

United States Patent

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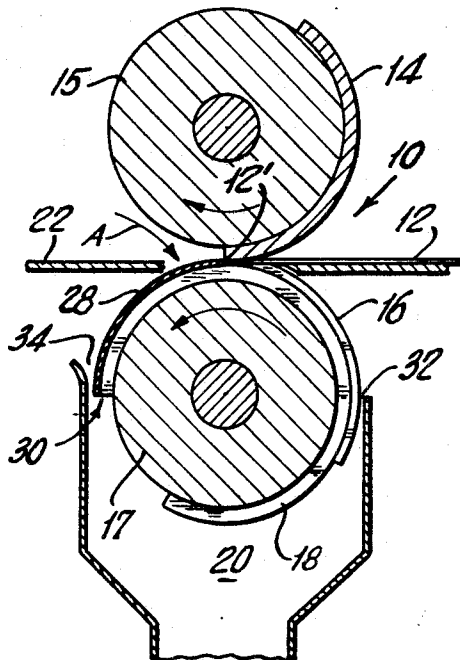
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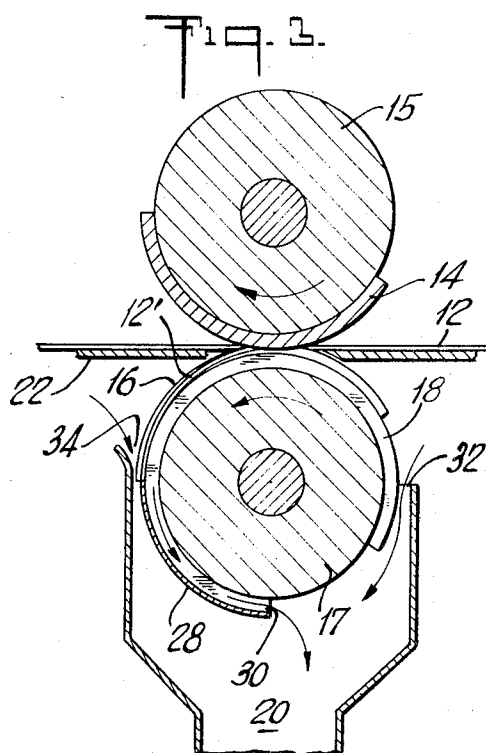
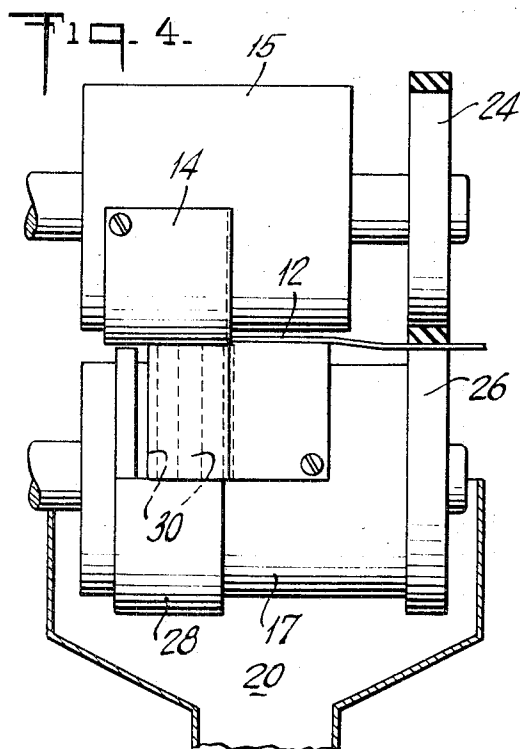
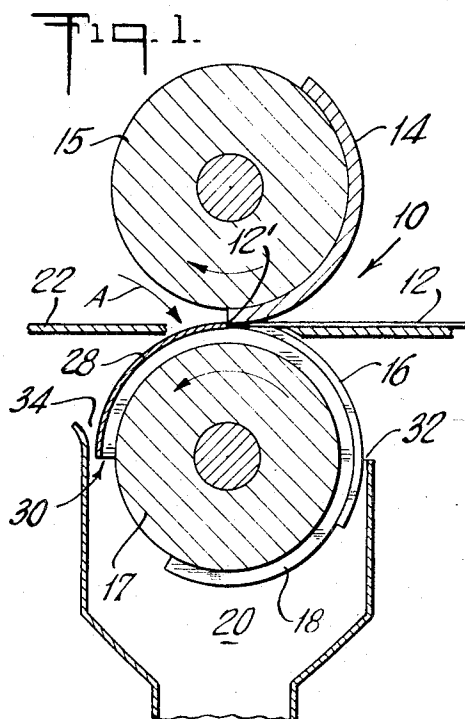
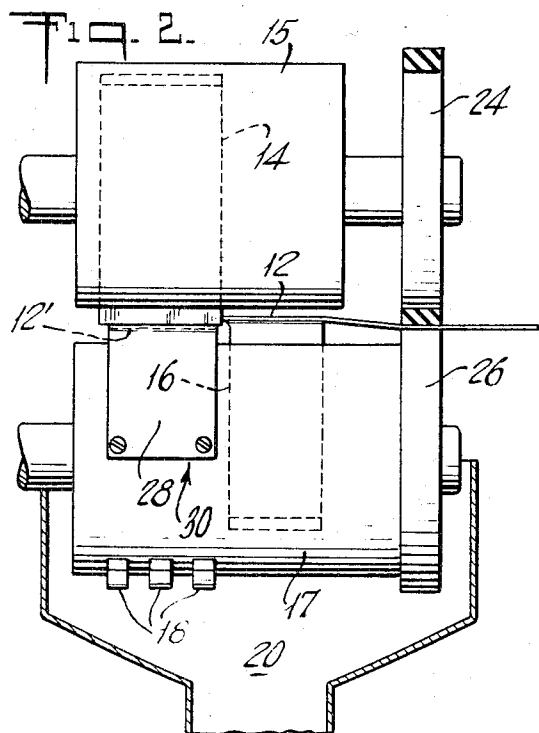
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[54] **CHIP REMOVAL APPARATUS**
8 Claims, 9 Drawing Figs.

[52] U.S. Cl..... **83/100,**
83/152, 83/911
[51] Int. Cl..... **B65h 35/08**
[50] Field of Search..... 83/98, 100,
152, 103, 911

ABSTRACT: A chip removal device for cut portions of paper or other material severed from a moving sheet or web without the use of extraneous equipment but utilizing a vacuum source. The chips are evacuated at the point of the cutting operation. Thereafter, the chips are transported away from the point of cutting operation to the chip exhaust system.

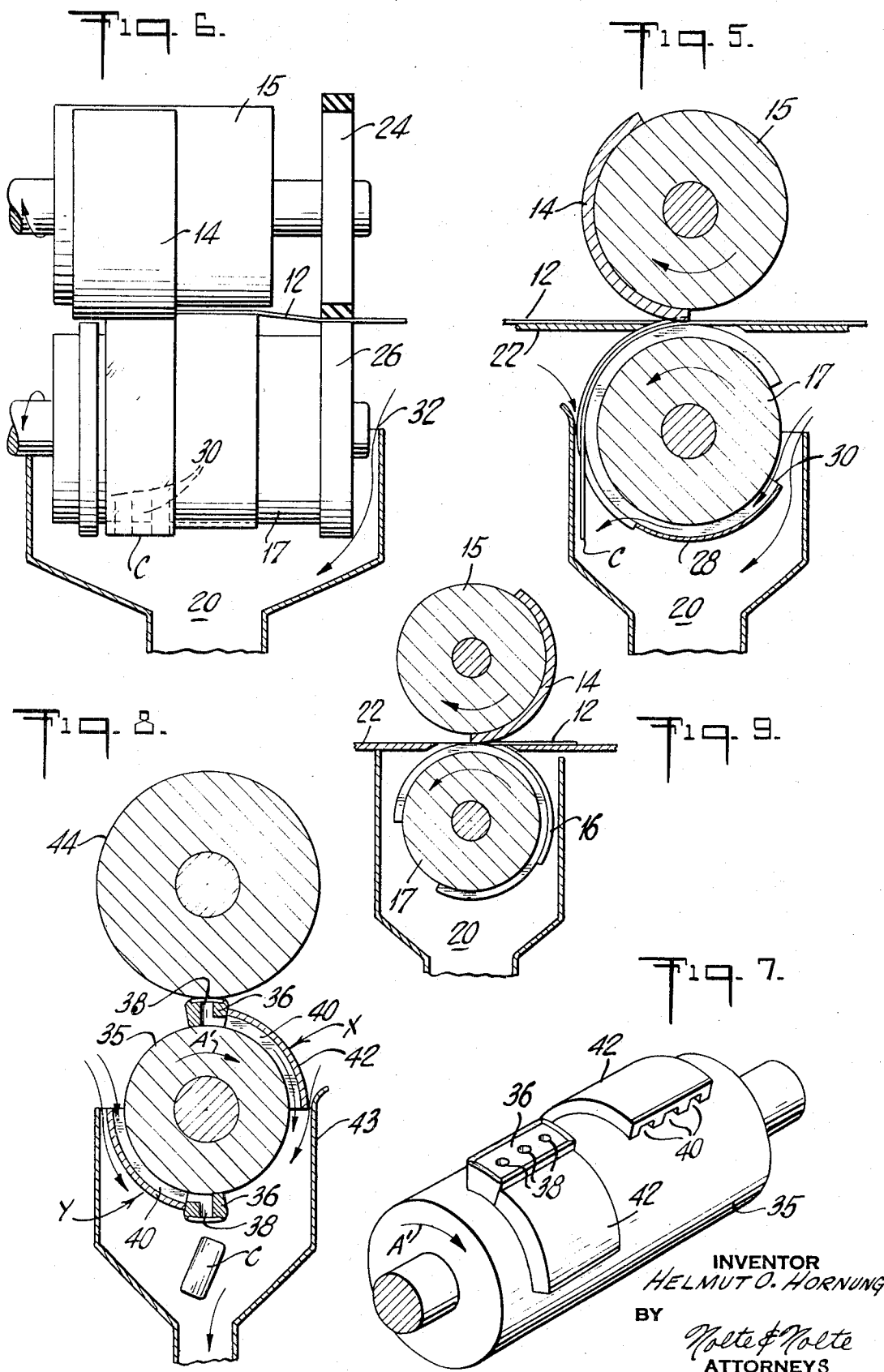




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CHIP REMOVAL APPARATUS

BACKGROUND OF THE INVENTION

In a material cutting operation from a moving sheet or web portion, waste paper parts which are called chips must be carried away from the operative parts of the apparatus to avoid interference by these waste parts with subsequent operations that are to be performed on the sheet or web.

Previous methods and devices for removing chips from a taut moving web include the use of air blowers or vacuum devices.

When the same or similar operations are performed on a single moving blank, the problem of chip removal becomes difficult because the blank is not under web tension and there is always the tendency for the blank to follow the chip. This may be because of incomplete cutting of the blanks or because the vacuum source or blower are too close to the cutting operation. In addition, there is the problem of large chips which cannot be drawn through a hollow shaft of the type incorporated in the high speed rotary shear blank cutting device as shown and described in U.S. Pat. No. 3,302,503 issued Feb. 7, 1967.

A further chip disposal arrangement can be used as shown in U.S. Pat. Nos. 3,106,121, 3,274,971 and 2,302,855 in which ducts to remove chips are shown.

Other arrangements are known which use suction to hold each of the chips until the position of each of the chips is in the waste disposal area. When the chip is in the proper position, then a blast of high pressure air is directed through the same duct, which previously had a vacuum therein, in order to blow the chips away from the cutters. The aforesaid arrangement require timing valves, hollow shafts, hoses as well as vacuum and pressure pumps. All of these elements make the arrangement more costly. In addition, the arrangement requires more power to overcome the inherent friction of the valves.

Moreover, as seen in U.S. Pat. No. 2,381,955 issued Aug. 14, 1955, there are mechanical devices which hold the chip for separation but these mechanical devices are usually damaged when the machine becomes jammed and inoperative.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a chip removal arrangement for material cutting machines without the use of bulky and extraneous devices, and which has a timed chip pickup at the point of the cutting sequence, and the transport and removal of the chip therefrom to an exhaust system.

Another object of the present invention is to provide a chip removal arrangement which is inexpensive to construct and has a high degree of reliability due to the fact that there are a minimum of operative parts therein.

A further object of the present invention is to provide a conduit connected directly to a rotatable cutting knife whereby the cutter shaft does not have to be hollow with its inherent weakening characteristics. Instead, covered ribs on the rotatable cylindrical element form conduits which conform to the circumference of the rotatable cylindrical element and are connected to openings in the face of the cutting knife. The housing is provided with a vacuum whereby air flow reversal as a result of rotating of the cutting knife will blow the chip from the cutting knife face to the chip exhaust area.

The invention will be more clearly understood from the following description of specific embodiments of the invention together with the accompanying drawings, in which:

FIG. 1 is a sectional view of a rotary shear cutter mechanism for a paper handling machine;

FIG. 2 is a front elevational view of said rotary shear cutter mechanism, with part thereof in section;

FIG. 3 is a sectional view of the rotary shear cutter mechanism as shown in FIG. 1 with the cutters rotated 90°;

FIG. 4 is a front elevational view of said rotary shear cutter mechanism with the cutters in the position illustrated in FIG. 3;

FIG. 5 is a sectional view of the rotary shear cutter mechanism with one of the cutters in still another position;

FIG. 6 is another frontal elevational view of said rotary shear cutter mechanism with the cutters in the position illustrated in FIG. 5;

FIGS. 7 and 8 illustrate another embodiment of the present invention where chips are cut from a sheet of thin material, such as paper, and a reversal of air flow blow the chip from the cutter; and

FIG. 9 is a sectional view of a rotary shear cutter mechanism which is an alternate embodiment of the present invention.

Referring to the drawings, a rotary shear cutter mechanism referred to generally by the numeral 10 is shown which is particularly adapted for use with a paper handling machine (not shown) such as the types in which a moving sheet or web material 12 is subject to a cutting operation. The rotary cutter mechanism 10 has an upper cutter 14 on a rotatable shaft 15 and a lower cutter 16 on a rotatable shaft 17. As seen in the position shown in FIG. 1 the upper cutter 14 has just initiated its shearing action into lower cutter 16. The material 12 to be cut may or may not have advanced beyond this initial shear-in point. A plurality of ribs 18 are located adjacent to the lower cutter 16 and extend circumferentially around a portion of rotatable shaft 17. A vacuum exhaust housing 20 surrounds the shaft 17 and optionally may extend up to the undersurface of paper support plate 22. The feed wheels 24 and 26 shown in FIG. 2 are adapted to deliver paper in the form of single sheets 12 through the paper handling mechanism. These wheels are not necessary if a web of material is pulled through the cutter mechanism. A chip 12' is seen in FIG. 2 which is waste material and is illustrated in the downwardly deflected position at the initiation of the shear between cutters 14 and 16. Thereafter, as a vacuum is created in vacuum exhaust housing 20 ambient air depresses the chip 12' on the top of the ribs 18 (FIG. 3), the ribs being slightly below the elevation of the outer diameter of lower cutter 16.

As seen in FIG. 1, when the cutters 14 and 16 begin to shear into one another, the resulting chip 12' cut from the material 12 must be held to the outer rib diameter of the lower rotatable shaft 17. A relatively thin plate 28 attached to the outer surfaces or diameters of the ribs 18 is located in front of the depressed chip 12', but not in the area where the chip 12' is held on the outer surfaces of the rib 18 and provides a cover forming air passages 30. Accordingly, when the rotatable cutters 14 and 16 commence the cutting operation, as seen in FIG. 1, the plate 28 extends into the area of vacuum or subatmospheric pressure in the vacuum exhaust housing 20. In this manner, a vacuum is drawn on the chip 12' through the passages 30 and thereby holds the chip 12' against the ribs 18 until the openings to the air passages or channels 30 rotate to the midpoint or 180° position of the shaft 17 (FIG. 5). The time of the hold down of the chip 12' can be changed by increasing or decreasing the length of the plate 28 on the passages 30. It should be noted that atmospheric air constantly flows in and around the openings 32 and 34 between the lower shaft 17 and its assembly and the exhaust duct 20.

Referring to FIG. 3, the cutters 14 and 16 have rotated 90° with the chip 12' being held down by ambient air pressure against one side of the chip 12'; and a vacuum applied to the other side of the chip 12'. Air continues to be drawn through the passages 30 in the direction of rotation of shaft 17. When the leading edge of passages 30 reaches the 180° point in the rotation of the shaft 17, as seen in FIG. 5, the same begins to make its travel in an upward direction against the flow of air. When the reversal of air flow occurs, the covered rib section functions as an air scoop reversing the direction of air flow through said covered rib section. This air reversal then blows the chip 12' away from the outer diameter of the ribbed section so that disposal can take place. Just prior to the chip 12' being blown away, ambient atmospheric pressure holds the trailing portion of the chip 12' to the rib 18. Thereafter, further rotation of the shaft 17 and the continuing air flow strips the chip 12' from the outer diameter of the ribs.

It should be noted that the length of cover plate 28 determines how long the chip 12' is held before release is provided by air flow reversal. The plate 28 additionally provides an extension to keep the sheet material from said exhaust duct area.

FIGS. 7 and 8 disclose an alternative embodiment of the present invention comprising a rotatable member 35 having a cutter 36 which is shown herein of the type suitable for cutting windows for envelope blanks. The cutter 36 has several openings 38 in the cutting face thereof and connected thereto are conduits or channels 40 formed by covered ribs 42. A backing member 44 coacts with rotatable cutter 36 in a known manner. A housing 44 has a subatmospheric pressure therein and when member 35 rotates in the direction of the arrow A a subatmospheric pressure prevails in the conduit 40 in the position X of the conduit and chip C adheres to the cutter 36, however when the conduit 40 rotates to the position Y atmospheric air is scooped down conduit 40 and blows chip C from the cutter. This action is clearly seen in FIG. 8, illustrating that the present construction eliminates the need for a hollow shaft forming a vacuum passageway, the latter, of course, resulting in the weakening of the structure of prior art cutting devices.

FIG. 9 illustrates another embodiment of the present invention in which the cover plate 28 is removed, but the ribs 18 remain. In this construction, the housing 29 extends to a location in close proximity to the undersurface of the paper support plate 22. As seen in FIG. 9, the ambient pressure indicated by the arrow A acts upon the chip 12' as it is being cut from the blank 12. The support plate 22, in this construction, separates the ambient and the subatmospheric pressure areas. The ambient air flows into and between the ribs 18. Thus the chip 12' is deflected and held on the ribs 18 and stays on the ribs until the shaft 17 rotates 180°, at which point the opposite flow of atmospheric air strips the chip 12' from the ribs 18.

I claim:

1. A chip removal arrangement for cut portions of a moving sheet of material comprising upper and lower relatively rotatable coacting cutters, a plurality of spaced ribs on said lower cutter, a cover secured over a portion of at least two adjacent ribs to form a passageway therebetween, a housing having an area of subatmospheric pressure adjacent to the lower rotatable cutter, said moving sheet being cut by the coating cutters and one surface of said chip therefrom being held against said ribs adjacent to one end of said passageway by the subatmospheric pressure in said passageway, ambient pressure deflecting and further holding another surface of said chip to the ribs of said lower cutter, said chip continuing to adhere to said ribs on the rotatable lower cutter until said lower cutter rotates to a position where a flow of air passes through said passageway and contacts said chip and blows said chip away from said lower cutter to an area for evacuation thereof.

2. A chip removal arrangement as claimed in claim 1 wherein the open end of said housing extends adjacent to said moving sheet of material.

3. A chip removal arrangement as claimed in claim 1 wherein ambient pressure is exerted against the outer side of said chip on said lower cutter while subatmospheric pressure prevails on the inner side of said chip before removal of said chip from said rotating lower cutter.

4. A chip removal arrangement for cut portions of a moving sheet of material comprising upper and lower relatively rotatable coacting cutters, a plurality of spaced ribs on said lower cutter, a housing forming an exhaust duct extending adjacent to said moving sheet of material, said moving sheet being cut by the coating cutters and the undersurface of the chip

therefrom being held against said ribs by the subatmospheric pressure in said housing, ambient pressure deflecting and further holding the top surface of said chip to the ribs of said lower cutter, said chip continuing to adhere to said ribs on the rotatable lower cutter until said lower cutter rotates to a position where a flow of air passes between said spaced ribs contacts said chip and blows said chip away from said lower cutter to an area for evacuation thereof.

5. A chip removal arrangement for cut portions of a moving sheet of material comprising at least one rotatable cutter, having an opening therein a backing member coacting with said rotatable cutter, at least one covered ribbed section on said rotatable cutter forming an elongated conduit which communicates directly with the opening in said rotatable cutter at one end thereof, a housing having an area of subatmospheric pressure adjacent to said rotatable cutter, the other end of said conduit communicating with the area of subatmospheric pressure in said housing, said chip being retained over the opening in said cutter because of subatmospheric pressure prevailing in said conduit during a predetermined period of rotation of said cutter and blown off said cutter when said cutter is rotated to a position in which air at atmospheric pressure moves through said conduit and contacts said chip to evacuate the same from said area of subatmospheric pressure in said housing.

6. A chip removal arrangement as claimed in claim 5 wherein said cutter is mounted on a cylindrical member and the covered ribbed section forming a conduit is curved to conform to the outer circumference of said cylindrical member.

7. A chip removal arrangement for cut portions of a moving sheet of material comprising upper and lower relatively rotatable coacting cutters, a plurality of spaced ribs on one of said cutters, a cover secured over a portion of at least two adjacent ribs to form an elongated passageway therebetween, a housing having an area of subatmospheric pressure adjacent to said one cutter provided with said spaced ribs, said passageway extending into said area of subatmospheric pressure, said moving sheet being cut by the coacting cutter and one surface of said chip therefrom being held against said ribs adjacent to said passageway by the subatmospheric pressure in said passageway, ambient pressure deflecting and further holding another surface of said chip to the ribs of said one of said cutters, said chip continuing to adhere to said ribs on said one of said cutters until the latter cutter rotates to a position where a moving stream of air passes through said passageway and contacts said chip and blows said chip away from said one of said cutters to an area for evacuation thereof.

8. A chip removal arrangement for cut portions of a moving sheet of material comprising upper and lower relatively rotatable coacting cutters, a plurality of spaced ribs on said lower cutter, a cover secured over a portion of at least two adjacent ribs to form a passageway therebetween, a housing having an area of subatmospheric pressure adjacent to the lower rotatable cutter, said moving sheet being cut by the coating cutters and the chip therefrom being held against said ribs adjacent to said passageway by the subatmospheric pressure in said passageway, ambient pressure deflecting and further holding said chip to the ribs of said lower cutter, said chip continuing to adhere to said ribs on the rotatable lower cutter until said lower cutter rotates to a position where a flow of air contacts said chip and blows said chip away from said lower cutter to an area for evacuation thereof, the length of said cover over said ribs determining the length of time said chip adheres to said ribs before the release thereof to the evacuation area.