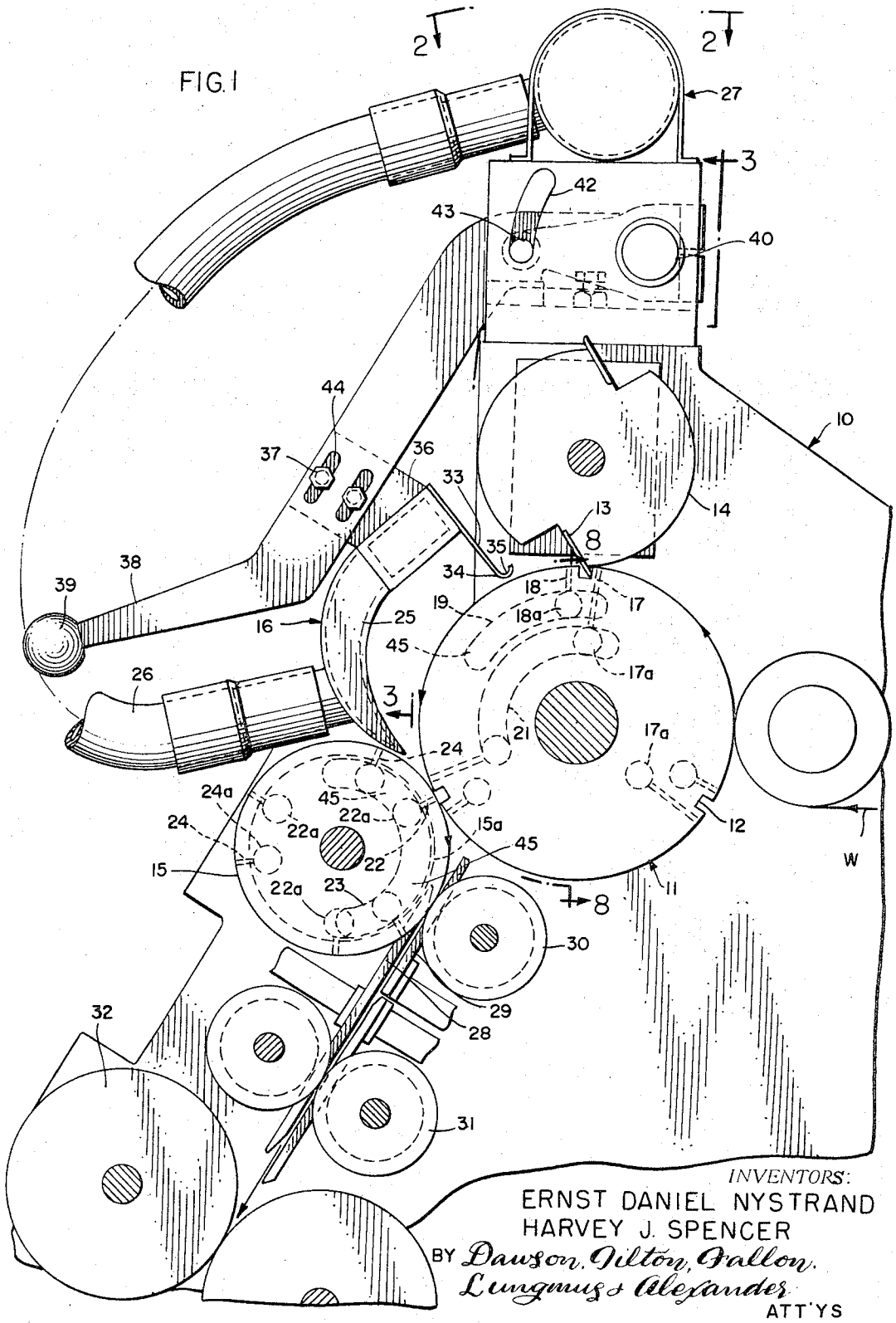
Aug. 29, 1967 E. D. NYSTRAND ETAL 3,338,575

WEB LAPPING APPARATUS

Filed March 10, 1965 3 Sheets-Sheet 1

FIG. 1



INVENTORS:
ERNST DANIEL NYSTRAND
HARVEY J. SPENCER
BY Dawson, Tilton, Fallon, Lungmus & Alexander
ATT'YS

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WEB LAPPING APPARATUS

Filed March 10, 1965 3 Sheets-Sheet 2

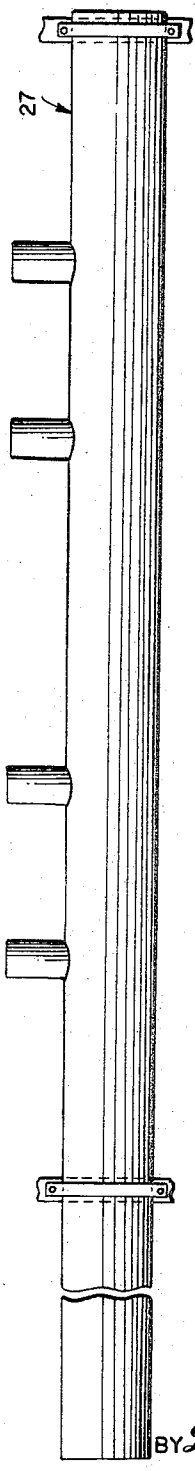

FIG. 2

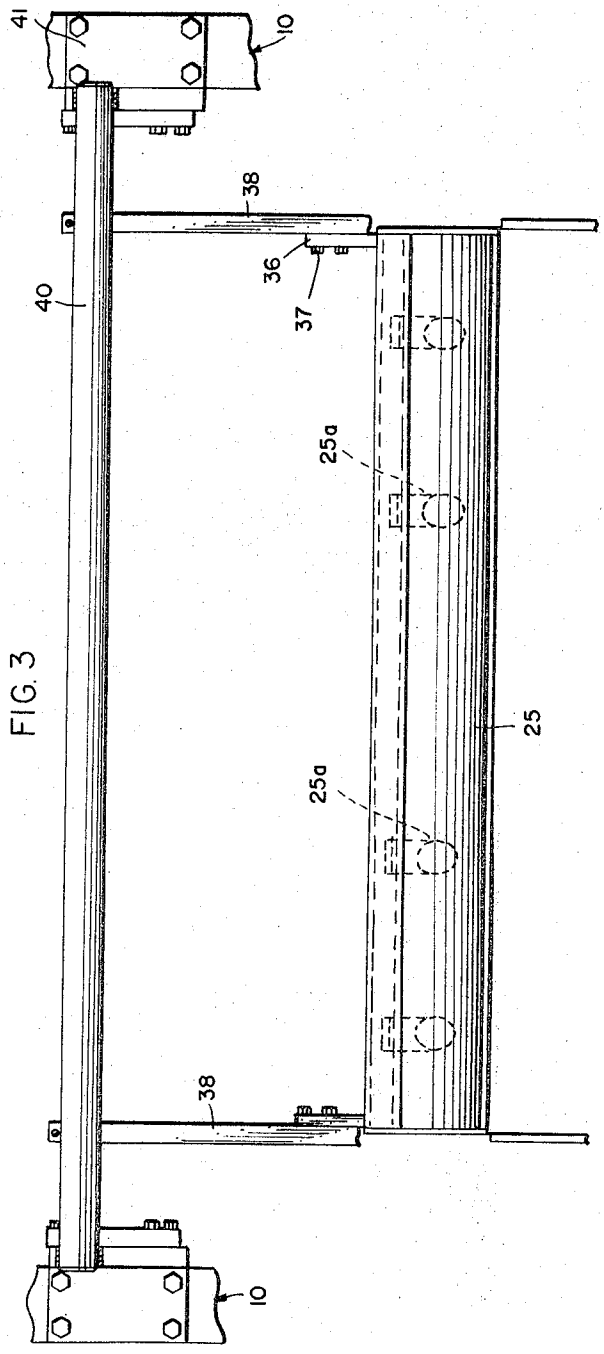

FIG. 3

INVENTORS:
ERNST DANIEL NYSTRAND
HARVEY J. SPENCER

BY Dawson, Dilton, Fallon, Lungmus & Alexander
ATT'YS

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FIG. 4

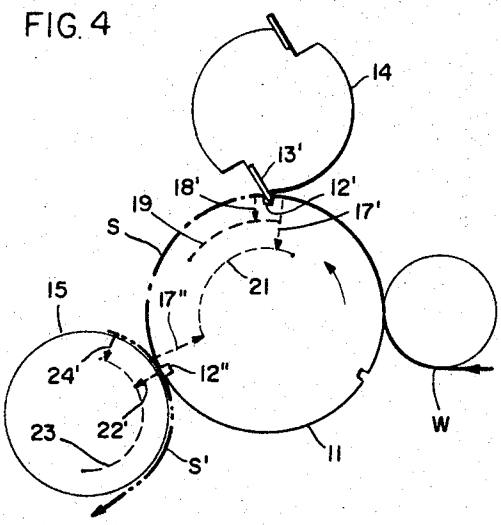


FIG. 5

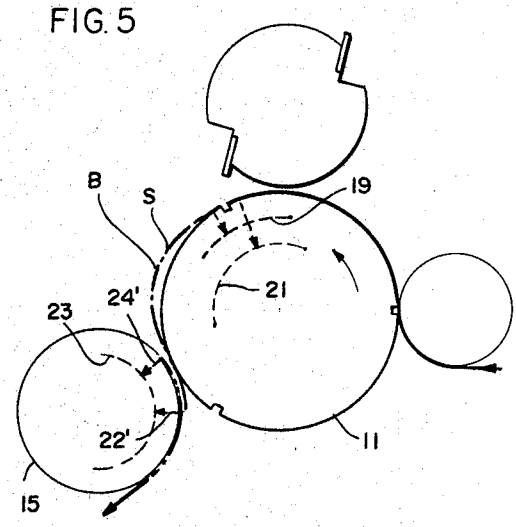


FIG. 6

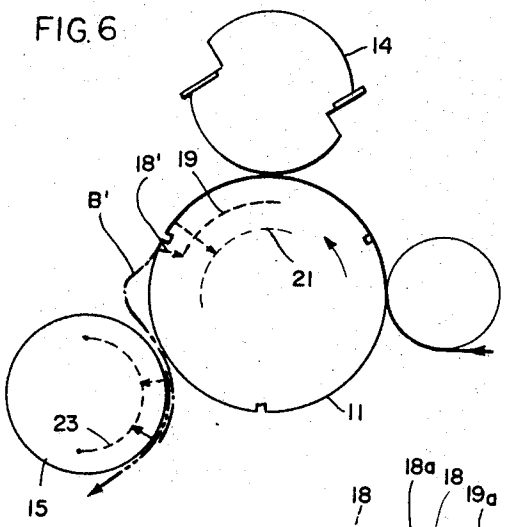


FIG. 7

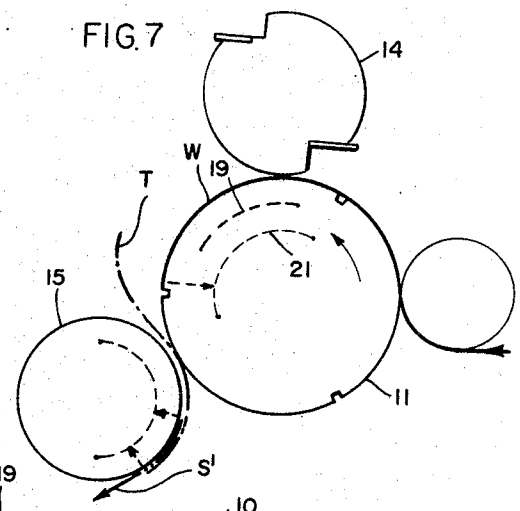
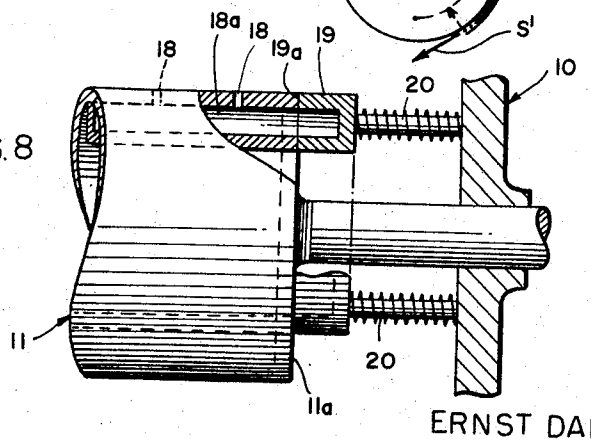


FIG. 8



INVENTORS:
ERNST DANIEL NYSTRAND
HARVEY J. SPENCER

BY Dawson, Dilton, Fallon, Lungmus & Alexander
ATT'YS

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WEB LAPPING APPARATUS

Ernst Daniel Nystrand and Harvey J. Spencer, Green Bay, Wis., assignors to Paper Converting Machine Company, Inc., Green Bay, Wis., a corporation of Wisconsin

Filed Mar. 10, 1965, Ser. No. 438,560
7 Claims. (Cl. 270—59)

This invention relates to web lapping apparatus, and, more particularly, to apparatus for developing a stream of severed sheets which are arranged in overlapping or shingled relation.

The invention finds utility in connection with the development of folded toweling wherein the separate sheets making up the package of toweling are interfolded so that the removal of one sheet partially extracts a second sheet for subsequent removal.

A principal object of this invention is to provide an apparatus and method for lapping of sheets whereby unique rotary mechanisms are employed which facilitate the achievement of high speeds with a minimum of vibration or other mechanically objectionable phenomena.

Another object of the invention is to provide a unique arrangement of vacuum means which coact to develop a slack loop in each sheet of a stream of severed webs whereby lapping or shingling is expeditiously achieved.

Other objects and advantages may be seen in the details of construction and operation set down in this specification.

The invention is explained in conjunction with an illustrative embodiment in the accompanying drawing, in which—

FIG. 1 is a fragmentary elevational view, partly in section, of a machine for overlapping and folding web material such as paper toweling;

FIG. 2 is a fragmentary elevational view of the apparatus of FIG. 1 as seen along the sight line 2—2 applied to FIG. 1;

FIG. 3 is a fragmentary sectional view as would be seen along the sight line 3—3 applied to FIG. 1;

FIGS. 4–7 are fragmentary schematic views showing the vacuum means responsible for achieving the sheet overlapping and which show the sheets in different stages of overlap; and

FIG. 8 is a fragmentary sectional view such as would be seen along the sight line 8—8 applied to FIG. 1.

In the illustration given and with particular reference to FIG. 1, the numeral **10** designates generally a frame which supports a number of rolls in rotatable fashion. The numeral **11** designates generally a cutting roll equipped with a plurality of longitudinally-extending, circumferentially spaced-apart cutting recesses **12**. Cooperating with the recesses **12** in transversely severing a web W (see FIG. 4) are knife blades **13** which are carried by a knife-carrying roll **14**.

The various rolls are rotated through gearing suitably carried by cross shafts and journaled in the frame **10**, the gearing being omitted for the sake of clarity of picturization of the important features of the invention. In this connection, the frame **10** also rotatably carries a retard roll generally designated **15** which, in the illustration given, rotates at two-thirds of the surface speed of the cutting roll **11**. As will be brought out in greater detail hereinafter, the speed relationship of the cutting and retard rolls may be varied according to the degree of lapping desired, it being appreciated, however, that the retard roll **15** always rotates at a slower surface speed than the cutting roll **11**.

Pivotally mounted on the frame **10** and interposed between the knife-equipped roll **14** and the retard roll **15**

is a vacuum shroud generally designated **16** which serves to aspirate the tail of a severed sheet away from the cutting roll **11** in the fashion shown in detail in FIGS. 4–7—to which reference will now be made.

Sequence of overlapping

Now referring to FIG. 4, it will be seen that a given recess **12'** in the cutting roll **11** is in register with a given knife **13'** of the knife-carrying roll **14**. This severs the web W and the leading edge of the remaining web is maintained in contact with the surface of the cutting roll **11** by means of vacuum ports **17'**. The trailing edge of the sheet S just developed by the coaction of the knife **13'** and the recess **12'** is maintained in contact with the periphery of the cutting roll **11** by means of another series of vacuum ports **18** (see particularly FIG. 8).

In FIG. 8, it is seen that the various axially aligned ports **18** communicate with a longitudinally-extending bore **18***a* provided in the cutting roll **11**. Cooperating with the bore **18***a* is an arcuate-shaped manifold **19** which provided as a stationary part of the frame **10**, i.e., stationary in the sense that it does not rotate with the cutting roll **11**. The manifold **19** is secured to the frame **10** by means of spring-equipped posts **20** so that a satisfactory seal exists between the confronting face **11***a* of the cutting roll **11** and the face **19***a* of the manifold **19**. As can be appreciated rfom a consideration of FIG. 1, the bore **18***a* traverses the manifold **19**, which is shown in dotted line. By the same token, a similar bore **17***a* is provided for each of the vacuum ports **17**, and the arcuate manifold cooperating with the ports **17***a* is designated **21**. The manifold **21**, like the manifold **19**, is non-rotatable, being fixed to the frame **10** for resilient engagement with the confronting face **11***a* of the cutting roll **11**. It is advantageous on wider machines to have a manifold **19** and associated parts at each end of cutting roll **11** and retard roll **15**.

Again referring to FIG. 4, it will be seen that at the instant of cutting the leading edge of the web W is urged against the surface of the cutting roll **11** by virtue of the vacuum being applied through the ports **17'**. This stems from the fact that the ports **17'** communicate with the manifold **21** which is indicated schematically in doted line, as is the vacuum port **17'**. Also at this moment, the trailing edge of the severed sheet S is urged against the surface of the cutting roll **11** by virtue of the vacuum existing in the vacuum ports **18'**—which are aligned with the manifold **19**. Also at this particular instant the vacuum port **17''** associated with the leading edge of the sheet S reaches the end of the manifold **21** so as to permit transfer of the leading edge of the sheet S from the cutting roll **11** to the retard roll **15**.

Transfer is effected through the operation of a series of vacuum ports **22** provided in the retard roll **15**. In FIG. 1, it will be seen that the vacuum ports **22** communicate with a longitudinally-extending vacuum bore **22***a* which is adapted to cooperate with arcuate vacuum manifold **23**. The manifold **23** is analogous to that shown in FIG. 8 relative to the manifold **19** associated with the cutting roll **11**. Further, each of the vacuum ports **22** has associated therewith a second row of vacuum ports **24** spaced rearwardly thereof in the direction of rotation, and communicating with longitudinally-extending bores as at **24***a*. Thus, a discrete forward portion of each sheet S is urged against the retard roll **15**.

At the time of transfer, it will be noted that the suction is discontinued insofar as the ports **17''** are concerned, but that the suction existing in the ports **22'** is functioning to effect transfer. The suction or vacuum employed is sufficient to effect the transfer notwithstanding the interposition of a previously severed sheet S' between the ports **22'** and the succeeding sheet S. For this purpose, we pre-

fer to have a slight spacing between the surfaces of the rolls **11** and **15**—of the order of 1/32"—so that there is a definite movement radially inwardly of the roll **15** of the forward edge of the sheet at the time of transfer.

Referring now to FIG. 5, it will be seen that the rolls **11** and **15** have rotated about 30° from that shown in FIG. 4. Here, it should be appreciated that it is not essential that the cutting be performed at any particular portion of the rotation of the roll **11**, but that the engagement of the knives **13** with the recesses **12** at the uppermost point of rotation is advantageous from a machine design standpoint. The actual layout of the cutting means and the point of transfer will depend on the size of the sheet being developed, the size of the various rolls, and the degree of overlap of successive sheets.

In FIG. 5, it is seen that the forward edge of the sheet S is being maintained against the surface of the retard roll **15** by means of the vacuum existing in the ports **22'** and **24'**. Although the angular velocity of the roll **15** in the illustration given is the same as that of the cuting roll **11**, the smaller diameter of the retard roll **15** develops a slower surface speed than that of the cutting roll **11**. Inasmuch as the trailing edge of the sheet S is traveling at the surface speed of the cutting roll **11**, while the leading edge of the sheet S is traveling at the slower surface speed of the retard roll **15**, a slack or belly portion B is developed in the intermediate portion of the sheet S.

This belly portion becomes more pronounced as at B' in FIG. 6, which is a showing of the rolls **11** and **15** advanced about 60° from the showing in FIG. 4. At about the configuration of elements in FIG. 6, the port **18'** reaches the end of the manifold **19**, and the trailing edge of the sheet S snaps away from the surface of the cutting roll **11**—to the disposition shown in FIG. 7—by virtue of the vacuum applied in a vacuum shroud **25**.

The vacuum shroud **25** is an elongated hood-like member, as can be appreciated from a consideration of FIG. 3. Along its length, the shroud **25** is equipped with nipples as at **25***a* which are coupled by means of flexible hoses **26** (see FIG. 1) to a vacuum manifold **27** (see also FIG. 2).

The showing in FIG. 7 is at about 90° from that seen in FIG. 4, and it will be noted that there is a pronounced tail T developed in the sheet S by virtue of the suction present in the shroud **25**. The showing in FIG. 7 clearly indicates how a succeeding sheet is moved into lapping relation with the previous sheet, since the web W is seen in FIG. 7 to be in partial lapping relation with the tail T.

For a three-time cutting roll, i.e., a cutting roll having three equally-spaced cutting recesses **12**, we prefer to have the release of the tail T occur about 60–70° in advance of the point of transfer. In the illustration given, this results in the cutting roll **11** having moved 50–60° from the cutting position illustrated in FIG. 4. However, as mentioned previously, the cutting can be performed when the cutting roll **11** is at other dispositions than that shown in FIG. 4. For example, if the cooperating knife roll **14** were moved to the right and downwardly in FIG. 7, cutting could be performed when the cutting roll **11** is in the configuration shown in FIG. 7. This would mean a relatively longer manifold, with no attendant advantage.

In FIG. 7, the sheet S' is seen to be moving tangentially of the retard roll **15**, and this is achieved by virtue of a set of stripping members **28** (see FIG. 1). These elongated, finger-like members are mounted on the frame **10** and are housed within annular grooves provided in the retard roll **15**—the grooves being designated by means of the dotted line marked **15***a* in FIG. 1. Cooperating with the strippers **28** are guide bars **29** to confine the now-lapped sheets.

Inasmuch as the web W is of substantial width, we utilize a roll **30** for the purpose of advancing the lapped sheets. Still referring to FIG. 1, the frame **10** is equipped with draw rolls **31** for continuing the advancement of the lapped sheets and to deliver the same into folding rolls

which may be employed to develop a zigzag fold conventionally used in many paper toweling installations. Rolls **31** may include slitting means for the purpose of longitudinally cutting the sheets S into discrete widths corresponding to the final package widths.

Still referring to FIG. 1 but now to the portion thereof showing the shroud **25**, it will be seen that the shroud **25**, at the entering end thereof, is equipped with a generally radially-extending plate **33** (relative to the cutting roll **11**) for the purpose of confining the vacuum, i.e., limiting the flow of atmospheric air into the chamber developed by the hood-like shroud **25**. The lower edge of the plate **33** is curved as at **34** to develop a slight gap which will limit the inflow of air yet will not snag sheets should the same have surface imperfections.

The shroud **25** is arranged for movement toward and away from the cutting roll **11**, and for that purpose is equipped with upwardly-extending arms **36** (see also FIG. 3). The arms **36** are secured by means of bolts **37** to pivot arms **38** provided as part of the frame **10**. In FIG. 1, it will be seen that the arms **38**, at their operating ends, have knobs **39**, while at their pivot ends are mounted on a shaft **40**. The shaft **40** is carried by suitable pedestals as at **41** (see FIG. 3), and the position of the arms **38** can be stabilized by means of a stud **43** operating within a slot **42** provided as part of the frame **10**. Further positioning of the shroud **25** is achieved through positioning the bolts **37** within the slot **44** provided in the arms **38**.

By varying the size of roll **15**, varying degrees of overlap can be achieved. Further, it will be appreciated that the overlapping or shingling of sheets is achieved without any reciprocatory motion. The vacuum-providing means is stationary and only two rotating rolls are employed. The extent of the applicaion of vacuum on the web W and sheets S, S', etc., can be varied conveniently through the interposition of blanks such as are designated schematically in FIG. 1 relative to the manifold **19** by the numeral **45**.

While in the foregoing specification a detailed description of an embodiment of the invention has been set down for the purpose of explanation, many variations in the details herein given may be made by those skilled in the art without departing from the spirit and scope of the invention.

We claim :

1. Apparatus for web lapping, comprising a frame, a cutting roll rotatably mounted on said frame, said cutting roll being equipped with longitudinally-extending vacuum port means in the surface thereof for advancing a web with said cutting roll in partial wrapping engagement therewith, knife means on said frame operably associated with said cutting roll for transversely severing said web along longitudinally spaced-apart lines to provide a succession of discrete sheets, a retard roll rotatably mounted on said frame in parallel, side-by-side relation to said cutting roll, said retard roll being equipped with longitudinally-extending vacuum port means in the surface thereof for transferring said web sheets from said cutting roll, and vacuum means interposed adjacent the path of a sheet being transferred from said cutting roll to said retard roll for displacing the trailing portion of said sheet, and means for rotating said retard roll at a surface speed slower than the surface speed of said cutting roll.

2. The structure of claim **1** in which said vacuum means includes a shroud on said frame positioned forwardly of said knife means over a portion of the periphery of said cutting roll.

3. The structure of claim **1** in which said cutting roll vacuum port means includes circumferentially spaced, longitudinally aligned ports for selective actuation to release the said trailing portion prior to the release from said cutting roll of the leading portion of the next sheet.

4. Apparatus for web lapping, comprising a frame, a cutting roll rotatably mounted on said frame, a knife-carrying roll also rotatably mounted on said frame and adapted to coact with said cutting roll in transversely severing a web partially wrapped on said cutting roll, a retard roll rotatably mounted on said frame in the path of a web segment developed by the coaction of said cutting and knife-carrying rolls, each of said cutting roll and retard roll being equipped with a plurality of vacuum ports for transferring the leading edge of said web segment from said cutting roll to said retard roll, means for rotating said retard roll at a surface speed lower than the surface speed of said cutting roll, and a vacuum shroud interposed between said cutting roll and retard roll in covering relation with a portion of the periphery of said cutting roll, said shroud being constructed and arranged to aspirate the trailing edge portion of a web segment away from said cutting roll whereby the leading edge of a subsequent web segment is adapted to pass under said trailing edge portion for creating a sequence of overlapped web segments.

5. The structure of claim 4 in which said vacuum shroud is equipped with an inner surface provided with a plurality of openings and arranged in confronting relation with said cutting roll peripheral portion, said shroud further including a vacuum chamber partially defined by said inner surface, and handle means pivotally mounted on said apparatus for positioning said shorud relative to said cutting roll.

6. The structure of claim 4 in which each of said cutting roll and retard roll is equipped with an arcuate vacuum manifold mounted on said frame, said cutting roll and said retard roll being equipped with longitudinally-extending bores adapted to selectively communicate with the associated vacuum manifold for urging the leading edge of a web segment into contact with the surface of the roll carrying the particular bore.

7. A method of web lapping, comprising advancing a web in partial wrapping engagement with a first roll, severing the leading portion of said web to provide a sheet, transferring the leading edge of said sheet into partial wrapping engagement with a second roll, said first roll being rotated at a faster speed than said second roll, retaining the trailing portion of said sheet in contact with said first roll for a discrete period following said transfer, releasing said trailing portion, and drawing the trailing portion away from said first roll by a vacuum to permit said web to be advanced into lapping relation with said trailing portion.

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EUGENE R. CAPOZIO, *Primary Examiner.*

P. WILLIAMS, *Assistant Examiner.*