

PATENT SPECIFICATION

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(54) CUTTING APPARATUS

(71) We, THE BRITISH BATA SHOE COMPANY, LIMITED, a British Company, of East Tilbury, Grays, Essex, RM18 8RL, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to electromagnetic cutting apparatus and in particular to an electromagnetic cutting apparatus for use in the shoe making field.

When manufacturing shoe uppers of flexible material, e.g., basketball shoes and the like, it is normal practice to sew a strip of binding tape along the upper and side edges of the quarters and tongues used to form the uppers. Such sewing is effected manually by a number of operators using separate sewing machines. The binding tape comes in a continuous strip or roll and is sewn onto a plurality of shoe upper components in sausage-fashion before cutting. In other words, an individual operator normally sews a continuous tape onto a plurality of upper components, which are thus interconnected by the binding tape. The tape is then cut manually to separate each of the upper components from each adjacent component. Such separation is effected manually, e.g., with scissors or by an automatically operated cutting device or chopper.

Obviously the manual cutting of the binding tape to separate the components is a lengthy operation and is to be avoided. Presently available automatic cutting apparatuses are pneumatically operated and, while much more efficient than manual cutting means, possess the disadvantage that the cutting of the strip is not always accurate.

A skilled sewing machine operator can sew binding tape onto shoe upper components at almost binding speed. In order to keep up with the operator. The cutting apparatus must be capable of making cuts in rapid succession. It will be appreciated that, with components interconnected in a sausage-like manner, the tape must be cut at the

trailing edge of one component and almost immediately thereafter at the leading edge of the succeeding component. If the cutting apparatus does not keep pace with the sewing machine operator, cuts are made either at a distance from the leading or trailing edge of the component, or on the component itself. In one case, tape wastage and a second trimming step to remove excess binding are necessary, and, in the other case, the shoe upper component is damaged.

It has been found that existing pneumatic apparatus cannot keep pace with skilled sewing machine operators, because the recovery rate of the cutting apparatus is often less than the speed of feed of the components and binding tape.

The object of the present invention is to solve the above problem by providing a cutting apparatus for relatively rapidly and accurately cutting a binding tape between a plurality of components fed from a sewing machine.

Accordingly, the present invention relates to a cutting apparatus for cutting a strip of binding tape connected to a shoe upper component and extending beyond at least one edge thereof, the cutting being performed at said one edge, said apparatus comprising a frame; a yoke on said frame; an arm slidably mounted in said yoke; a table portion on said frame for receiving said component and tape; a casing on one end of said arm opposite said yoke and above said table portion of the frame; a plunger housed in said casing and projecting therefrom toward said table portion of the frame; a blade on the outer end of said plunger for cutting said tape during passage of the component and tape over said table portion of the frame; an electromagnetic drive for moving said plunger and blade from a rest position to a cutting position; a sensor for actuating said drive when said component and said tape are properly located beneath said blade; and means for returning said plunger and said blade to said rest position, said electromagnetic drive including a core formed of

magnetic material mounted on said plunger in said casing; a coil around said core; and a circuit for energizing said coil in response to signals from said sensor, said sensor including photoelectric cells positioned in the path of travel of said component in advance of said blade, and a light source for illuminating said photoelectric cells.

The use of electronic components in a cutting apparatus of the type described herein results in a rapid response to the apparatus to the cutting requirements encountered in the seriatim sewing of binding tape to components.

The invention will now be described in greater detail with reference to the accompanying drawings, which illustrate a preferred embodiment of the invention, and wherein:

Figure 1 is a partly sectioned side view of a cutting apparatus in accordance with the present invention;

Figure 2 is an elevation view of the chopper portion of the apparatus of Figure 1 in the direction of arrow 2 in Figure 1;

Figure 3 is a back elevation view of the apparatus of Figure 1;

Figure 4 is a cross section taken generally along line IV—IV of Figure 3;

Figure 5 is a plan view of the apparatus of Figure 1;

Figure 6 is a block diagram of a control circuit for use in the apparatus of Figures 1 to 4; and

Figures 7 to 11 are schematic graphs of the pulses occurring in the circuit of Figure 6, the ordinates representing voltages and the abscissae representing time.

With reference to the drawings, the cutting apparatus of the present invention includes a frame 1 mounted on a base plate 3. The frame 1 is connected to the base plate 3 by bolts 4 and 5, which permit vertical adjustment of the frame 1 on the base plate 3. The upper end 6 of the frame 1 is in the form of a yoke 7 or split ring for slidably supporting an arm 8, which extends outwardly from the yoke 7 over a flat table portion 10 of the frame 1. A pair of bolts 11 interconnected opposing ends 13 of the yoke 7 for securing the arm 8 in any desired position.

A generally cylindrical casing 15 is securely mounted on the outer end of the arm 8 and forms part of a cutting device. The casing 15 includes integral top and side walls 16 and 17, respectively, and a bottom wall 19. The bottom wall 19 is provided with inwardly and outwardly extending tubular portions 20 and 21, respectively which form a housing for a plunger 23 in the form of a rod. The inner end 25 of the tubular wall portion 20 is bevelled, i.e., frusto-conical in cross-sectional configuration for mating with a frusto-conical recess 26 in the bottom end of a cap 28 pro-

vided on the upper end of the plunger 23 in the casing 15. The inwardly extending tubular wall portion 20 and the cap 28 are surrounded in the casing 15 by a coil 30 forming part of an electromagnetic circuit (described hereinafter in greater detail). Thus, the cap 28 on the plunger 23 forms a magnetic core for the electromagnetic circuit, and accordingly is formed of a suitable magnetic material, e.g., iron. The cap 28 is normally biased upwardly away from the bottom wall 19 of the casing 15 by a helical spring 32 mounted co-axially on the plunger 23 and extending between the interior of the cap 28 and an enlarged bore 33 in the tubular wall portion 20.

As shown in Figure 2, a flat, generally rectangular blade 35 is securely mounted in the recessed lower, outer end 37 of the plunger 23 by means of a bolt 38 and nut 40. The inner end 42 of the blade 35 is convex and bevelled, and abuts against a concave notch 44 in the outer end 37 of the plunger 23. Thus, the blade 35 is self-adjusting, i.e., when the flat cutting edge 45 strikes a flat surface, the blade 35 can rotate about the axis of the bolt 38 so that the entire cutting edge 45 strikes such flat surface.

For cooperating with the blade 35 in a cutting action, a hard metal insert 46 is provided in the table portion 10 of the frame 1. A V-shaped notch 48 in the insert 46 facilitates proper cutting action, since the vertex of the notch 48 defines the point of cutting. The insert 46 is located in an anvil 50, which is removably mounted on the table portion 10, whereby the anvil 50 and insert 46 can readily be replaced when damaged or otherwise altered by wear.

A holder in the form of a plate 52 is removably mounted with bolts 54 at the side of the table portion 10 adjacent to the anvil 50 for photoelectric sensors 56 and 57. The sensors 56 and 57 include a pair of photoelectric cells 58 and 59 mounted at spaced apart points in the plate 52, and fibreglass filaments (not shown) extending upwardly to adjacent the top surface of the plate 54 for transmitting light from a light source 60 to the photoelectric cells. The use of fibre optics in the sensors 56 and 57 renders the sensors much more sensitive to the presence or absence of light from the light source 60.

The operation of the apparatus will now be described with reference to Figures 5 to 11.

While a binding tape 63 (Figure 5) is being continuously sewn onto an upper component 65 travelling in the direction of arrow 66 through a sewing machine 68, it is desirable to cut the binding strip at the leading edge 69 and at the trailing edge (not shown) of the component 65. Since the components 65 are fed very quickly through the sewing machine 68, the time lapse between cuts (particularly between cuts at the trailing edge of one com-

ponent and the leading edge of the next component) is very small.

The sensors 56 and 57 form parts of a circuit (Figure 6) including pulse conditioners 71 and 72 for modifying the output signal 74 (Figure 7) from the sensor 56 to form pulse 75 (Figure 8). The pulse 75 is fed into a gating pulse timer 76, in which the pulse 75 is modified to pulse 78 (Figure 9). The pulse 78 opens gates of pulse conditioners 80 and 81, the former of which also receives a pulse 74' (Figure 7) from the sensor 57. If during the existence of pulse 78, a change of illumination of sensor 57 occurs, pulses 83 and 84 (Figure 10) are emitted by the pulse conditioners 80 and 81. The pulses 83 and 84 are modified by trigger pulse systems 86 and 87 to form trigger pulses 89 and 90. The trigger pulses 89 and 90 control power impulse systems 92 and 93, which discharge condensers 95 and 96 into the coil 30 in the casing 15.

The condenser 95 is discharged into the coil 30 when the sensor 57 is illuminated and condenser 96 is discharged when the sensor 57 is occluded or blanked, but only when gating pulse 78 is available.

In mechanical terms, the operation of the apparatus will now be described with reference to Figure 5.

The binding tape 63 is continuously sewn onto an upper component 65, and the resulting product is fed to the cutting apparatus, i.e., onto the anvil 50. The sensors 56 and 57 are occluded by the component 65, and, upon occlusion of the second sensor 57, the condenser 95 discharges to energize the coil 30 which causes the cap 28 (i.e., core) to move downwardly with the plunger 23 and the blade 35 to cut the tape 63 at the leading edge 69 of the component 65. The helical spring 32 immediately returns the cap 28, the plunger 23 and the blade 35 to the rest position (Figure 1). Upon completion of the sewing of the tape 63 to the component 65, the trailing edge thereof uncovers first the sensor 56 and then the sensor 57 which results in transmission of another set of signals to the circuit causing the condenser 96 to discharge. Since the tape 63 is fed continuously into the cutting apparatus with components 65 continuously being attached thereto, the above cycle of operation is repeated for each component.

The time of chopping and then energy of impact of the blade 35 are dependent on (1) the parameters of the solenoid defined by the cap 28, coil 30 and plunger 23, (2) the mass of magnet core defined by cap 28 and the plunger 23, (3) the spring 32 and (4) the charge of condensers 95 and 96. Such parameters are preferably selected so that the binding tape or strip 63 is cut in time shorter than 3 milliseconds and within a tolerance preferably not greater than $\pm 1/32''$.

WHAT WE CLAIM IS:—

1. A cutting apparatus for cutting a strip of binding tape connected to a shoe upper component and extending beyond at least one edge thereof, the cutting being performed at said one edge, said apparatus comprising a frame; a yoke on said frame; an arm slidably mounted in said yoke; a table portion on said frame for receiving said component and tape; a casing on one end of said arm opposite said yoke and above said table portion of the frame; a plunger housed in said casing and projecting therefrom toward said table portion of the frame; a blade on the outer end of said plunger for cutting said tape during passage of the component and tape over said table portion of the frame; an electromagnetic drive for moving said plunger and blade from a rest position to a cutting position; a sensor for actuating said drive when said component and said tape are properly located beneath said blade; and means for returning said plunger and said blade to said rest position, said electromagnetic drive including a core formed of magnetic material mounted on said plunger in said casing; a coil around said core; and a circuit for energizing said coil in response to signals from said sensor, said sensor including photoelectric cells positioned in the path of travel of said component in advance of said blade, and a light source for illuminating said photoelectric cells.
2. Apparatus according to Claim 1, including an anvil removably mounted in said table portion beneath said blade; and a hard metal insert in said anvil for receiving said blade during cutting of the tape.
3. Apparatus according to Claim 1 or Claim 2, including a plate removably mounted on said frame adjacent said anvil, said sensor including photoelectric cells in said plate, said photoelectric cells being positioned in the path of travel of said components over said table portion in advance of said blade and a light source above said table portion for illuminating said photoelectric cells.
4. Apparatus according to any preceding claim, wherein said blade is a flat blade pivotally mounted on the outer end of said plunger and having a flat outer cutting edge extending transversely of said tape, whereby the blade is self-adjusting to ensure complete cutting action by the blade.
5. Apparatus according to any preceding claim, wherein the photoelectric cell is incorporated in circuitry arranged for generation of a pulse on change in cell illumination from the light source by arrival of a shoe upper component at a predetermined location, and for triggering discharge of a condenser in the circuit in response to said pulse.
6. Apparatus according to Claim 5, wherein said circuit includes a pair of normally charged condensers connected to said coil and



ponent and the leading edge of the next component) is very small.

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1. A cutting apparatus for cutting a strip of binding tape connected to a shoe upper component and extending beyond at least one edge thereof, the cutting being performed at said one edge, said apparatus comprising a frame; a yoke on said frame; an arm slidably mounted in said yoke; a table portion on said frame for receiving said component and tape; a casing on one end of said arm opposite said yoke and above said table portion of the frame; a plunger housed in said casing and projecting therefrom toward said table portion of the frame; a blade on the outer end of said plunger for cutting said tape during passage of the component and tape over said table portion of the frame; an electromagnetic drive for moving said plunger and blade from a rest position to a cutting position; a sensor for actuating said drive when said component and said tape are properly located beneath said blade; and means for returning said plunger and said blade to said rest position, said electromagnetic drive including a core formed of magnetic material mounted on said plunger in said casing; a coil around said core; and a circuit for energizing said coil in response to signals from said sensor, said sensor including photoelectric cells positioned in the path of travel of said component in advance of said blade, and a light source for illuminating said photoelectric cells.

2. Apparatus according to Claim 1, including an anvil removably mounted in said table portion beneath said blade; and a hard metal insert in said anvil for receiving said blade during cutting of the tape.

3. Apparatus according to Claim 1 or Claim 2, including a plate removably mounted on said frame adjacent said anvil, said sensor including photoelectric cells in said plate, said photoelectric cells being positioned in the path of travel of said components over said table portion in advance of said blade and a light source above said table portion for illuminating said photoelectric cells.

4. Apparatus according to any preceding claim, wherein said blade is a flat blade pivotally mounted on the outer end of said plunger and having a flat outer cutting edge extending transversely of said tape, whereby the blade is self-adjusting to ensure complete cutting action by the blade.

5. Apparatus according to any preceding claim, wherein the photoelectric cell is incorporated in circuitry arranged for generation of a pulse on change in cell illumination from the light source by arrival of a shoe upper component at a predetermined location, and for triggering discharge of a condenser in the circuit in response to said pulse.

6. Apparatus according to Claim 5, wherein said circuit includes a pair of normally charged condensers connected to said coil and



one or other of the condensers is discharged in response to said pulse.

- 5 7. Apparatus according to Claim 5 or Claim 6, in which the arrival of a shoe upper component interrupts light from the light source normally conveyed to said cell by fibre optics located at one end adjacent the shoe upper component path.

8. Cutting apparatus substantially as here-

inbefore described with reference to, and as 10 shown in, the accompanying drawings.

9. Shoe upper components having binding tape thereon cut by apparatus according to any of Claims 1 to 8.

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