disposed in the general direction of movement of the web, from their respective pivots; and means for applying forces to said roller means tending to swing them, around their respective pivots, in directions away from the axis of the web.

8. A device for providing lateral tension in a moving web, comprising: separate roller means engaging opposite edges of the web; a pivot, substantially normal to the plane of the web, on which each of said roller means is mounted for a free swinging movement, said roller means being disposed in the general direction of movement of the web from their respective pivots and means for applying force to said roller means tending to swing them, around their respective pivots, in directions away from the axis of the web.

9. In a device for maintaining a moving web in a wrinkle-free condition: separate roller means adapted to frictionally engage the moving web for a fraction of its width, near the opposite edges thereof, and tending, by virtue of their engagement with the moving web, to maintain a predetermined distance therebetween; and means for applying separating forces to said roller means which forces are, by virtue of the engagement of the roller means with the web, transferred to the web as spreading forces which constitute lateral tension in the web.

10. In a device for maintaining a moving web in a wrinkle-free condition: means, substantially stationary relative to the longitudinal movement of the web, for gripping the edges of the web laterally, while allowing it substantially unimpaird freedom of longitudinal movement; and means for continuously applying forces to said gripping means, in directions tending to separate them, thereby maintaining lateral tension in the web between said gripping means.

11. Method of maintaining a section of a mov-

ing web in a wrinkle-free condition, which comprises subjecting each of the opposite edges of the web to a rolling action, at a fixed location in the path of travel of the web; balancing the lateral tension in the web at this location against a predetermined mechanical force; and continuously adjusting the directions of said rolling actions, in accordance with said balance, thereby maintaining a predetermined substantially constant lateral tension in the web in said location.

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