March 9, 1965 J. M. SIMONS ETAL 3,172,613

METHOD AND APPARATUS FOR SPLICING A WEB OF SHEET MATERIAL TO A MOVING WEB

Filed July 3, 1963 2 Sheets-Sheet 1

Fig. 1

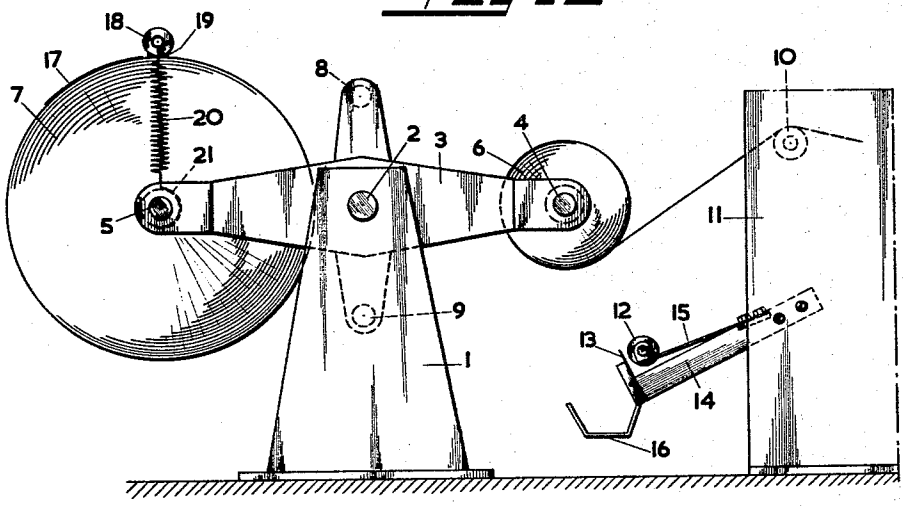
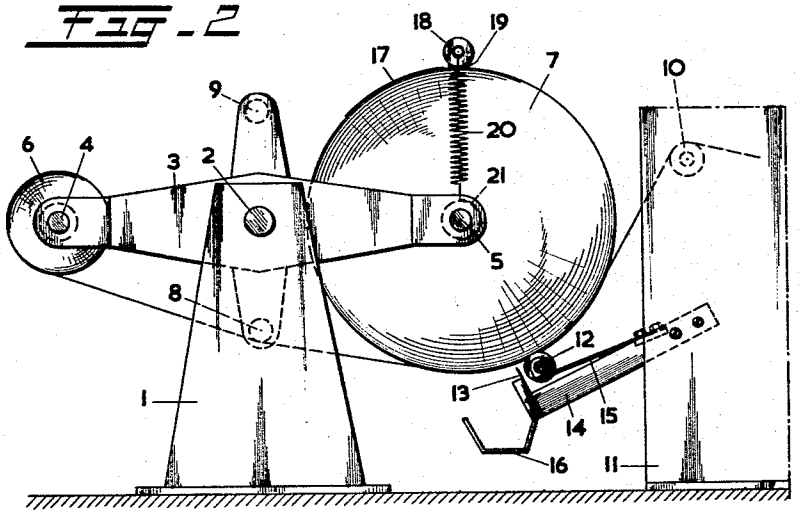


Fig. 2



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Fig. 3

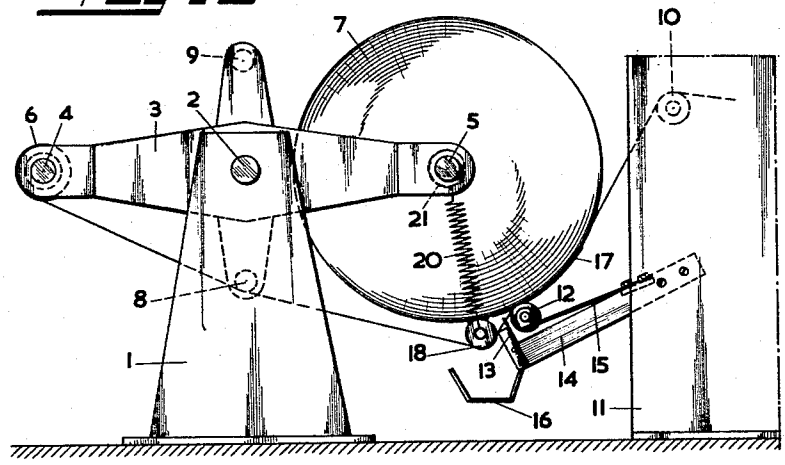
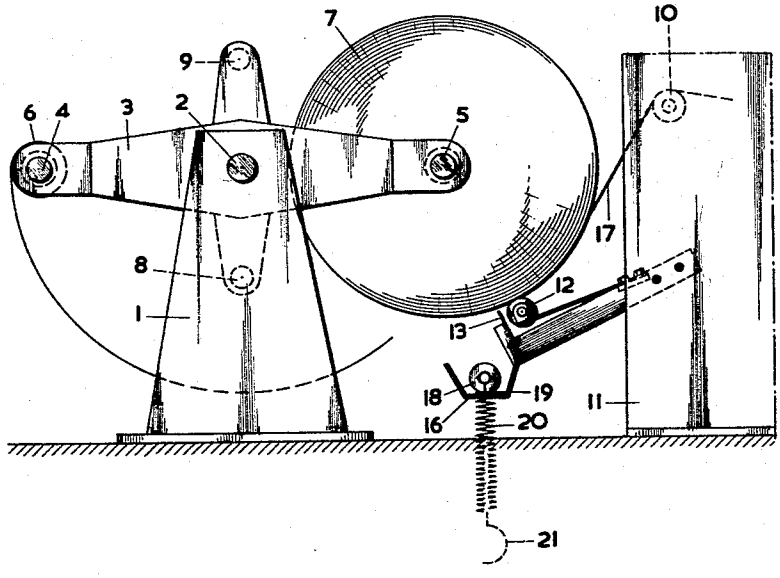


Fig. 4



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METHOD AND APPARATUS FOR SPLICING A WEB OF SHEET MATERIAL TO A MOVING WEB

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14 Claims. (Cl. 242—58.2)

The invention relates to a method and apparatus for splicing a web of sheet material in roll form to a moving web.

In a known method and apparatus the free end portion of the web of a fresh roll of sheet material is provided with adheesive and a portion of the web of the fresh roll following the free end portion is pressed against moving web, coming off a supply roll, the surface of the fresh roll being made to move along with the moving sheet material to splice the free end portion to the moving web by means of the adhesive, the moving web being subsequently severed behind the splice so effected.

A method and apparatus of the foregoing character are known from the United States patent specification No. 1,856,341 and from the article "Continuous Unwinding Equipment," by R. J. Jacobs in the "American Paper Converter" (May and June 1953.)

In apparatus of the foregoing character, severing is effected a short time after splicing with the result that a free flap of the web coming off the supply roll remains on the side of the splice, adjacent the fresh roll. In high-velocity machines (for instance with a web velocity of about 150 metres per minute), the length of this free flap can be large, and may result in damage to parts of the apparatus as well as to the sheet material of the web.

A free flap of the foregoing nature is especially troublesome when the sheet material is paper which is wetted in its passage through a machine. Owing to the capillary action of the space between the free flap and the web a considerable quantity of liquid is entrained in this space, and the strength of the paper is thereby reduced. In order to avoid this occurrence the wetting sections of the machine can be put out of operation during the passage of the free flap portion of the splice. This procedure however, is not very desirable as it is wasteful of material and time.

It is an object of the present invention to provide a method and apparatus of the general character described above but in which no free flap is formed, so that the difficulties referred to are avoided.

Another object of the invention is to provide a method and apparatus by which the splicing of a fresh web roll to a moving web can be effected so reliably that important savings of material otherwise wasted can be achieved, yet which are so simple and economical to install that existing rollstands can be readily adapted to give the savings.

According to the present invention there is provided a method of splicing an adhesive coated free end portion of a web withdrawable from a first roll thereof to a moving web issuing from a second roll, said method comprising effecting rotation of said first roll so as to cause the said adhesive coated free end portion to travel at substantially the same linear speed as the said moving web, effecting intimate contact between the traveling adhesive coated free end portion and the moving web whereby to splice the two together, and as the splice is made bringing a displacement member moving with the surface of said first roll into engagement with a portion of the moving web immediately behind said splice and displacing

said web portion away from the first roll by said displacement member so as to sever the moving web immediately behind said splice.

According to especially advantageous aspects of the invention, the displacement member is positioned onto a portion of the surface of the first roll located behind the adhesive coated end portion before the said rotation of the first roll is effected, and the displacement member is carried into engagement with the moving web portion behind the splice, so as to displace that web portion and sever it against a knife disposed adjacent to the first roll, by the said rotation of the first roll whereby the splicing is effected. Moreover, the displacement member is detachably positioned on the surface of the first roll so that it may be removed therefrom, as by blocking its movement while continuing the rotation of the first roll, after it has displaced the web portion behind the splice so as to sever the moving web.

The method according to the invention also comprises a method in which the first roll is rotated by bringing the said moving web into frictional contact therewith.

Apparatus for carrying out the method described above comprises means for rotatably mounting the said first and second rolls, means for effecting rotation of the first roll so as to cause the said adhesive coated free end portion to travel at substantially the same linear speed as the said moving web issuing from the second roll, means for effecting intimate contact between the adhesive coated free end portion and the moving web whereby to splice the two together, a blade arranged to sever the moving web immediately behind the said splice, and means for displacing a portion of the moving web immediately behind said splice away from the web issuing from the first roll and against the said blade.

Preferably the apparatus comprises means for rotatably mounting the said first and second rolls, a displacement member which may be detachably mounted on the first roll immediately behind the said adhesive coated free end portion so as to extend across the width of the respective web, means for bringing the moving web into frictional contact with the first roll to effect rotation thereof, a blade which is mounted adjacent the region in which the moving web makes frictional contact with the first roll, the arrangement being such that the rotation of the first roll will cause the adhesive coated free end portion to make intimate contact, and thus become spiced to, the moving web, and the displacement member being employable to cause the portion of the moving web immediately behind said splice to be severed by being displaced outwardly away from the first roll and against the blade, and means for effecting disengagement of the displacement member from the first roll.

A specific embodiment of apparatus according to the invention is illustrated merely by way of example in the accompanying drawings, in which:

FIGURE 1 is a side elevation of the apparatus in which those parts which are not essential for the invention are omitted, and

FIGURES 2–4 are similar side elevations diagrammatically illustrating the various positions which are occupied successively by the chief parts of the apparatus according to FIGURE 1 during different steps in the method according to the invention.

The apparatus illustrated comprises two frame plates 1, to which are fastened coaxial studs 2. Rotatably supported on each stud is a yoke 3. The yokes 3, which together form a rigid unit, can be rotated on the studs 2 (by means such as a motor, not shown). Rotatably mounted between the yokes 3 are removable spindles 4 and 5 which serve as holders for rolls of sheet material (such as paper) and freely rotatable guide rollers 8 and 9. The spindles 4 and 5, each of which carries a roll

of sheet material 6 and 7 respectively, are provided with means (e.g. pneumatically expanding clamping members) which serve to secure the rolls of material to the respective spindles. Each spindle is also provided with a braking device (such as a band brake engaging a brake pulley which is mounted on the spindle), by means of which rotation of the spindle can be prevented or the spindles decelerated. The roll 6 acts as a supply roll from which a web of sheet material passes around the guide roller 10, into a machine 11; the roll 7 is a fresh roll, which is to replace the roll 6 when the latter is used up.

A short distance beneath the spindle 4, there is mounted roller 12 and a fixed blade 13 the longitudinal direction of both being parallel to the axes of the spindles 4 and 5. The blade 13 is serrated in a conventional manner. The roller 12 and the blade 13 are located between levers 14, which are attached to the frame plates of the machine 11. If desired, the position of the levers 14 can be adjustable. The roller 12 is supported so as to be freely rotatable on leaf springs 15, which are mounted on the levers 14. A pair of hooks or a receiving basket 16 is also mounted on the levers 14.

Referring to FIGURE 1, when the supply roll 6 is nearly used up the fresh roll 7 is put in readiness on the spindle 5. The roll 7, like the roll 6, is wound anticlockwise (as illustrated) and its free end portion is provided with adhesive which serves to splice the fresh roll 7 to the web coming off the roll 6 in a manner to be described. The adhesive 17 may comprise conventional adhesive material applied in a known manner such, for example, as a combination of a coating of glue and strips of adhesive tape, the roll 7 being placed on the spindle 5 in such a way that the free end portion 17 is uppermost.

A tubular displacement member 18 is mounted immediately behind the free end portion 17 viewed from the leading edge of the roll 7, the member 18 resting on the upper surface of the roll 7. The axis of the member 18 is parallel to the axis of the spindle 5, and the member 18 is provided with a layer 19 of foam rubber or similar material, on the portion of its surface which rests against the roll 7. At its ends the displacement member 18 is provided with studs, which project beyond the roll 7, and to which are attached helical springs 20, one at each end of the roll. The other end of each of the springs 20 is formed into an open hook 21, which engages the end of the spindle 5 which projects beyond the roll 7. The hook 21 is bent in such a way that it just loops under the spindle 5, but can easily be removed sideways from the spindle 5.

The springs 20 are in slight tension so that the member 18 is held tightly against the surface of the roll 7.

Shortly before the roll 6 has been completely unwound the yokes 3 are rotated on the studs 2, clockwise according to the figures until the positions of the rollers 6 and 7 are interchanged, as shown in FIGURE 2, the roll 7 being rotated relatively to the yokes, as by being held against turning while the yokes are rotated, in such a way that it remains in the same orientation as shown in FIGURE 1, i.e. with the free end portion 17 and the displacement member 18 uppermost.

As the position of FIGURE 2 is approached the underside of the fresh roll 7 contacts the web of sheet material coming off the supply roll 6, and upon further rotation of the yokes 3 it pushes the web downwards. The tendency of the roll 7 to start moving along with the web owing to the friction between the moving web and the surface of the roll 7, is prevented by a braking device coupled with the spindle 5, and the web therefore slips over the surface of the stationary roll 7. Further rotation of the yokes 3 into the position shown in FIGURE 2 causes the moving web to bear against the guide roller 12, whereupon the guide roller 12 rotates freely due to the frictional contact with the sheet material. The guide roller 12 is held pressed over its whole length against the web by the leaf springs 15. When the supply roll 6 is nearly unwound and the fresh roll 7 is to be put into use, the braking device coupled with the spindle 5 is released, allowing the roll 7 to rotate due to the frictional contact of the moving web. After having rotated through a relatively small angle the surface of the fresh roll 7 has a circumferential velocity which is equal to the velocity of the web. The adhesive portion is thus brought into contact with the moving web and due to the tension in the web and under the pressure of the roller 12, the moving web is pressed against the adhesive portion with sufficient force to effect a splice. The fact that the roller 12 is spring-mounted allows the roller 12 to follow any irregularities in the roll 7, while maintaining the desired contact.

The tubular member 18 moves with the surface of the fresh roll 7 and, as is clear from FIGURE 3, pushes the moving web away from the roll 7 and against the blade 13. The moving web coming off the supply roll 6 is thereby severed immediately behind the spliced portion. From FIGURE 3 it is clear that no free flap is formed adjacent the splice.

Further rotation of the fresh roll 7 causes the displacement member 18 to impinge on the blade 13 or on other stationary machine parts in the vicinity of the blade, and consequently the tubular member 18 is not able to move any further. The continued rotation of the spindle 5 then causes the hooks 21 to be disengaged, so that displacement member 18 is released and drops into the receiving basket 16, as illustrated in FIGURE 4.

The remainder of the supply roll 6 is then removed and a further fresh roll 7 is placed on the spindle 4. The fresh roll 7 is then provided with an adhesive portion and the tubular member 18, springs 18, and hooks 21 placed in position on the fresh roll 7 as previously described. The displacement member 18 may be in the form of a rod, or a lath, or the like. Instead of using springs 20 and hooks 21, the member 18 can be held on the upper surface of the fresh roll 7 in some other way permitting easy release, for example the means of rubber suction pads or a pressure sensitive adhesive.

Instead of the apparatus described above, in which the holders of the rolls of web-shaped material are mounted in rotatable yokes, it is also possible to use apparatus in which the holders are movably mounted on a stationary supporting structure, as described in the article "Continuous Unwinding Equipment," by R. J. Jacobs, Examples 3 and 5.

What we claim is:

1. A method of splicing an adhesive coated end portion of a web withdrawable from a first roll thereof to a moving web issuing from a second roll, comprising effecting rotation of said first roll so as to cause said adhesive coated end portion to travel at substantially the linear speed of said moving web, effecting intimate contact between the traveling adhesive coated end portion and said moving web so as to splice the two together, and as the splice is made bringing a displacement member moving with the surface of said first roll into engagement with a portion of said moving web behind the splice and displacing said moving web portion away from the first roll by said displacement member so as to sever the moving web behind the splice.

2. A method according to claim 1, said rotation of said first roll being effected by holding said moving web in frictional contact with the surface of said first roll.

3. A method according to claim 1, said displacement member being brought into engagement with said moving web portion by rotating said member with a portion of the surface of said first roll located immediately behind said adhesive coated end portion.

4. A method according to claim 1, wherein by said displacing of said moving web portion the moving web behind the splice is pressed against and severed by a knife disposed adjacent to said first roll.

5. In a method according to claim 1, before effecting said rotation of said first roll positioning said displacement member onto a portion of the surface of said first

roll located behind said adhesive coated end portion, thereafter by said rotation carrying said displacement member on said surface portion into engagement with said moving web portion, and upon having displaced said web portion by said member so as to sever the moving web removing said displacement member from said first roll.

6. A method of splicing an adhesive coated end portion of a web withdrawable from a first roll thereof to a moving web issuing from a second roll, comprising detachably mounting on the surface of the first roll immediately behind said adhesive coated end portion a displacement member which protrudes radially from said surface and extends across the width of the moving web, effecting rotation of said first roll by holding said moving web in frictional contact with said surface, by said rotation bringing said end portion into intimate contact with and thus splicing it to said moving web and carrying said displacement member into engagement with the portion of said moving web immediately behind the splice, thus displacing said web portion outwardly away from said first roll and pressing it against a knife to sever the moving web, and then removing said displacement member from said first roll.

7. A method according to claim 6, said removing of said displacement member being effected by blocking further movement thereof with said surface while continuing the rotation of said first roll.

8. Apparatus for splicing an adhesive coated end portion of a web withdrawable from a first roll thereof to a moving web issuing from a second roll, comprising means for rotatably mounting the said first and second rolls, a displacement member adapted to be positioned on the surface of the first roll at a location behind said end portion so as to protrude radially from said surface and extend across the width of the moving web, means for bringing said moving web and said first roll into frictional contact to effect rotation of said first roll by said moving web, whereby said end portion is brought into contact with and spliced to said moving web, a knife for severing said moving web, said knife being mounted adjacent to the region of contact between the moving web and the first roll, and means for holding said displacement member positioned on said surface as aforesaid until the splice is made and thus causing said member moving with said surface to displace outwardly away from said first roll and against said knife the portion of said moving web immediately behind the splice, whereby to sever the moving web.

9. Apparatus according to claim 8, further comprising pressure means adjacent to said knife acting to keep a portion of the moving web ahead of said outwardly displaced portion in contact with said first roll.

10. Apparatus according to claim 9, said pressure means comprising a roller spring-urged against said first roll.

11. Apparatus according to claim 8, said holding means comprising tension springs having ends thereof connected to the ends of said displacement member and having their other ends detachably anchored on said means for rotatably mounting said first roll, said other ends detachably by rotation of said first roll relative to said displacement member.

12. Apparatus according to claim 8, further comprising means including a fixed abutment member arranged in the path of the movement of said displacement member with said surface to block said movement and cause said displacement member to be removed from said first roll by continued rotation of said first roll after the severing of said moving web.

13. Apparatus according to claim 12, said abutment member being constituted by a body portion of said knife.

14. Apparatus according to claim 8, said means rotatably mounting said rolls comprising a pivoted beam having said rolls rotatably mounted on ends thereof at opposite sides of the pivot thereof, there being web guide means spaced from one end of said beam and over which said moving web passes from said second roll, said second roll normally being situated at the side of said pivot nearer to said guide means, said beam being rotatable about said pivot so as to cause said first and second rolls to change places relatively to said guide means and thereby bring into frictional contact said first roll and the moving web passing from said second roll to said guide means.

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RUSSELL C. MADER, *Primary Examiner.*

MERVIN STEIN, *Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,172,613 March 9, 1965

Jacobus M. Simons et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 18, for "adheesive" read -- adhesive --; column 2, line 46, for "spiced" read -- spliced --; column 6, line 15, for "detachably" read -- being detachable --.

Signed and sealed this 3rd day of August 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents