

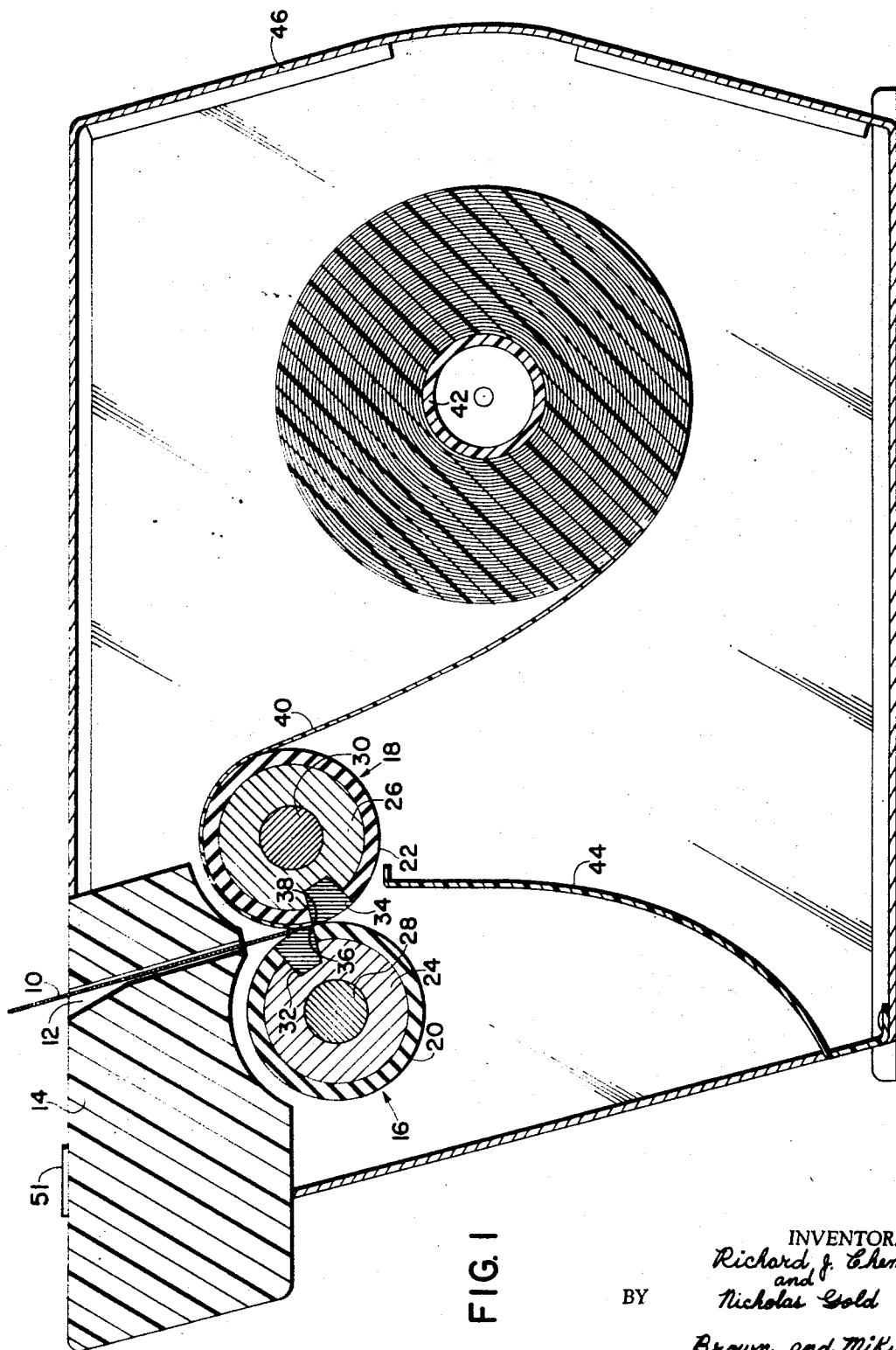
April 15, 1969

R. J. CHEN ETAL
APPARATUS FOR LAMINATING AND CUTTING INCLUDING A PAIR
OF ROLLERS WITH CUTTING EDGES

3,438,835

Filed March 4, 1966

Sheet 1 of 2



INVENTOR.
Richard J. Chen
and
Nicholas Gold
BY
Brown and Mikulka
ATTORNEYS

April 15, 1969

R. J. CHEN ETAL
APPARATUS FOR LAMINATING AND CUTTING INCLUDING A PAIR
OF ROLLERS WITH CUTTING EDGES

3,438,835

Filed March 4, 1966

Sheet 2 of 2

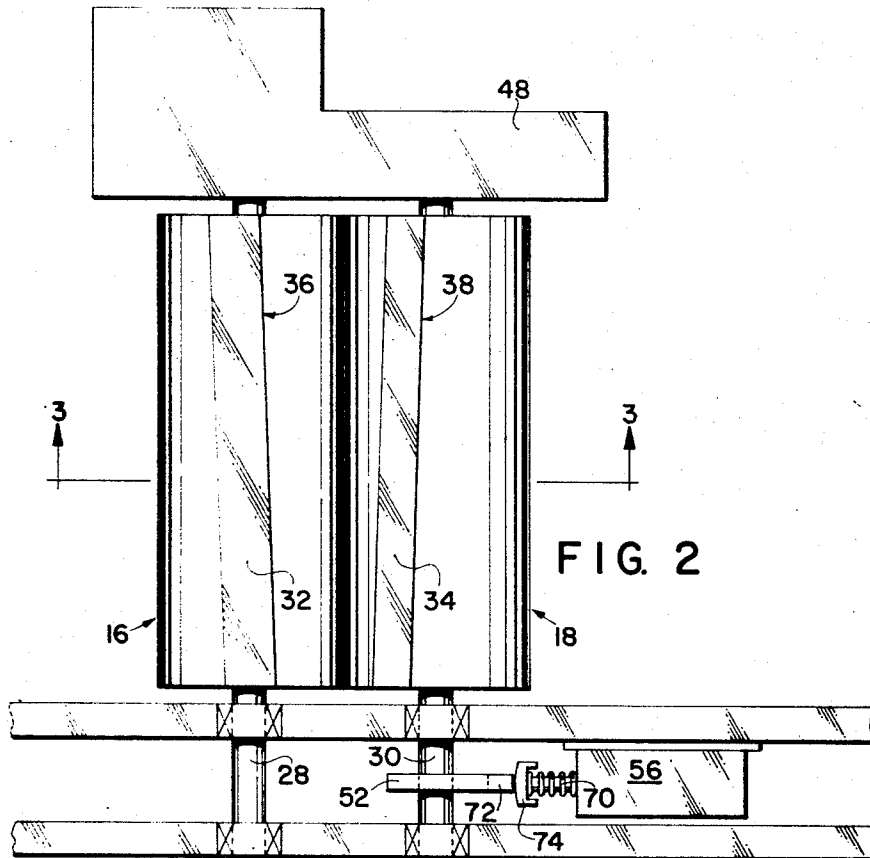


FIG. 2

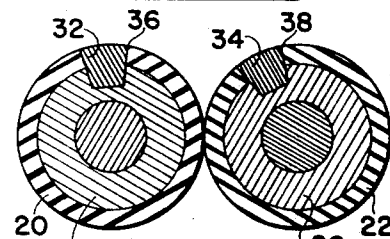


FIG. 3

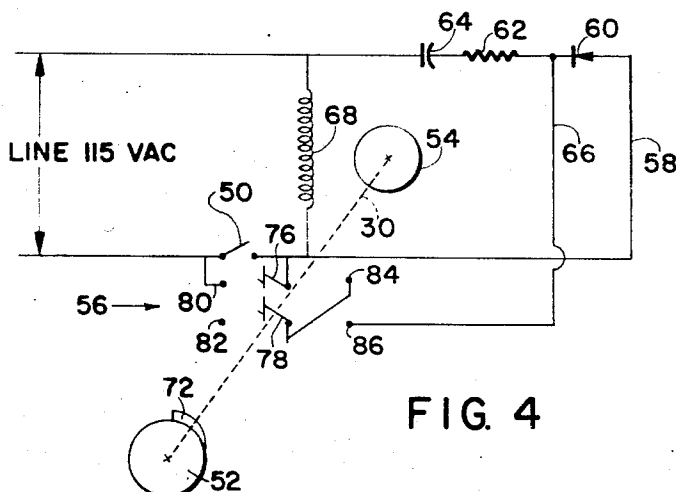


FIG. 4

INVENTOR.
Richard J. Chen
and
Nicholas Gold
BY
Brown and Mikulka
ATTORNEYS

1

2

3,438,835

APPARATUS FOR LAMINATING AND CUTTING INCLUDING A PAIR OF ROLLERS WITH CUTTING EDGES

Richard J. Chen, Winchester, and Nicholas Gold, Arlington, Mass., assignors to Polaroid Corporation, Cambridge, Mass., a corporation of Delaware

Filed Mar. 4, 1966, Ser. No. 531,880

Int. Cl. B32b 31/18, 31/20

U.S. Cl. 156—522

8 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus laminates the image-bearing surface of a photographic print to a continuous web of plastic material and then severs the portion of the web laminated to the print from the remainder of the web.

This invention relates to apparatus for laminating and cutting sheet materials and more particularly to apparatus producing a lamination from a photographic print and a continuous web of plastic material.

The apparatus has particular use in the production of identification cards from a photographic print bearing the desired identification information. Photographic prints of the type produced by the well-known color diffusion transfer process are of particular advantage. These photographic products include a sheet of photosensitive material and a color print-receiving layer which are superposed during development of the color negative and production of the color print. Thereafter, the print-receiving layer is stripped from the photosensitive sheet. When freshly stripped from the photosensitive material the print is "wet" and if, while it is in this wet condition, it is pressed against the surface of a rigid or semi-rigid vinyl having a suitable coating with a hydrolyzed surface; a virtually indestructible bond is formed between the hydrolyzed surface and the wet surface of the color print. This bond and the materials necessary for the formation thereof are described in a U.S. patent application in the names of Howard C. Haas and Harold O. Buzzell, Ser. No. 451,894, filed Apr. 29, 1965, and entitled, "Laminations."

It is anticipated that the photographic positive will be laminated to the hydrolyzed vinyl surface immediately after it is stripped from the photosensitive material and thus while it remains "wet." If, however, the photographic positive is allowed to dry prior to lamination, the lamination may be effected by wetting either the hydrolyzed surface or the image-bearing surface of the photographic print prior to pressing the print and the hydrolyzed surface together.

High pressures are not necessary to achieve the bond, contact is sufficient, but firm pressure is necessary during the laminating operation to insure complete surface-to-surface contact of the photographic print and the hydrolyzed surface and to expel air which may tend to be trapped between the two layers.

The laminating and cutting apparatus which is the subject of this invention may comprise a pair of laminating and cutting rollers having resilient, engaging surfaces, means for supporting a continuous plastic web supply and means to guide the end of the web and the print into the nip of the rollers. The print and the plastic web pass between the rollers upon rotation thereof, the wet surface of the photographic print and the hydrolyzed surface of the web being arranged in face-to-face contact. Contact is assured by the engaging surfaces of the rollers and since the surfaces of the lamina adhere to each other upon contact, the lamination is formed as the materials pass between the rollers without the addition of adhesive or further wetting agents.

The cutting means comprises a pair of cutting edges, one installed in each of the laminating and cutting rollers such that it is flush with or recessed below the surface of the material forming the resilient surface of the roller when the resilient material is uncompressed and exposed when the material is compressed. The cutting edges are so positioned within the rollers that upon each revolution of the rollers the blades move into co-operating severing relationship at the nip, or point of common tangency, thereof, to sever that portion of the continuous plastic web which has been laminated to the print from the remainder of the web supply. The engagement of the rotating rollers is effective to compress the resilient surfaces thereof along the nip of the rollers to thereby expose the cutting edges as they moved to the co-operating cutting relationship.

The laminating machine and the laminating and cutting rollers in particular yield superior results to other known laminating machines due to the above-described unique relationship between the resilient surfaces of the rollers and the cutting edges. The cutting edges sever the plastic web by means of a shearing action, only a very small amount of shearing contact between the cutting edges being necessary. Shearing contact of more than a few thousandths of an inch causes excessive friction and wear on the cutting edges and creates significant drag in the operation of the machine. By recessing the cutting edges into the resilient surfaces of the rollers such that they protrude beyond the surface only when the surfaces are compressed and then by such an amount that only a very small amount of the blades protrude beyond the recessed surfaces of the rollers for establishing shearing contact, excessive drag and wear is avoided. It is apparent that if the blades extended beyond the surfaces of the uncompressed rollers, they would necessarily extend relatively far beyond the surfaces of the rollers when in the compressed state and thus be subject to a substantial amount of the objectionable overlapping during the severing operation.

It is an object of this invention to provide a novel and improved apparatus for laminating a photographic print to a sheet of transparent plastic material.

It is also an object to provide a laminating machine having a pair of resilient laminating rollers each having incorporated therein a cutting blade which co-operates with the cutting blade of the other roller to sever at least one of the lamina subsequent to the laminating operation.

It is a further object to provide a laminating machine having a pair of resilient laminating rollers which incorporate shear bars, the shear bars being so installed in the laminating rollers that the rollers may provide pressure to the lamina without creating excessive overlapping of the cutting edges of the shear bars when they reach co-operating positions at the nip of the rollers.

It is also an object of this invention to provide a laminating machine which will first perform a laminating operation, then a cutting operation, and finally, automatically cut itself off.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the apparatus possessing the construction, combination of elements and arrangement of parts which are exemplified in the following detailed disclosure, and the scope of the application which will be indicated in the claims.

For a fuller understanding of the invention and the objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings wherein:

FIGURE 1 is a cross-sectional view of a preferred embodiment of the laminating apparatus taken along a plane

perpendicular to the axis of rotation of the laminating rollers;

FIG. 2 is a view of the laminating rollers taken along the common tangent of the rollers;

FIG. 3 is a cross-sectional view along line 3—3 of FIG. 2; and

FIG. 4 is a schematic wiring diagram of an electrical control system useful in the practice of this invention.

The laminator which is the subject of the present invention includes a pair of laminating rollers, 16 and 18, mounted for rotation about parallel axes in housing 46. A spool 42, carrying a roll of the continuous plastic web 40, is also rotatably mounted in housing 46 and located adjacent rollers 16 and 18 such that the leading end of web 40 is drawn over roller 18 and engaged in the nip of rollers 16 and 18. An element 14, on housing 46, includes a tapered slot 12 for guiding a photographic print 10 into the nip of rollers 16 and 18, such that it will be drawn therebetween upon rotation of the rollers. Laminating rollers 16 and 18 consist primarily of relatively rigid cylindrical portions 24 and 26 mounted on shafts 28 and 30, resilient sleeves 20 and 22 covering portions 24 and 26, and shear bars 32 and 34.

Shear bars 32 and 34 are for severing that portion of continuous web 40 which has been laminated to a photographic print 10 from the remainder of the continuous web. Shear bars 32 and 34 are mounted in laminating rollers 16 and 18 such that the distances of their respective cutting edges, 36 and 38, from the axes of rotation of the rollers is less than the uncompressed radii of the rollers, but greater than the compressed radii of the rollers. The parallel axes of the rollers are separated by distance which is less than the sum of the uncompressed radii of rollers 16 and 18, thereby establishing the relationship between the rollers which insures that their surfaces engage and slightly compress each other to form a nip, as shown in FIGURE 1.

The laminator is electrically driven in a manner to be described subsequently. When the drive means is activated, the rollers make one complete revolution and automatically stop. The position from which they start and at which they stop is shown in FIGURE 1, that position being the one occupied by the rollers just subsequent to the completion of the severing operation, which operation will also be subsequently described.

A color print 10, when first stripped from the image-receiving negative is "wet" and while in this "wet" condition, it is inserted in tapered slot 12 in member 14 until it abuts blade 32 and the leading end of web 40 near the nip of rollers 16 and 18. Actuating button 51 (FIG. 1) of switch 50 (FIG. 4) is then depressed to cause the electrical drive means to drive the rollers such that photographic print 10 and plastic web 40 are drawn therebetween in face-to-face contact. The compression between the rollers serves to press the wet surface of color print 10 evenly against the hydrolyzed surface of web 40 whereby the surfaces are securely bonded together in the manner described in the above-mentioned Haas and Buzzell patent application Ser. No. 451,894.

The linear extent of the circumference of each of the rollers is slightly greater than the length of the photographic print, thus upon one revolution of the rollers the photographic print will pass completely between the nip of the rollers. The cutting edges 36 and 38 are at least as long as web 40 is wide and are so arranged in rollers 16 and 18, respectively, that they co-operate to sever plastic material 40 at the nip of the rollers after photographic print 10 has completely passed therethrough. Thus, upon one revolution of rollers 16 and 18, the lamination of the photographic print to the plastic web is effected and the plastic web is severed. The severed laminate drops down chute 44 and the rollers are abruptly stopped in this post-severing position. The new leading edge of web 40 remains gripped in the nip of rollers 16 and 18, between resilient surface 22 of roller 18 and shear bar 32 of roller 16, such that the rollers are appropriately

positioned for insertion of another print 10 and repetition of the laminating and severing operation.

Shear bars 32 and 34 may be installed in rollers 16 and 18 in slightly helical fashion, the helical twist of blade 38 being equal in magnitude and opposite in direction to the helical twist of cutting edge 36. This construction causes the severing operation to begin along one edge of plastic web 40 and proceed thereacross, in scissor-like fashion, to the other edge of the plastic web. The cut established by this apparatus is superior to that effected by apparatus forming a simultaneous cut across the width of the web since the cut which proceeds from edge to edge is easier to produce and creates less shock on the machine than the simultaneous cut. It should, however, be understood that the severing edges 36 and 38 may be aligned parallel to the rotational axis of rollers 16 and 18 to thus effect the entire cut at once, if so desired. The cut produced by the helical blade arrangement does not extend across the web in precise perpendicular alignment to the edge of the web, but proceeds at an angle slightly larger than 90°. This result is not objectionable since the laminated print is to be subjected to a further operation for trimming it to a precise size and shape.

It should be observed, as best shown in FIGURE 3, that at any cross-section perpendicular to the rotational axes of rollers 16 and 18, the rotational displacement of cutting edge 36 and cutting edge 38 from the nip of rollers 16 and 18 is equal. This relationship is maintained by a gearing system interconnecting the two rollers and connecting them to an electric drive motor 54. The gearing system, as well as the electric motor, is mounted in housing 48 and may be of any appropriate conventional construction, not shown. When cutting edges 36 and 38 move to the severing position at the nip of rollers 16 and 18, a surface of the shear bar of each roller presses against that portion of the resilient surface of the other roller adjacent the shearing edge of such other roller to compress the same, thus reducing the radius of each of the rollers at a location adjacent its cutting edge. This depression of the resilient surfaces of the rollers causes each of the cutting edges to protrude slightly from the surface of its respective roller and engage the cutting edge of the opposing roller, thus severing plastic material 40.

The schematic wiring diagram shown in FIGURE 4 will now be described in relation to the operation of the laminator. The rotation of rollers 16 and 18 must be terminated in an abrupt and positive manner just after completion of the severing operation so they will be properly positioned for beginning the next laminating and severing cycle. The rollers tend to continue rotation, due to momentum, after the power is cut off. In this continued rotation is permitted, the rollers will move past the desired post-severing stopping position. This overtravel will cause the rollers to be positioned such that the severing operation of the next laminating and severing cycle will be completed prior to the completion of one revolution of the rollers and thus be completed prior to completion of the laminating operation.

A capacitor discharge electric brake is effective for securing the desired stopping action. Switch means 56, operative in response to eccentric cam 52 on rotary shaft 30, and switch 50 establish a sequence of operation whereby armature winding 68 of motor 54 is energized to initiate rotation, capacitor 64 is charged, the line current to winding 68 and capacitor 64 is cut off in response to one revolution of rollers 16 and 18 and the capacitor discharges to apply a direct current across winding 68 to terminate rotation. Application of direct current across the armature winding induces a magnetic force therein which locks the armature of motor 54, and thus all rotary parts, against further rotation.

The operation will now be described in more detail. After insertion of print 10 into the nip of rollers 16 and 18 as described above, button 51 is depressed to close momentary contact switch 50 to thereby complete the circuit

through winding 68 and through line 58, diode 60, resistor 62 and capacitor 64. This serves to initiate rotation of all rotary parts including cam 52 and to begin charging capacitor 64.

Cam 52 is so constructed that raised portion 72 thereof is effective to urge plunger 74 in a first direction against the bias of spring 70. When the plunger is so moved contact arms 76 and 78, which form a part of the staggered throw, double pole, double throw switch means 56, are in contact with poles 84 and 86, respectively. Upon initial rotation of cam 52, plunger 74 rides off raised portion 72 of the cam such that the force of spring 70 moves the plunger in a second direction, opposite to the first. In response to movement of plunger 74 in the second direction, contact arm 76 moves from pole 84 into contact with pole 80 thus shunting momentary contact switch 50 so that the circuit remains completed after momentary contact switch 50 is opened. Just subsequent to movement of contact arm 76, contact arm 78 moves from pole 86 to unconnected pole 82. After one revolution of rollers 16 and 18 and cam 52, thus just after the completion of the severing operation, portion 72 of the cam moves plunger 74 back in the first direction to reverse the switching action. Contact arm 78 first moves away from pole 82 and into contact with pole 86; then arm 76 moves from pole 80 to pole 84. Movement of arm 76 from pole 80 opens the circuit thus disconnecting winding 68 and all other components, including capacitor 64, from the line current. Connection of arm 76 with pole 84, however, completes a circuit through winding 68, capacitor 64, resistor 62, line 66, pole 86, arm 78, pole 84, and arm 76 to allow the capacitor to discharge and thereby apply the aforesaid direct current across winding 68 to terminate rotation. Switch means 56 is now in the position it occupied prior to closure of switch 50 and the rollers have been stopped at the desired post-severing position, thus the laminating machine is ready for reactuation.

It should of course be understood that the drive means disclosed and the circuitry involved are shown and described by way of example only and that any suitable drive or brake means could be used.

Since certain changes may be made in the above apparatus without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrated and not in a limiting sense.

What is claimed is:

1. Apparatus for laminating in face-to-face relation, a pair of sheet materials, at least one of which is supplied in a continuous web form, and severing portions of said web after lamination thereof to the other of said materials, said apparatus comprising, in combination:

- (a) a pair of rollers mounted for rotation about parallel axes and having resilient, engaging surfaces;
- (b) means facilitating movement of said sheet materials to a position between said rollers for compressive engagement and advancement between said resilient surfaces in response to rotation of said rollers, said means comprising:

- (1) means adjacent said rollers for rotatably mounting said continuous web in roll form and for guiding a leading end thereof to a position of engagement between said resilient surfaces; and

- (2) means to guide a leading end of the other of said pair of sheet materials to a position of engagement between resilient surfaces, said pair of sheet materials being drawn through said rollers in compressive, face-to-face relationship in response to rotation of said rollers; and

- (c) severing means including a pair of co-operable cutting edges, one associated with each of said rollers, positioned adjacent said surfaces at a distance from said axes not in excess of the uncompressed

radii of said rollers, and having a length at least equal to the width of said web;

- (d) said axes being spaced apart by a distance less than the sum of said radii, whereby said surfaces are compressed at the point of engagement by a sufficient amount to allow said cutting edges to overlap one another at said point of engagement.

2. Apparatus according to claim 1 wherein said cutting edges are helically disposed within said rollers, said cutting edge of said first roller having a helical twist equal in magnitude and opposite in direction to the magnitude and direction of the helical twist of said cutting edge of said second roller.

3. Apparatus according to claim 1 further comprising:

- (a) drive-means for imparting rotary motion to said rollers; and

- (b) means for terminating said rotary motion in response to completion of one revolution of said rollers, said rotary motion being terminated just subsequent to completion of said severing operation.

4. Apparatus according to claim 3 wherein said drive-means comprises a rotary electric motor and a gear train, said gear train serving to transmit rotary motion from said motor to said rollers and to maintain said rollers in such relative position that the rotational displacement of said rollers is always equal in magnitude and opposite in direction.

5. Apparatus according to claim 4 wherein said means for terminating said rotary motion comprises:

- (a) a capacitor in circuit with the winding of said rotary electric motor;

- (b) switch means in said circuit for connecting said winding and said capacitor to a power source for energizing said motor and charging said capacitor; and

- (c) means operative in response to one revolution of said rollers to disconnect said winding of said electric motor and said capacitor from said power source and to maintain said winding in circuit with said capacitor such that said capacitor discharges through said winding to establish a magnetic force in said electric motor to terminate rotation of the rotor thereof and thus terminate rotation of said gear train and said rollers.

6. Apparatus for laminating a wet diffusion transfer color print to a continuous web of a resinous film having a coating with a hydrolyzed surface to which the wet surface of said print adheres upon compressive contact, said apparatus comprising, in combination:

- (a) a pair of laminating rollers having resilient, engaging surfaces and rotatably mounted for drawing said color print and coated resinous film therebetween;

- (b) means for guiding said color print into engagement between said surfaces of said rollers;

- (c) means for guiding said coated resinous film into engagement between said surfaces of said rollers such that said hydrolyzed surface of said coating is in face-to-face contact with the wet surface of said print, and such that said coated resinous film and said print are drawn through said rollers in said face-to-face contact in response to rotation of said rollers; and

- (d) severing means including a pair of co-operable cutting edges, one positioned adjacent the surface of each of said rollers, for severing said coated resinous film substantially transverse its length subsequent to said drawing of said print and the opposing portion of said coated resinous film through said rollers, each of said co-operable cutting edges being located a distance from the axes of rotation of the roller upon which it is positioned not in excess of the uncompressed radius of said roller.

7. Apparatus according to claim 8 wherein said cutting edges are helically disposed within said rollers, said cutting edge of said first roller having a helical twist equal in magnitude and opposite in direction to the magnitude

7

and direction of the helical twist of said cutting edge of said second roller.

8. Apparatus for laminating in face-to-face relation, a pair of sheet materials, at least one of which is supplied in continuous web form, and severing portions of said web after lamination thereof to the other of said materials, said apparatus comprising in combination:

(a) a pair of rollers having resilient surfaces rotatably mounted for compressively engaging and drawing said pair of sheet materials therebetween;

(b) severing means including a pair of co-operable cutting edges, one associated with each of said rollers, positioned adjacent said resilient surfaces, said resilient surfaces being compressed at the locus of engagement by an amount sufficient to allow said cutting edges to move into severing relationship with one another at said locus of engagement;

(c) means for supporting said continuous web and leading an end thereof to a position of engagement between said resilient surfaces; and

8

(d) means for guiding a leading end of the other of said pair of said materials to a position of engagement between said resilient surfaces, in face-to-face relationship with said continuous web, whereby said pair of materials are drawn through said rollers in compressive face-to-face relationship when said rollers are rotated.

References Cited

UNITED STATES PATENTS

2,951,410	9/1960	Brown	83—345
3,309,983	3/1967	Dresser	156—522
3,340,130	9/1967	Dunn et al.	156—555

DOUGLAS J. DRUMMOND, *Primary Examiner.*

U.S. Cl. X.R.

83—116, 345; 156—530, 555