

June 1, 1965

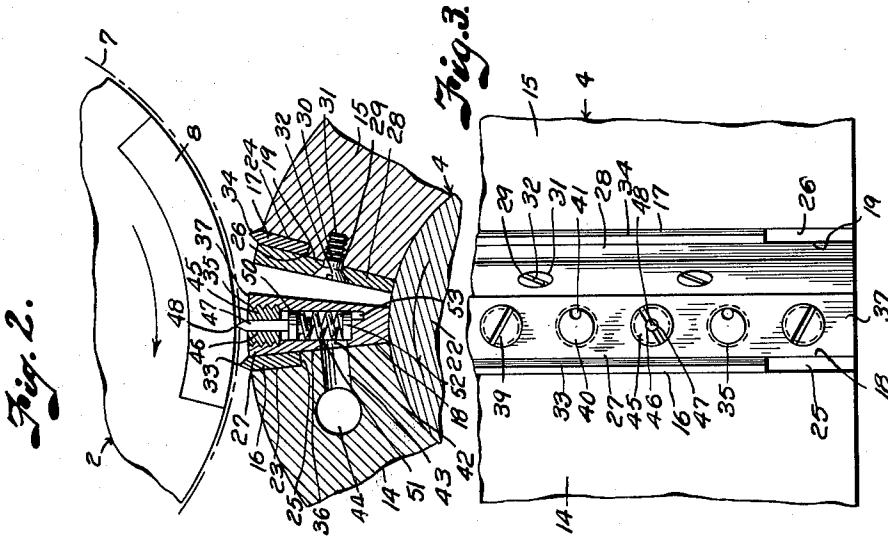
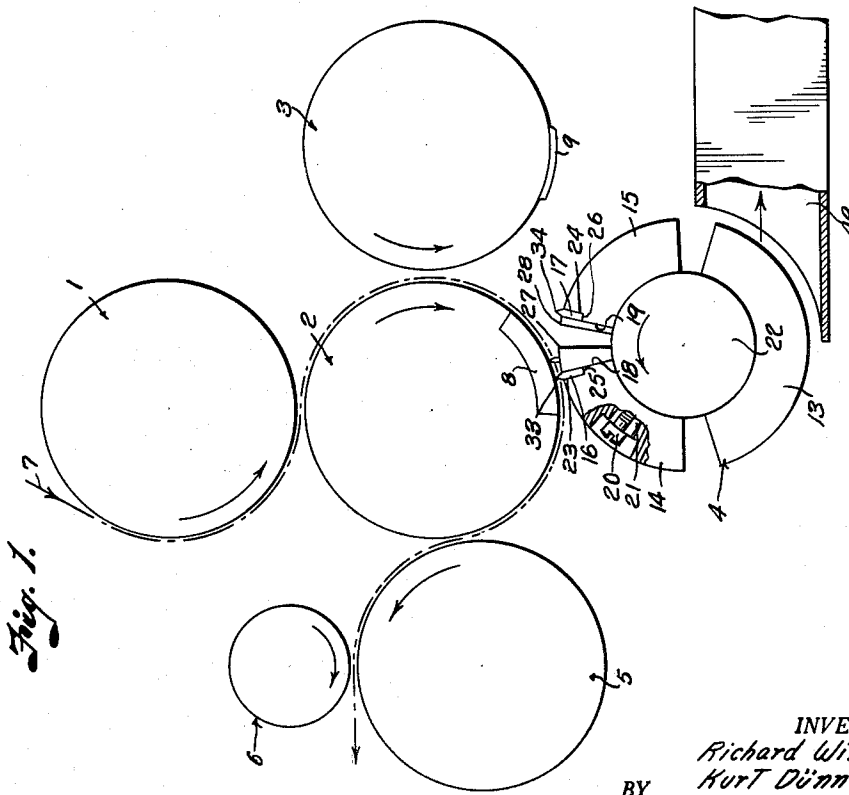
R. WINKLER ETAL

3,186,274

MECHANISM FOR REMOVING WASTE RESULTING FROM CUTTING
WINDOW OPENINGS IN SHEET MATERIAL

Filed Nov. 21, 1961

2 Sheets-Sheet 1



INVENTOR.
Richard Winkler
Kurt Dünnebier
BY
Paul E. Mullendore
ATTORNEY

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2 Sheets-Sheet 2

Fig. 5.

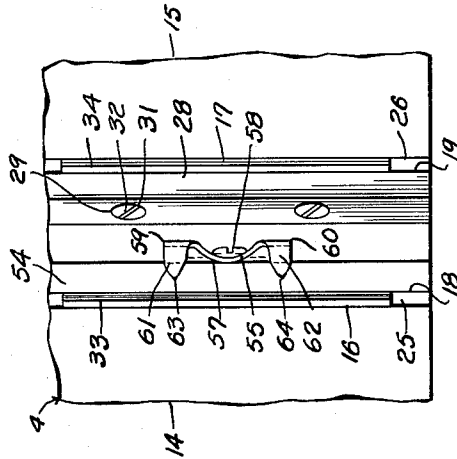


Fig. 6.

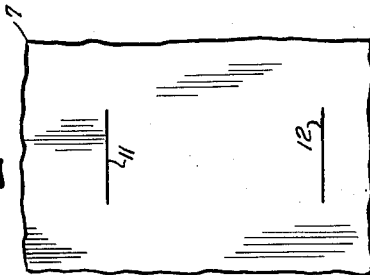


Fig. 7.

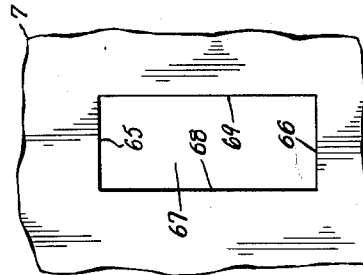
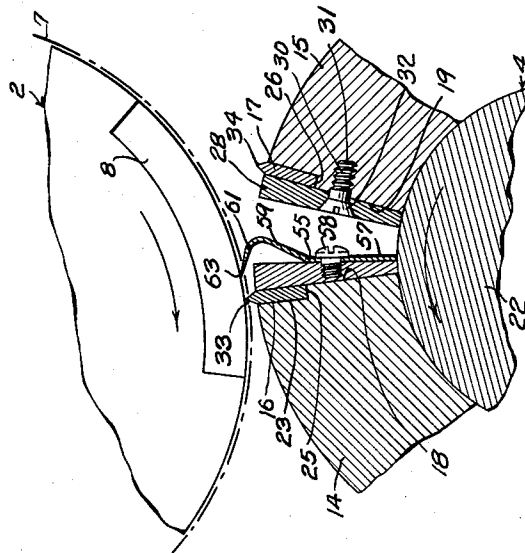


Fig. 4.



INVENTOR.
Richard Winkler
BY Kurt Dünnebier
Paul E. Mullenbore
ATTORNEY

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MECHANISM FOR REMOVING WASTE RESULTING FROM CUTTING WINDOW OPENINGS IN SHEET MATERIAL

Richard Winkler, Rengsdorf, near Neuwied, Rhineland, and Kurt Dünnebier, Wollendorf, near Neuwied, Rhineland, Germany, assignors to Berkley Machine Company, Kansas City, Mo., a corporation of Missouri

Filed Nov. 21, 1961, Ser. No. 153,928

Claims priority, application Germany, Mar. 17, 1961,

W 29,666

9 Claims. (Cl. 83—103)

This invention relates to a mechanism for removing waste resulting from cutting window and similar openings in sheet material, as in the making of window envelopes or the like in rotary machines.

With such machines, the window openings are cut in a continuous web or in individual blanks carried between rotating cutting tools and a hard countercylinder. Thus when the cutting operation is effected by a hard-on-hard cutting system, the paper is not so completely separated at the cut edges as with a slicing cut of a die or the like. Consequently, particularly when the cutting tools are blunted to some degree, the waste is incompletely separated and the uncut filaments of the paper must be torn off to remove the waste pieces from the window openings.

The waste pieces may be removed by suction alone when the working efficiency of the envelope making machine is not over three hundred windows per minute, but at higher speeds the force of the applied suction is not sufficient for removing the waste pieces. Consequently, with higher machine efficiencies supplementary needles or points are used for spearing the waste pieces to effect their removal, in conjunction with the suction.

Heretofore, such spear points required corresponding openings or recesses in the hard cylinder opposite such points. In some instances these openings may be filled with rubber or similar resilient material, but such openings interfere with changing set-up of the machine to different formats or different locations of the window openings, and careful attention is required to see that the spear points or needles exactly register with the openings in a hard cylinder.

The necessity of providing openings in the hard cylinder is not only troublesome, but also makes it necessary to have hard segments in the cylinder larger than is desirable, to assure that the blade comes into contact therewith after adjustment. Thus the difficulty of changing the set-up for different formats or even different positions and sizes of the openings, as well as the greater cost of the larger hard segments, increase the cost of making window envelopes.

It is, therefore, an object of the present invention to avoid the disadvantages of present mechanisms, so that the cost of the cutting and waste removing mechanisms may be reduced, and the setting up operations therefor greatly simplified.

It is also an object of the invention to provide resiliently mounted needles or spear points which in their normal position project from the periphery of the cutting cylinder, so that they penetrate the waste material and yield on contact with the hard surface of the countercylinder, but retain a sufficient hold on the waste material during seizing thereof by the suction.

Further objects of the invention are to provide needles with points arranged to be resilient in radial directions and to provide points which are directed obliquely to the leading transverse cutter for picking out the waste, in which case the suction may be eliminated.

In accomplishing these and other objects of the invention, we have provided improved structure, the preferred forms of which are illustrated in the accompanying drawings, wherein:

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FIG. 1 is a diagrammatic view of one side of a mechanism for cutting window openings in envelope material and removing the waste in accordance with the present invention.

FIG. 2 is a fragmentary end elevational view of the countercylinder and a cross sectional view of the cutter cylinder which is equipped with resiliently supported needles, the illustration being on a larger scale than FIG. 1.

FIG. 3 is a partial plan view of a portion of the cutter cylinder shown in FIG. 2.

FIG. 4 is a view similar to FIG. 2 of a modified form of the invention employing spring fingers instead of the needles in FIG. 2.

FIG. 5 is a partial plan view of the portion of the cutter cylinder shown in FIG. 4.

FIG. 6 is a partial view of a paper web or blank after the end cuts have been made by the first of the cutter cylinders to start formation of a window opening.

FIG. 7 is a similar view after the transverse cuts have been made to interconnect the end cuts and after the waste material has been removed from the opening bounded by the cuts.

Referring more in detail to the drawings:

1 designates a guide cylinder, 2 a countercylinder, 3 and 4 cutter cylinders, 5 a second guide cylinder, and 6 a counter roller, that are suitably mounted to rotate on horizontal axes and which are suitably supported in the side frames (not shown) of an envelope making machine and continuously driven in timed relation with each other. A web of paper 7, or a series of individually cut blanks, is guided by the guide cylinder 1 around the countercylinder 2 and between the guide cylinder 5 and the counter roller 6. The cylinders 1, 2 and 5 may have suitable suction ports extending through the peripheries thereof, to hold the paper web or blanks while being transferred past the cutter cylinders 3 and 4 at a rate for making one window opening per cylinder revolution. The countercylinder 2 has a hard segment 8 inset in the periphery thereof, whereby its outer surface registers with the cylindrical surface of the cylinder and which forms a backing against which cuts are made through the web or blanks, as the case may be.

The first cutter cylinder 3 carries cutters 9 which extend substantially in the direction of rotation of the cylinder and are spaced apart according to the length of the window opening to be formed, and the cutters are of a length to cut the height of the opening, so that when the cutters make contact with the paper material on the segment 8 of the countercylinder 2, spaced apart cuts 11 and 12 are formed in the paper material, as shown in FIG. 6.

The cutter cylinder 4 has a fixed segment 13 and two adjustably movable segments 14 and 15, arranged to be positioned to and from each other, to vary the spacing between transverse cutter blades 16 and 17. The cutter blades extend along facing sides 18 and 19 of the movable segments 14 and 15. The segments 14 and 15 are secured and retained in adjusted position by fastening devices 20 extending through slotlike openings 21 in the segments and into the cylindrical core 22 of the cylinder 4. The cutter blades 16 and 17 have a length corresponding to the length of the window opening and are clamped in recesses 23 and 24 that are respectively provided in the facing sides 18 and 19 of the segments 14 and 15 and to seat radially against shoulders 25 and 26 that are provided by the recesses 23 and 24. The cutter blades 16 and 17 are retained in the recesses by clamping plates 27 and 28 that extend along the facing sides 18 and 19 and which are secured thereto by fastening devices such as screws 29, having shanks 30 extending through openings in the plates and into threaded sockets 31 that are

provided in the faces of the segments. The heads 32 of the screws are preferably countersunk within the faces of the plates 27 and 28, so as not to interfere with adjustment of the segments on the core 22 of the cylinder. The cutter blades have cutting edges 33 and 34 projecting from the periphery of the segments, as best shown in FIG. 2, to penetrate the paper as the blades 16 and 17 move consecutively into engagement with the paper 7 in providing the transverse cuts of a window opening while the paper is being backed by the hard segment 8 of the counter roller 2. The fixed segment 13 of the cutting cylinder serves as a counterweight for the movable segments.

In carrying out the present invention, the clamping plate 27 for the cutter blade 16 is substantially thicker than the clamping plate 28 for the cutter blade 17, so that it is sufficiently wide to accommodate a row of openings 35 provided by bores 36 extending inwardly from the outer edge 37 thereof and terminating short of the inner edge of the plate 27. The arrangement of the openings in the plate is best illustrated in FIG. 3.

As shown in FIG. 3, it will be noted that the openings 35 are rather closely spaced, to accommodate various lengths and locations of window opening to be cut in the paper material. The openings 35 that are not used when cutting a given width of window opening are closed by externally threaded plugs 39 that are turned into the openings which are not to be used. The other of the openings, which are to be used for suction ports, are closed by plugs 40 having suction orifices 41 extending therethrough. Extending laterally through the plate 27 at the lower ends of the bores are openings 42 registering with openings 43 in the segment 14 and which connect with a suction duct 44 that extends longitudinally through the segment and which is suitably connected with a vacuum pump, not illustrated for the reason that the manner of supplying the suction forms no part of the present invention.

As above pointed out, suction is sufficient to engage and hold the waste to be carried on the segments about the periphery of the cutter cylinder when the working efficiency of the enveloping making machine is not over three hundred windows per minute. However, when the envelope making machine is speeded up to increase the output thereof, the suction does not have sufficient force for seizing and removing the waste pieces at the higher speeds. Therefore, to supplement the force of the suction in accordance with the present invention, certain of the bores 36 within the length of the window opening are provided with special plugs 45 having axial bores 46 for slidably supporting needles 47 (FIGS. 2 and 3) having pointed ends 48 to penetrate the waste and hold the waste in cooperation with suction through the suction ports to carry the waste with the cutter cylinder into position for discharge under suction that is created in a suction duct 49 (FIG. 1) to carry away the waste upon shutting off suction through the suction ports.

In order that the points of the needles may not be blunted by contact with the hard segment 8 on which the cutter blades operate, the needles 47 have heads 50 positioned in those bores and resiliently backed by coil springs 51 having their lower ends seated on spring seats 52 that are fixed in the bottom of certain bores 35, as best shown in FIG. 2. The springs 51 have sufficient action to support the needles for penetration of the paper material, but are sufficiently yieldable to prevent blunting of the points thereof against the hard segment 8 and to eliminate the necessity of recesses in the segment. The spring seat 52 is anchored from rotation in the bore by a stud 53.

The form of the invention illustrated in FIGS. 4 and 5 is used advantageously in a machine working with a web material, and which may not be equipped with suction ports for holding the waste pieces to the cutter cylinder. In this form of the invention, the clamping plate 54 is substituted for the plate 27. Secured to the clamping plate 54 are fingers 55 formed of flat, resilient, springlike

material, and which have a shank portion 57 secured to the plate 54 by screws 58. Extending outwardly from the shank portion 57 are divergent fingers 59 and 60, each terminating in forwardly extending prongs 61 and 62, having points 63 and 64, the points 63 and 64 being arranged obliquely to the cutter blade 16 for piercing the waste at an angle, that is, in a direction more tangent than radially with respect to the countercylinder 2. In their normal position, the points extend beyond the periphery of rotation of the cutter blade 16, so that when they contact the hard segment 8 they are depressed thereby, to draw the waste from the opening formed in the web incidental to forward rotation of the cutter cylinder 3.

While we have described the spring fingers as formed of flat spring metal, it is obvious that they may be otherwise formed to provide the general shape of the fingers illustrated in FIGS. 4 and 5 of the drawings.

The operation of the invention described in FIGS. 1 to 3, inclusive, is as follows:

With the machine in operation and the web being carried around the cylinders 1, 2 and 5, the cylinders 2 and 3 are so timed that the segment 8 and cutters 9 are brought into registry to make the end cuts 11 and 12 in the web that form the ends 65 and 66 of the window opening 67 shown in FIG. 7. With continuing rotation of the cylinders, movement of the web therewith carries the segment 8 supporting the portion of the web having the end cuts 11 and 12 into contact with the cutting point 33 of the first cutter blade 16, which cooperates with the hard segment 8 in making the forward cut to join the end cuts 11 and 12 and form the forward edge 68 of the window opening shown in FIG. 7. Simultaneously the spring loaded needles 47 are pressed by the segment 8 somewhat deeper in their bores against action of the springs 51 to pierce the waste that is contained within the cuts which form the front side and end edges of the window opening, during which time the suction openings 41 receive vacuum and act on the waste piece in conjunction with the needles, to carry the waste piece from out of the opening of the web and onto the periphery of the cylinder 4 incidental to rotation thereof. Subsequently the cutting point 34 makes contact with the web to make the final cut that forms the edge 69 of the window opening 67. Since the needles or prongs are in their extended position from the surface of the knife cylinder 4, the points of the needles have a higher speed than the surface speed of the paper web or blanks. This gives the points of the needles a surface speed which is higher than the surface speed of the paper. Hence, when the points or prongs engage the waste, they tend to tear the waste away from the paper of the web, thus severing any remnant fibers, et cetera. The waste piece is now free, and on reaching the mouth of the suction duct 49, vacuum through the suction ports 41 is suspended and the suction through the duct 49 is effective to withdraw the waste material from the needles and carry it away to a place of disposal through the duct 49.

In the embodiment of the invention illustrated in FIGS. 4 and 5, there is no suction for engaging the waste material, however, the pointed prongs 61 and 62 of the fingers 59 and 60, being directed tangentially with respect to the cutter blade 16, pass through the web at an angle, as shown in FIG. 4, while they are being carried forwardly incidental to rotation of the cutter cylinder 4. The points 63 of the fingers, on penetrating the waste at an angle, pick the waste from the opening of the web and carry the waste therewith to a disposal duct 49. It is to be noted that the springs 51 have sufficient strength and the resiliency of the picks or fingers 59, 60 is such as to permit the penetrating needles or prongs 61 and 62 to be yieldable when in contact with the hard surface segment of the cylinder 2, while allowing penetration into the waste material to be withdrawn from the web.

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

1. In combination with a rotatable cylinder having a hard smooth arcuate surface cooperating with a rotatable

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cylinder having spaced knife means for completing cut of a window opening in a web or the like under movement around the cylinder with the hard surface, a movable needle carried by the knife carrying cylinder and disposed between said spaced knife means and having a point for penetrating the web or the knife while the web overlies the hard surface and is being carried upon said hard surface to pick out waste produced in the window opening incidental to rotation of said cylinders, and spring means resiliently backing the needle and having sufficient strength to permit the needle to be yieldable while allowing penetration into said waste portion.

2. In an apparatus of the character described for cutting window openings in envelope material in a rotary machine for making window envelopes or the like, a rotatable countercylinder having a hard smooth arcuate surface portion, a rotatable knife cylinder cooperating with said hard surface portion for completing cut of a window opening under movement of the envelope material around the countercylinder, said knife cylinder including spaced knife blades projecting above the periphery of the cylinder, and a resilient needle disposed between said cutter blades and having a point projecting beyond the periphery of said knife cylinder engaging the material and adapted to be pushed back by the hard surface portion of the countercylinder to cause penetration of the point in the waste piece within said opening for picking out of said waste piece incidental to rotation of the cylinders, the resiliency of said needle being such as to permit said needle to be yieldable while allowing penetration of the point thereof into the waste piece.

3. An apparatus as described in claim 2 wherein the needle has reciprocable support in the knife cylinder, and the resiliency is provided by a spring seated in the knife cylinder and bearing upon the needle, with said spring providing the strength to permit said needle to be yieldable while allowing said penetration.

4. In an apparatus of the character described for cutting window openings in envelope material in a rotary machine for making window envelopes or the like, a rotatable countercylinder having a hard smooth arcuate surface portion, a rotatable cylinder cooperating with the countercylinder and having spaced knife means for completing cut of a window opening under movement of the envelope web material around the countercylinder and across said hard surface portion, vacuum means carried by the said cutting cylinder and disposed between said spaced knife means for seizing and removing waste material left in said envelope material by such cutting operation, and an auxiliary waste removal means including a resilient needle carried by the said cutting cylinder disposed between said spaced knife means and adjacent said vacuum means and having a point projecting beyond the periphery of the cutting cylinder engaging the waste material and adapted to be pushed back by the hard surface cylinder to cause penetration of the point in the waste for picking out of said waste from said web incidental to rotation of the cylinders while the vacuum means becomes effective in seizing said waste, the resiliency of said needle being such as to permit said needle to be yieldable while allowing penetration of the point thereof into said waste.

5. An apparatus as described in claim 4 wherein the needle has reciprocable support in the cutting cylinder, and the resiliency is provided by a spring seated in the cutting cylinder and bearing upon the needle, with the spring providing the strength to permit said needle to be yieldable while allowing said penetration.

6. In an apparatus for cutting window openings in envelope material when making window envelopes or the like, rotatable cylinders for feeding the envelope material therebetween, one of said cylinders having segments providing the cylindrical surface therefor and spaced apart to provide knife seats in facing ends of said segments, spaced knives in said seats having projecting cutting edges for penetrating of the material to complete the front and

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rear cuts of a window opening, said other cylinder having a hard smooth arcuate surface segment inclusive of the cutting edges to back the envelope material and cooperate with said cutting edges in making said cuts, clamping means cooperating with said seats to retain the knives, the forward of said clamping means having radical bores, needles having sliding support in said bores and provided with points extending beyond the periphery of the knife cylinder, and springs yieldingly supporting the needles with the points projecting from the segments, said springs having strength to permit the needles to be pushed back by the hard surface segment for applying a force on said needles sufficient to effect penetration of the points in the waste material between said cuts for picking out the waste material from the material providing the envelope incidental to rotation of the cylinders.

7. In an apparatus for cutting window openings in envelope material when making window envelopes or the like, rotatable cylinders for feeding the envelope material therebetween, one of said cylinders having segments providing the cylindrical surface therefor and spaced apart to provide knife seats in facing ends of said segments, spaced knives in said seats having projecting cutting edges for penetrating of the material to complete the front and rear cuts of a window opening, said other cylinder having a hard smooth arcuate surface segment inclusive of the cutting edges to back the envelope material and cooperate with said cutting edges in making said cuts, clamping means cooperating with said seats to retain the knives, the forward of said clamping means having a plurality of radial bores, means for establishing suction through certain of the bores to seize waste material between said cuts to the knife carrying cylinder, needles having sliding support in other of said bores and provided with points, and springs yieldingly supporting the needles with the points thereof projecting from the segments, said springs having strength to permit the needles to be pushed back by said hard surface segment for applying a force on said needles sufficient to effect penetration of the points to start movement of the waste material from the material which provides the envelopes.

8. In an apparatus for cutting window openings in envelope material when making window envelopes or the like, rotatable cylinders for feeding the envelope material therebetween, one of said cylinders having segments providing the cylindrical surface therefor and spaced apart to provide knife seats in facing ends of said segments, knives in said seats having projecting cutting edges for penetrating of the material to complete the front and rear cuts of a window opening, said other cylinder having a hard surface segment inclusive of the cutting edges to back the envelope material and cooperate with said cutting edges in making said cuts, clamping means cooperating with said seats to retain the blades, resilient members having prongs projecting obliquely in the direction of cylinder rotation, and means for supporting said resilient members with the prongs thereof projecting from the cylindrical surface of the leading segments, said resilient members having strength to permit deflection by the hard surface segment while allowing penetration of said prongs through the waste portion of the material between said cuts for removal with rotation of the cylinders.

9. In an apparatus of the character described for cutting window openings in envelope material in a rotary machine for making window envelopes or the like, a rotatable countercylinder having a hard surface portion, a rotatable knife cylinder cooperating with said hard surface portion for completing cut of a window opening under movement of the envelope material around the countercylinder, and a resilient needle having a point projecting beyond the periphery of said knife cylinder to be pushed back by the hard surface portion to cause penetration of the point in the waste piece within said opening for picking out of said waste piece incidental to rotation of the cylinders, the resiliency of said needle being such

as to permit said needle to be yieldable while allowing penetration of the point thereof into the waste piece, said needle comprising a spring metal part having a shank securing the part to the cutting cylinder and diverging fingers provided with angular points projecting in the direction of rotation of the knife cylinder to penetrate said waste at an angle for facilitating hold on the waste by said fingers.

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ANDREW R. JUHASZ, *Primary Examiner.*

CARL W. TOMLIN, *Examiner.*