

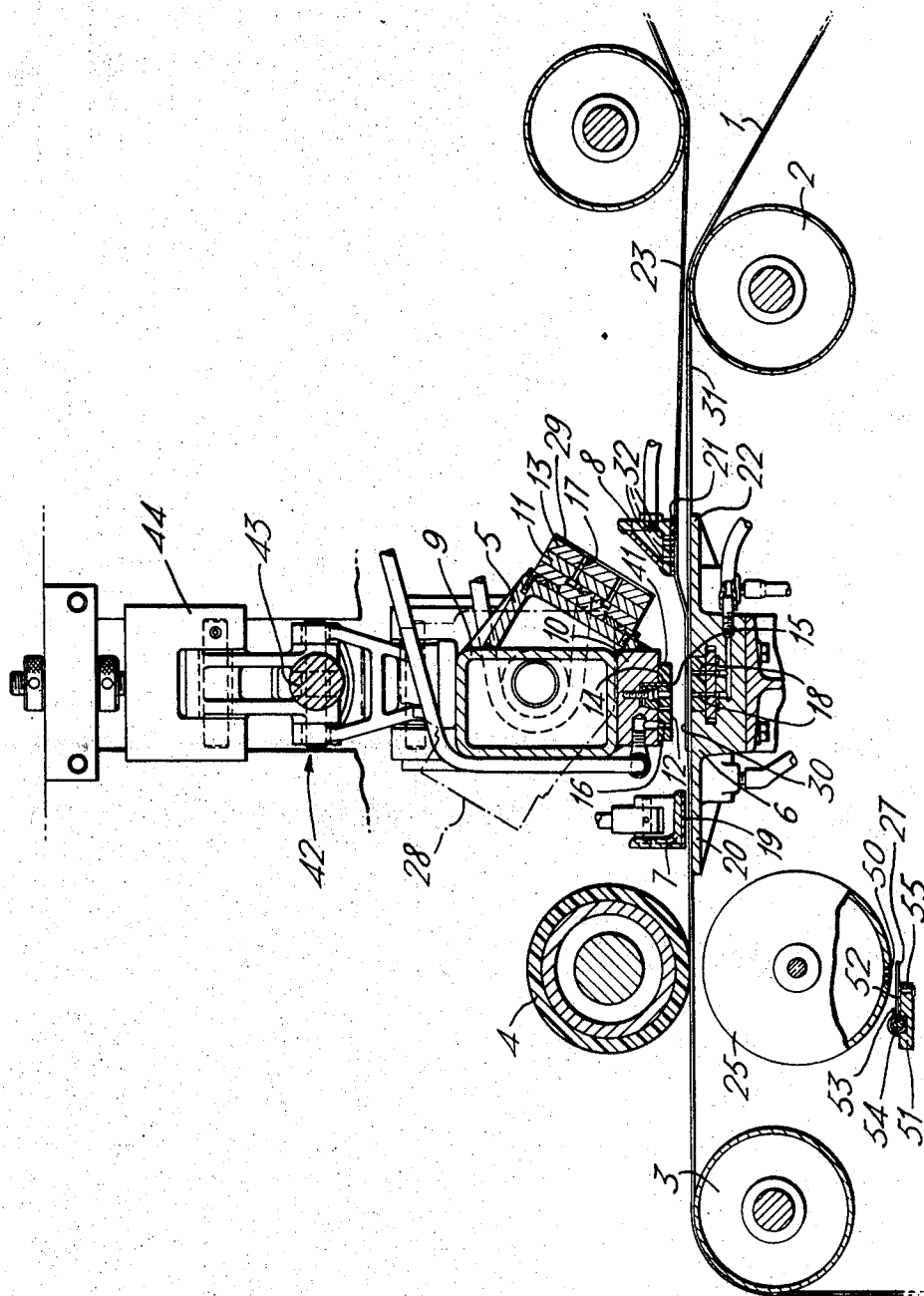
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BUTT-SPLICING

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BUTT-SPLICING

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9 Claims

ABSTRACT OF THE DISCLOSURE

Butt-splicing apparatus having an anvil on which the webs to be spliced are held one above the other and a splicing head rotatable above the anvil and movable towards and away from the anvil firstly to cut the webs and then to apply a piece of adhesive tape across the trailing end of the outgoing web and the leading end of the incoming web, the offcut from the incoming web being removed meantime.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to butt-splicing and is particularly concerned with splicing the web from a new reel of sheet material on to the running web from an expiring reel by the method which comprises cutting both the running web and the incoming web, abutting the leading edge of the incoming web to the trailing edge of the running web and joining the one to the other by means of an adhesive tape overlay applied across the joint. This method of splicing is commonly employed in joining the webs of material supplied to printing machinery. In some fields of printing the same printing press is required to deal with a number of different materials which might, for instance, embrace cardboard and papers of different thicknesses. Difficulties arise in providing machinery and in particular butt-splicing machinery which is capable of dealing with all these materials.

SUMMARY OF THE INVENTION

Some of the objects of the present invention lie in providing an improved method of and improved apparatus for butt-splicing which can be used to butt-splice a wide range of sheet materials. To this end the invention provides for both the running and the incoming webs to be cut in a single stroke by a knife cutting on to an anvil. The quality of the cut may be enhanced by providing the anvil with a suitably resilient surface. Preferably provision is made to grip both the webs firmly during the cutting operation immediately adjacent to either side of the cut. This can be done by sheathing the knife within a slot in a resilient member which during each cutting operation is compressed between a carrier upon which the knife is mounted and the anvil to bare the knife for the cut and to clamp the webs against the anvil. Conveniently the knife and anvil comprise the ram and butt respectively of a toggle press.

In another aspect of the invention both the running and the incoming webs are firmly held in position throughout the cutting and the taping operations. Preferably the cutting operation is carried out upon a flat surface and the adhesive tape is applied to the joint by bringing a flat pressure pad to bear against the joint on that surface.

A further difficulty arises in conveniently disposing of the off cut from the incoming web and another object of this invention lies in providing an improved method of overcoming this difficulty. To this end the invention con-

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templates removing the knife from the cutting zone by means of a knife carrier prior to applying the adhesive tape and securing the offcut to the knife carrier so that it is removed therewith. Conveniently this can be done by applying suction through ports in or adjacent to the knife carrier. In one embodiment of the invention the pressure pad and the knife carrier are rotated about a common axis to bring them into and out of the operating zone.

Further according to the invention there is provided apparatus comprising a knife and anvil for cutting the web, a first clamping device disposed downstream of the cutting zone to secure the running web, a second clamping device disposed upstream of the cutting zone to secure both the incoming and the running webs and a third clamping device disposed between the first clamping device and the cutting zone to secure that part of the leading edge of the incoming web that extends beyond the cutting zone.

Still further according to the invention there is provided butt-splicing apparatus comprising a knife and anvil for cutting the incoming and running webs and clamping means to secure the webs in position on the anvil prior to cutting, means to remove the knife from the cutting zone after the cutting operation so that an adhesive strip can be applied across the joint, and means to secure the offcut of the incoming web to the knife or knife carrier so that the offcut is removed from the cutting zone therewith. There may be provided a flat anvil and flat pressure pad means adapted to receive and secure the adhesive strip and to apply it across the joint on the anvil. Conveniently the knife is a rule knife having a serrated cutting edge and the anvil is sufficiently resilient to receive enough of the knife to make a clean cut without materially making any permanent deformation in the anvil surface. One example of such a material is polyurethane. Conveniently a suction pad is provided adjacent to the cutting knife to be movable therewith out of the cutting zone so as to engage the end piece of the incoming web which is to form the offcut for the purpose of gripping it and removing it from the cutting zone with the knife. Conveniently the clamping devices are mechanical clamps each having an upper and a lower clamping surface between which the web or webs are engaged, and the upper clamping surface of the second clamping device may have suction ports connected with suction means to assist in the positioning of the incoming web prior to the splicing operation. In the latter case it is desirable to construct the second clamping device so that it is capable of being opened to a position in which the clamping surfaces are spaced apart by a distance which is only great enough to allow for convenient insertion of the incoming web and positioning thereof with the assistance of the suction applied through the suction ports whilst the outgoing web is still running.

In one embodiment of the invention the knife and the adhesive tape applicator are mounted to be rotatable about a common axis which is conveniently parallel to the cut to be made and positioned vertically thereabove and the two may be carried in a common housing which is rotatable between a first position in which the knife is disposed directly above the cut to be made, a second position in which the adhesive strip applicator is disposed for applying the adhesive strip to the joint, and a third position in which the applicator is readily accessible for the reception of the adhesive strip.

BRIEF DESCRIPTION OF THE DRAWING

Apparatus in accordance with the invention will now be described by way of example with reference to the embodiment shown in the accompanying drawing, which is a side view in section of a butt-splicing machine.

3 DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, a running web 1 is fed over an input roller 2, through a splicing zone, and is led out to operating machinery such as printing machinery above a lower idle roll 3 and beneath an upper friction driven roll 4. A butt-splicing apparatus is positioned in the splicing zone and comprises a rotatable cutting and taping head 5 positioned directly above an anvil 6 and clamps 7 and 8 positioned respectively down and upstream of the anvil and between the two sets of rollers. The anvil surface and one jaw of each of the clamps 7 and 8 all form part of a continuous flat table which supports the two webs 1 and 23 throughout the splicing. The rotatable head 5 has a generally tubular housing 9 of rectangular cross-section upon which are mounted a knife carrier 10 and a tape applicator 11. Each of these has a flat rectangular operating surface, 12 and 13, respectively, which extends parallel with the axis of rotation of the head 5, and these are spaced 60° apart from one another around the axis of rotation. The knife carrier 10 is provided with a serrated-tooth rule knife 14 which extends transversely across the direction of advance of the running web slightly obliquely to the direction of movement thereof. The knife 14 is carried in a slot 15 in a resilient sheath 41 on the knife carrier 10 and this sheath 41 is compressible between the knife carrier 10 and the anvil 6 to bare the knife for cutting. Suction ports, such as 16, open into the face 12 of the knife carrier 10 on the downstream side of the knife 14. These ports 16 are connected with a suction source and are used to pick up the offcut from an incoming web from a new reel. The tape applicator 11 is also provided with suction ports such as 17 so that it can readily pick up and position a piece of tape to be applied across the spliced joint. The head 5 is arranged to be vertically movable so as to bring either the knife carrier 10 or the tape applicator 11 into engagement with the anvil 6 when it is positioned thereabove. The anvil 6 is provided with further suction ports 18 which also assist in the positioning and location of the running web and has an operating surface which is formed of polyurethane to be sufficiently resilient to receive the knife blade at the end of the cutting stroke without undergoing any permanent deformation. The clamp 7 is a simple mechanical clamp having two web-engaging clamp pieces 19 and 20. Clamp 8 on the upstream side of the running web also has two clamping pieces, 21 and 22, of which the upper clamping piece 21 is connected to a suction source by way of ports 32 opening into the clamping face to assist in the positioning of an incoming web 23 from a new reel. Clamp 8 has an open position in which the upper clamping piece 21 is positioned just above but spaced from the running web 1 so that the incoming web 23 may be fed in and positioned between the running web and the clamping piece 21 prior to arresting the running web 1 for the butt-splicing operation.

The cutting and taping head 5 is moved vertically by means of a toggle mechanism comprising a pair of toggle links disposed one at each end of the head, of which one is shown generally at 42, and actuated by means of a toggle bar 43 interconnecting the two toggle links and operated from a pneumatic motor, not shown. Each toggle link extends between a reaction head 44 and one support bearing of the head 5.

A taping roller 25 is positioned on the underside of the web directly beneath driven roller 4 to have its upper surface normally spaced just beneath the running web 1. The roller 25 is provided with suction ports 50, and means to admit suction thereto, to pick up a length of pressure sensitive adhesive tape 27 from a tape loader 51. The tape loader 51 has a non-stick tape bearing surface 52 and a slot 53 to receive and position the tape and is mounted for rotation in the machine frame on a shaft 54. In addition the tape loader 51 is arranged to

be manually movable axially of the tape roller 25 to a position where the operator can charge it with tape. A graduated scale 55 is provided along one edge of the tape loader to enable the operator to position the tape accurately.

The operation of the butt-splicing apparatus will now be described. With the web 1 from the expiring reel still running, the head 5 is rotated to the position 28 (shown in chain-dotted lines) where single sided pressure-sensitive adhesive tape 29 is applied, care being taken to position it so that it will not overlap the edges of the web 1 or the web 23. Suction is now admitted to the various suction ports, and with the clamp 8 in a position with the clamping member 21 spaced above the web 1, the leading end of the incoming web 23 from a new reel is fed under the clamping surface 21 where it is gripped by suction and is then drawn to a position between the cutting zone and the clamp 7.

The head 5 is now rotated until the cutting knife carrier 10 is positioned in the cutting zone. Whilst the web from the expiring reel is still running, the operator draws the tape loader 51 out of the machine, charges with the length of tape 27 and pushes it back into its operative position where it is rotated, to bring the tape 27 up to the suction ports 50 so that the suction applied through these ports can hold it to the roller 25. This is rotated a few degrees to bring it to a position where the circumferential distance of the tape 27 from the top point of the roller 25 is equal to the distance of the knife 15 from that point.

When splicing is required, the running web 1 is stopped and clamps 7 and 8 are closed, thereby holding the two webs 1 and 23 securely in position. To maintain a continuous feed of web there is provided downstream of the splicer a reservoir which accumulates a part of the web while the reels are running and pays the accumulation out when the reels are stopped during splicing.

The toggle mechanism is now operated so that toggle bar 43 completes a single forward stroke. On the first part of the stroke toggle links 42 open so that the cutting and taping head 5 is lowered, ramming the knife head 10 hard against the anvil 6. The sheath 41 is compressed as a result of which it clamps the two webs 1 and 23 firmly in position on the anvil and the knife 14 is bared and pressed into the anvil 6 cutting cleanly through both webs on the way. Upon completion of its stroke toggle bar 43 closes the links 42 retracting the head 5.

The cutting and taping head 5 is then rotated to the position in which the tape applicator 11 is directly above the anvil 6. The offcut formed by the waste part 30 of the web 23 on the downstream side of the cut is held to the cutting head 10 by the suction applied through the port 16 and is thus removed from the cutting zone as the head is rotated. The toggle bar 43 is returned so that head 5 is once again lowered and the adhesive tape 29 is brought into engagement with the webs 1 and 23 on either side of the cut which has just been made in the two webs; pressure is applied and the suction is disconnected from the ports 17. The taping head 5 is then raised leaving the tape in position and a neatly formed spliced joint. Meanwhile roller 25 has been raised to bring it into engagement with the web 1, the clamps are released and the web is started up again, whereupon it draws away from the trailing part 31 of the web from the expiring reel and the joint advances through the rollers 4 and 25 where a further tape 27 is applied to the underside of the joint.

During the whole of the cutting and taping operation both ends of the webs are held securely in position by the clamps 7 and 8 and by the suction in the anvil 6 so that no curling or slipping can take place and the joint is formed neatly with the edges closely abutting one another.

Difficulties are known to arise in so forming a butt-spliced joint that the two edges abut one another without any gap. The effect of forming the joint with a gap is that it is necessary to apply a further adhesive strip across

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the other side of the joint, otherwise the adhesive surface of the first strip causes the web to tend to stick to parts of the machinery with which it subsequently comes into contact and to other parts of the web on which it may be laid if, for instance, it is subsequently wound on to a reel again.

In many operations it is undesirable to apply a further adhesive strip since this materially increases the thickness of the joint formed, to an extent which may be sufficient to interfere with the satisfactory performance of subsequent operations which are carried out on the web, such as, for example, printing.

The invention provides means for overcoming this difficulty arising from the fact that the edges of the webs are so closely butted that the adhesive surface of the tape is wholly protected so that, if the operating condition are such as to require it, the joint need only be taped on one side.

What I claim as my invention and desire to secure by Letters Patent is:

1. Apparatus for butt-splicing an incoming web of sheet material from a new reel to a running web from an expiring reel, said apparatus comprising means for feeding said running web through a splicing position and adjacent said incoming web of sheet material from a new reel, whereby said webs are superimposed, a stationary anvil on one side of said superimposed webs at said splicing position, means on the opposite side of said webs at said splicing position coacting with said anvil for cutting the two webs together in a single stroke whereby the trailing end of said running web and the leading end of said incoming web abut each other ready to form a joint, said cutting means comprising a knife, means to grip said webs on both sides of said knife during cutting to hold the cut ends against movement, said gripping means comprising a resilient member having a slot therein to accommodate said knife and which during each cutting operation is compressed against the anvil to expose the knife for the cut and to clamp the webs against the anvil, the operating surface of said anvil adjacent said superimposed webs being flat and sufficiently resilient to receive the sharp edge of said knife whereby a clean cut is made in said web without making a permanent deformation in the anvil surface, and means to apply and press adhesive tape across the abutted ends of the webs to form said joint.

2. Apparatus according to claim 1 wherein the anvil surface comprises polyurethane.

3. Apparatus according to claim 1 comprising clamping means to hold both the running and the incoming webs

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firmly in position throughout the cutting and the taping operations.

4. Apparatus according to claim 3 wherein said clamping means comprises a first clamping device disposed downstream of the splicing position to secure the running web, a second clamping device disposed upstream of the splicing position to secure both the incoming and the running webs.

5. Apparatus according to claim 4 wherein the first and second clamping devices are mechanical clamps each having an upper and a lower clamping surface between which the said webs are engaged.

6. Apparatus according to claim 5 wherein the upper clamping surface of the second clamping device has suction ports connected with suction means to assist in the positioning of the incoming web prior to splicing.

7. Apparatus according to claim 1 in which said cutting means is movably mounted so as to permit removal of said cutting means from the splicing position prior to applying the adhesive tape, said cutting means including means for securing the off-cut from the incoming web, whereby said off-cut is removed simultaneously with the removal of said cutting means.

8. Apparatus according to claim 7 wherein the means to secure the offcut from the incoming web comprises a suction pad adjacent the knife.

9. Apparatus according to claim 1 wherein said cutting means and the means to apply the adhesive tape are rotatably mount about a common axis parallel to the cut to be made and positioned vertically thereabove.

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