United States Patent

Johnson et al.

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[45] **June 20, 1972**

[54] CARD CUTTING APPARATUS

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[52] **U.S. Cl.**.....**83/99;** 83/155, 83/167, 83/276, 83/373, 83/402, 83/436, 83/444, 83/447, 83/451, 83/925 R

[51] **Int. Cl.**.....**B65h 35/06**

[58] **Field of Search**.....83/98, 99, 100, 373, 402, 444, 83/447, 167, 102, 107, 152, 451, 155, 436, 276; 226/196, 198

[56] **References Cited**

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2,117,797	5/1938	Flynn et al.	83/373 X
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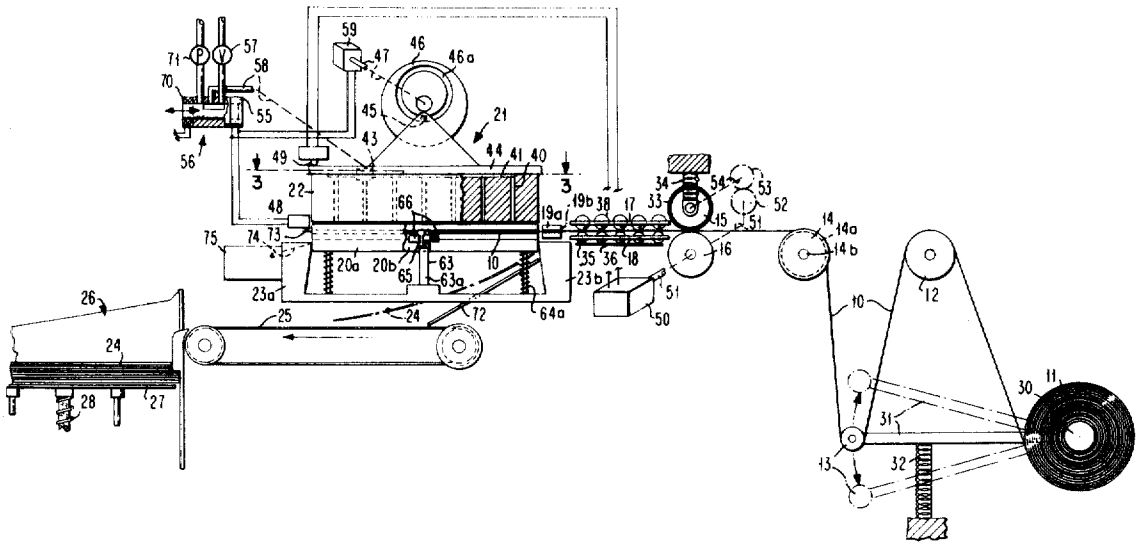
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[57] **ABSTRACT**

Cards are formed by intermittently die cutting both ends simultaneously from a web of polyester material, providing cards of a width equal to that of the web. This "cookie-cutter" approach leaves a small scrap strip between cards, but assures that the cards will be of consistently accurate length with precisely positioned corner cuts or rounded corners being formed at the same time as the transverse end cut. During the punching stroke, the uncoated side of the web is attracted by vacuum to the punch just before it enters the die; and two U-shaped movable guides that laterally support the web are spread apart to release the card as it is cut from the web; whereupon air under pressure is supplied to the punch to divert the scrap strip into a receptacle and release the card onto a conveyor for stacking.

7 Claims, 7 Drawing Figures



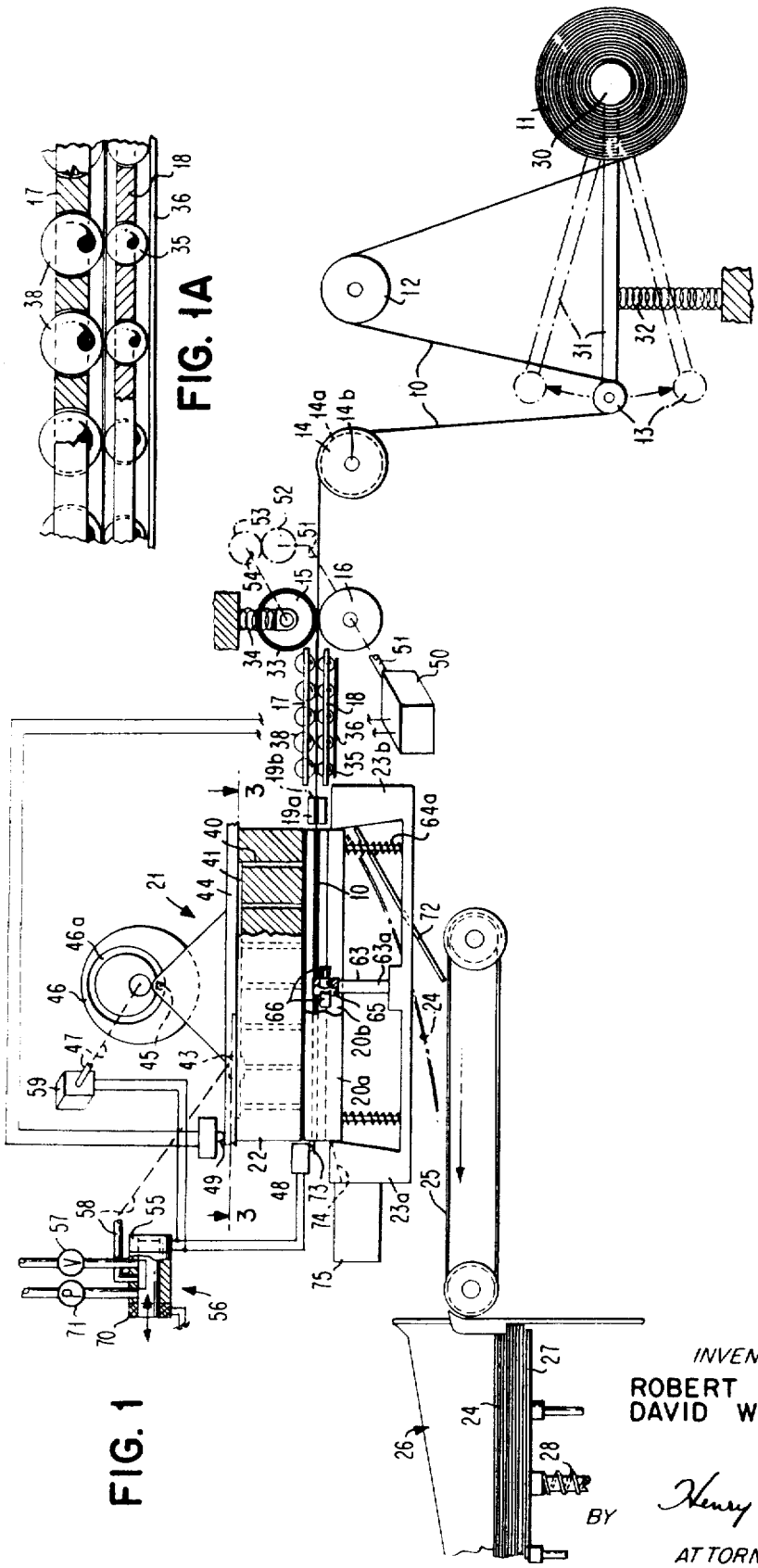


FIG. 1

FIG. 1A

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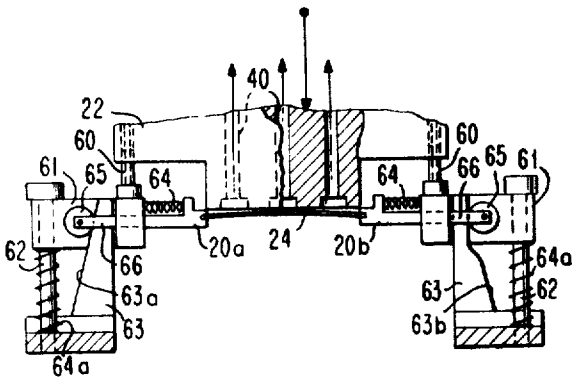


FIG. 2A

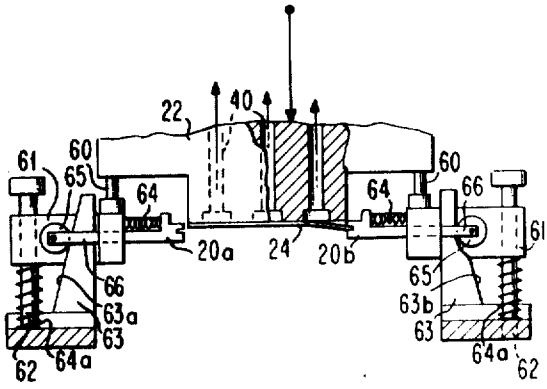


FIG. 2 B

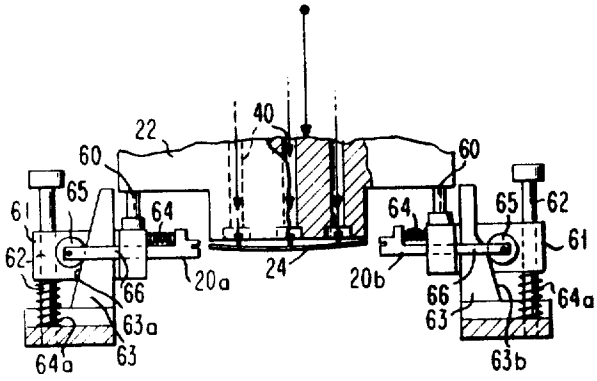


FIG. 2C

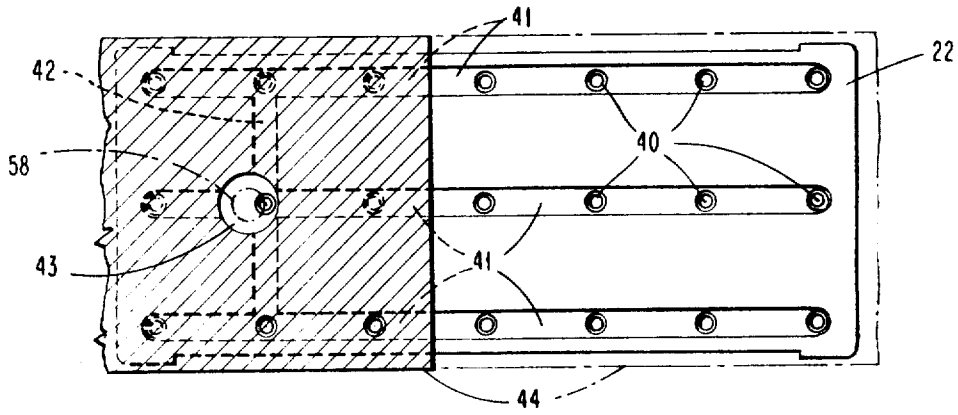
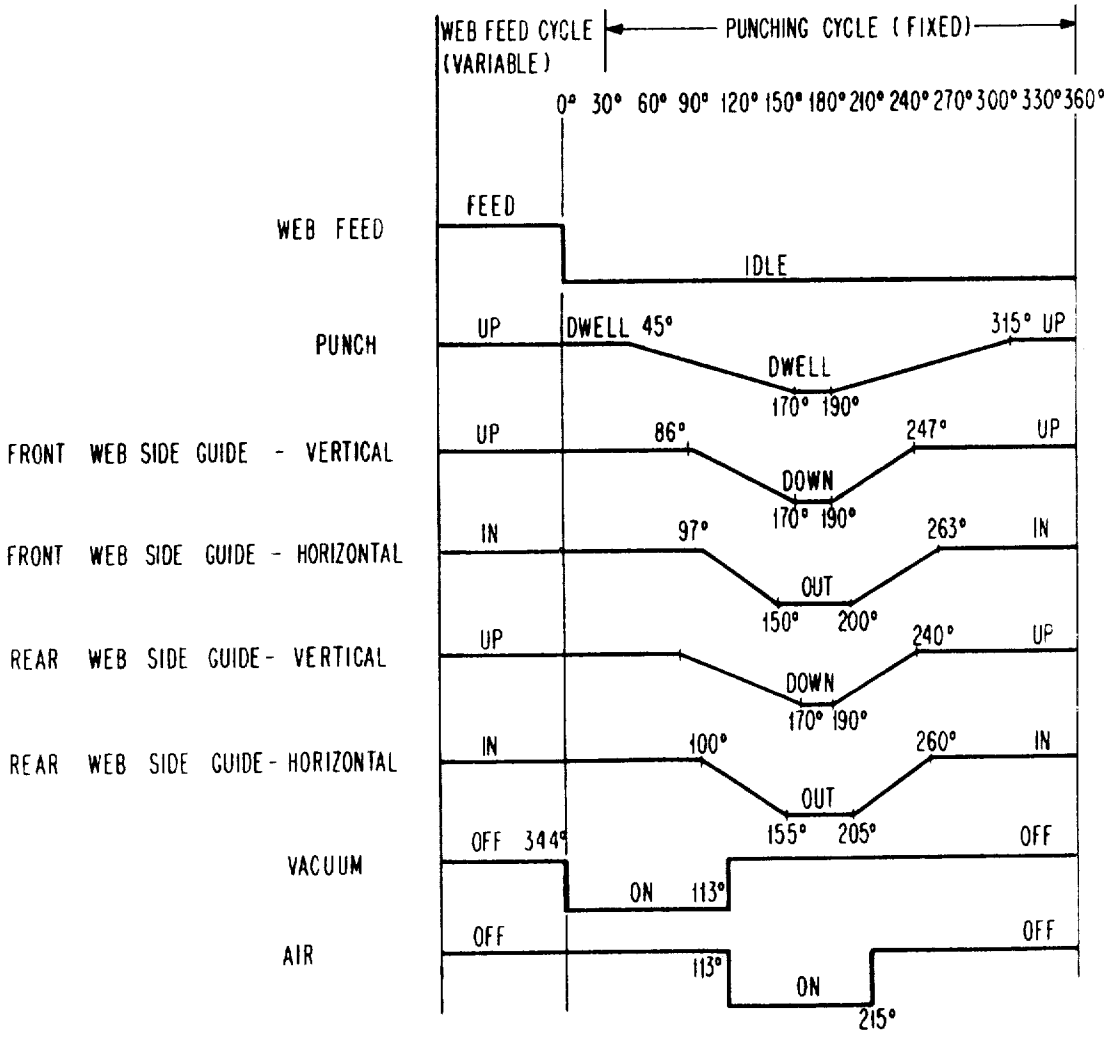

41
42
22
40
58
41
43
44

FIG. 3

FIG. 4


WEB FEED CYCLE (VARIABLE)
PUNCHING CYCLE (FIXED)
0° 30° 60° 90° 120° 150° 180° 210° 240° 270° 300° 330° 360°
WEB FEED
FEED
IDLE
PUNCH
UP
DWELL 45°
315° UP
DWELL
170° 190°
FRONT WEB SIDE GUIDE - VERTICAL
UP
86°
247°
UP
DOWN
170° 190°
FRONT WEB SIDE GUIDE - HORIZONTAL
IN
97°
263°
IN
OUT
150° 200°
REAR WEB SIDE GUIDE - VERTICAL
UP
240°
UP
DOWN
170° 190°
REAR WEB SIDE GUIDE - HORIZONTAL
IN
100°
260°
IN
OUT
155° 205°
VACUUM
OFF 344°
OFF
ON 113°
AIR
OFF
OFF
113°
ON
215°

CARD CUTTING APPARATUS

This invention relates to apparatus for cutting cards of precise configuration from a web having a readily damaged magnetic or other coating. It relates, more particularly, to such apparatus which is intermittently operable to cut leading and trailing edges of desired configuration simultaneously from a web to provide cards of accurately controlled length and a width corresponding to that of the preselected web.

BACKGROUND OF THE INVENTION

It is common practice to cut tabulating cards from a web with a succession of rolls. For example, U. S. Pat. No. 3,261,522 discloses a score roll that first provides oppositely arranged curved cuts extending inwardly from each lateral edge of the web; then a cut-off roll makes one transverse cut to sever the card from the web, the card thus severed having rounded corners at its trailing edge while two forwardly extending projections remain on the web which are removed by a corner cut roll that provides either rounded corners at the leading edge or one rounded corner and one slash cut. U. S. Pat. No. 3,283,635 discloses a feed roll which cuts out oppositely arranged V-like notches extending inwardly from each lateral edge of the web to provide what will become the trailing edge of one card and leading edge of the succeeding card after a cut-off roll severs the web across the center line of the notches; and a corner slash cut is later provided, if desired, by a corner cut roll. On the other hand, U. S. Pat. No. 3,433,107 discloses a cut-off roll which makes one transverse cut completely across the web, thus simultaneously performing the functions of the score and cut-off rolls disclosed in U. S. Pat. No. 3,261,522; but it requires a corner cut roll to remove the forwardly extending projections.

While these arrangements have proved satisfactory for cutting tabulating cards from paperstock, they are unsuitable for making cards cut from a magnetically coated polyester web. This is because polyester material is hard to cut, leading to misregistration between successive cuts and inability to produce cards consistently within close tolerances; and the magnetically coated recording surface can easily become scratched or damaged with the arrangements employed in the above-cited prior art. There is a need for apparatus that will enable polyester cards with a magnetically coated recording surface or other readily damaged surface to be cut from a web to accurate length and with closely defined consistent end configurations.

SUMMARY OF THE INVENTION

Toward this end, and according to the invention, a web is advanced intermittently to a punch station by a rubber coated roll spring-biased into contact with a steel roll to provide a resilient nip, with the coated surface of the web contacting the steel roll. The web then advances first through the respective nips of two laterally spaced sets of longitudinally spaced juxtaposed steel balls loosely retained in guide plates; then through oppositely arranged channels provided by fixed guides that support the web along its opposite lateral edges; and finally through similar longitudinal channels provided in oppositely arranged movable guides disposed between a movable punch and stationary die at the punch station.

During the initial phase of the punching stroke upon advancement of the leading portion of the web into the punch station, the downward movement of the punch mechanically spreads the movable guides, preferably sequentially, as vacuum applied via ports through the punch face attracts the web and holds it registered while a card is being cut in a cookie-cutter fashion from the web by simultaneously cutting both the leading and trailing edges of the card. Then compressed air, instead of vacuum, is supplied to the ports, preferably sequentially, to blow a small scrap strip laterally into a receptacle and blow the card down onto a conveyor preferably with the leading edge tilted down. The conveyor advances the card into a stacker.

Other objects and advantages will become more apparent from the following more detailed description of the invention and from the accompanying drawings, wherein:

FIG. 1 is a side elevational view, partly in section and partly schematic, of a card-cutting apparatus embodying the invention, showing the punch in raised position ready to initiate a punching operation;

FIG. 1A is a fragmentary enlarged view of a portion of the apparatus shown in FIG. 1;

FIGS. 2A, B, and C are end views, to enlarged scale, taken along the line 2—2 of FIG. 1, and showing the sequential positions of the punch and movable guides during a punching operation;

FIG. 3 is a top plan view of the punch; and

FIG. 4 is a timing diagram showing the sequence of operations during a punching cycle.

DESCRIPTION

The card-cutting apparatus embodying the invention is provided for cutting cards of consistently constant dimension from a web **10** comprising a substrate of polyester material or the like which is difficult to cut accurately and which has a coating, of such as magnetic oxide material, that is easily scratched or otherwise rendered unserviceable. As illustrated in FIG. 1, such a web is unwound from supply roll **11** and pulled over idler rolls **12,13,14** by pull rolls **15,16** which push the web between ball-carrying guide plates **17,18**. The web then successively advances through oppositely arranged channels provided in fixed guide members **19*a*,19*b*** and in movable guide members **20*a*,20*b***. These channeled members **19,20** support the web along its opposite lateral edges to a very slight degree, such as about 0.04 inch, to provide minimal rubbing contact with the coated surface of the web. The fixed guide members **19*a*,19*b*** are adjacent the input end of a punch station, designated generally **21**; whereas the members **20*a*,20*b*** are disposed adjacent the entire front and rear sides of the punch station.

The punch station **21** comprises a vertically reciprocable punch **22** that moves down between longitudinally spaced die blocks **23*a*,23*b*** to shear the web simultaneously along two longitudinally spaced edges to cut the leading and trailing edges concurrently to provide an accurately dimensioned card **24**. Successive cards, as they are cut, are suitably conveyed, as by a conveyor belt **25**, to a stacker **26**. As cards are delivered to stacker **26**, a platform **27** descends against resistance of a bias spring **28** to maintain the level of the card stack substantially constant.

Conventional means are provided for supporting the supply roll **11** and assuring that substantially constant tension will be maintained on the web **10** as it is unwound by pull rolls **15,16**. Briefly, this means comprises a braking unit (not shown) connected to supply roll spindle **30** and controlled by a lever arm **31** that carries idler roll **13**. Normally, lever arm **31** assumes a neutral or mid position, in which it is shown in solid lines, and in which it exerts a slight preselected drag on the spindle corresponding to a desired degree of web tension. If tension should increase above this desired degree, the web will pull arm **31** upward relaxing the brake; whereas if tension decreases below the desired degree, bias spring **32** will pull the arm downward for further applying the brake to increase web tension.

Pull rolls **15,16** are both driven intermittently at preselected constant intervals by suitable means including an electromagnetic clutch **50** to advance a desired length of web material into the punch station **21** at the end of each return stroke of the punch **22**. Upper roll **15** has a rubber covering **33** and is loaded by a spring **34** against the steel lower surface of roll **16** to insure accurate feeding of the web. Idler roll **14** has flanges **14a** spaced apart slightly more than the width of the web to provide a guide channel; and the roll has adjustable screw-threaded engagement along the idler shaft **14*b*** to permit the roll to be positioned laterally and locked by lock nuts (not

shown) as necessary to compensate for any sideways curvature of the web.

As best shown in FIG. 1A, lower guide plate **18** loosely retains three laterally spaced rows of longitudinally spaced stainless steel balls **35** which roll on a polished stainless steel plate **36**. Upper guide plate **17** loosely retains one row of stainless steel balls **38** of slightly larger diameter than balls **35**; and each ball **38** has its center vertically aligned with a corresponding ball **35** in the center row of plate **18**. The balls **35,38** are caged loosely enough so that they can contact each other if and when no web material intervenes; and when the web is interposed between the balls, the upper balls **38** will rest on the web, exerting a downward force thereon corresponding merely to their own weight. These loosely retained stainless steel balls **35,38** enable the web to move freely, without damage to its coated surface, from the pull rolls **15,16** into the facing guide channels in the fixed guide members **19*a*,19*b*** and thence into the similar channels in movable guide members **20*a*,20*b***; the guide members assure that the increment of web advanced to the punch station **21** will be meticulously positioned for accurate punching.

A plurality of ports **40** open through the lower face of punch **22**. As illustrated in FIGS. **1** and **2A–C** and **3**, these ports are arranged in three transversely spaced rows, each comprising seven longitudinally spaced ports interconnected by longitudinal channels **41** in the upper face of the punch which also provides a transverse channel **42** interconnecting the respective channels **41**. Air under pressure or vacuum is alternately supplied to channels **41,42** and hence ports **40** via a supply port **43** provided in a suitable punch guide **44** (only partly shown in FIGS. **1** and **3**) that constrains the punch to assure controlled vertical movement. Vertical movement of guide **44** and hence punch **22** is effected by a follower pin **45** that rides in a cam slot **46*a*** in a rotatable cam **46**. Cam **46** is mounted on a shaft **47** that is rotated 360° by an electromagnetic clutch **59** when a microswitch **48** is closed by the leading edge of the web **10** at the end of a web feed cycle.

OPERATION

Assume initially that the punch guide **44** and hence punch **22** have just attained their uppermost position, in which they are shown in FIG. **1**. Guide **44** will close microswitch **49** to activate clutch **50** which through any suitable means, such as a shaft **51**, gears **52,53** and a shaft **54** drives both pull rolls **15,16**. These rolls **15,16** will be rotated a precise degree sufficient to advance the web **10** through guide members **19,20** and cause the leading edge of the web to project slightly beyond members **20** and activate microswitch **48**.

At this instant, all components will be in the respective positions in which they are shown in FIG. **1**; the web feed cycle (see FIG. **4**) will have just been completed; and the punch cycle will have been initiated, in the following manner, by the closure of switch **48**.

Closure of switch **48** energizes winding **55** of a three-position solenoid **56** to cause the latter to connect port **43** to a vacuum source **57** via a suitable conduit, such as **58**. The suction thus applied via ports **40** (see FIG. **2A**) to the web **10** will attract its uncoated surface to the lower face of the punch **22**, while the web is still supported by guides **19*a*,19*b***.

Meanwhile, closure of switch **48** also energizes electromagnetic clutch **59** which through suitable means, such as shaft **47**, rotates cam **46** one complete revolution. As cam **46** rotates, it acts through follower **45** to move the punch **22** downward. Screw-threaded into the punch **22** and previously adjusted are two pairs of adjusting screws **60** (only one pair shown in FIG. **2A**) which move down with the punch and bear on corresponding blocks **61** that are constrained to move vertically by guide studs **62** screw-threaded into cam blocks **63**. A spring **64**, assisted by a spring **64*a***, seats against each block **61** to bias a respective one of the guide members **20*a*,20*b*** toward the corresponding side edges of the web **10** to a degree permitted by a respective roller follower **65**. Each follower **65** is supported on a bifurcated element **66** having a shank axially slidable in a bore through a flange in block **61** and screw-threaded into a respective guide member. Hence, as the punch **22** and blocks **61** move vertically downward, followers **65** will roll down along respective cam surfaces **63*a*,63*b***, causing guide members **20*a*,20*b*** to be pulled away from the web against resistance of respective springs **64,64*a***. The cam surfaces **63*a*,63*b*** preferably differ slightly so that, as shown in FIGS. **2B** and **4**, guide member **20*b*** will disengage from the web slightly after guide member **20*a***. This assures that the vacuum applied via ports **40** will have adequate time to capture the web.

Within the web now held firmly against the punch and accurately positioned with respect to the die blocks **23*a*,23*b***, the movable guide members **20*a*,20*b*** will have been spread apart and out of the way of the descending punch, as the punch with web attached enters the die blocks. Each die block **23*a*,23*b*** preferably has a slight apex (not shown) toward its center so that the web **10** will be penetrated at its transverse center and then progressively cut toward the sides with a shearing action, thereby desirably reducing the requisite cutting force and eliminating side forces.

Thus the leading and trailing edges of a card **24** are cut simultaneously from the web, assuring it will be of precise length and configuration. The punch and die blocks preferably provide a card with straight edges but beveled or rounded corners.

As the punch approaches its lowermost position (see FIG. **4**), a microswitch (not shown) is closed to cause winding **55** of solenoid **56** to become deenergized and energize a winding **70** to successively disconnect the supply port **43** from vacuum source **57** and connect it to a source **71** of compressed air; whereupon the cut card **24** will not be blown off the punch as shown in FIG. **2C**. As illustrated in FIGS. **1** and **3**, the supply port **43** is positioned so that the compressed air will be effective in those ports **40** near the leading edge of the cut card **24** somewhat sooner than in those toward the trailing edge of the card to deflect the leading edge of the card down first as shown by a broken line in FIG. **1**. Ramp **72** in cooperation with side guides (not shown) direct the card **24** onto belt **25** which conveys the cards to stacker **26**.

Meanwhile, the piece of scrap **73** generated by the punching stroke and corresponding to the slight amount of web which had extended forwardly of the punch will be blown down a chute **74** into a scrap box **75** by some of the air supplied to ports **40**.

As the punch starts up, another microswitch (not shown) is closed to deenergize both windings **55** and **70** and thus cause solenoid **56** to cut off supply of both pressure and vacuum fluid to port **43** (see FIG. **4**).

It will thus be seen that the apparatus embodying the invention desirably comprises a punch to which the uncoated side of the web material is adhered by vacuum so the coated side remains untouched by the punch and die blocks. Movable guide members **20*a*,20*b*** assure reliable feeding of the web and the shallow channels in these members assure against damage to the coated side of the web. Steel rollers contact the coated side of the web to prevent damage, and the use of the rubber pull roll **15** in conjunction with steel pull roll **16** assures that no foreign matter can be forced into the coated side of the web. A card of precise dimension is cut in one stroke, cookie-cutter fashion, with a minimum of scrap.

It will be apparent that various changes may be made without departing from the spirit, scope and teaching of the present invention. Accordingly, the apparatus herein disclosed is to be considered merely as illustrative, and the scope of the invention is to be limited only as specified in the claims:

We claim:

1. Apparatus for cutting cards from a web, comprising, in combination,

punch means and a die means disposed at a punch station,

means for advancing the free end of the web to the punch station,

oppositely arranged guide members at the station for supporting the web adjacent its lateral edges during operation of the advancing means,

means for moving the punch means relative to the die means to punch out a card from the web by making continuous transverse cookie-cutter-like cuts along at least two oppositely arranged edges simultaneously upon completion of the operation of the advancing means,

means responsive to the movement of said punch means during a punching stroke to spread said guide members out of the way of the punch means,

said punch means having a plurality of ports opening through its punching face,

means for supplying suction to the ports during the initial phase of the punching stroke to adhere the web to the punch means just before it pushes the web through the die means and to hold the web in position as the guide members are spread, and

means forming part of said movement responsive means to spread one of the movable guides from one side of the web after the other movable guide to allow the suction applied through said ports adequate time to capture and register the web.

2. Apparatus according to claim 1, including

means to supply fluid under pressure to said ports sequentially in the final phase of a punching stroke to blow the cut card off the punch means one edge first.

3. Apparatus according to claim 1, wherein

the web is coated on one side, as with a magnetic recording surface,

the guide members provide facing channels that overlap the lateral edges of the web a very slight distance to minimize damage to the coating, and

the opposite side of the web is attracted to and registers against the punch means during the initial phase of the punching stroke.

4. Apparatus according to claim 1, wherein

the continuous transverse cuts are along what will define the leading and trailing edges of the card, and

a scrap strip is provided between the leading edge of the web and the leading edge of the card as cut, and including

a receptacle adjacent one edge of the die means for receiving the scrap strip, and

means operative during the final phase of the punching stroke for blowing the scrap strip into the receptacle and diverting it away from the card.

5. Apparatus according to claim 1, wherein

the continuous transverse cuts are along what will define the leading and trailing edges of the card, and

a scrap strip is provided between the leading edge of the web and the leading edge of the card as cut, and including

a receptacle adjacent one edge of the die means for receiving the scrap strip,

a conveyor below the die means for receiving the card when cut, and

means operative during the final phase of the punching stroke for blowing the scrap strip into the receptacle and diverting it away from the card and blowing the card toward the conveyor, and

the lateral edges of the card being defined by the preselected width of the web.

6. Apparatus according to claim 1, including

fixed guide members just upstream of the punch station for supporting the web upon spreading of the movable guide members during a punching stroke.

7. Apparatus according to claim 1, wherein

one side of the web is coated with a medium that is readily damaged, and

said advancing means comprises a rubber-coated roll spring loaded against a steel roll to provide a resilient yieldable nip through which the web is advanced without damage to the coating, at least one of said rolls being driven, and

a pair of parallel plates interposed in the web path between said rolls and the punch station and vertically spaced apart a distance greater than the web thickness,

each of said plates loosely retaining at least one longitudinally extending row of spaced stainless steel balls,

the balls having their center lines aligned, the row of balls in the uppermost plate resting by their own weight on the uncoated side of the web.

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