Oct. 9, 1945. O. C. ROESEN 2,386,345

DEVICE FOR SPLICING WEBS

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Fig. 1.

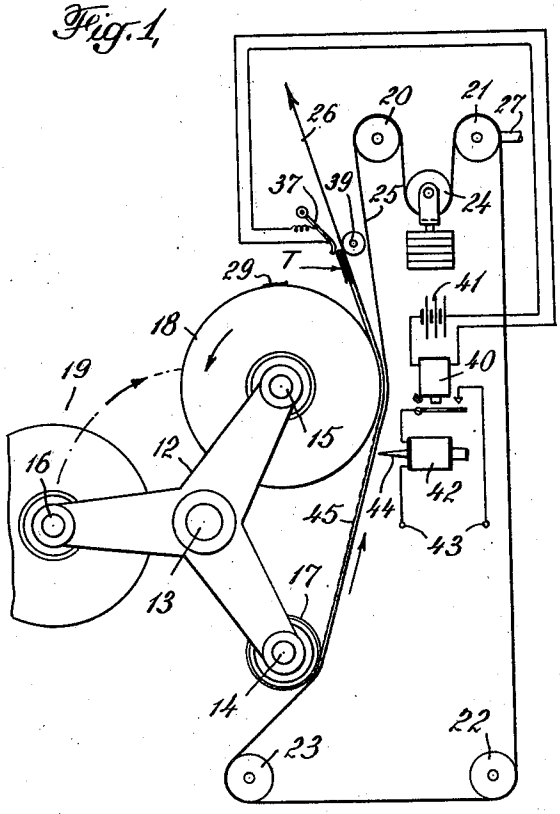



Fig. 2.

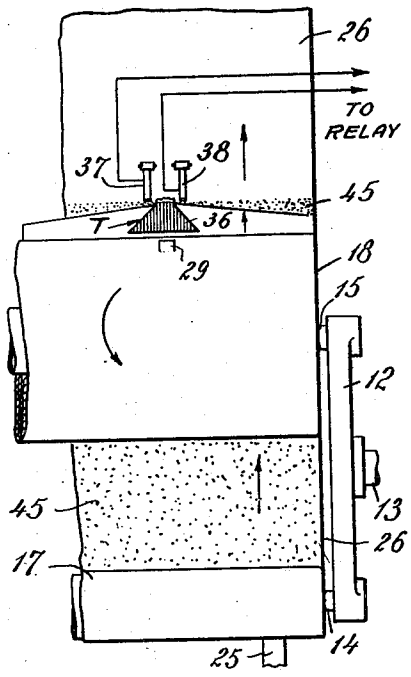



Fig. 3.

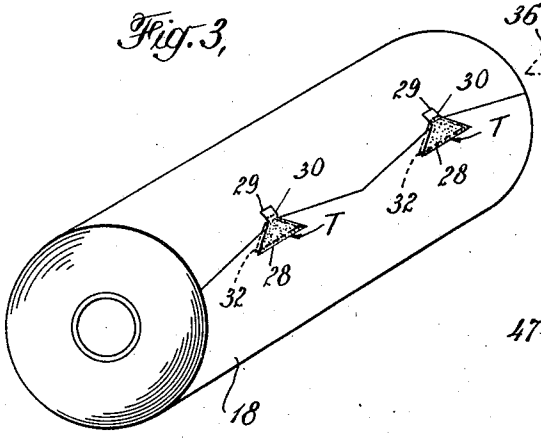



Fig. 4.

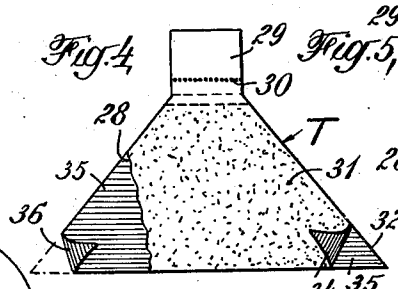



Fig. 5.

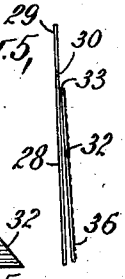



Fig. 6.

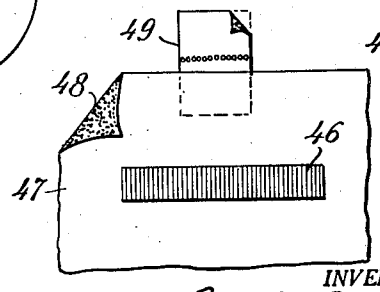
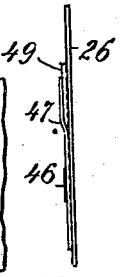



Fig. 7.




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Fig. 8

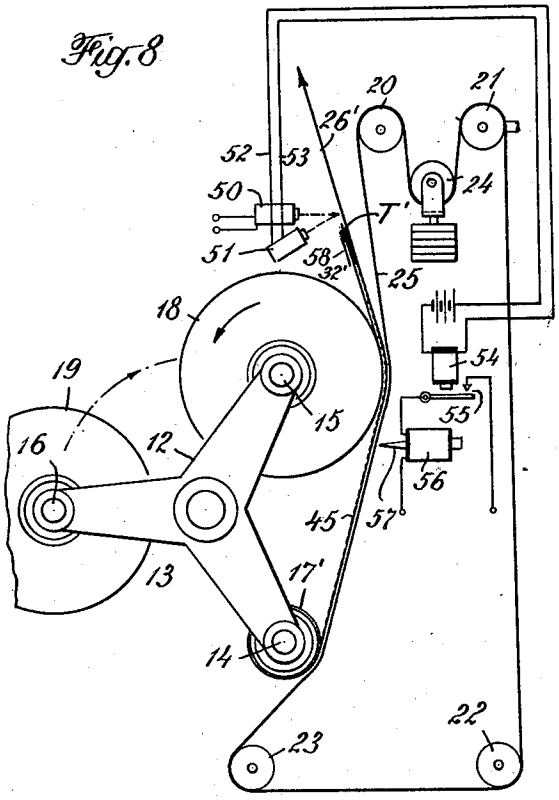



Fig. 9.

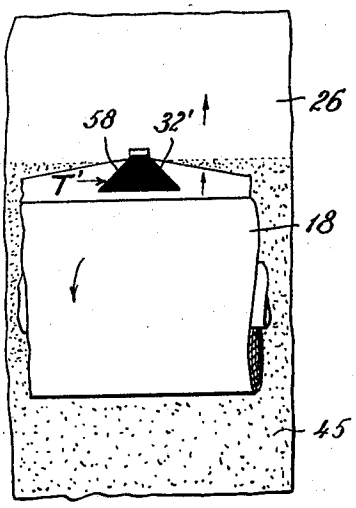



Fig. 10.

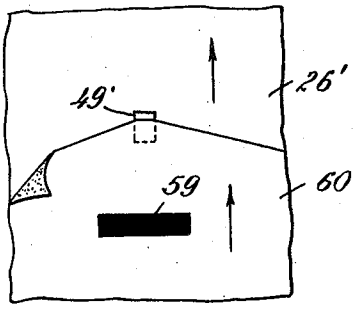
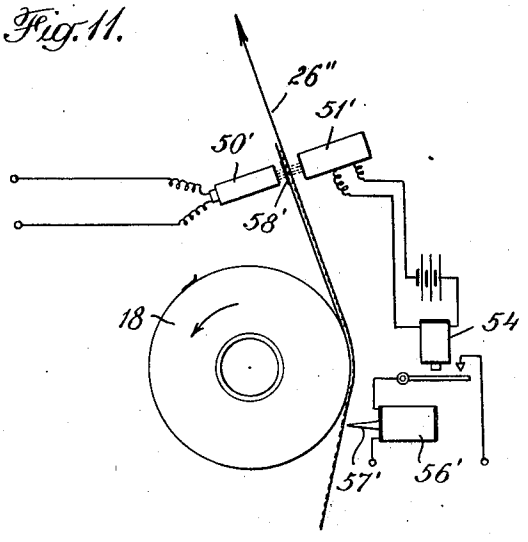



Fig. 11.




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# UNITED STATES PATENT OFFICE

2,386,345

## DEVICE FOR SPLICING WEBS

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Application February 16, 1944, Serial No. 522,579

15 Claims. (Cl. 242—58)

This invention relates to the splicing of webs and more particularly concerns the splicing of the leading end of the web on a new or replacement web roll to the core or inner end of a similar web from another roll while the latter web is running to a printing press or other web consuming apparatus.

The paper or other flexible web fed to a printing press, wrapping machine, roll winding machine or other web consuming mechanism is fed from rolls which must be replaced periodically as they are consumed. It is desirable that the roll replacement be made without stopping or retarding the speed of operation of the web consuming apparatus. It is further desirable that the old or expiring web roll be substantially completely used before the web running therefrom is spliced to that from a new roll.

High speed web roll changing has heretofore been accomplished by mechanism in which a new roll bearing a layer of adhesive at its leading edge is accelerated to a surface velocity substantially equaling the speed of the running web, and thereafter when the roll supplying the running web has been substantially consumed, the running web is pressed against the periphery of the new roll at a suitable point and the splice is made when the adhesive on the new web contacts the running web, after which the web from the expiring roll is severed. The point at which the splice is made is customarily judged by the operator, and since failure to splice before the old roll runs out seriously delays operation of the web consuming mechanism, the operator usually splices when there is still an ample reserve of web left on the old roll. This amount of web is therefore wasted.

By the method and apparatus described and claimed in my Patent No. 2,320,656, a web roll may be replaced without substantial wastage of web from the expiring roll, since the point in the running of the old roll at which the splice is made is determined by a layer of special adhesive at or close to the core end of the running web. However, that method and the above described older splicing methods necessarily leave a considerable overlap or tail of the old web trailing behind the point where the old and new webs are spliced together, this tail resulting from the fact that the webs travel at a high velocity at which it is impossible for the operator to actuate the old web severing mechanism quickly enough after the splice is made to cut the old web close to the splice. A long tail of web trailing behind the splice is undesirable for various reasons. Products such as printed pages, wrappers, etc., formed from the double thickness web must be discarded, and the long web tail frequently flies out from the running web particularly at points where the web turns at sharp angles in passing through the press or other apparatus with the result that the tail becomes fouled with another section of the web or with other mechanism.

I have heretofore devised a method and apparatus for insuring severance of the old web close to the space, as described and claimed in my co-pending application Serial No. 483,045, filed April 14, 1943. It is proposed in accordance with the present invention to provide improved means for severing the web running from an expiring roll close to the point where a new web end is spliced to the running web. The invention also embraces improved means for both splicing a web from a new roll to a web running from an expiring roll close to the end of the expiring web and severing the web from the expiring roll at a point close to that at which the splice is made. It is further proposed to provide means of the type described including a device which also incorporates means for removably securing the leading end of the web on the new roll to the new roll surface while that roll is being accelerated. More particularly, in a preferred form of the invention, I propose to employ a tab or analogous device which releasably secures the leading end of the new web to its roll, which causes adherence between such leading web end and the running web and which further acts, after the splice is made, to control the severing of the old web close behind the splice.

In describing the invention in detail, reference will be made to the accompanying drawings in which certain embodiments of the invention are illustrated. In the drawings:

Fig. 1 is a diagrammatic elevation illustrating apparatus embodying the invention as applied to a paper web splicing operation;

Fig. 2 is a front elevation of a portion of the mechanism shown in Fig. 1;

Fig. 3 is a perspective view of a new web roll prepared for use in the apparatus of Figs. 1 and 2;

Fig. 4 is an enlarged plan view of a web end tab device embodying the invention;

Fig. 5 is an edge view of the tab shown in Fig. 4;

Fig. 6 is a plan view of a new roll web end prepared for splicing in accordance with a modification of the invention;

Fig. 7 is an edge view of the web end shown in Fig. 6 after the splice is made;

Fig. 8 is a diagrammatic side elevation of apparatus similar to that shown in Fig. 1 and embodying a modified form of the invention;

Fig. 9 is a partial front elevation of the apparatus shown in Fig. 8;

Fig. 10 is a partial elevation illustrating a pasting operation performed with the means illustrated in Figs. 6 and 7; and

Fig. 11 is a side elevation of apparatus similar to that illlustrated in Fig. 8 showing a modified form of responsive means.

Referring to Fig. 1, I have illustrated a conventional 3-roll reel 12 which is rotatable about a central axis 13 and carries three web rolls on spindles 14, 15 and 16. As shown, the spindles 14 carry a web roll 17 that is substantially consumed, and new web rolls 18 and 19 are respectively mounted on the spindles 15 and 16. A set of conventional tension belts extends parallel to the roll surfaces around the idler rollers 20, 21, 22 and 23, and a weighted or otherwise biased idler roller 24 maintains the belts 25 at the desired tension. The belts 25 are preferably driven at a speed substantially equal to that of the running web 26 by suitable means such as a shaft 27 connected with the press or other web consuming apparatus. The belts 25 are narrower than the web 26 and in accordance with the conventional practice may be spaced apart transversely of the web, although this arrangement is not essential to the invention.

In accordance with the present invention, a control actuator is provided on the under surface of the web on a new roll adjacent the leading end of this web, and means responsive to the passage of such control actuator are located adjacent the running web just beyond the point where that web engages the new roll surface. The actuator responsive means controls the operation of a knife or other web severing device that cuts the web from the expiring roll just after the splice is made. The arrangement is such that when the leading end of the new roll web is spliced to the running web and so pulled away from the new roll surface, the under surface of this web end is immediately moved past the responsive means, thus releasing or extending the knife which cuts the old web close behind the splice.

Each new roll of the web is prepared for splicing by removably securing the leading end of the web thereon to the underlying layer of web forming the roll surface. In accordance with one aspect of the invention, this is accomplished by an improved tab device T illustrated in Figs. 4 and 5. The embodiment of my improved tab there illustrated comprises a sheet of paper or other thin flexible material having an outer web end surface-engaging portion 28 and a roll surface-engaging portion 29 separated by a weakened portion which may comprise a transverse row of perforations 30. The outer surface of the portion 28 carries a layer 31 of a special self-sticking adhesive which is of the nature of a rubber cement. Adhesives of this type are described in detail in my Patent No. 2,320,656. As there explained, this self-sticking adhesive has the properties of adhering tenaciously to the paper or other web when applied thereto in liquid form, but when dried, the surface of the adhesive layer does not adhere to an uncoated web surface. The dried self-sticking adhesive coatings cohere tenaciously with similarly applied and dried coatings.

The under surface of the outer web surface-engaging portion 28 of the tab T carries a layer of gum or adhesive 34 of known conventional type which may comprise a dried water soluble adhesive such as that used on gummed tapes and envelope flaps. An inner web surface engaging-portion 32 underlies the portion 28 and may be permanently secured thereto at 33 by glue or other suitable means. The surface of the portion 32 adjacent the portion 28 carries a layer of gum or like dried water soluble adhesive 35. The other surface of the portion 32 carries a layer or coating 36 of electrically conductive material such as metal foil or metallic paint.

One or more of the tabs T may be employed to removably secure the leading end of the new roll web to the roll surface. Each tab T may be secured to the leading web end at or adjacent a leading point thereon as shown in Fig. 3. The outer portion 28 of the tab is stuck to the outer surface of the web by the adhesive 34, and the inner portion 32 is stuck to the under surface of the web end by the adhesive 35. The roll surface-engaging portion 29 is stuck to the roll surface adjacent the web end by any suitable strong adhesive which may comprise a layer of dried water soluble gum or adhesive carried by the portion 29.

In the embodiments of Figs. 1 to 6, the actuator responsive means comprises a pair of electrically conductive brushes or arms 37 and 38 suitably supported to engage the inner surface of the running web 26 just beyond the point where this web engages the new roll surface. If necessary or desirable, a roller 39 or other backing means may be disposed in contact with the running web 26 opposite the point of contact of the brushes therewith. The brushes 37 and 38 are connected in a circuit including in series a relay 40 and a source of energy illustrated by the battery 41. The relay 40 is arranged when energized to close a circuit including a knife operating solenoid 42 and a source of energy represented by the terminals 43. With the disclosed arrangement, when the brushes 37 and 38 are electrically connected, the relay 40 and the solenoid 42 are successively energized and a knife 44 is propelled outward between the belts 25 to cut the web from the expiring roll 17 close behind the splice. The knife solenoid 42 may be carried by a pivoted arm or other movable support so that it may be moved out of the path of the reel carried rolls when the reel is rotated, in accordance with conventional practice.

The web on each roll carries a layer 45 of the above described self-sticking adhesive on its inner surface adjacent its core end. This layer 45 extends longitudinally of the web for a distance at least equal to the circumference of the largest new web roll employed.

When the roll 17 has run off to the point where replacement must soon be made, the reel 13 is turned clockwise to bring the new roll 18, prepared as described above, into contact with the running web 26, backed by the belts 25. Such contact accelerates the new roll to web speed. When the roll 17 is substantially used up, the adhesive layer 45 comes in contact with the surface of the new roll 18, but because of the above explained nature of this adhesive, the layer does not stick to the uncoated surface of the new roll. When the leading end of the new roll web contacts the adhesive layer 45 on the running web 26, the self-sticking adhesive 31 on the tabs T is tightly stuck to the running web by the co-

herence of the adhesive layers 31 and 45. The leading end of the new web is then pulled from the new roll surface, the tabs T breaking along the row of perforations 30, and the conductive coating 36 on the tab portion 32 is moved past the brushes 37 and 38 and electrically connects them, thereby operating the knife 44 as explained above. In this manner, the splice is automatically made adjacent the end of the expiring web, and that web is cut close to the splice so that the formation of a long trailing web tail is avoided. The brushes 37 and 38 are so disposed transversely of the web as to be aligned with one of the tabs T as best shown in Fig. 2.

The knife actuating conductive layer need not comprise a part of the new roll and securing tab, but may be a layer or coating 46 of metal foil or paint applied to the under surface of the new roll web 47 adjacent its leading end, as shown in Figs. 6 and 7. As there illustrated, the self-sticking adhesive layer 48 may be applied directly to the outer surface of the new web end, and this end may be removably secured to the roll surface by any known means such as frangible gummed tabs 49 of the type described and claimed in U. S. Patent No. 1,996,497. The operation of this embodiment is the same as that described above in connection with Figs. 1 to 5. The modification of Figs. 1 to 5 permits application of the knife control actuator, the web end securing means and the web end adhesive in a single operation.

In a modified form of the invention illustrated in Figs. 9 to 11, the actuator responsive means comprise suitable devices sensitive to changes in the intensity of light. Thus as illustrated in Fig. 8, a beam of light is projected onto the under surface of the running web 26' from a suitable light source 50, and the reflected portion of that beam enters a photoelectric scanning device 51 of known construction. The arrangement is such that so long as the intensity of the reflected light beam entering the device 51 is above a predetermined value, a photoelectric cell or like light responsive means maintains the circuit between the wires 52 and 53 open, but when the intensity of the reflected light beam is reduced, as by a passage of a black or dark area on the web, the wires 52 and 53 are connected, the relay 54 is energized, closing its contacts 55, and the solenoid 56 is thereby energized and operates the knife 57 to sever the web from the expiring roll 17'. The control actuator may comprise a black or dark colored inner surface 58 on the inner portion 32' of a tab T' which is otherwise similar in construction to the tab T described above. The light projector 50 and scanning device 51 are so disposed laterally of the web that the reflected light beam passing between these devices strikes the web in alignment with one of the tabs T'. The operation of this modification of the invention will be apparent from the description of the apparatus shown in Figs. 1 through 7.

The control actuator may comprise a black or dark area 59 on the under surface of the new roll web 60 adjacent its leading end and independent of the web end securing tab 49'. This arrangement has been illustrated in Fig. 10.

The scanning device may be designed and arranged to be governed by light transmitted through the web rather than by light reflected therefrom. Such an arrangement is illustrated in Fig. 11, where the light source 50' projects a light beam through the running web 26'' from its under surface, and the scanning device 51' disposed adjacent the outer surface of the web maintains the relay 54' de-energized and the knife 57' retracted so long as a light beam of predetermined intensity passes through the web. When a control actuator such as a dark area 58' of a tab part intercepts the transmitted beam, the device 51' energizes the relay 54' which in turn energizes the solenoid 56' and projects the knife 57' outward to cut the web from the expiring roll close behind the splice. With the transmitted light arrangement of Fig. 11, the darkened area comprising the control actuator need not be on the under surface of the new web end or tab, but may be disposed on either surface thereof.

Scanning devices of the type illustrated at 51 and 51' are described more in detail in my co-pending application Serial No. 483,045, filed April 14, 1943, and entitled "Web splicing."

I claim:

1. In apparatus for splicing the leading end of the web on a new roll to a web running past the cylindrical surface of the new roll from an expiring roll after the new roll is accelerated to running web speed, in combination, a control actuator of electrically conductive material on the under surface of the new roll web adjacent its leading end and means responsive to movement of said control actuator along the path of the running web leaving the new roll surface for severing the web running from the expiring roll to the new roll surface immediately after the splice is made.

2. In apparatus for splicing the leading end of the web on a new roll to a web running past the cylindrical surface of the new roll from an expiring roll after the new roll is accelerated to running web speed, in combination with a layer of adhesive on the outer surface of the leading end of the new roll web for sticking said end to the running web, a layer of electrically conductive material on the under surface of the leading end of the new roll web, a pair of electrical contacts engaging the under surface of the running web where it leaves the new roll surface and adapted to be electrically connected by said layer of conductive material when the new roll web end moves past said contacts after the splice is made, and means for severing the web running from the expiring roll to the new roll surface when said contacts are so connected.

3. In apparatus for splicing the leading end of the web on a new roll to a web running past the cylindrical surface of the new roll from an expiring roll after the new roll is accelerated to running web speed, in combination, at least one tab removably securing the leading end of the new roll web to the roll surface including an under portion extending beneath said web end and secured thereto and a roll engaging portion separably connected to said under portion and fixed to the roll surface adjacent said web end, a control actuator on said under portion, and means responsive to the movement of said tab carried control actuator along the path of the running web leaving the new roll surface for severing the web running from the expiring roll to the new roll surface immediately after the splice is made.

4. In apparatus for splicing the leading end of the web on a new roll to a web running past the cylindrical surface of the new roll from an expiring roll after the new roll is accelerated to running web speed, in combination, at least one tab removably securing the leading end of the new roll web to the roll surface and including an

outer portion fixed to the outer surface of said web end, an under portion extending beneath said web end, a layer of splicing adhesive on the outer surface of said outer portion, a control actuator on said under portion and a roll engaging portion separably connected to said outer and under portions and fixed to the roll surface adjacent the web end, and means responsive to the movement of said tab carried control actuator along the path of the running web leaving the new roll surface for severing the web running from the expiring roll to the new roll surface immediately after the splice is made.

5. In apparatus for splicing the leading end of the web on a new roll to a web running past the cylindrical surface of the new roll from an expiring roll after the new roll is accelerated to running web speed, in combination, at least one tab removably securing the leading end of the new roll web to the roll surface including an under portion extending beneath and secured to said web end and a roll engaging portion separably connected to said under portion and fixed to the roll surface adjacent said web end, a layer of adhesive on the outer surface of the leading end of said new roll web, a control actuator on the under surface of said under tab portion, actuator responsive means adjacent the under surface of the running web where it leaves the new roll surface and actuated by the passage of said control actuator, and means governed by said actuator responsive means for severing the web running from the expiring roll to the new roll surface when said control actuator passes said responsive means.

6. In apparatus for splicing the leading end of the web on a new roll to a web running past the cylindrical surface of the new roll from an expiring roll after the new roll is accelerated to running web speed, in combination, at least one tab removably securing the leading end of the new roll web to the roll surface including an under portion extending beneath and secured to said web end and a roll engaging portion separably connected to said under portion and fixed to the roll surface adjacent said web end, a layer of adhesive on the outer surface of the leading end of the new roll web, a control actuator on the under surface of said under tab portion, a circuit closing device adjacent the under surface of the running web where it leaves the new roll surface and adapted to be actuated by the passage of said control actuator to close an electric circuit, and means for severing the web running from the expiring roll to the new roll surface when said circuit is closed.

7. In apparatus for splicing the leading end of the web on a new roll to a web running past the cylindrical surface of the new roll from an expiring roll after the new roll is accelerated to running web speed, in combination, at least one tab removably securing the leading end of the new roll web to the roll surface including an under portion extending beneath and secured to said web end and a roll engaging portion separably connected to said under portion and fixed to the roll surface adjacent said web end, a layer of adhesive on the outer surface of the leading end of the new roll web, a layer of electrically conductive material on the under surface of said under tab portion, a pair of electrical contacts engaging the under surface of the running web where it leaves the new roll surface and adapted to be electrically connected by said tab carried layer of conductive material when the new roll web end moves past said contacts after the splice is made, and means for severing the web running from the expiring roll to the new roll surface when said contacts are so connected.

8. In apparatus for splicing the leading end of the web on a new roll to a web running past the cylindrical surface of the new roll from an expiring roll after the new roll is accelerated to running web speed, in combination, at least one tab removably securing the leading end of the new roll web to the roll surface including an under portion extending beneath and secured to said web end, an outer portion fixed to and overlying the outer surface of the web end and a roll engaging portion separably connected to said under and outer portions and fixed to the roll surface adjacent said web end, a layer of adhesive on the outer surface of said outer tab portion, a control actuator on the under surface of said under tab portion, actuator responsive means adjacent the under surface of the running web where it leaves the new roll surface and actuated by the passage of said control actuator, and means governed by said actuator responsive means for severing the web running from the expiring roll to the new roll surface when said control actuator passes said responsive means.

9. In apparatus for splicing the leading end of the web on a new roll to a web running past the cylindrical surface of the new roll from an expiring roll after the new roll is accelerated to running web speed, in combination, at least one tab removably securing the leading end of the new roll web to the roll surface including an under portion extending beneath and secured to said web end, an outer portion fixed to and overlying the outer surface of the web end and a roll engaging portion separably connected to said under and outer portions and fixed to the roll surface adjacent said web end, a layer of adhesive on the outer surface of said outer tab portion, a layer of electrically conductive material on the under surface of said under tab portion, a pair of electrical contacts engaging the under surface of the running web where it leaves the new roll surface and adapted to be electrically connected by said tab carried conductive layer when the new roll web end moves past said contacts after the splice is made, and means for severing the web running from the expiring roll to the new roll surface when said contacts are so connected.

10. In apparatus for splicing the leading end of the web on a new roll to a web running past the cylindrical surface of the new roll from an expiring roll after the new roll is accelerated to running web speed, in combination, at least one tab removably securing the leading end of the new roll web to the roll surface including an under portion extending beneath and secured to said web end, an outer portion fixed to and overlying the outer surface of the web end and a roll engaging portion separably connected to said under and outer portions and fixed to the roll surface adjacent said web end, a layer of adhesive on the outer surface of said outer tab portion, a dark area on the under surface of said under tab portion, light responsive means adjacent the under surface of the running web where it leaves the new roll surface and actuated by the passage of said dark area and means governed by said light responsive means for severing the web running from the expiring roll to

the new roll surface when said light responsive means is so actuated.

11. A tab for removably securing the leading end of the web on a web roll to the roll surface while accelerating such roll and splicing such web end to a running web comprising a web engaging tab portion secured to and extending beneath the under surface of the web adjacent its end, a roll engaging tab portion secured to the roll surface adjacent the web end, a weakened portion separably connecting said tab portions and a control actuator on said web engaging tab portion.

12. A tab for removably securing the leading end of the web on a web roll to the roll surface while accelerating such roll and splicing such web end to a running web comprising a web end engaging tab portion carrying a control actuator on its under surface, a roll surface engaging tab portion, a weakened portion separably connecting said web end and roll surface engaging tab portions, and an adhesive on the under surface of said roll surface engaging portion and on the outer surface of said web end engaging portion for fixing said portions respectively to a roll surface and a web end.

13. A tab for removably securing the leading end of the web on a web roll to the roll surface while accelerating such roll and splicing such web end to a running web comprising an outer web end surface engaging portion, a layer of splicing adhesive on the outer surface of said outer portion, an under web end surface engaging portion, a control actuator on the under surface of said under portion, a roll surface engaging portion, a weakened portion separably connecting said roll surface engaging portion to said outer and under web end surface engaging portions, and layers of adhesive on the under surface of said roll surface engaging portion, the under surface of said outer web end engaging portion and the outer surface of said under web end engaging portion.

14. A tab for removably securing the leading end of the web on a web roll to the roll surface while accelerating such roll and splicing such web end to a running web comprising an outer web end surface engaging portion, a layer of splicing adhesive on the outer surface of said outer portion, an under web end surface engaging portion disposed beneath said outer portion and secured thereto adjacent one edge thereof, a layer of electrically conductive material on the under surface of said under portion, a roll surface engaging portion, a weakened portion separably connecting said roll surface engaging portion to said outer portion, and a layer of dried adhesive on the under surface of said roll surface engaging portion, the under surface of said outer web end engaging portion and the outer surface of said under web end engaging portion.

15. A tab for removably securing the leading end of the web on a web roll to the roll surface while accelerating such roll and splicing such web end to a running web comprising a web engaging tab portion secured to the web adjacent its end, a roll engaging tab portion secured to the roll surface adjacent the web end, a weakened portion separably connecting said tab portions and a control actuator on said web engaging tab portion.

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