Jan. 30, 1968 D. F. DREHER 3,365,992

WEB SEVERING APPARATUS

Filed Sept. 23, 1965 2 Sheets-Sheet 1

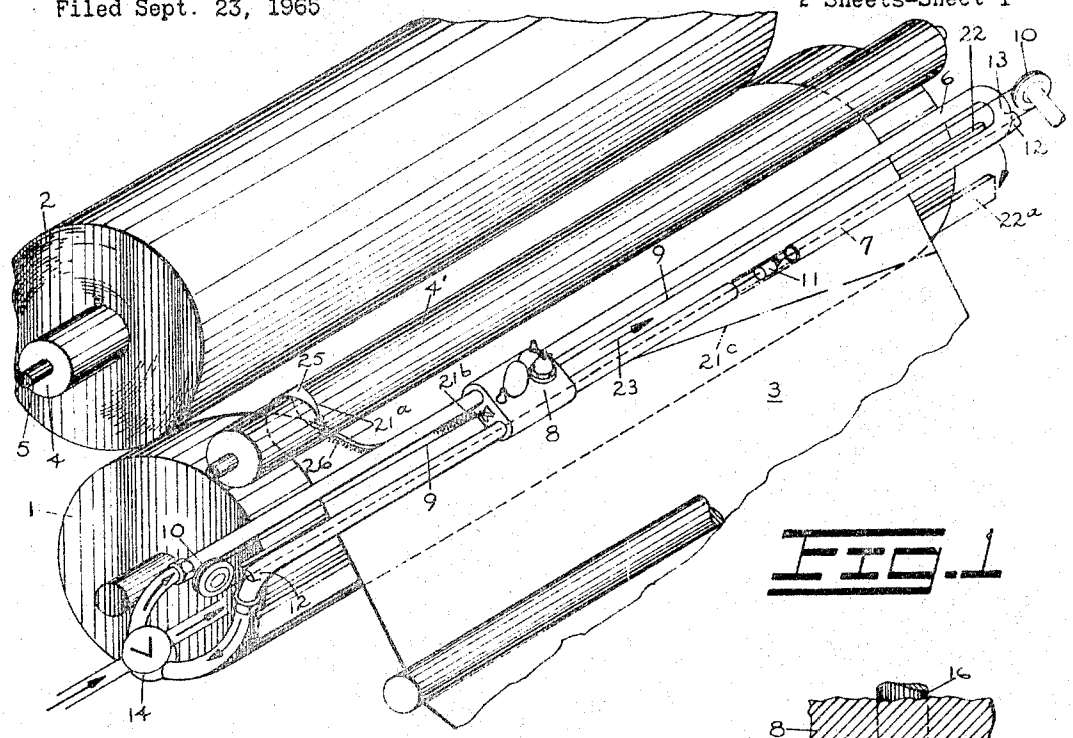


FIG. 1

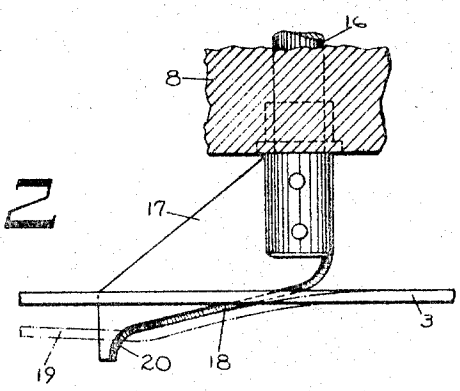


FIG. 2

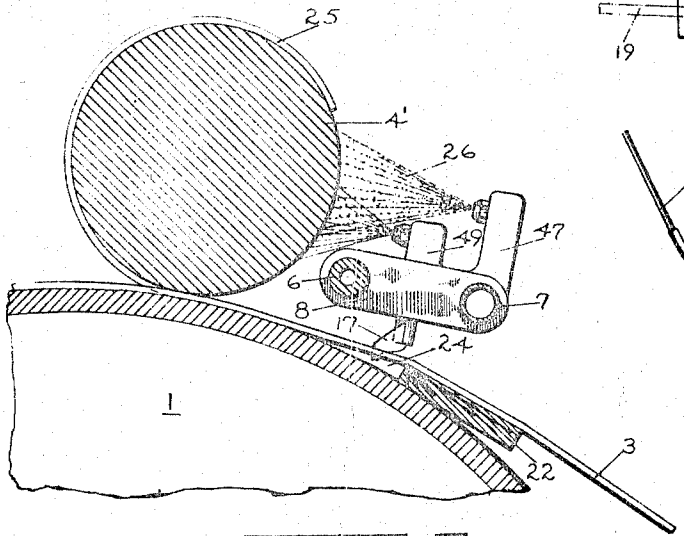


FIG. 5

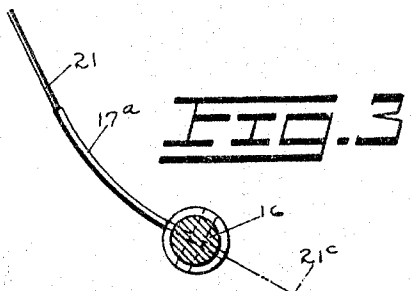


FIG. 3

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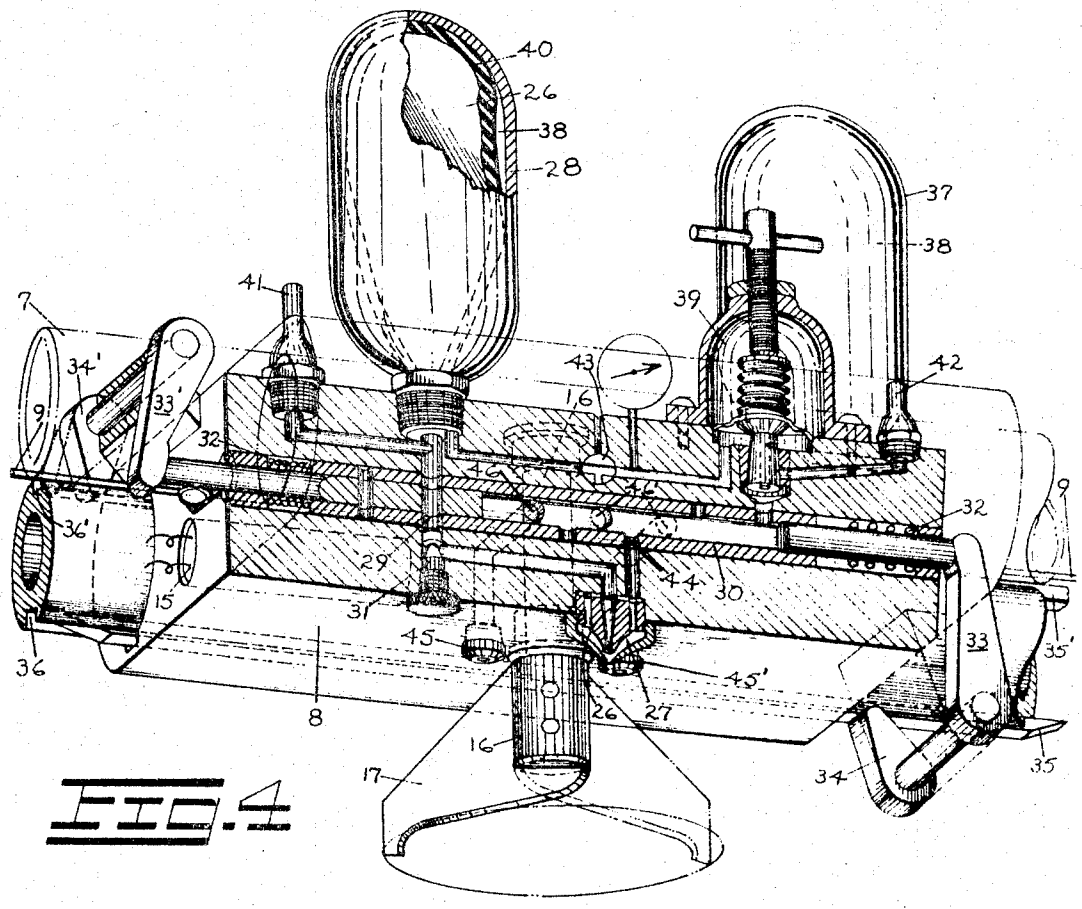
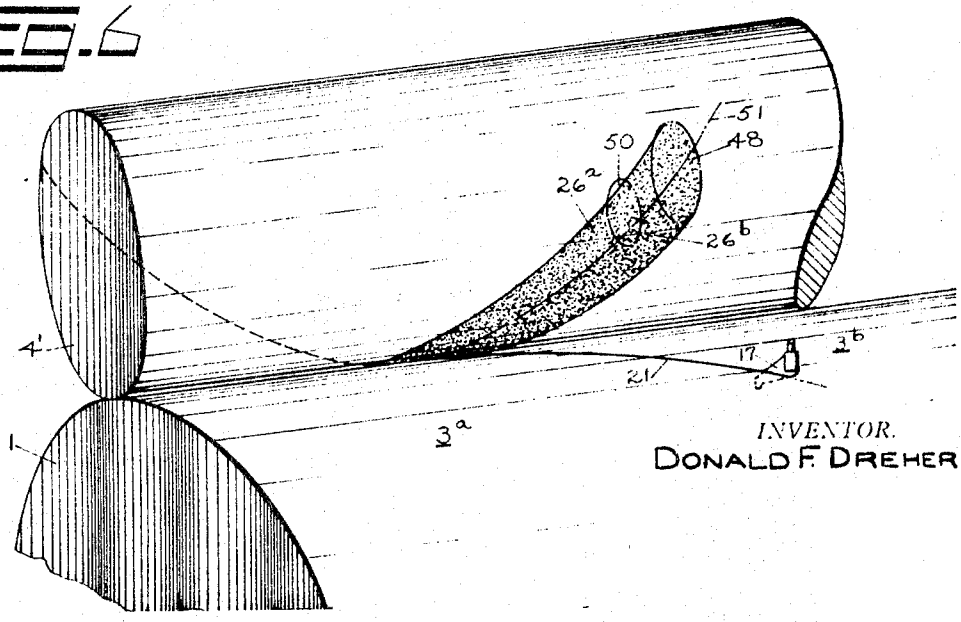



FIG. 4

FIG. 6

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3,365,992

# WEB SEVERING APPARATUS

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Continuation-in-part of application Ser. No. 304,920, Aug. 27, 1963. This application Sept. 23, 1965, Ser. No. 489,545

21 Claims. (Cl. 83—614)

This is a continuation-in-part of my copending application Ser. No. 304,920, filed Aug. 27, 1963, now Patent No. 3,277,761. It relates to apparatus for severing continuous webs of paper and the like while traveling at high speed, and more particularly to the handling of relatively heavy stocks such as paperboard, including severance at the winding reel and means for facilitating attachment of the severed web in starting a new roll.

My described copending application teaches the storage of energy within, or immediately adjacent either end of, a web-spanning apparatus and instant release of the stored energy in such manner as to propel a dartlike severing blade assembly into high velocitied traverse of the traveling web. Although the method therein described is ideally suited to the purposes for which it was designed, including principally the severing of paper, foil, film and other lightweight webs, heavy duty applications such as the severing of paperboard tend to require greater amounts of force than it is practical to apply by the techniques previously described. In addition, instantaneous severance is incompatible with certain rewinding arrangements, e.g., when using a Pope reel in the manner later suggested, in which the severing instrument must be propelled at controllable rate(s) of speed.

Some of these problems were anticipated by the previous application, which suggested that a cable-towed slashing blade could be used in handling heavier paperboard. The instant application describes this type of apparatus more completely and includes means for applying adhesive in order to effect attachment of the leading end of the traveling web to a newly inserted core or winding mandrel coincident with the web's severance.

The objects of the instant invention include those which were outlined in the previous application except for differences inherent in the two systems, and in addition thereto, to provide positively powered severance at controllable rates of speed and angulations crossweb, a pivotable blade assembly which permits a clean slicing action through the thickness of the web whatever be the crossweb angulation or direction of the severing instrument, integral means for application of adhesive to effect web attachment to a winding mandrel or to another traveling web, said means including air jet evaporation of excess solvent so as to tackify the adhesive surface and to improve its pickup capability.

These and other objects of the invention may better be understood by referring to the accompanying drawings, in which

FIGURE 1 is a diminutive perspective view of the web severing apparatus in operation on a Pope winding reel.

FIGURE 2 is a frontal elevation of the pivotable web incising element, close to actual size.

FIGURE 3 is a plan view of a similar element in which the cutting blade is capable of flexure.

FIGURE 4 is a perspective view showing the underside of the transversely motionable carriage assembly, including vertical section within the assembly, this view also being approximately actual size.

FIGURE 5 is a diminutive end elevation of the apparatus in mounted relationship to the proximate elements of a Pope reel, showing spray application of adhesive to the newly inserted winding mandrel.

FIGURE 6 is a frontal elevation of the same arrangement, showing the positional arrangement of adhesive application relative to the mating line of web severance as the two elements merge into the winding nip.



Referring now to FIGURE 1, the illustration shows a driven winding drum 1 against which a finished roll 2 of paperboard 3 has been wound upon a mandrel 4, the axis of which is maintained in radial planar relationship to the axis of the winding drum 1 by guides (not shown) in which the stub ends 5 of the mandrel 4 are bearinged. When a new roll is to be started, a second mandrel 4' is dropped into place atop the winding drum 1 upweb from the finishing roll 2 and similarly bearinged in a second pair of guides. Mounted immediately upweb from the newly inserted mandrel 4' is the web severing apparatus which constitutes the substance of the invention herein described. The said apparatus consists of two tubular machine-spanning support elements 6, 7 and a motionable carriage assembly 8 which is drawn crossweb in either direction by cables 9. These may be attached to driven reels at opposite sides of the machine, or they may form a loop drawn around pulleys 10 at each end of the apparatus, the loop being completed by the carriage 8 and suitably tensioned by inclusion of spring and turnbuckle or by other accoudrement, permitting either or both pulleys to be powered reversibly, or to serve as idlers as in the preferred form illustrated, in which the return portion of the cable loop 9 is threaded lengthwise through the upweb tubular support element 7 which becomes an hydraulic cylinder housing a piston 11 through which the cable 9 may be passed and to which it is securely attached. Its entry into each end of the cylinder 7 is glanded 12 so as to maintain fluid pressure within the hydraulic system, it being advantageous to this end that the cable comprise a single filament such as piano wire or high tensile stainless steel, in consequence of which the diameter of the supporting pulleys 10 should be sufficient to handle the relative stiffness of such a filament with minimal distortion. Alternatively it will be recognized that this system could be operative with compressed air, in which event stranded cable could be substituted and the glands 12 merely restrictive. It will be noted that the downweb tubular element 6 may be utilized in the fluid circuit in combination with the 180° return bend 13 as shown in the drawing, thereby permitting the leads to be proximate at one side of the machine. The system is operable with a four-way valve 14, preferably with a neutral position so that the carriage assembly 8 may be positioned at any desired point beyond the margins of the traveling web 3 when inoperative. The need for more sophisticate valving arrangements will become evident as the invention is further described, but these will not be delineated since they comprise techniques well known in the art.

FIGURE 2 details the web severing element which is positioned centrally in the motionable carriage assembly 8, the pivoting shaft 16 bearing therein, extending downward therefrom and holding the severing blade 17 at such height as first to engage the web 3 near, or just behind, the pivotal axis. As the blade 17 first contacts the edge of the web 3 it swivels into traling position and is drawn across the web angularly, the inclination of severance being a function of relative speeds of crossweb transit and web flow. Being free so to pivot into perfect angular position, the shallowly inclined razorlike edge 18 follows precisely the track established by the point of contact with the web's surface, slicing ever deeper into the web and utilimately through it. As the leading portion of the incising edge 18 dulls, the web will be pushed farther along the inclined slicing edge as indicated by the web's phantomed position 19 in which the final severance is accomplished by the abruptly inclined portion 20 of the blade. As the farther trailing portion becomes less keen,

the operator will be forewarned by its tendency to rag the paperboard, at which time the blade must be sharpened or replaced.

FIGURE 3 shows the severing instrument in trailing position, the blade 17*a* in this instance having sufficient flexure to follow the track 21 of the leading surface incision as it arcs into changed angularity in consequence of rapid increase in transit speed. The axis upon which the severing element pivots is generally perpendicular to the plane of the web, but certain deviations therefrom may be dictated for purposes of rotational clearance or may be geometrically desirable in connection with specialized profiles of the severing instrument and/or with angular deviants in severability relative to grain of the web or its flow. If the web is to be straight-line severed abruptly, e.g., at a transit speed somewhat greater than that of the web, it may be advantageous to tilt the pivotal axis slightly backward so that the blade tends to dig forward into the oncoming web, quite in the manner demonstrated by planing across a fluid surface as in water skiing; except that, as similarly taught by the analogy, if the blade is slowly transited relative to web flow so that it trails shallowly into the incoming flow (viz: heading across it), the result would be comparably disasterous unless the axis were tilted somewhat laterally, the correct tilting of the axis of course being in plane perpendicular to the line of severance. It also will be apparent that other embodiments of the invention could require the severing instrument to be vertically motionable, e.g., by resistably permitting such motion in the bearinged pivot shaft 16 or cross-pivotally in its seizure of the said instrument per se.

Referring again to FIGURE 1, a machine-spanning web-riser plate 22 is transiently positioned in contact with the driven winding drum 1 immediately upweb from the transverse line of severance over which the directional arrow 23 is superposed in the drawing. This plate lifts the web away from the drum 1, as will be more clearly understood by reference to FIGURE 5, providing clearance 24 for the severing blade and oppositional support for the web close to its traveling point of severance. When the web-riser plate is withdrawn, as indicated in its phantomed position 22*a*, the web drops into nonintersecting relationship with the severing blade 17, thereby permitting the carriage 8 to be moved crossweb to either side of the machine without effect upon the traveling web. It will be apparent, however, that the operational traverse is bidirectionally capacitied.

It also should be noted that the swiveling, or trailing blade, technique is broadly applicable to other modes of transit and carriage, including those disclosed in the described copending application, and that it may be usefully employed with variously shaped blades and other types of severing elements, e.g., rotary score-cutting against a surface-hardened roller, or a blade shearing through the web against an expendable and replaceable timpan sheath wrapped around the winding drum or an equivalent means for web support. If further should be noted that various of the embodiments described in these copending applications may be utilized advantageously in web-splicing apparatus, that which is yet to be described being especially pertinent thereto since it includes means for concomitant application of adhesive to the traveling web.

Having in mind the primary elements of the apparatus as hereinbefore described, FIGURE 1 illustrates how it may be used on a Pope reel winding paperboard at the time of starting a new roll without interruption in web flow or change in machine speed. The carriage assembly 8 began its crossweb traverse at slow speed, in this case about one fourth the speed of the traveling web 3 as indicated by the slope of the initial incision 21*a* which forms a pennant-shaped leading segment 25 at the left hand margin of the web, this pointed segment being picked up by the newly inserted mandrel 4'. When the leading segment 25 is secure in such attachment, the carriage assembly 8 may be driven rapidly crossweb as indicated by the changed slope of the incision 21*b* and its phantomed completion 21*c*. Since pickup of the leading segment 25 tends to be uncertain, manual control of the carriage 8 often is desirable since it permits the operator to stop the crossweb transit, return the carriage to its starting position and make a second attempt, without having lost web continuity and caused the machine to be stopped. This should not be misconstrued as negating the desirability of automatic control, toward which end the subject invention is dedicated, it being apparent that as web speeds further increase, failsafe feedback fulfilling the need just described would demand automation. The manifold advantages of multispeed transit of the severing element also will be apparent to those skilled in the art, which include facilitating pickup of the leading segment, minimizing the amount of web lost in the proceess, and stabilizing the winding on the new mandrel as quickly as possible in order to minimize differences in wound circumference in consequence of having tapered the leading edge. In the example illustrated, complete severance has been accomplished in approximately two revolutions of the mandrel.

Pickup of the leading segment 25 may be accomplished by various means, sometimes including the use of wand and/or air jet or by a timely dobbing of adhesive, all such techniques demanding skill and often involving hazards to men, product and equipment. One of the purposes of the instant invention is to eliminate such hazards and to render the roll changing operation more foolproof. One contribution toward such end is suggested in FIGURE 1, which shows a strip of adhesive 26 applied to the leading edge of the web immediately behind the line of severance 21*a, b*. The adhesive applicator is a part of the carriage assembly 8, and positioned adjacent the pivot of the severing element.

This assembly is detailed in FIGURE 4, in which the body section 8 is supported and freely slidable upon the tubular machine-spanning elements 6, 7, and carries the centrally positioned web severing element 16, 17 in its crossweb traverse. The adhesive applicator 27 is positioned immediately in front of the pivotal shaft 16 of the severing element, the adhesive 26 being fed to the applicator from a pressurized reservoir 28 through porting 29 in the distributing sleeve valve 30, the flow being meterable through a fixed orifice or adjustably by needle valve 31. The distributing valve 30 is actuated from its spring 32 centered or closed position to that shown, by the lever 33 which is cam 34 operated through a pivotal connecting shaft by the riser key 35 inserted lengthwise in the keyway 36 milled in the downweb machine-spanning element 6. Thus the position and length of the cam riser 35 directly controls the application of adhesive 26, permitting it to be short intervaled and applied only to the tip of the leading segment 25 or extendably continuing across whatever portion of the web is desired. It also will be apparent that in the arrangement shown, the cam/lever assembly 33, 34 is unidirectionally operative against the valve 30, since contact with the riser key 35 on the return stroke moves the lever 33 oppositely away from actuating contact with the valve 30. Duplication of the valve actuating mechanism permits independently controllable bidirectional operation of the apparatus, matching parts (as shown in FIG. 4) being oppositely positioned and operative, and identified by prime-suffixed reference characters.

A pressurized air tank 37 is included in the motionable carriage assembly as illustrated. This storage of compressed air 38 may be utilized advantageously for several purposes, these including controllably constant pressurization of the adhesive supply reservoir, atomization of the adhesive application and partial air jet drying of the exposed surface of the applied adhesive. Constant pressure is maintained by the regulating valve 39 which delivers pressurized air 38 inside the outer wall 28 of the

adhesive reservoir and therein pressurizes the adhesive supply which is contained within a collapsible bladder 40. Ballcheck nipples 41, 42 are connected with the respective supply reservoirs 28, 37 and are provided in order to facilitate charging the reservoirs at such intervals as may be required, a three-way valve 43 being inserted in the connecting air duct so that either reservoir may be vented, e.g., when the adhesive supply is being replenished. Alternatively, either supply may be delivered by connecting hose line to the carriage instead of being borne thereupon as a part of the motionable assembly.

The adhesive may be applied to the web by any one of several means or by certain combinations thereof, the choice often being dictated by the type and consistency of the adhesive which is to be used. Among these may be included ribboned extrusion with or without following squeegee, a fountaining brush applicator, or by spray nozzle with or without air atomization. An atomized spray applicator 27 is indicated in FIGURE 4, to which the adhesive 26 is interruptably ducted as previously described, while the air enters through porting 44 of the compound valve 30 from the regulating valve 39. The porting of the distributing valve 30 is such as to deliver both adhesive and air simultaneously to the applicator nozzle 27 whenever the valve is actuated in either direction, thereby permitting bidirectional operation, the pattern of each adhesive application being selective in consequence of being individually controllable by the oppositely positioned and operative cam/riser keys 35, 35'.

Two-way operation of the distributing valve 30 is further advised by selectivity in supplying air to the drying jets 45, 45' to which air is delivered alternately through portings 46, 46', it being pointless to activate whichever jet leads the adhesive application and is thus ineffectually positioned for drying the applied adhesive. Although the surface drying capacity of jetted air can approach the phenomenal, the design and position of the nozzle increases in importance as higher machine speeds are encountered. Since its primary purpose is to assure pickup of the leading segment 25, its positioning relative to the adhesive applicator 27 is properly dictated by the anticipated initial slope 21*a* of the web incision.

FIGURES 5 and 6 illustrate a modification in adhesive application, in this example the adhesive being transversely applied to the rotating mandrel 4' instead of directly to the web 3, and so positioned as to be in mating relationship with the web incision, as indicated in FIGURE 6. The adhesive 26 is fanned from the spray head 47 against the mandrel 4' and patterned thereon as indicated by the phantomed oval 48, the fanned deposit in this case being centered upon the mating line 51 of the web incision 21. In trailing angular position therefrom, the drying nozzle 49 patterns its impact against the deposited adhesive as indicated by the smaller phantomed oval 50, and thus is directed against the trailing portion 26*a* of the adhesive deposit, this area being that which will mate with the leading edge 3*a* of the web behind the incision 21 to which the adhesive must be instantly tenacious. The leading portion 26*b* of the deposited adhesive thereby is permitted to transfer wet to the trailing edge 3*b* of the expiring web, causing it to be anchored as it winds into the finished roll 2.

To those who are knowledgeable of quick-setting adhesives it will be apparent that heat-liquifiable compositions may be used in preference to solvated or liquid-extended types, for which purpose FIGURE 4 shows an electric heating cartridge 15 installed in the body 8 of the carriage, the arrangement being such as to heat the entire carriage assembly, for which suitable allowance must be made for operation at elevated temperature, thrust-operable electrical connectors being simple to install at either end of the supporting assembly 6, 7 so that the proper temperature may be developed and maintained during the nonuse intervals between operative transits. In such applications, the supplementary air jets 45, 45', 49 may be utilized to cool the deposited adhesive layer, and thus render it more quickly adhesionable.

It will be further apparent that many of the embodiments of the invention herein disclosed and described are applicable broadly to transference of a traveling web from one spindle to another, thus having utility in conjunction with both winding and unwinding apparatus, the root elements common to both including web continuity (either in or out), severance and attachment. Additionally, it will be understood that said embodiments are specific solely for the purpose of clarity in explanation, and are not to be construed as limiting the apparatus either in physical form or in application to properly related areas of use.

I claim as my invention:

1. In an apparatus for serving a traveling web of paper wherein an incising instrument is motioned transversely of, and in intersectable relationship with, said web, the combination thereof with means for pivoting said instrument freely about an axis aligned essentially perpendicular to the plane of said web at the point of incision, said perpendicular alignment thereof being inclusive of deviations in degree for specialized purposes, said instrument having its web-intersectable portion extending radially from said axis, whereby when said instrument is motioned crossweb said portion will trail from said axis and position itself angularly as a function of crossweb speed relative to web travel, permitting the web to be incised cleanly at the precise trailing angle developed by said function.

2. The device described in claim 1, including means for alteration of speed during its crossweb transit.

3. The device described in claim 1, wherein said instrument comprises a blade having a sharpened incising edge and being so profiled that said edge is inclined shallowly relative to said plane near the normal point of intersection therewith, therebeyond outward from said axis the incising edge is extended in length and depth sufficiently to insure satisfactory severance of the web.

4. The device described in claim 3, wherein the incising profile generates smoothly from said shallow incline to an abrupt angle relative to said plane at the terminus of said edge outward from said axis, whereby when the more shallowly inclined sections of the incising edge dull increasing portions of the web's thickness will be incised by farther trailing sections of said blade, thereby forewarning of deterioration in the blade's keeness by a tendency to rag the final severance.

5. The device described in claim 3, wherein said blade is flexurable and adapted thereby to permitting clean incision of said web when transcribing an arc such as that occasioned by alteration of driven speed during crossweb transit.

6. The device described in claim 3, wherein the plane of said blade is tilted from the true said perpendicular so as to cause said edge to incise oppositionally into the inflowing web at a planar angle acute to the departing web.

7. The apparatus as described in claim 1, wherein said web is supported upon a rotating cylinder and a retractable support member is provided thereadjacent, said member being adapted to lifting a segment of the web tangentially from the cylinder into said intersectable relationship during the severing interval, whereby when said member is thus positioned it will provide upweb support for the web proximate the transiting point of inclusion, and when retracted it may permit non-severing transit of said instrument.

8. In an apparatus for severing a traveling web of paper by means of transiting a cutting tool transversely thereof and in intersectable relationship therewith, wherein said apparatus comprises a tubular machine-spanning member positioned parallel to the crossweb transit of said tool, a transitable carriage upon which said tool is mounted, a counter-motionable piston housed within said member and adapted to being powered by differential fluid pressure against its opposite faces, a reciprocatable closed

cable loop connecting said carriage and piston, and sheaves positioned alignedly at opposite ends of said member adapted to providing tensionable end supports for said loop, wherein the improvement comprises, and in combination, a relatively incompressible hydaraulic fluid, suitable glanding for said cable at either end of said member, and means for controlling the volumetric flow rate of said fluid, whereby said transit can be powered positively and its speed controlled precisely.

9. In an apparatus for serving a traveling web of paper by means of transiting a cutting tool transversely thereof and in intersectable relationship therewith, wherein said apparatus comprises a tubular machine-spanning member positioned parallel to the crossweb transit of said tool, a transitable carriage upon which said tool is mounted, a counter-motionable piston housed within said member and adapted to being powered by differential fluid pressure against its opposite faces, a reciprocatable closed cable loop connecting said carriage and piston, said sheaves positioned alignedly to opposite ends of said member adapted to providing tensionable end supports for said loop, wherein the improvement comprises, and in combination, said carriage adapted to bearing externally upon, and being guided transitably by, said member.

10. The apparatus as described in claim 9, wherein a second parallel member spans the machine and said carriage is adapted to bearing similarly upon said second member, and wherein said second member may be tubular and made intercommunicative with the member first described with respect to fluid circuitry.

11. In an apparatus for severing a traveling web of paper in conjunction with the transfer of said web from one spindle to another at uninterrupted machine speed, a transversely-motionable carriage assembly having guidance support means, said assembly including a web severing instrument and means for concomitant application of adhesive proximate the web incision by said instrument.

12. The assembly as described in claim 11, wherein said assembly is adapted to apply a heat-liquifiable adhesive.

13. The assembly as described in claim 11, including carriage assembly borne means for utilizing compressed air purposed in connection with said application of adhesive.

14. The assembly as described in claim 13, wherein said carriage assembly borne means includes air jet means for accelerated tackification of the applied adhesive.

15. The assembly as described in claim 11, wherein said carriage assembly includes a pressurized supply of said adhesive.



16. The assembly as described in claim 11, wherein said carriage assembly includes a supply of compressed air purposed in connection with said application of adhesive.

17. The assembly as described in claim 11, wherein adjustable timing means is provided for the application of adhesive, whereby the flow of adhesive may be controlled as a function of carriage position in crossweb transit.

18. The assembly as described in claim 17, wherein dual timing means are provided, each said timing means being unidirectional and operative oppositely from the other, whereby said carriage assembly may be made operative in either direction.

19. The assembly as described in claim 11, wherein said adhesive is applied by said application means to the surface of an adjacent rotating member and thence into contact with the web approximate said incision.

20. The apparatus as described in claim 11, wherein driving means for motioning said carriage assembly is incorporated within said support.

21. In an apparatus for winding successive rolls of paper without interruption from a continuous inflowing web supply, said apparatus comprising a reel having separate mandrels upon which said paper alternately can be wound, and transversely motionable means for severing said paper whereby a leading edge portion thereof can be incised and attached to a starting mandrel prior to completing web severance, wherein the improvement comprises, and in combination, a severing instrument being pivotable about an axis approximately perpendicular to said paper and means for application of adhesive proximate the point of severance, said instrument and application means being transited crossweb concomitantly.


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