

July 14, 1942.

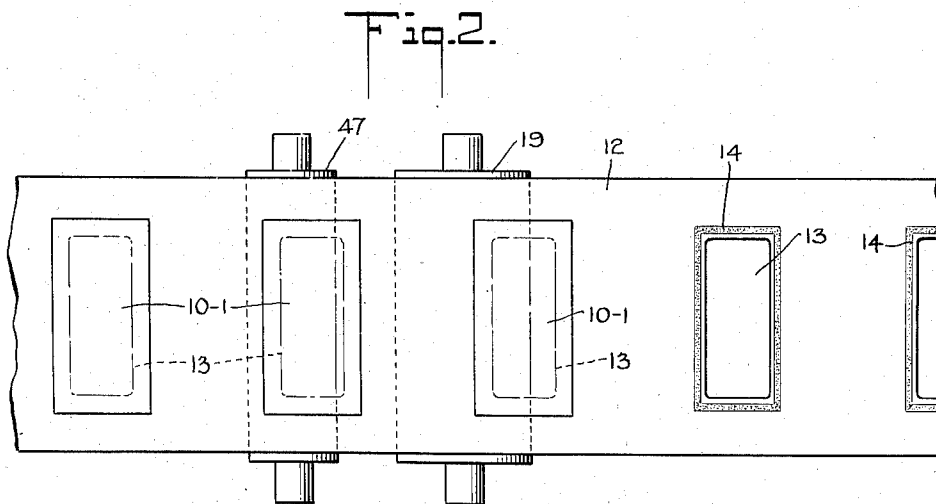
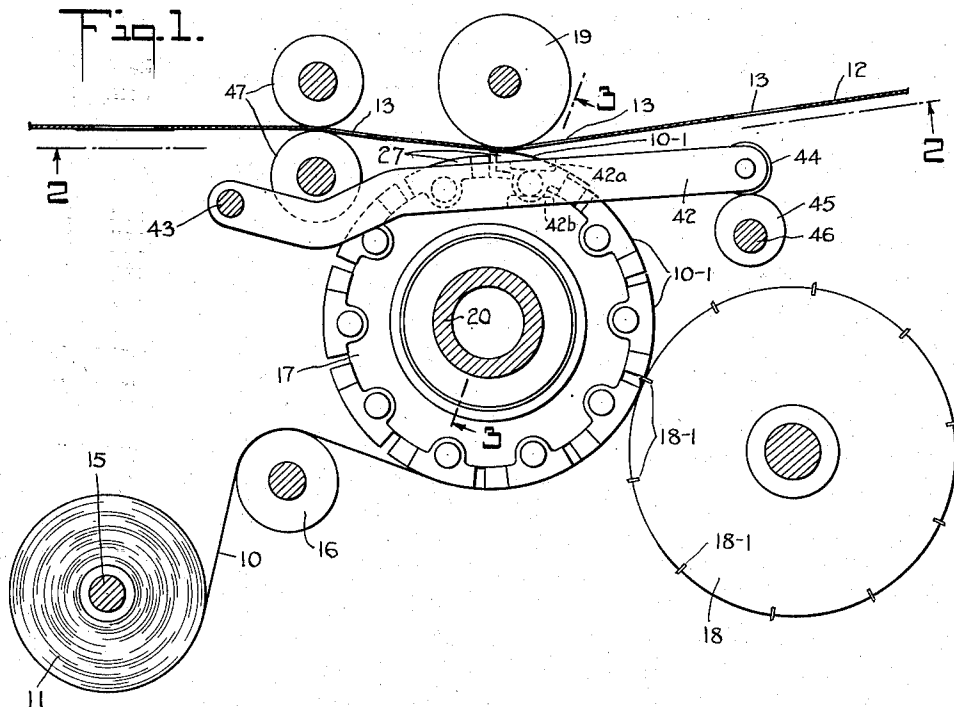
A. P. BAMFORD

2,289,336

METHOD AND MEANS FOR APPLYING SHEET MATERIAL TO OTHER MATERIAL

Filed Sept. 5, 1940

4 Sheets-Sheet 1



INVENTOR
ARTHUR P. BAMFORD

Henry J. Luke
ATTORNEY

July 14, 1942.

A. P. BAMFORD

2,289,336

METHOD AND MEANS FOR APPLYING SHEET MATERIAL TO OTHER MATERIAL

Filed Sept. 5, 1940

4 Sheets-Sheet 2

Fig. 3.

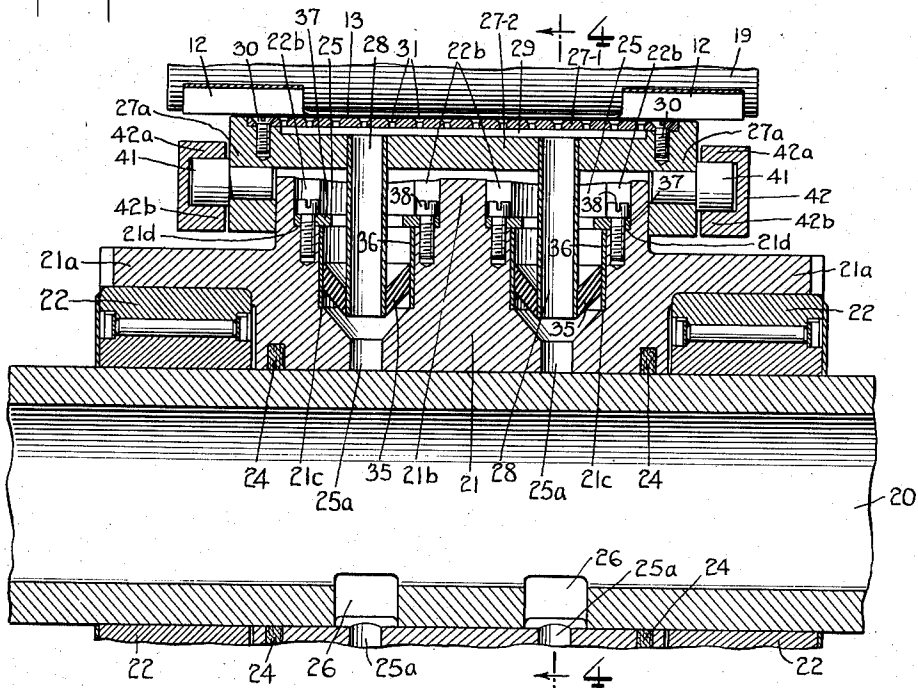


Fig. 4.

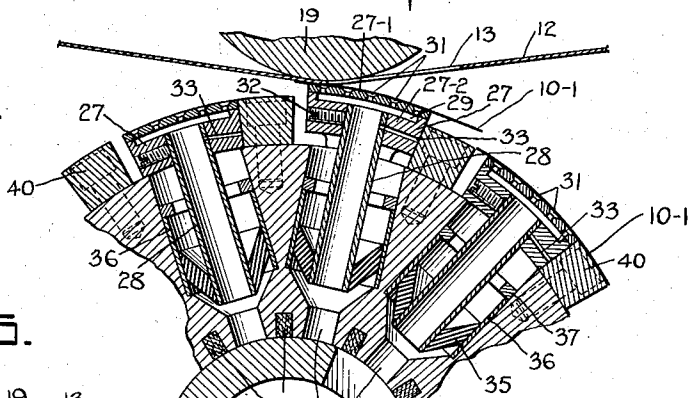
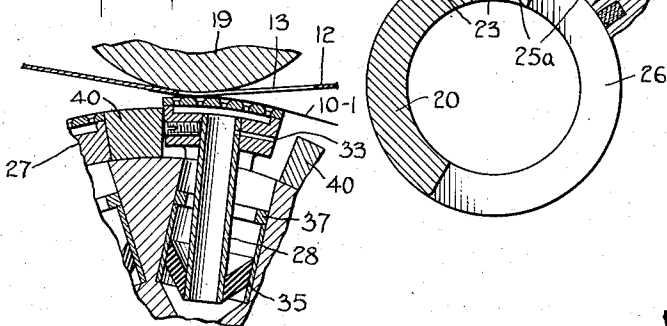


Fig. 5.



INVENTOR
ARTHUR P. BAMFORD

BY *Henry J. Lucki*
HIS ATTORNEY

July 14, 1942.

A. P. BAMFORD

2,289,336

METHOD AND MEANS FOR APPLYING SHEET MATERIAL TO OTHER MATERIAL

Filed Sept. 5, 1940

4 Sheets-Sheet 3

Fig. 6.

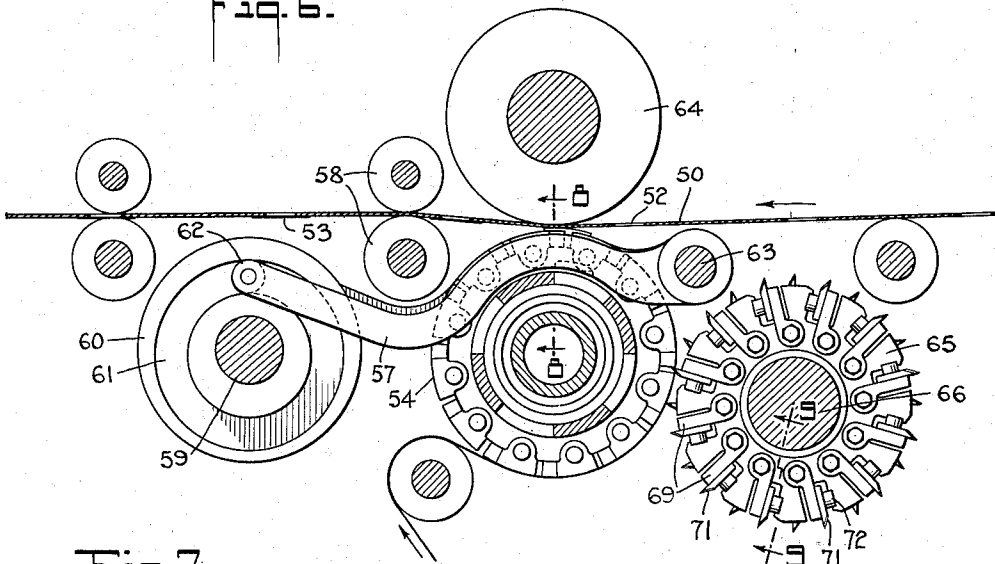


Fig. 7.

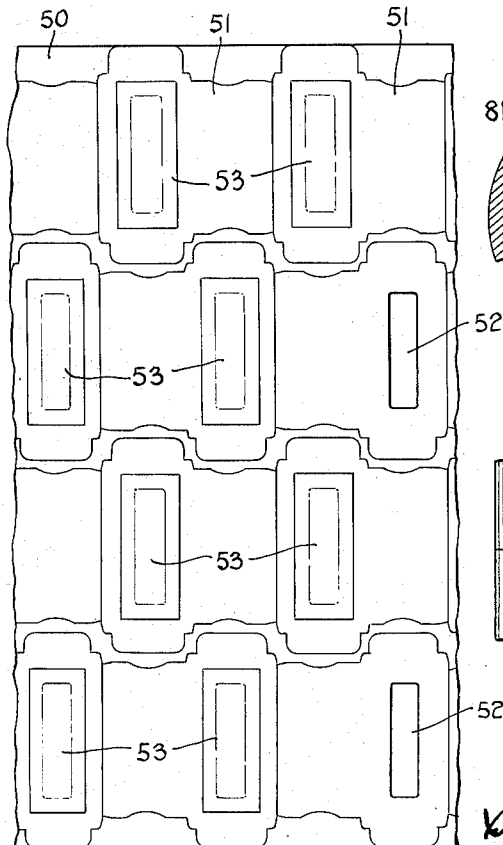


Fig. 12.

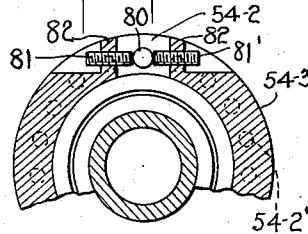
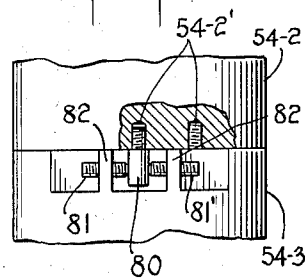


Fig. 13.



INVENTOR
Arthur P. Bamford
BY *Harry J. Lucke*
HIS ATTORNEY

July 14, 1942.

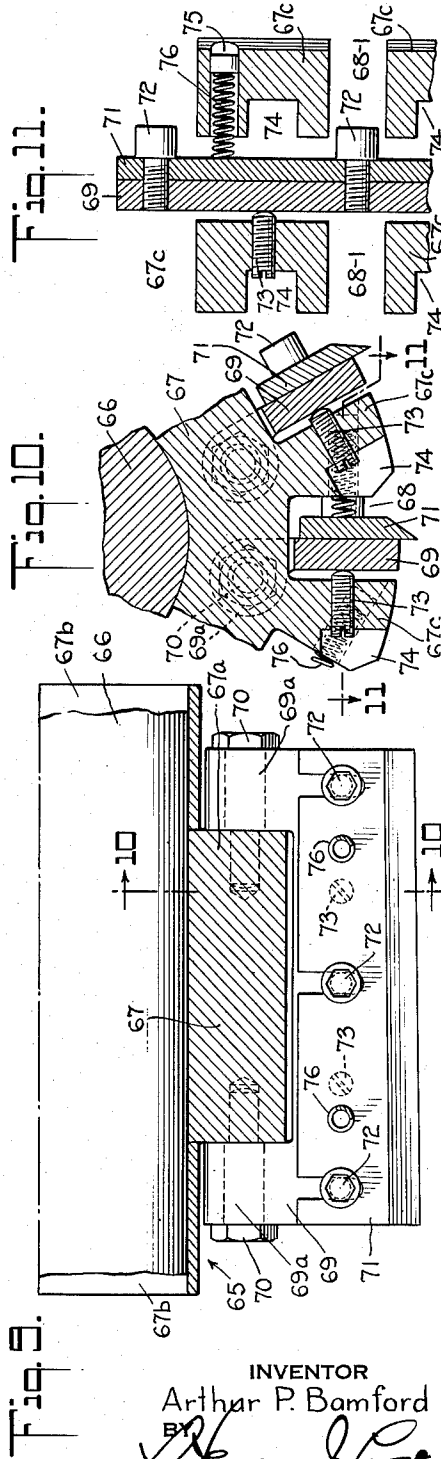
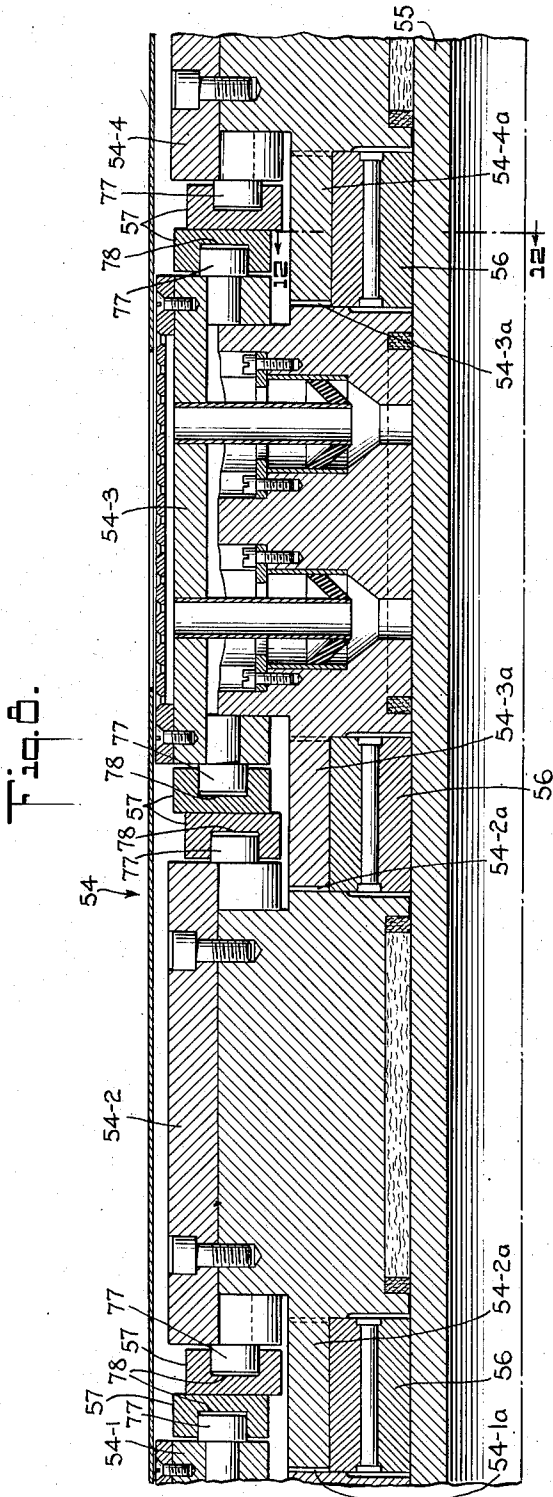
A. P. BAMFORD

2,289,336

METHOD AND MEANS FOR APPLYING SHEET MATERIAL TO OTHER MATERIAL

Filed Sept. 5, 1940

4 Sheets-Sheet 4



INVENTOR
Arthur P. Bamford
BY *Henry J. [Signature]*
HIS ATTORNEY

UNITED STATES PATENT OFFICE

2,289,336

METHOD AND MEANS FOR APPLYING SHEET
MATERIAL TO OTHER MATERIALArthur P. Bamford, Millburn, N. J., assignor to
William F. Grupe, Lyndhurst, N. J.

Application September 5, 1940, Serial No. 355,421

27 Claims. (Cl. 93—36)

This invention relates to the attachment of sheet material to suitable base material which moves relative to the sheet material to be attached.

The sheet material to be attached is usually and preferably pliable, a specific example being sheet cellulose acetate, such as "Cellophane." It preferably comprises a plurality of individual sheets, which may be separated from a continuous web just prior to the attaching operation.

The base material may vary considerably in character so long as there is surface area suitable for receiving the sheet material to be attached. It may be a continuous web of sheet material having a series of individual surface areas to which individual sheets are to be attached, as, for example, in the manufacture of "windowed" containers. Again, it may comprise a series of individual pieces of sheet material, or of individual articles, to each of which an individual sheet is to be applied.

A use for which the invention is well suited, and one which is here specifically illustrated and described, is the attachment of sheet cellulose acetate window panes over adhesively encircled window openings cut out in and sequentially spaced along the length of a base web of sheet material, such as paperboard stock suitably blanked out for the production of individual "windowed" cartons. This, of course, represents only one possible use of the invention, and the illustrated machine represents only one possible form of apparatus, pursuant to the invention, for carrying out the method of the invention.

An object of the invention is to provide for high speed and accuracy to an extent heretofore never attained in the attaching of sheet material as above described. The accomplishment of this object makes for savings in cost of the materials used, and for low-cost production of the final product.

Another object is to provide for the attaching of sheet material, as above described, by apparatus which is comparatively simple in operation and construction and which may be readily adjusted to meet various changeable factors of use, such as size differences in the materials worked upon from time to time, differences in arrangement of the several locations to which the sheet material is applied during any given instant of use, etc.

In accomplishing the purposes and above named objects of the invention, an outstanding preferred feature of the method resides in continuously moving a strip of the sheet material to

be applied into an applying zone at a constant rate of travel, the applying zone being disposed proximate the base material which is continuously moved therethrough at a constant rate of travel greater than the constant rate of travel of the strip of sheet material to be applied; and in severing a portion or successive portions from the strip of material to be applied and attaching such severed portion or portions to the base material without altering the respective constant rates of continuous travel.

Another preferred feature resides in the displacing of the severed portion of the strip of material to be applied, or of any individual piece or length of the material to be applied, substantially radially outwardly from an arcuate path of travel along which that severed portion is brought into proximity with the base material, and in attaching a leading portion thereof to the base material, preferably while providing for subsequent movement of the severed portion, or other individual piece or length, substantially tangentially of the stated arcuate path of travel.

An outstanding feature of preferred forms of apparatus for carrying out the method of the invention resides in the provision of preferably a rotary suction carrier upon which the individual portion, or successive individual portions, of the strip of sheet material to be applied may be severed from the strip while being carried into the applying zone at a constant rate of continuous travel, and in the provision of a suction element or elements, preferably a suction sector or sectors, mounted on the suction carrier for substantially universal movement and for individually carrying the individual portion or portions of sheet material to be applied into contact with the other material, mechanism being provided for displacing the suction element, or for successively displacing the suction elements, outwardly and substantially radially of the suction carrier.

The rotatable suction carrier is preferably provided with individual suction pads, preferably of sector-like character, which are individually mounted for limited, relatively free movement about, and substantially radially of, the rotative axis of the suction carrier without disturbing the supply of suction. Thus, in applying the carried individual sheets of pliable material to base sheet materials or to suitable articles which are moving along a path substantially tangential to the rotating suction carrier, the individual suction pads are adapted to be pulled, during the application operation, in such manner as to compen-

sate for any difference in speeds between the two materials.

The individual sheets are held to the respective suction pads by suction, and adhere to the base sheet material, or articles, by the force of friction produced by pressure, or by the sticking action of applied adhesive, thus acting as successive intermediaries in the correlation of motions of the rotating suction carrier and the relatively faster moving base sheet material, or articles, to which they are being applied. Provision is made for breaking the suction grip at an appropriate time so that an actual transfer of each carried sheet is permitted. Provision is preferably made for successively moving the respective suction pads outwardly of the carrier into desired applying position, and, thereafter, for successively moving them back into normal position.

An important feature of the suction carrier resides in the fact that it may be composite in nature, that is, composed of a series of lesser individual rotatable carriers adjustably mounted in end-to-end alignment on a common suction-effecting shaft, each lesser individual carrier being individually actuated—so far as the movement of their respective suction pads are concerned—relative to the others. Thus, individual sheets of pliable material, side-by-side across the width of the suction carrier as a whole, can be applied in any desired timed relationship relative to one another. This permits the covering of individual areas of application which are staggered across the width of a web of material to which the individual pliable sheets are applied, as in the case of window openings cut from a web blanked out for the ultimate formation of cartons or the like.

In preferred embodiments of the invention, wherein a suction cylinder is employed as the suction carrier, the individual suction pad sectors of the suction cylinder are each provided with suction pipes which extend radially toward the central axis of the cylinder and serve as stem mountings. The suction pipes are disposed in respective well recesses, which also extend radially in the cylinder and afford clearance for universal movement of the stem mountings. The lower ends of the suction pipes extend through and are secured in sealed relationship to respective flexible resilient diaphragms, which completely seal the upper portions of the well recesses from the lower portions thereof, and are capable of universal articulation in their capacity of supporting mountings for the suction pipes. The lower portions of the well recesses are arranged for intermittent communication with the main suction conduit as the suction cylinder rotates about the main suction conduit as an axis.

It is desirable that that end of the strip of sheet material to be applied, from which the individual portions or lengths are successively severed, be continuously fed to and carried by the suction cylinder so that the severing may be accomplished thereon during rotation thereof. For carrying out the severing operation continuously without altering the continuous rotation of the suction cylinder at its constant rate, shear means may be provided, preferably by positioning shear blades at successive locations circumferentially about the cylinder and between mutually adjacent suction pad sectors, and by positioning a cutting or knife cylinder, carrying shear blades disposed for cooperation with the shear blades of the suction cylinder, in a suitable position relative to the suction cylinder.

Further features and objects of the invention will be apparent from the following detailed description and the accompanying drawings.

In the drawings:

Fig. 1 represents a vertical section taken through the suction cylinder and associated mechanism of a preferred embodiment of the invention at the moment of pressure application of an individual sheet of the pliable material to a rapidly moving web of base material, the knife cylinder being illustrated diagrammatically;

Fig. 2 represents a bottom plan view of the web, specifically, a web of window-provided paper-board stock, as taken on the line 2—2, Fig. 1;

Fig. 3 represents an enlarged fragmentary vertical section taken on the line 3—3 of Fig. 1;

Fig. 4 represents a section taken on the line 4—4 of Fig. 3;

Fig. 5 is a view similar to that of Fig. 4 but illustrating a smaller fragment at a stage of operation immediately subsequent to that of Fig. 4;

Fig. 6 is a view corresponding to that of Fig. 1, but representing another preferred embodiment of mechanism, and illustrating the knife cylinder in structural form;

Fig. 7 represents an enlarged fragmentary plan view of a web of opaque sheet paper-board stock blanked out by score lines and provided with window openings for the ultimate formation of cartons;

Fig. 8 represents an enlarged fragmentary vertical section taken axially through a composite suction cylinder designed for use with the blanked out web of Fig. 7;

Fig. 9 represents an enlarged vertical section taken on the line 9—9, Fig. 6;

Fig. 10 represents a vertical section taken on the line 10—10, Fig. 9;

Fig. 11 represents a horizontal section taken on the line 11—11, Fig. 10;

Fig. 12 represents a detail sectional view corresponding to one taken on line 12—12 of Fig. 8, but illustrates another embodiment which provides for peripheral adjustment, relative to one another, of the individual cylindrical suction units of a composite suction cylinder; and

Fig. 13 represents a detail top plan view of two adjacent cylindrical suction units of a composite suction cylinder, embodying the adjustable feature illustrated in Fig. 12.

As aforesaid, the generic principles of the invention are applicable to a variety of different machine constructions for operating under a variety of different conditions on a variety of materials. The illustrated embodiments of apparatus represent merely the application of the generic concepts to specific instances.

As illustrated, the relatively thin pliable sheet material to be attached may be transparent sheet cellulose acetate, such as "Cellophane," in the form of a strip 10 which is supplied from a roll 11, and is applied to a rapidly moving web 12 of, say, opaque paper-board stock which has window openings 13 punched out at spaced intervals along its length while the web is moving. A suitable adhesive has been applied around the margins of the window openings 13, see 14, Fig. 2, and serves to secure the applied transparent sheets over the window openings.

The resulting product is a continuous web of paperboard material suitable for use in the making of windowed cartons for the merchandising of a variety of products.

In the applying of the pliable sheets of cellulose acetate to the web of paper-board, the strip

10 is fed from the roll 11, which latter is mounted for substantially free rotation on a suitable shaft 15; is passed over an idler roller 16 onto the suction cylinder 17; is cut into individual sheets, as by means of the cutting knife cylinder 18 which cooperates with the suction cylinder 17; and is successively applied to the web 12 under a pressure roller 19 which cooperates with articulatively mounted individual suction pads of the suction cylinder 17.

The construction of the suction carrier, in this case a cylinder, constitutes one of the important features of the invention in the attainment of the objects thereof.

The carrier is adapted to rotate about a fixed axis in proximity to the path of movement of the other sheet material or article. It is provided with sector-like suction pads successively aligned about the rotative axis. Each of the suction pads has a suction surface approximately commensurate with the size of the pliable sheet that it is called upon to carry into the feeding zone of the machine. Each is mounted for limited, relatively free movement about the rotative axis of the carrier, and for limited, substantially radial movement relative thereto, so that each may be moved outwardly into applying position, and pulled forwardly by the web during the attaching operation, at substantially the velocity of the moving sheet or article to which the carried pliable sheet is to be attached.

The suction cylinder 17 is mounted on, and for rotation about, a central hollow shaft 20 as an axis. It comprises a cylindrical body 21 which supports the movable suction pads of the cylinder, and is per se mounted upon hollow shaft 20 by means of roller bearings 22. That portion of the cylinder body which is disposed between the roller bearings, bears lightly against the hollow shaft, and, by means hereinafter described, forms air seals therewith at a plurality of spaced locations.

The length of the cylindrical body 21 depends upon the width of the pliable window sheet to be applied. It may, however, be extended to take care of several parallel rows of window openings in a single web or of an arrangement similar thereto, as is set forth in detail hereinafter.

In the illustrated embodiment, which is adapted to take care of a single row of window openings, the end hub formations 21a border a raised central portion 21b upon which the movable suction pads rest.

The central portion of the cylindrical body 21 between hubs is divided into sector sections by inlaid spaced longitudinal strips 23, Fig. 4, of relatively soft yieldable packing material, which hug the outer surface of the hollow shaft 20 and provide air seals. Inlaid circular strips 24, Fig. 3, of the same yieldable material are disposed at the ends of the central portion of cylindrical body 21 and provide air seals which complete the defining of fully air sealed sector sections running lengthwise of, i. e., coaxially with, the cylinder as an entirety.

Disposed within the confines of each of the air sealed sector sections of the cylindrical body 21, and extending between and opening into the outer and inner cylindrical surfaces thereof, are radial recesses 25, the number in any given instance depending upon the axial dimension of the cylinder. In the present instance there are two recesses 25 aligned side-by-side and along the axis of the cylinder, see Fig. 3, forming wells.

The recesses 25 serve to accommodate the ar-

ticulatively mountings of the movable suction pads, and serve, further, as conduits for exhausting air from the suction pads and, thus, for producing suction at the gripping surfaces thereof.

The recesses 25 are advantageously of uniform bore throughout the greater part of their lengths from the outer cylindrical surface of the body 21 toward the inner cylindrical surface thereof, and advantageously converge into funnel-like formations 25a at the innermost ends thereof.

The hollow shaft 20 communicates at one end (not shown) with a source of suction, such as a vacuum pump, and is sealed against the inflow of air at the other end in any well known manner (not shown). In line with the funnel-like openings 25a of recesses 25, are arcuate slots 26 cut through the wall of tubular conduit 20. The funnel-like openings 25a of pairs of recesses 25, in respective sector sections, register with the slots 26 during a portion of their travel around hollow shaft 20 as an axis, and, during such periods of registration, the slots 26 function as ports for the withdrawal of air from the suction pad assemblies.

The suction pad assemblies each comprise a suction pad proper 27, which extends axially of the cylindrical body 21, within the confines of a sector section thereof, and spans the raised central portion 21b between the hubs 21a. They each further comprise suction pipes, in the form of pipe stems 28, corresponding in number to the number of recesses 25 in a sector section and arranged for reception within the central portions of the respective recesses when installed.

The suction pad proper 27 embodies a subcutaneous chamber 29 which extends over approximately the length and width thereof. The subcutaneous chamber 29 is preferably provided by the composite arrangement of an arcuate surface plate 27-1 fitted over the recessed upper surface of a body portion 27-2 of the suction pad proper 27, and secured thereto, as, for instance, by screws 30, Fig. 3.

The arcuate surface plate 27-1 has a considerable number of perforations 31 spaced apart over substantially its entire extent, the perforations communicating with the subcutaneous chamber 29.

The suction pad proper 27 is mounted on the pipe stems 28 by inserting ends of the pipe stems into appropriately located and dimensioned receiving holes provided through the body portion 27-2. Set screws 32 secure the suction pad proper to the pipe stems.

For breaking the residual suction in the suction pads after passages 25a pass beyond the arcuate slots 26 and are closed by the solid wall of shaft 20, passages 33 extend from one longitudinal side face of the suction pad proper through the body portion 27-2 and register with coordinating openings provided in the pipe stems 28, thus communicating with the longitudinal pipe openings which extend through such pipe stems.

The opposite ends of the pipe stems 28 pass through and are sealed about their outer circumferential surfaces to flexible resilient diaphragms 35, which are preferably rubber. The diaphragms 35 are sealed around their outer peripheries to the inner walls of sleeves 36. The sleeves 36 have an outside diameter of such dimension as to afford a snug fit within the uniformly bored portions of recesses 25. The sleeves 36 abut against annular shoulders 21c, formed adjacent the upper portions of the funnel-like openings 25a of the recesses 25, and extend toward the

major openings of the respective recesses to locations coincident with the oppositely related ledges 21d, which form the bottoms of oppositely related marginal recesses 22b associated with the recesses 25.

Washers 37, provided with oppositely extending ears for coordination with the marginal recesses 22b, are secured within the recesses 25, contiguous with the top edges of sleeves 36. Machine screws 38 may pass through the respective oppositely extending ears of washers 37 and engage the material of the ledges 21d. It is advantageous that the sleeves be sealed in place by the application of shellac or some other suitable sealing medium to those outside walls thereof which contact the walls of the recesses 25, and also to the end edges thereof which abut against washers 37.

Each suction pad assembly is thus articulatively mounted relative to the cylindrical body 21, and is air sealed in its movable relationship thereto, so that the suction is controlled in a desired predetermined manner.

The ends of each suction pad proper 27 overhang the marginal edges of the raised central portion 21b, and have opposite end portions 27a, 27a which extend radially toward the axis of the cylinder.

On the outer cylindrical body 21, between the individual suction pad assemblies, shear strips 40 are rigidly secured, as by means of machine screws. The suction pad assemblies are so mounted that the suction pads proper 27 normally bear down snugly against the outer cylinder surface of the cylindrical body 21 and bear back snugly against the forward face of shear strips 40. Thus, as the cylinder 17 rotates in cutting coordination with the cutting knife cylinder 18, the individual cutting blades 18-1 which are preferably resiliently mounted as will hereinafter appear and which are spaced apart and project from the circumferential surface of cutting cylinder 18, cooperate with the rearward shear faces of shear strips 40 to successively cut individual sheets 10-1 from the sheet-strip of pliable window material 10.

For moving the individual suction pads proper 27 substantially radially outwardly of the suction cylinder 17 into contact with the moving web of window-provided web 12, cam roller studs 41, 41 are secured within holes provided through the end portions 27a, 27a, of the suction pads proper, and short tracks for receiving the respective roller studs along a short portion of the path of rotation of the suction cylinder 17 are formed by sets of spaced projections 42a, 42b and 42a, 42b, which extend from the inside faces of the lever arms 42, 42, respectively. The lever arms 42, 42, are pivoted at one set of ends on a common shaft 43, and have rollers 44, 44 rotatably mounted at their opposite ends, respectively. Eccentric cams 45, 45, are spaced apart on a common shaft 46, and support rollers 44, 44, respectively. Rotation of shaft 46 is correlated with rotation of suction cylinder 17 in such manner that the lever arms 42, 42 are raised by the action of the eccentric cams as the roller studs 41, 41 enter and pass through the receiving trackways formed by the sets of spaced projections 42a, 42b and 42a, 42b.

The parts are so configured and arranged, and are so timed in their relative movements, that only the forward marginal edge portion of each suction pad proper 27 is brought into pressure contact with the web 12, see particularly Figs 1 and 4. As the suction cylinder 17 con-

tinues to rotate the particular suction pad assembly concerned drops, see Fig. 5, the drop, of course, being caused by the action of the cam roller studs in the cam trackways, plus the resilient action of the diaphragms 35.

The adherence of an individual pliable sheet 10-1 of window material to the rapidly moving web 12, and the suction grip of the corresponding suction pad proper 27 on the individual pliable sheet, causes the suction pad assembly to move forward at substantially the speed of the web 12, while the remainder of the suction cylinder 17 lags behind.

Accordingly, that particular suction pad proper moves, as in Fig. 5, relative to the adjacent shear strips 40, and opens a gap between its rearward longitudinal face and the forward face of the rearward shear strip. As explained heretofore, the suction cylinder is, at this moment, so disposed relative to the hollow shaft 20 that the openings 25a of the suction pad are closed. The residual suction is dissipated by the inflow of atmospheric air through passages 33, and the suction grip on the individual pliable sheet is, therefore, positively released. The suction pad, accordingly, springs back by reason of the resilient mounting 35, into its normal position with its rearward longitudinal face bearing back against the forward face of the shear strip, so that passages 33 are again closed to inflow of atmospheric air.

Cooperating pressure rollers 47 are provided to insure intimate adherence of the applied individual sheets of pliable window material to the margins of the window openings, and to "iron out" each window smoothly.

For certain uses, it may be preferable to dispense with the cutting cylinder. Under such circumstances, the sheet-strip of pliable window material 10 may be perforated transversely of its length at spaced intervals therealong in substantially the manner of rolled paper towels. Each individual length of the pliable sheet window material, between mutually adjacent lines of perforations, will then be torn free from the remainder of the strip during its application to the web 12, or to the series of suitable articles which might take the place of the web 12.

In many instances, it is desirable that the suction cylinder be of extended length and composite in nature for operating simultaneously upon a plurality of sequential and side-by-side locations in the material or articles to which the pliable sheet material is to be applied. This is particularly true in the case of a continuous web of paper-board or generally similar stock which has been cut, and which has been scored across its width and along its length, to define carton blanks provided with window openings.

A fragment of a web 50, such as is described above, is illustrated in Fig. 7, the individual carton blanks 51 being blanked out relative to each other and to the dimensions of the web such that there is a minimum of waste of the material of the web. The window openings 52, to which the transparent pliable sheet windows 53 are applied, are disposed in staggered relationship across the width of the web.

The web fragment illustrated in Fig. 7 represents that portion of the web 50 of Fig. 6 which is being operated upon. The apparatus illustrated in Figs. 6, and 8 through 11, is of the above referred to type, having an extended suction cylinder of a composite nature.

The suction cylinder, designated 54, is made

up of a plurality of cylindrical suction units, 54-1, 54-2, 54-3, 54-4, Fig. 8, mounted end-to-end on a common suction conduit 55. Each of the individual cylindrical suction units is similar, in all important respects, to the individual suction cylinder described in detail heretofore with reference to Figs. 1 through 5 of the drawings. Each is mounted upon roller bearings 56, which correspond to roller bearings 22 in the previously described embodiment. The hub portions 54-1a, 54-2a, 54-3a, and 54-4a of the respective cylindrical suction units are, however, formed in such manner as to mutually interlock, so far as any two adjacent cylindrical suction units are concerned, over a roller bearing common thereto. The arrangement may be one of alternate fingers and grooves forming serrated hubs, the fingers of one hub interlocking with the grooves of the other hub, see the arrangement illustrated generally in Fig. 8.

Lever arms 57, corresponding to those indicated 42 in the previously described embodiment, are configured to accommodate the full diameter of the lower pinch roller of the set of co-operating pinch rollers 58, 58, Fig. 6, and are somewhat differently arranged relative to pivot locations and cams than are those of the previously described embodiment.

The cam shaft 59 carries, rigidly mounted thereon, circular cam elements 60 which have eccentric circular trackway grooves 61 formed in the lateral faces thereof for receiving the roller studs 62. The roller studs 62 are journaled at the free ends of lever arms 57. The opposite ends of lever arms 57 are pivoted on a shaft 63 which extends across the width of the suction cylinder.

Pressure roller 64 is illustrated as larger in diameter than that of the previously described embodiment, but the characteristics of the applicator can vary within wide limits depending upon the particular circumstances. In the present instance, pressure roller 64 is composite in nature, being made up of individual cylindrical suction units rigidly mounted, end-to-end, on a common shaft which extends across the width of the suction cylinder.

The cutting or knife cylinder is illustrated diagrammatically in the previously described embodiment, but is here illustrated in a specific form in which the individual blades are resiliently mounted for effective and smooth coordination with the sector-like suction sections of the suction cylinder. The cutting or knife cylinder is also composite in nature, being formed by individual cylindrical units 65 rigidly mounted end-to-end on a common shaft 66.

Each cylindrical unit 65 of the knife cylinder comprises a tubular body element 67, Figs. 10 and 11, which is feathered to the shaft 66 in any appropriate manner (not shown), said body portion 67 including a part 67a extending radially outwardly, adjustably positioned between positioning sleeves 67b, 67b. The circumferentially protruding portion 67a is provided with deep longitudinal radial grooves 68 spaced apart equally therearound by distances which bear a relation to the positions of the individual sector-like suction pad sections of the suction cylinder, as will hereinafter appear, and are further provided with deep circumferential grooves 68-1, spaced apart along the width thereof and forming a plurality of projecting lugs 67c, see Fig. 11.

The deep grooves 68 are configured for the

reception of respective knife carriers and knife blades and means for resiliently positioning the same therein. Preferably the deep grooves 68 are rectangular in right cross section and extend along the entire length of the circumferentially protruding portion 67a, so that the bifurcated knife carriers 69 may fit therein, respectively, and so that the bearing arms 69a, 69a, which comprise the bifurcations thereof, may be journaled to the main body of the circumferentially protruding portion 67a, as, for instance, by the machine screw type of securing means indicated at 70, 70, Fig. 9.

The knife blades 71 are adjustably secured to knife carriers 69 by means of set screw and slot combinations of well known type as indicated at 72, Figs. 9 and 11.

For positioning the knife carriers and carried knife blades in the deep grooves 68 so that they will firmly, yet resiliently, coact with the coordinating shear faces of the shear elements of the suction cylinder, set screws 73 are threaded through the projecting lugs 67c, so that their ends protrude a predetermined distance into the grooves 68. Recesses 74, Figs. 10 and 11, are provided in the respective projecting lugs 67c to facilitate the placement of the set screws 73.

Grooves 68-1 accommodate and afford access to the heads of the bolts 72.

Closed-ended passages 75, formed in the respective projecting lugs 67c, receive coil spring elements 76, which extend into the deep grooves 68 in opposition to set screws 73 and force the knife carriers and the carried knife blades against the protruding ends of the set screws 73, thus, firmly and resiliently positioning the knife blades relative to the shear faces of the shear elements of the suction cylinder for shearing coaction therewith.

The individual cylindrical units 65 of the composite knife cylinder are positioned relative to one another, see Fig. 6, to correspond to the positioning of the individual cylindrical suction units of the suction cylinder 54, the relative positioning of the latter being determined by the layout of the blanks 51 of the cut and scored web 50. The suction cylinder 54 and knife cylinder are correlated in rotation by suitable drive mechanism of usual construction (not illustrated), as is the case in the previously described embodiment, to insure smooth and proper cutting of individual sheets of pliable material from the strip of pliable material.

As will be noted from Fig. 8, each cylindrical suction unit of the suction cylinder is provided with two lever arms 57, one at each end, and roller studs 77 project from the ends of each sector-like suction pad into groove trackways 78 provided in the lever arms 57. Two lever arms are accommodated above each journal bearing 56 with sufficient clearance between one another to permit unrestricted motion relative to each other in the actuation of each sector-like suction pad outwardly from the longitudinal axis of the suction cylinder.

In the embodiment illustrated in Figs. 8 and 9, the cylindrical suction units of the composite suction cylinder are fixed relative to one another. Adjustability between adjacent cylindrical suction units may, however, be had, as appears from Figs. 12 and 13, where preferred adjusting means are illustrated with reference to the axially aligned cylindrical suction units 54-2, 54-3 of the composite suction cylinder. As illustrated, a set of tapped openings, see

54—2' for the cylinder 54—2, is provided, into any one of which may be set a poppet 80. In the adjoining cylindrical suction unit 54—3, are provided adjustable set screws 81, 81', cooperating with such poppet 80, such set screws being disposed in tapped openings of ribs 82, 82, preferably formed by a machining operation. Upon properly setting the set screws 81, 81', the poppet 80, and, therewith, the cylindrical suction unit 54—2, is adjusted relative to the cylindrical suction unit 54—3. Similar adjustment between other adjoining cylindrical suction units of the composite suction cylinder is had by like adjustable means. By reason of this adjustability between the individual cylindrical suction units, the sets of peripherally arranged suction pads of respective cylindrical suction units may be staggered when and as desired for accommodating any desired degree of staggering of the window openings 52 in the base sheet material 50, see Fig. 7.

It is contemplated, of course, that various other arrangements of mechanism may be functionally effective in lieu of those specifically illustrated. For instance, the flexible and resilient means supporting a hollow stem 28 of a suction pad 27 may comprise a metallic spring mounting of suitable and well known type which provides support and universal movement for the stem, and a separate flexible diaphragm of rubber or like material which seals the well recess against inflow of atmospheric air.

While the invention is here illustrated and described with respect to certain preferred embodiments thereof, many changes may be made without departing from the generic spirit and scope of the invention as set forth herein and in the claims that follow.

I claim:

1. The method of applying pliable sheet material to web material, comprising continuously moving the web material along an approximately rectilinear path and through an applying zone at a constant rate of travel; continuously moving a length of the pliable sheet material into said applying zone along an arcuate path at a constant rate of travel which is less than that of said web material; displacing said length of pliable sheet material toward said web material and substantially radially from its said arcuate path as it enters said applying zone, and attaching the leading portion of the pliable sheet material to said web material, without altering the said continuous and constant rates of travel.

2. The method of applying pliable sheet material to web material, comprising moving the web material along an approximately rectilinear path and through an applying zone; moving a length of the pliable sheet material into said applying zone along an arcuate path at a rate of travel which is less than that of said web material; displacing said length of pliable sheet material toward said web material and substantially radially from its said arcuate path as it enters said applying zone; and attaching the leading portion of the pliable sheet material to said web material.

3. Apparatus of the class described, comprising means for continuously moving two strips of material at different, but respectively constant, rates of travel; means for severing a portion from the slower traveling strip; and means for supporting and applying the severed portion to the faster traveling strip, said last named means comprising a unitary cylindrical carrier having suction sectors articulatively mounted relative to one another and to the said cylindrical carrier for sup-

porting the individual severed portions of the slow traveling strip and for applying them successively to the faster traveling strip.

4. Apparatus of the class described, comprising means for continuously moving two strips of material at different, but respectively constant, rates of travel; means for severing successive portions from the slower traveling strip; and means for supporting and applying the severed portion to the faster traveling strip, said last named means comprising a unitary cylindrical carrier having individual suction sectors articulatively mounted relative to one another and to the said cylindrical carrier for supporting the individual severed portions of the slower traveling strip and for applying them successively to the faster traveling strip; said cylindrical carrier further including shear strip elements disposed alternatively between said mutually displaceable suction sectors.

5. Apparatus of the class described, comprising means for continuously moving two strips of material at different, but respectively constant, rates of travel; means for severing a portion from the slower traveling strip; and means for supporting and applying the severed portion to the faster traveling strip, said last named means comprising a cylindrical carrier which includes radially displaceable suction sectors for supporting and applying the severed portion of the slower traveling strip to the faster traveling strip.

6. Apparatus of the class described, comprising means for continuously moving two strips of material at different, but respectively constant, rates of travel; means for severing a portion from the slower traveling strip; and means for supporting and applying the severed portion to the faster traveling strip, said last named means comprising a cylindrical suction carrier which includes radially displaceable flexibly mounted suction sectors for supporting and applying the severed portion of the slower traveling strip to the faster traveling strip.

7. Apparatus of the class described, comprising means for continuously moving two strips of material at different, but respectively constant, rates of travel; means for severing a portion from the slower traveling strip; and means for supporting and applying the severed portion to the faster traveling strip, said last named means comprising a cylindrical suction carrier for carrying an integral portion of the slower traveling strip; and a therewith associated rotary severing element adapted for severing action on the said integral portion of the slower traveling strip carried by said cylindrical suction carrier, said cylindrical suction carrier having suction sectors for supporting and applying the severed portion of the slower traveling strip to the faster traveling strip.

8. Apparatus of the class described, comprising means for continuously moving two strips of material at different, but respectively constant, rates of travel; means for severing a portion from the slower traveling strip, and means for supporting and applying the severed portion to the faster traveling strip, said means comprising a cylindrical suction carrier for carrying an integral portion of the slower traveling strip, and a therewith associated rotary severing element adapted for severing action on the said integral portion of the slow traveling strip carried by said cylindrical suction carrier, said cylindrical carrier having individually articulatively suction sectors for supporting and applying the severed portion of the slower traveling strip to the faster traveling strip;

and cam means for positively moving said suction sectors.

9. In apparatus of the character described, the combination of a unitary counter-pressure roller for supporting and guiding a traveling web; a suction carrier for supporting strip material, said suction carrier including suction sectors articulatively mounted relative to one another and to the said suction carrier and being disposed in close but spaced relation to said counter-pressure roller; and means for positively moving said sectors, successively, toward said counter-pressure roller for bringing said strip material into contact with said traveling web.

10. In apparatus of the character described, the combination of a counter-pressure roller for supporting and guiding a traveling web; a rotary suction carrier for supporting strip material; said suction carrier including a plurality of independently displaceable suction sectors, and being disposed in close but spaced relation to said counter-pressure roller, and means for displacing said suction sectors radially, relative to the rotative axis of said rotary suction carrier, for carrying said strip of material into contact with the traveling web, said suction sections being movable in a substantially tangential direction while said strip material is in contact with the traveling web.

11. Apparatus comprising means for continuously moving a web of material at a constant rate of travel; means for continuously moving multiple strips of pliable material in mutually parallel relationship, parallel with the said web, at a mutually constant and mutually identical rate of travel which is slower than the rate of travel of said web; means for severing individual lengths from the said multiple strips of pliable material; and means for applying said individual lengths to said web in multiple across the width thereof, said applying means comprising a plurality of independently adjustable suction cylinders aligned end-to-end, a fixed shaft on which the said suction cylinders are mounted in common, and means for adjusting said suction cylinders circumferentially, relative to each other, on said fixed shaft.

12. Apparatus for carrying and applying strip material comprising suction pad means; movable means supporting said suction pad means; means for providing suction at the holding pad surface of said suction pad means; and means mounting said suction pad means for substantially universal movement relative to said movable supporting means.

13. Apparatus for carrying and applying strip material, comprising a movable support having a well formed therein; suction pad means having a supporting portion extending into said well; means sealing the bottom of said well from the atmosphere; means for controlling withdrawal of air from said well; flexible and resilient means spaced apart from the bottom of said well, completing the sealing of at least a portion of the well against the atmosphere and securing said suction pad supporting portion therein for substantially universal movement; said suction pad means having suction passages formed therein, opening into the pad surface thereof and extending through said supporting portion to communication with that portion of the said well which is sealed from the atmosphere.

14. A suction cylinder for carrying and applying strip material, comprising a cylindrical body recessed to provide wells about its circumferential surface; suction pads individually mounted

on said cylindrical body and aligned sequentially about the circumferential surface thereof for individually independent, and substantially universal, movement relative thereto, said suction pads each having at least one open-ended hollow stem extending into a correspondingly disposed well of said cylindrical body, each of said suction pads having passages therethrough communicating with the pad surface thereof and with the upper open end of its said stem, the lower open end of each stem extending into the lower portion of its corresponding well, and flexible and resilient means securing the respective stems within their respective wells for substantially universal movement relative to said cylindrical body, and sealing, from the atmosphere, those portions of said wells which are located below the lower open ends of the corresponding stems.

15. A machine of the class described comprising rotatable suction means having suction surface portions individually articulatively mounted for limited movement about, as well as substantially radially of, the axis of rotation, means for rotating said suction means, and means for moving each of said successively aligned suction surface portions substantially radially outwardly and substantially radially inwardly, within a given zone disposed along the rotative path, as the said rotatable suction means rotates.

16. A machine of the class described comprising a rotatable suction cylinder having sector-like suction pads individually articulatively mounted for limited movement about, as well as substantially radially of, the axis of rotation, means for rotating said suction cylinder, and means for moving each of said suction pads substantially radially outwardly and substantially radially inwardly, within a given zone disposed along the rotative path, as the said rotatable suction cylinder rotates.

17. A machine of the class described comprising a rotatable suction cylinder which includes, a cylindrical body having recesses formed therein, from its outer surface inwardly, within respective sector divisions thereof; sector-like suction pads having suction pipe stems extending therefrom and within the respective recesses of said cylindrical body; flexible resilient diaphragm means securing said suction pipe stems to the walls of said recesses and air-sealing the inner portions of said recesses from the outer portions; means for rotating said suction cylinder; means for exhausting air from the said inner portions of said recesses, and from the suction pipe stems disposed therein, along a limited zone disposed about the path of rotation, as the said suction cylinder rotates; means for breaking the residual suction remaining in said suction pads immediately after said suction pads have respectively passed beyond said limited zone; and means for moving each of said suction pads substantially radially outwardly and substantially radially inwardly within a given zone disposed along the rotative path, as the said suction cylinder rotates.

18. A machine of the class described comprising a rotatable suction cylinder having suction pads articulatively mounted thereon; means for rotating said suction cylinder; engaging means projecting from each of said suction pads; and cooperative engaging means disposed within the path of travel of said projecting engaging means for engagement therewith along a portion of the rotative path of said suction cylinder, said cooperative engaging means being independently

mounted and arranged to cause said suction pads to individually articulate in a prescribed manner as they rotate therepast.

19. A machine of the class described comprising a rotatable suction cylinder having sector-like suction pads individually articulatively mounted thereon longitudinally of the axis of rotation thereof and spaced apart successively about the said axis of rotation; shear elements, having rearward longitudinal shear faces, secured rigidly to said suction cylinder between mutually adjacent suction pads, the arcuate distance between mutually adjacent shear elements being greater than the arcuate span of an individual suction pad, and said suction pads being so mounted as to normally press backwardly against the forward longitudinal face of an adjacent shear element; means for rotating said suction cylinder; blade means adapted to cooperate in shear action with the said shear faces of respective shear elements as said suction cylinder rotates; means for moving each of said suction pads in a prescribed manner within a certain zone along the path of rotation of said suction cylinder; and means for feeding pliable sheet material onto the cylindrical surface of said suction cylinder as the said suction cylinder rotates.

20. A machine of the class described comprising a rotatable suction cylinder mounted for rotation on and about a tubular conduit which has been slit through about a portion of its periphery at predetermined locations, said suction cylinder including a cylindrical body having recesses formed therein, from its outer surface inwardly, within respective sector divisions thereof; sector-like suction pads having suction pipe stems extending therefrom and within the respective recesses of said cylindrical body; flexible resilient diaphragm means securing said suction pipe stems to the walls of said recesses and air-sealing the inner portions of said recesses from the outer portions thereof; means for rotating said suction cylinder; means mounted independently of said suction cylinder for engaging each of said suction pads, successively, and for moving them in a prescribed manner as the said suction cylinder rotates, said means having a predetermined placement relative to the slots of said slotted tubular conduit; means for exhausting air from said slotted tubular conduit; and means for breaking the residual suction remaining in said suction pads after said suction pads have respectively passed beyond the said slots of said slotted tubular conduit.

21. A machine of the class described comprising a rotatable suction cylinder having sector-like suction pads individually articulatively mounted thereon longitudinally of the axis of rotation thereof and spaced apart successively about the said axis of rotation; shear elements, having rearward longitudinal shear faces, secured rigidly to said suction cylinder between mutually adjacent suction pads, the arcuate distance between mutually adjacent shear elements being greater than the arcuate span of an individual suction pad, and said suction pads being so mounted as to normally press backwardly against the forward longitudinal face of an adjacent shear element; means for rotating said suc-

tion cylinder; means for moving each of said suction pads in a prescribed manner within a certain zone along the path of rotation of said suction cylinder; means for feeding pliable sheet material onto the cylindrical surface of said suction cylinder as the said suction cylinder rotates; and a cutting cylinder disposed for coaction with the said suction cylinder in shearing the said pliable sheet material into individual sheets, said cutting cylinder comprising a series of knife blades individually resiliently mounted on said cutting cylinder and extending substantially parallel with the longitudinal axis thereof and in mutually spaced relationship about the circumferential surface thereof.

22. Means for synchronizing the rates of travel of two materials travelling at mutually different rates, comprising a unitary suction carrier for one material, said suction carrier including individual suction pad means articulatively mounted relative to one another and to the said suction carrier.

23. A suction cylinder comprising a cylindrical supporting body, and a plurality of individual suction pads articulatively mounted in said supporting body for individual movement relative to one another and to the said supporting body.

24. A suction cylinder comprising a cylindrical supporting body having recesses therein forming wells from the outer circumferential surface thereof inwardly, individual suction pads articulatively mounted in said wells for individual movement relative to one another and to said supporting body, a tubular suction passage extending centrally through said supporting body along the longitudinal axis thereof, said recesses extending into communication with said tubular passage, and means sealing said suction pads within said wells and against the inflow of air into said wells except through said suction pads.

25. A suction cylinder comprising a cylindrical supporting body having a tubular passage extending therethrough along its central longitudinal axis, gasket strips inlaid into the walls defining said tubular passage, said gasket strips extending longitudinally, and being spaced apart around, the said walls, marking off sectors in said supporting body, and recesses forming wells within said sectors and extending from communication with the said outer cylindrical surface of said supporting body to communication with the said tubular passage.

26. A rotatable suction carrier comprising a fixed tubular conduit, and a plurality of individual suction cylinders mounted on said tubular conduit for individual adjustment thereon circumferentially thereof, and means for securing said individual suction cylinders in adjusted relationship relative to one another and to said tubular conduit.

27. In apparatus of the type specified, a suction carrying and applying device, comprising a rotary support, a plurality of arms articulatively secured to said support for movement therewith and for individual movement relative to one another and to the said support, individual suction pads carried, respectively, by the respective arms at the extremities thereof, and channels for exhausting air from said suction pads.

ARTHUR P. BAMFORD.