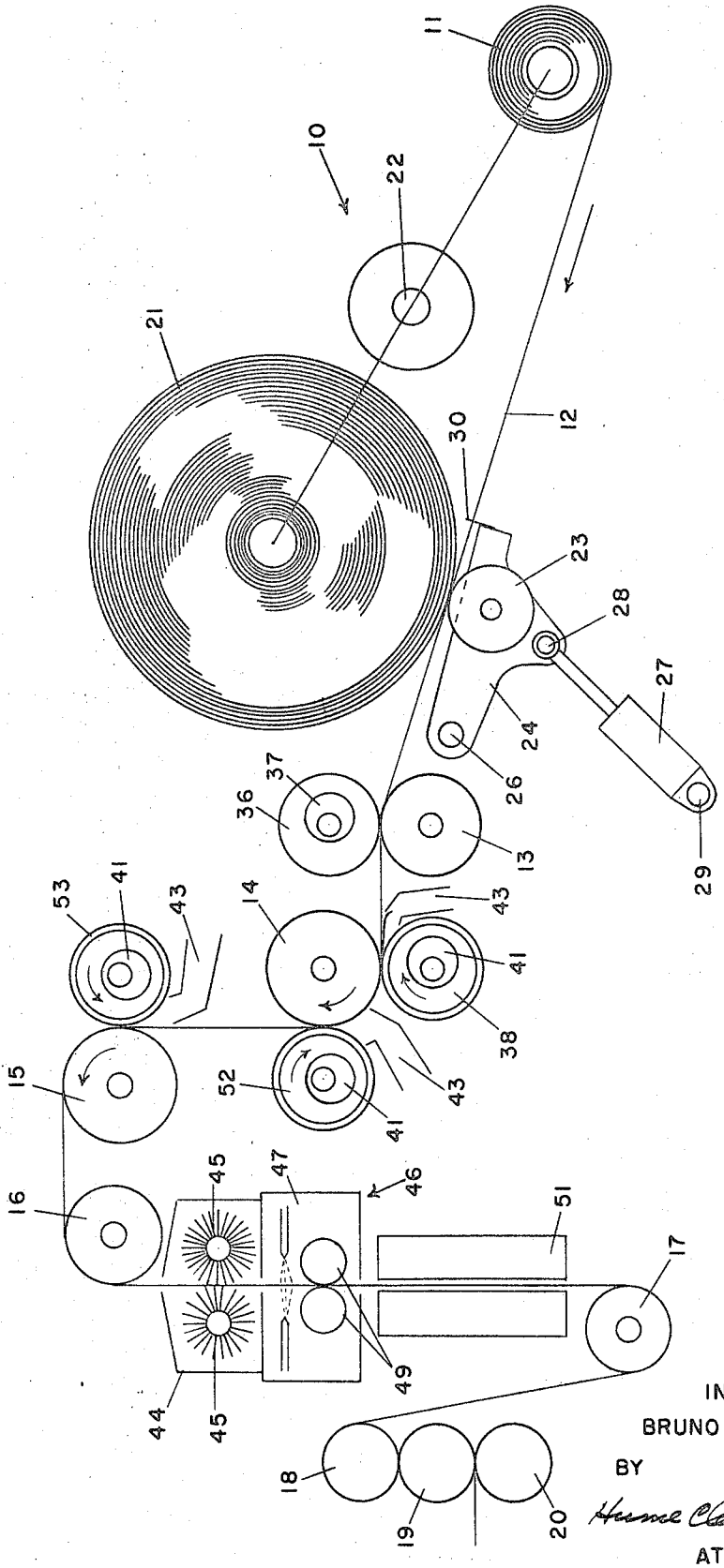
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METHOD FOR SPLICING WEBS

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FIG. 1




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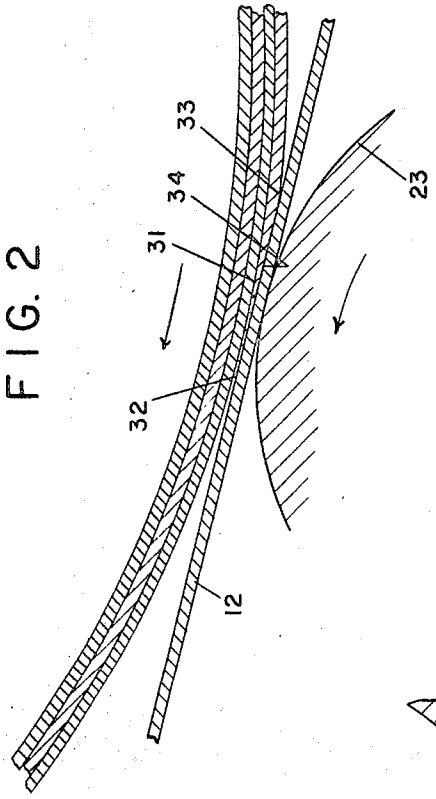



FIG. 2

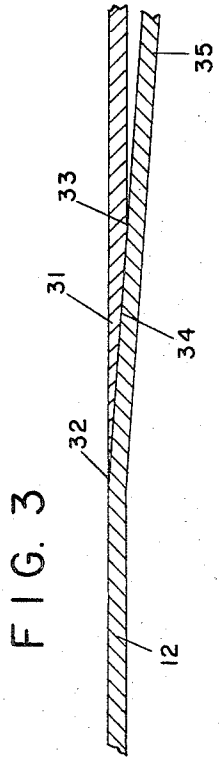



FIG. 3

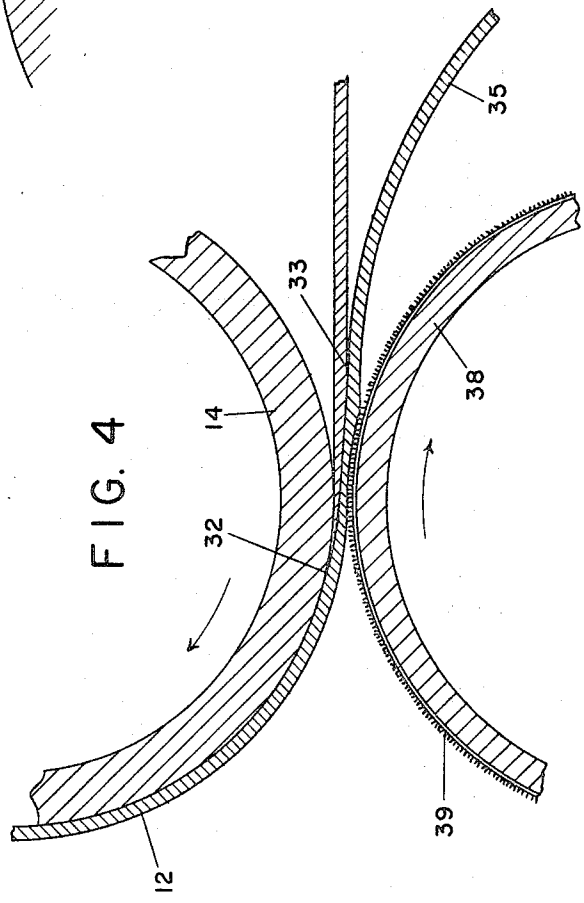



FIG. 4

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3,575,759

# METHOD FOR SPLICING WEBS

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U.S. Cl. 156—159 4 Claims

## ABSTRACT OF THE DISCLOSURE

The invention is directed to a method for splicing relatively thick, cardboard webs wherein a simple overlap splice is first effected whereupon the spliced web is directed through abrading means to thereby reduce the double web thickness of the splice to substantially normal web thickness.

The invention pertains to web handling machines. It is directed more specifically to an improved method and apparatus for splicing web material, particularly cardboard or the like relatively thick material while said material is being fed at a constant speed to a web processing machine.

In the operation of web processing machines such as rotary printing presses and rotary die cutting and creasing presses, it is highly desirable, once the machines have been set in operation, to keep them running at a constant speed for as long as possible and preferably until a given job is completed. This is important because each time such press is tripped, slowed-down or stopped, a finite period of time is required before the various mechanisms of the press regain a state of equilibrium or balance at the normal running speed. Until this balanced state is achieved, the products produced are not generally of an acceptable quality and they are accordingly disposed of as waste. Therefore, any means whereby frequent changes in the normal operation of these presses can be avoided constitutes a significant advantage to the operators.

One of the primary and heretofore unavoidable reasons for interrupting the normal operation of cardboard processing machines at frequent intervals has been due to the splicing function. Obviously, it would be advantageous to employ "flying pasters" for this purpose, such as are commonly used in conjunction with newspaper presses and which would be capable of effecting splices at normal press speed. This has been impracticable heretofore, however, because such devices form an over-lap splice and the resultant double thickness of cardboard at the splice would far exceed the permissible limits of the processing machine. Consequently, it would be necessary to trip the units to avoid smashing the coacting elements as the splice passed through. Not only would this require special detectors and timing means for coordinating the tripping motion with the movement of the splice, but such tripping of the units also would disturb the balanced condition of the press. Therefore, any advantage gained by effecting the splice at press speed would be offset by the tripping action and the resultant amount of waste incurred.

It has been the general practice therefore to employ special devices for making butt-joint splices in cardboard webs to eliminate the need for tripping the press units. The latter devices have been used quite extensively but they do not eliminate the problem. To make a butt splice it is necessary that the web be stopped, at least momentarily. Although some of the splicers incorporate web reservoir means so that the press proper does not have to be stopped completely while the splice is made, nevertheless they do require that the speed of the press be substantially reduced. Consequently, this disturbs the normal running balance or equilibrium of the press with the result that a substantial amount of waste is incurred until the press returns to normal operation.



The present invention completely overcomes the disadvantages of the known splicing systems and contemplates a method and apparatus which will enable splices to be made in cardboard webs without in any way disturbing the normal operation of the press. In accordance with the invention an overlap splice may be effected by means of a conventional flying paster device after which the excess thickness of the web in the area of the splice is reduced to substantially normal web thickness before it enters the processing machine. Moreover, special means may be provided for treating the web after the excess thickness has been removed so that in many instances, not even the spliced area of the web need be wasted.

It is a primary object of this invention, therefore, to provide an improved method and apparatus for splicing relatively thick cardboard webs which can be accomplished while the web processing machine continues to operate at a normal speed.

Another object of the invention is to provide a splicing system for cardboard webs which includes the step of forming an overlap splice by means of a conventional high speed flying paster and which includes the provision of means for reducing the thickness of the web in the area of the splice before the latter enters the processing machine.

A further object resides in the provision of means for cleaning and treating the web in the area of the splice to thereby preclude problems which may be caused by loose fibers or particles clinging to the web.

Other objects and advantages will become apparent from the following description and the accompanying drawings which illustrate a preferred embodiment of the invention and wherein;

FIG. 1 is a relatively schematic side elevational view of a web feeding and splicing apparatus, incorporating the novel features of this invention;

FIG. 2 is an enlarged sectional view illlustrating how the leading edge of a new roll of web material is spliced to the web being fed from an expiring roll;

FIG. 3 is an enlarged sectional view illustrating the appearance of the completed splice and how the lead edge of the new roll preferably is prepared prior to the splicing operation; and,

FIG. 4 is an enlarged sectional view illustrating how the excess thickness of the web is removed in the area of the splice prior to entering the processing machine.

With reference now to the drawings, the invention is disclosed in conjunction with a web feeding mechanism which includes a conventional turnover supply roll stand indicated by the reference number **10** which is adapted to provide a support for two rolls of web material to be processed. One roll **11** is shown as located in the feeding position and the web **12** which is being withdrawn therefrom, is directed over a series of guide rollers **13, 14, 15, 16** and **17** to the rollers **18, 19** and **20** of a conventional infeed unit which serves to withdraw the web from the roll **11** and feed it at the proper rate into a converting machine such as a rotary printing or die cutting and creasing press.

The other roll **21** represents a fresh roll of the web material which has previously been prepared for the splicing operation and it is shown as being located in the standby position preparatory to being spliced to the web **12** as the roll **11** is about to expire. Although the respective associated mechanisms have not been shown, since they form no part of the present invention, it will be understood that the roll stand **10** includes suitable brake means for controlling the speed of the rolls **11** and **21**

whereby to maintain the desired tension in the web as it is being withdrawn. Also, suitable drive means are provided for accelerating each new roll, such as the roll **21**, up to the speed of the web **12** prior to effecting a splice and, of course, means are provided for rotating the rolls **11** and **21** bodily about the axis of the main supporting shaft **22** of the roll stand between the feeding and standby positions.

As the web **12** travels from the roll **11** to the guide roller **13** it normally is spaced a short distance from the periphery of the new roll **21** in the standby position. However, when a splice is made, the web **12** is pressed against the periphery of the new roll, which at that time has been accelerated up to the linear speed of the web **12**, by means of a presser roll **23** that is located below the path of the web and adjacent the new roll **21**.

The presser roll is adapted to be moved between a retracted position wherein it is spaced a substantial distance from the web **12**, a ready position wherein it supports the web **12** closely adjacent but not in contact with the new roll **21**, and a splice position wherein it presses the web **12** into intimate contact with the surface of the new roll **21**. For this reason it is journalled for rotation in spaced arms **24** that are pivotally mounted on a cross shaft **26** and these arms in turn are adapted to be moved between the respective positions by means such as the air cylinders **27** which are pivotally connected to the arms as at **28** and to a frame member as at **29**.

The arms **24** also provide support for a knife **30** which extends transversely across the path of the web and which is adapted to sever the trailing portion of the web **12** upon movement of the presser roll **23** to the splice position.

The apparatus described thus far is essentially the same as that commonly used for feeding and splicing webs being fed to newspaper presses. In this standard procedure, the new roll **21** of newspaper stock is made ready for the splicing operation when it is first installed on the roll stand so that the splice can be effected at the required time without interrupting the operation of the press. The make-ready essentially consists of taping the lead edge of the new web roll in position so that it will not unwind when the new roll is accelerated up to web speed and applying a band of adhesive on the outer surface of the new web roll adjacent the leading edge thereof so that when the expiring web is pressed against the periphery of the new web roll, the leading edge thereof will break away from the roll and adhere to the web. Simultaneously with the pressing of the web against the new web roll, the knife **30** severs the trailing portion of the expiring roll so that the splice is completed and the web will commence to be fed from the new roll.

This procedure obviously produces an overlap splice, but because newspaper stock is relatively thin, ranging in thickness from about .003" to .004", the double thickness of the splice can be accommodated by the press units. Cardboard, on the other hand, ranges between about .012" to .040" in thickness, and therefore, the double thickness of a conventional overlap splice would far exceed the limits of any converting machine and would necessitate tripping of the working members.

Accordingly, the present invention contemplates an improved method of splicing cardboard which utilizes the known mechanisms but which introduces a novel variation in the make-ready procedure for the new roll and the addition of means for conditioning the web after a splice has been made.

With reference now to FIGS. 2 and 3 a preferred method of the invention contemplates preparing the new roll, when it is first mounted in the roll stand, by beveling or chamfering the leading edge **31** thereof so that it will taper from substantially a knife edge as at **32**, to the full web thickness as at **33**. The length of the taper may vary with relation to the thickness of the web, but it should not be substantially less than about two inches so as to provide adequate surface area for an effective splice.

Upon completing the preparation of the lead edge of the new web roll, it is attached by suitable tape or other adhesive to the surface of the roll so that it will not unwind when the new roll is accelerated up to the speed of the running web and the beveled surface **34** is coated with an adhesive so that it will adhere to the running web when the latter is pressed into contact with the periphery of the new roll by the presser roll **23**.

It will be apparent that when initially mounted on the roll stand and while it is being made ready, the new roll will occupy the position of roll **11** in FIG. 1. At this time the web will be feeding from a roll in the position of roll **21** in FIG. 1. After preparation of the new roll is completed, the roll stand will be actuated to move the new roll to the stand by position of roll **21** and the latter roll will be moved to the feeding position of roll **11**.

When the roll **11** reaches a predetermined minimum diameter, the new roll **21** will be accelerated up to the speed of the running web **12** by any conventional means commonly used for this purpose. Following this action the air cylinders **27** will be activated to move the presser roll to the ready position wherein it supports the web **12** closely adjacent, but slightly spaced from the new roll **21**. Thereafter, when the expiring roll **11** has reached a further predetermined minimum diameter, the air cylinder will be activated to move the presser roll **23** to the splice position wherein the expiring web **12** will be pressed against the new roll, as illustrated in FIG. 2, and the adhesive on the tapered surface **34** of the new roll will cause the leading edge thereof to adhere to and follow the expiring web **12**. At the same time or immediately thereafter the knife **30** will cut off the trailing portion of web **12**.

In order to assure that the splice is sufficiently secure as to carry the new web through the following splice processing stations, the web is directed through a nip formed by the idler roller **13** and a pressure roller **36** so that the leading edge of the new web roll will be positively secured to the expiring web **12**. The roller **36** preferably comprises a cylinder having a continuous surface and it is journalled for rotation in adjustable eccentric bearing housings **37** or equivalent structure which will provide for adjustment of said roller **36** relative to the idler roller **13** in accordance with the thickness of the web material. The roller **36** may be driven constantly at the same speed as the roller **13** through intermeshing gears on the respective roller shafts, but such drive preferably would include clutch means so that the roller **36** could be disengaged from the drive and remain idle except when a splice is made. The bearing housings **37** also are connected to trip means, not shown, but which are effective to rotate the bearing housings so that the roller **36** can be maintained in a tripped position, spaced from the roller **13**, except when a splice is made.

The trip mechanism preferably is adapted to be actuated so that it will move the roller **36** to its operative position upon actuation of the presser roll **23** and then return said roller to its inoperative, tripped position immediately after the splice has passed.

After passing through the nip of the rollers **13** and **36**, the splice appears as illustrated more clearly in FIG. 3. It will be noted that the top surface of the web is substantially continuous, being interrupted only by a relatively fine line along the knife edge **32** of the new web roll. The old web **12**, on the other hand is deflected in a plane parallel to the tapered surface **34** of the new web from the point **32** to the point **33**. Accordingly, in this area of the splice the thickness thereof progressively increases from normal web thickness to substantially double web thickness at the point **33** and this double thickness continues for the length of the remaining tail portion **35** of the old web. It is essential, therefore, that the excess material in the area of the splice and the tail portion **35**

of the old web, be removed before the splice enters the converting machine.

Accordingly, upon passing through the nip of the rollers **13** and **36**, the web is directed through an abrading station which essentially consists of the idler roller **14** and a co-acting cylinder **38** which is arranged immediately below and parallel to the roller **14**. The cylinder **38** is adapted to be driven in a direction opposite to the movement of the web, as indicated by the arrows in FIGS. 1 and 4 and it has a continuous peripheral surface provided with abrading means, such as, for example, the abrasive granules **39** illustrated in FIG. 4. The abrasive granules are adapted to remove the excess material in the area of the splice as well as the tail portion **35** of the severed web as the splice passes through the nip of said roller and cylinder. The cylinder **38** is journalled for rotation in eccentric bearing housings **41** which are adjustable so that the surface of the cylinder can be spaced from the idler roller **14** in accordance with the thickness of the web material to be processed and the eccentric housings are also connected to suitable trip means, not shown, so that they can be actuated to move the cylinder between an operative position, as illustrated, and an inoperative position wherein it is spaced a substantial distance from the roller **14**.

Under normal circumstances, the cylinder **38**, in its operative position, would be spaced from the idler roller **14** a distance slightly less than the thickness of the web. Accordingly, as the splice passes through the nip of said rollers, as illustrated in FIG. 4, the abrading cylinder **38** will grind away the excess thickness of the web material so that the area of the splice will be substantially the same thickness as the remainder of the web.

Moreover, it will be seen that as the splice passes between the roller **14** and abrading cylinder **38**, the said cylinder will remove that material constituting a portion of the initial or original web **12**. Consequently as it reaches a point adjacent the end **33** of the tapered portion **34** of the new web, it will cut through and thereby sever the loose tail portion **35** of the old web so that it will not be carried through the converting machine.

If desired, vacuum means as represented by the chamber **43** may be positioned adjacent the entry side of the nip to entrap and remove the dust particles created by the abrading cylinder **38**.

In many circumstances, the web may be directed from the abrading station directly into the infeed rollers and thence into the converting machine. On the other hand, if the web is to be fed into a printing press it is desirable that all dust and loose particles be removed therefrom so that such particles will not affect the printing or contaminate the ink. In such case, upon leaving the cylinder **38**, the web is directed through a vacuum cleaning station which essentially consists of a chamber **44** having rotary brushes **45** mounted therein on each side of the web and which remove the dust and loose particles from the web.

With the apparatus arranged as shown in FIG. 1 it will be noted that the new web is spliced to the top surface of the expiring web. Therefore this surface, which is adapted to receive subsequent processing, is not marred by the abrading means and if the lead edge of the new roll has been properly prepared, and carefully beveled the splice will be virtually undetectable and the product formed or printed on the splice will, in many instances, be acceptable.

If the web is to be perfected, however, i.e. printed on both sides, the rough, abraded side of the splice would be objectionable and the product formed or printed thereon would have to be discarded. Accordingly, the invention contemplates the provision of a web reconditioning unit **46** consisting of a chamber **47** which contains spray nozzles **48** or the like for spraying a surface coating material onto the abraded portion of the web and which nozzles can be on either one or both sides of the web. After passing the spray nozzles, the web is then directed between finishing rollers **49** which serve to distribute and smooth out the coating material so as to provide a uniform, smooth coated surface over the abraded area, whereupon the web is directed through a drying unit **51** to dry the coating material before it enters the infeed unit.

Under some circumstances and depending upon the material in the web, it may be desirable to perform the abrading function in two or more steps. In such case the abrading cylinder **38** would be provided with a relatively coarse granular coating and it would serve to remove the major portion of the excess splice material. A second abrading cylinder **52** would then be positioned immediately after cylinder **38** and adjacent roller **14**. The second abrading cylinder would be similarly mounted and actuated but it preferably would be coated with finer granules so as to provide a smoother finish on the web.

It will also be noted that in the arrangement thus far described, the new web is spliced to the top surface of the expiring web and the excess material is removed from the bottom thereof. In some instances it may be desirable or imperative that the new roll be spliced to the bottom surface of the expiring web. In such case the direction of the web could be changed by employing additional guide rollers so that the foregoing abrading rollers would operate on the top surface thereof. However, another abrading cylinder **53** could be provided adjacent the idler roller **15** to take care of such situations. Under such circumstances the abrading cylinders **38** and **52** would be tripped to an inoperative position.

The provision of an additional abrading roller **53** has the further advantage in that it can be used in conjunction with the preceding abrading cylinders whereby the make-ready procedure of the new rolls could be simplified. If, for example, it is impracticable to bevel the leading edge of the new roll as illustrated in FIG. 2, it would still be possible to utilize an over-lap splice without incurring the above mentioned problems. In such event, a simple over-lap splice could be made which would first be passed through the nip of the roller **14** and abrading cylinder **38** which latter cylinder would be spaced from the roller **14** so that it would remove substantially only one-half of the excess over-lap thickness from one side of the web. Thereafter, the web would pass through the nip formed by the abrading cylinder **53** and the idler roller **15** which would be set so as to remove the remaining excess thickness of the splice from the other side of the web. Accordingly, the splice would be reduced to normal web thickness in two successive steps, one on each side thereof and could then pass through the press without necessitating tripping of the units.

In a splicing system of this type, it will be appreciated that suitable trip mechanisms are incorporated therein for moving the various rollers, cylinders and web reconditioning members between operative and inoperative positions relative to the web. For convenience purposes, the mechanisms for effecting such tripping motions have not been shown because they are not critical to the invention and any of the well known conventional arrangements may be employed. In other words, any suitable mechanical, hydraulic, pneumatic or electrical device may be employed to impart the necessary angular motion to the eccentric bearing housings **37–41** etc. to thereby shift the cylinders between operative and inoperative positions. Furthermore, these devices would be responsive to a splice detector or possibly the movement of the presser roll **23** to the splice position, so that they would be moved to and from their operative positions sequentially and in timed relation with the passing of the splice.

The said tripping devices also would be connected to the bearing housings by means including, for example, an adjustable turnbuckle or worm and worm gear means whereby the housings can be adjusted relative to the trip mechanism to position the abrading cylinders, etc. rela-

tive to the coacting guide rollers in accordance with the thickness of the cardboard to be processed.

All of the abrading rollers would be rotated in a direction opposite to the direction of the web travel and they may be actuated from the main drive through suitable gearing and clutch means or they may be driven by independent drive means which would be energized only when a splice is to be made.

It should also be understood that whereas we have referred to abrading cylinders herein and more specifically to cylinders having granules applied to or coated on their surface, this is not to be regarded as a limitation. Actually any suitable cutting, shaving, grinding or sanding means may be utilized for this purpose, such as a milling cutter, or a grinding cylinder for example, and therefore the term abrading means or abrading cylinder as used in the foregoing description and in the appended claims is intended to encompass any such means which may be utilized to cut, shave, grind, sand or otherwise remove the excess thickness of the web.

Having thus described a preferred embodiment and method of invention;

What is claimed is:

1. The method of splicing a new roll of relatively thick web material to a web of like material traveling at a constant speed from an expiring roll to a converting machine comprising, the steps of beveling the lead edge of the new roll while at rest to provide a tapered surface for contact with the traveling web, applying adhesive along the tapered lead edge of the new roll also while it is at rest, then accelerating the new roll up to the speed of the traveling web, pressing the traveling web against the periphery of the new roll whereby the adhesive coated leading end of the new roll adheres to and travels with the traveling web and forms an over-lap splice of substantially double web thickness, severing the trailing portion of the traveling web after the splice is effected and while the traveling web continues to advance at a constant speed, and passing the traveling web and the over-lap splice at the same constant speed through an abrading station to remove the excess thickness of web material in the area of the splice.



2. The method as set forth in claim 1, including the additional step of passing said web through a cleaning station after it has passed through the abrading station to remove dust and lint from the abraded splice before it enters the converting machine.

3. The method as set forth in claim 1, including the steps of applying coating material to the abraded surface of the web, smoothing and distributing the coating material uniformly over the abraded area, and then drying the coating material before it enters the converting machine.

4. The method as set forth in claim 1 including the step of passing the web through a second abrading station to thereby smooth the rough, abraded surface of the splice after it leaves the first abrading station.

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