MECHANISM FOR PRODUCING TEAR STRIPS


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ABSTRACT OF THE DISCLOSURE

Apparatus for producing tear-strips from a continuous web (of width equal to the desired length of tear strip) comprises an intermittent web feed, a conveyor to receive strips cut from the web, and knives operable while the web is stationary to cut across the web progressively from the down-stream edge (relative to the conveyor movement), together with means continuously urging each strip during cutting towards the conveyor. The conveyor is conveniently a suction belt or drum, the suction serving to produce an air-stream which urges the strips towards the conveyor. The apparatus may also include provision for continuously feeding a wrapper web and attaching the tear-strips thereto.

This invention relates to mechanism for producing tear-strips and applying the tear-strips to a web of wrapping material, as is required for example in cigarette packing machines.

A tear-strip is narrow relative to its length, and earlier mechanisms for producing and applying tear-strips have, at least until recently, in general been supplied with tear-stripe material already of the required width; said material has been fed from a reel or drum to cutting mechanism arranged to operate intermittently so as to sever strips of desired length, the actual length of each strip being determined by the length fed forward between successive cutting operations.

Recently, it has been found advantageous in various respects to employ a web of tear-stripe material whose width is equal to the length of the desired tear-strips. This however introduces the necessity for a comparatively long cut and it is an object of the present invention to provide improved apparatus for producing tear-strips from a relatively wide strip or web.

According to the invention, we provide apparatus for producing tear-strips from an elongated web of material of width equal to the desired length of the tear-strips to be produced, comprising feed means for advancing such a web between a pair of cutter knives extending transversely of the direction of advance of said web, and conveyor means arranged to receive tear-strips severed from said web and remove said tear-strips from the vicinity of said knives, one of said knives being fixed and the other knife being movable relative to said fixed knife in which the movable knife is so arranged relative to the fixed knife as in operation to cut the web progressively from edge to edge, the cut starting at the downstream edge of the web (considered in relation to the movement of the conveyor means).

It will be understood that the terms "upstream" and "downstream" are used with their common meanings, i.e. the upstream edge of the web is that edge past which the motion of the conveyor means is directed towards the far edge of the web.

The knives may take various forms; we may mount the movable knife for pivotal movement relative to the fixed knife, i.e. so that the two knives operate in the manner of scissors, the pivotal axis being slightly farther downstream than the downstream edge of the web to be cut. Preferably, however, we provide a movable knife which is reciprocable at right angles to the plane of the web; the progressive cutting is then achieved by providing one of the knives with a cutting edge inclined to the plane of the web, so that the spacing between the cutting edges of the two knives decreases in the direction of movement of the conveyor means.

In another form of apparatus employing a reciprocable knife, the conveyor means may take the form of a suction drum and the feed means is then arranged to advance the web to the knives with a substantially cylindrical curvature; one of the knives has a cutting edge curved to conform to the curvature of the web while the other knife has a cutting edge with a larger-radius curvature, so that cutting is progressive.

The movable knife may be provided with pneumatic means arranged to produce an air-blast so directed as to urge tear-strips cut by knives towards the conveyor means. Such pneumatic means conveniently includes a plurality of air-passages in the movable knife itself and means for connecting said air-passages to a source of compressed air.

Most conveniently the conveyor means comprises a suction conveyor in the form of an endless air-permeable belt to one face of which suction is applied so that atmospheric pressure serves to hold each tear-strip severed by the knives against the other face of the belt. In an alternative arrangement the conveyor means may comprise an endless impervious belt of electrically insulating material, e.g., nylon, arranged to become electrostatically charged so that tear-strips are held thereto by electrostatic attraction.

In general, apparatus according to the invention as above defined will be used as part of a device for applying a succession of tear-strips to a continuous web of wrapper material, which after application of the tear-strips may either be stored on reels until required or, as is preferred, fed directly to consuming apparatus such as a cigarette packer.

As a further feature of the invention, therefore, we provide a device for applying a succession of tear-strips to a continuous web of wrapper material, including apparatus for producing tear-strips as defined above together with means for feeding a continuous web of wrapper material, said wrapper feeding means being arranged to guide wrapper web past the conveyor means to receive the tear-strips therefrom in succession.

Preferably such a device includes means for applying a band of adhesive to the wrapper web, such adhesive applying means being so disposed that the wrapper web passes the adhesive applying means before reaching the vicinity of the conveyor means. The device may also include heating means past which the wrapper web is guided after receiving the tear-strips, such heating means then serving to cure the adhesive previously applied to the wrapper web, to secure the tear-strips securely thereto. If the tear-strips and/or the wrapper web are of thermoplastic material, then the adhesive applying means may not be needed as heating alone may suffice to bond the tear-strip to the wrapper web.

In order that the invention may be well understood, preferred embodiments thereof will now be described in more detail, reference being made to the accompanying drawings, in which:

FIGURE 1 is an end view of a device embodying the invention employing a reciprocable knife;

FIGURE 2 is a front view of the device of FIGURE 1, with certain parts omitted;
FIGURE 3 is a front view of another device embodying the invention, employing a pivoted knife.

FIGURE 4 is a front view of a modified form of device;

FIGURES 5 and 6 are end views of the device of FIGURE 4; and

FIGURE 7 shows somewhat diagrammatically yet another form of said device.

First referring to FIGURE 1, a web 1 of tear-strip material, of width (normal to the plane of the drawing) equal to the length of tear-strips to be made is drawn from a supply reel 2 by feed rollers 3. Rollers 3 are actuated intermittently by any convenient drive means (not shown) such as a ratchet drive, so as to advance at each actuation a length of the web 1 equal to the desired width of tear-strip. After passing through the rollers 3, the web 1 travels between guides 4 and below a fixed knife 5 having a lower face 6 slightly inclined to the horizontal; the edge of face 6 remote from rollers 3 serves as the cutting edge of knife 5 and cooperates with a movable knife 7 carried on a support member 8 which is in turn carried by arms 9 secured to a shaft 10. The shaft 10 is connected to a further drive means (not shown) arranged to rotate the shaft 10 through a small angle clockwise and then return it, so that knife 7 moves up past (and in contact with) the cutting edge of knife 5 and then returns; in FIGURE 1 the movable knife 7 is shown at an intermediate point in its upward motion.

The rollers 3 and shaft 10 are operated alternately by their respective driving means, so that the knife 7 moves up and down between successive operations of the rollers 3. When the said rollers operate, and hence the web 1 advances, knife 7 is in its lowest position and the leading end of the web 1 is fed above it; then the next subsequent operation of shaft 10 causes the knife 7 to rise and the web 1 is severed by the action of the cooperating edges of knife 5 and knife 7. As at each operation of the rollers 3 the web 1 is advanced by the desired width of a tear-strip, each operation of knife 7 cuts from the leading end of the web 1 a strip of such width.

Such cutting produces a detached strip above the knife 7, and such strip is blown upwards by an air-blast emerging from apertures in the upper surface of knife 7. Said apertures are connected by internal passages (indicated at 11) through knife 7 and support member 8 to an external flexible pipe 12 connected to a source of compressed air (not shown).

Above the movable knife 7, at a level a little higher than that of the cutting edge of the fixed knife 5, lies the lower run 13 of a conveyor belt 14 carried by two rollers 15 in conventional manner. The belt 14 is however an air-pervious belt, and above said lower run 13 is mounted a suction-box 16 connected to a suction pump (not shown); the box 16 has an open lower face closed by the lower run 13 of the belt 14 so that atmospheric pressure causes air to flow through said lower run into the box.

Whenever a tear-strip is formed by the action of the knives 5, 7 as described above, as soon as the cutting is complete the air-blast through the apertures in knife 7 causes the severed strip to move up until it encounters the lower run 13 of belt 14; the strip then blocks the air-flow through the belt, the pressure in suction box 16 falls, and the strip is held against the belt by virtue of the pressure difference across it, i.e. because the lower face of the strip is subject to atmospheric pressure and its lower face to a lower pressure.

The fixed knife 5 has its bottom face 6, and hence its cutting edge, inclined to the horizontal, so that the spacing between the knives 5, 7 (with knife 7 in its lowest position, as in FIGURE 2) decreases in the direction of travel of the lower run 13 of belt 14. It will be apparent that, as knife 7 rises, the strip severed from web 1 will first be cut free at its downstream, i.e. left-hand end (FIGURE 2) and as cutting proceeds this end will be increasingly free to move up to the belt, under the influence of the air-blast through the apertures in knife 7. Although part of the strip thus comes into contact with the belt before cutting is complete, insufficient frictional grip develops between the strip and the belt to break the strip, as until cutting is complete and the whole strip lies on the belt there is a substantial area of the lower run 13 of belt 14 which remains uncovered and hence the pressure difference between atmosphere and the interior of suction box 16 is less than when the whole strip lies against the belt. A slight pull is however exerted on the strip which in fact tends to assist in holding the uncut part of web 1 against the fixed knife 5 as is desirable for a clean cut.

The inclination of the cutting edge of knife 5 is important, being directed as shown to avoid buckling of the strip during cutting—i.e. right-hand end of the strip were to be freed first, its engagement with the belt would tend to carry it towards the uncut portion which is undesirable.

The web 1 of tear-strip material is so directed by the guides 4 that it lies in a plane parallel to the inclined lower face of the fixed knife 5 in the vicinity of said knife. Preferably the axis of feed reel 2 is inclined to the horizontal at the same angle as the lower face of knife 5, although as the required angle of inclination is relatively small it is permissible to mount reel 2 with its axis horizontal and introduce the required inclination of the web 1 as it passes through the rollers 3 and guides 4.

Once each strip is completely severed from the web 1, it travels with the belt 14 round the left-hand (FIGURE 2) roller 15 to a horizontal upper run of said belt. A wrapper web 16 is continuously fed from a supply box 16 round a guide roller 19 so placed that the web 17 reaches the belt 14 tangentially just as the latter has started going round the downstream (left-hand) roller 15. At this point, the belt 14 has just moved clear of the suction box 16 and a tear-strip held therein as previously explained would tend to fall off in the absence of web 17. However, the web 17 prevents the fall of strips and the latter are, as they travel round said left-hand roller 15, pressed between web 17 and belt 14. As web 17 passes round guide roller 19, it is also engaged by a gumming wheel 20 which transfers to the web 17 a line of adhesive derived by said wheel from a gum pot 21 via a wick feed 22. Said line of adhesive is so positioned across the width of the web 17 that it is engaged by the tear-strips as they come into engagement with the web 17. As the strips travel with the web, and pressed against it, around the left-hand roller 15, along the upper run of belt 14, and then part-way round the right-hand roller 15 before leaving the belt, the said tear-strips are effectively caused to adhere to the web 17 so long as the speed of belt 14 is low enough to allow time for the adhesive to set. Should higher speeds be desired, then a heater may be placed above the upper run of belt 14, as indicated in dashed lines at 23, to accelerate setting of the adhesive.

Turning now to FIGURE 3, we show an alternative form of device embodying the invention. In this form, a fixed knife 105 is mounted adjacent to the upper run 113 of a conveyor belt 114, which like belt 14 of FIGURE 2, is an air-pervious belt carried by rollers 115 and below said upper run 113 is mounted a suction box 116 connected to a suction pump (not shown). The suction box 116 has an open upper face closed by the upper run 113 of the belt so that atmospheric pressure causes air to flow through said lower run into the box.

A movable knife 107 is mounted on a pivot 125 placed a little above and to the right of the right-hand end of the fixed knife 105, so that the two knives 105, 107 function in a scissors-like manner whenever the movable knife 107 is oscillated on its pivot. A web of tear-strip material is fed between the two knives 105, 107 by means (not shown) which may comprise rollers and guides as shown in FIGURE 2. In the device now being considered the
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web of tear-strip material will also be advanced intermittently, each advancing movement being made at a time when the movable knife 107 is clear of the fixed knife 105 (as shown in FIGURE 3). Various forms of drive may be provided for the knife 107; a simple and convenient arrangement as shown includes a rotatable drive shaft 126 carrying a crank 127 which in turn is linked by a connecting rod 128 to an operating arm 129 forming an extension of the knife 107 to the right of its pivot 125.

In FIGURE 3, movable knife 107 is shown approximately half-way through a cutting stroke and a tear-strip 130 can be seen in a half-severed condition. Rollers 115 rotate clockwise and the upper run 113 of belt 114 moves from left to right. Cutting of each tear-strip starts at the right (i.e. downstream) end and the air stream through said upper run 113, previously mentioned, causes the severed part of each tear-strip to be urged towards and held against the belt while cutting proceeds; as soon as cutting of the strip is complete, the already existing contact between the strip and the belt will cause the strip to be pulled under the lower run 112 to the right.

As in the device of FIGURES 1 and 2, a wrapper web, here identified as 117, is fed from a supply reel 118 so as to reach the belt 114 tangentially as the latter has just started going round the downstream (right-hand) roller 115. Before reaching the belt 114, however, web 117 passes round two guide rollers 116 between which it is engaged by a gumming wick 120 fed by a gum pot 121. Wick 120 serves the same purpose as gumming wheel 20 (FIGURE 2), i.e. it puts on wrapper web 117 a line of adhesive so positioned across the width of web 117 that it is engaged by the tear strips as they come into engagement with said web. It will be seen from FIGURE 3 that the leading (right-hand) end of each tear-strip will be gripped between the web 117 and the belt 114, backed by the right-hand roller 115, before the trailing end of the same tear-strip has passed out of register with suction box 116; thus the tear-strips, once severed, are held in position on belt 114 until their location against the line of adhesive on web 117 is established.

Web 117 feeds off belt 114 and right-hand roller 115 at 131. If the speed of the device and characteristic of the adhesive applied to web 117 so require, a heater may be placed adjacent to the web 117 in this area, e.g. as indicated in dashed lines at 132. In FIGURE 6 is illustrated a further form of device embodying the invention.

Much of the device shown in these figures corresponds closely to one or other of the embodiments previously described. It may therefore briefly be said that here a reciprocating knife 207 cooperates with a fixed knife 205 to cut tear-strips from a continuous web 201; said web reaches the knives via feed rollers 203 and guides 204.

The movable knife 207 is carried by support members 208 on arms 209 which are rockable on a shaft 210. As each tear-strip is cut, it falls on to upper run 213 of a suction belt conveyor 214 carried by rollers 215 and pivot 216.

A wrapper web 217 is fed to the belt conveyor 214 via guide roller 219, gumming wheel 220 (with which a gumming device 222 is associated) and a further guide roller; wheel 220 applies a line of gum to web 217 and when the latter reaches belt 214, said gum is pressed against tear-strips severed by the knives and by the time the web 217 leaves the belt 214, passing around a guide roller 224, the tear-strips are firmly secured to the web 217.

The knife 207 is driven from a drive shaft 226 by means of eccentrics 227 on said shaft which operate connecting rods 228 pivotally secured to operating arms 229 in the manner depicted in FIGURE 4. The driving force of feed rollers 203 is driven intermittently, to advance web 201 by a distance equal to the desired width of a tear-strip; this drive also comes from shaft 226, via an eccentric 232 which through a connecting arm 233 operates a sec-
and/or the strip directly i.e. by connection through brushes or the like to an electric supply, in many cases sufficient charge is developed on a moving nylon belt without such connection.

What we claim as our invention and desire to secure by Letters Patent is:

1. Apparatus for producing tear-strips from an elongated web of material of width equal to the desired length of the tear-strips to be produced, comprising feed means for advancing such a web, a pair of cutter knives extending transversely of the direction of advance of the web, means for operating said feed means and said knives alternately to respectively feed and sever successive portions of said web equal in length to the desired width of the tear-strips, conveyor means arranged to receive the tear-strips thus produced and remove the same from the vicinity of the knives in a direction generally transverse to the direction of advance of the web, one of said knives being fixed and the other knife being movable relative to the fixed knife and so arranged as in operation to cut the web progressively from edge to edge, the cut starting at the downstream edge of the web considered in relation to the movement of the conveyor means, and means for continuously urging each strip during cutting from the knives towards the conveying means.

2. Apparatus as claimed in claim 1, in which the movable knife is reciprocable.

3. Apparatus as claimed in claim 1, in which the movable knife is reciprocable.

4. Apparatus as claimed in claim 3, in which the feed means is arranged to advance the web in substantially plane disposition to the knives and the movable knife is reciprocable at right-angles to the plane of the web, one of the knives having a cutting edge inclined to the said plane.

5. Apparatus as claimed in claim 3, in which the conveyor means is a suction drum and the feed means is arranged to advance the web to the knives with a substantially cylindrical curvature, one of said knives having a cutting edge with a curvature coaxial with that of the drum and the other knife having a cutting edge curved about a centre displaced from the axis of the drum.

6. A device for applying a succession of tear-strips to a continuous web of wrapper material, including apparatus for producing tear-strips as claimed in claim 1 together with means for feeding a continuous web of wrapper material, said wrapper feeding means being arranged to guide the wrapper web past the conveyor means to receive tear-strips therefrom in succession.

7. A device as claimed in claim 6, including means for applying a band of adhesive to the wrapper web, such adhesive applying means being so disposed that the wrapper web passes the adhesive applying means before reaching the vicinity of the conveyor means.

8. A device as claimed in claim 7, including heating means past which the wrapper web is guided after receiving the tear-strips.

9. Apparatus as claimed in claim 1 wherein said means for urging each strip towards the conveying means comprises an air-stream directed towards the conveying means.

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DOUGLAS J. DRUMMOND, Primary Examiner