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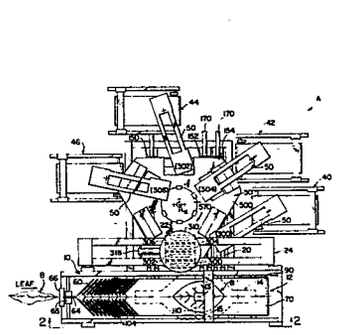
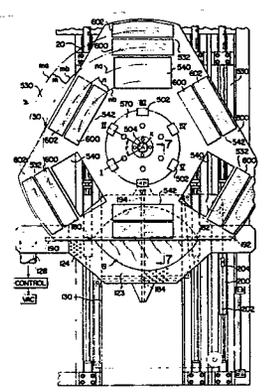
(54) Method and device for cutting and transferring a contoured tobacco sheet profile.

(57) A device for cutting and transferring a contoured tobacco sheet profile, such as a cigar wrapper, from a sheet of tobacco material, such as a natural tobacco leaf B or a portion thereof, as the tobacco sheet is supported on a cutting surface 123 at a cut-transfer position comprises a transfer element 30 with a cut-away first portion 530 and adjacent profile receiving second portion 532 is moved in a path M over the cutting surface 123 so that the first and second portions of the transfer element are moved in succession to the cut-transfer position at which the cutting operation is to be performed. A cutter 22 is located at the cut-transfer position for cutting the profile from the tobacco sheet while the cut-away portion of the transfer element is at the cut-transfer position. This cutter includes at least one cutting element 300, 302, 304, 306 which is selectively movable between a position extending through the cut-away portion 530 of the transfer element and into cutting engagement with the tobacco sheet material B and a retracted position providing clearance for the transfer element. After a profile has been cut from the tobacco sheet material, it is captured onto the cutter and moved away from the cutting surface 123 so that the profile receiving portion 532 of the transfer element can be moved under the cutter 22 and between the cutter and the cutting surface at the cut-transfer position.





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Thereafter, the cutter and captured profile are moved against the profile receiving portion 532 of the transfer element to transfer the cut profile to the transfer element 530. Then, the transfer element 530 is indexed or moved from the cut-transfer position for conveying the cut profile to a selected remote position for subsequent processing. Also, the transfer element is provided with a succession of cut-away or clearance portions 530, 540 and profile receiving portions 532, 542 so that the transfer element can be indexed successively from position-to-position for successive cutting and transferring at one location. The transfer element is a low inertia table 500 basically formed from two surface defining structures with an intermediate honeycomb core.

METHOD AND DEVICE FOR CUTTING AND TRANSFERRING A CONTOURED TOBACCO SHEET PROFILE

The present invention relates to the art of cutting tobacco profile elements, such as cigar wrappers, from a tobacco material, such as a natural tobacco leaf or portion thereof.

The specification of our European Patent Application No.79300323.7 published under Publication No.0,004,170 is incorporated by reference herein as background information.

The present invention, the scope of which is defined in the appended claims, is particularly applicable for cutting profiled cigar wrappers from natural tobacco leaves and it will be described with particular reference thereto; however, it is appreciated that the invention has broader applications and may be used for cutting various tobacco profiles from tobacco sheet material or other profiles from other thin sheet flaccid material.

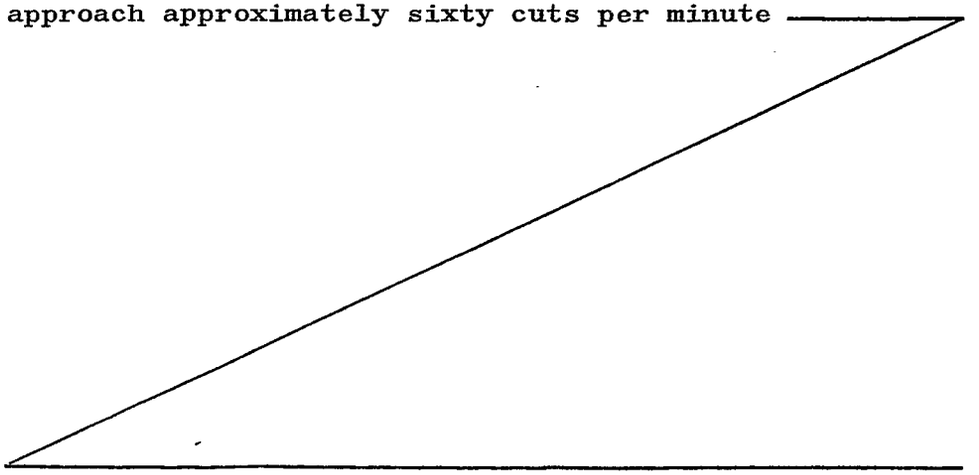
In manufacturing cigars, an outer wrapper is provided over the filler, and sometimes over the filler and a binder, to provide the appearance demanded by

consumers. Although wrappers are sometimes cut from man-made cigar sheets, the more common procedure is to cut the wrapper from a natural tobacco leaf. A wrapper is now cut from natural leaves by a primarily manual process. An operator orients the sheet on a cutter and the cutter is then actuated. The cut wrapper is then wrapped around a cigar. Some attempts have been made to store the cut wrapper on bobbins of sheet material for use on a machine which removes the wrapper from the bobbin and wraps it around the cigar. Because of the manual labor costs and fatigue experienced by operators of this manual process, substantial efforts have been devoted in the tobacco industry to machines for automatically cutting cigar wrappers from natural tobacco leaves. The first of these automatic machines is disclosed in the prior application incorporated by reference herein. In that application, a whole tobacco leaf is scanned to locate the proper cutting positions. The leaf is then positioned under a cutter at a cut position to cut successive wrappers from the natural tobacco leaf at the desired locations. The present invention relates to an apparatus and method for cutting and then transferring the cigar wrapper to a subsequent processing operation after the leaf has been oriented with respect to the cutter for cutting a wrapper therefrom. This invention does not relate to the specific arrangement for providing the proper cut position but only the handling of the wrapper during the cutting operation and then the transferring operation which transfers the wrapper from the cut position of the automatic machine to a remote position where it is stored or processed in accordance with any desired procedure.

When automatically cutting and handling cigar wrappers, the machine should operate rapidly, have a relatively few number of moving operations, a low number

of moving components and a structure which reduces the inertia forces necessary to obtain rapid automatic cutting and transferring of the cigar wrapper from the cutting position to some remote position for subsequent processing.

An embodiment of the present invention which is presently preferred and is described hereinafter comprises a device and method for cutting and transferring a wrapper from a tobacco leaf which is supported on a cutting surface at a cut position, which device and method minimize the basic problems involved in rapid cutting and transferring of the very light and delicate cigar wrapper. To understand the problems created by automatic machines for cutting cigar wrappers from natural tobacco leaves, either whole or partial, it must be realized that machines are extremely expensive, involve substantial development and engineering costs, and require a commitment of resources by a company converting from manual to automatic cutting and handling of cigar wrappers. To justify the expense, cost and corporate commitment, a machine for automatically cutting and transferring and handling cigar wrappers must operate at a speed greater than about thirty cuts per minute. This type of speed which may approach approximately sixty cuts per minute



involves a totally different concept in mechanisms for cutting, transferring and handling the tobacco leaf and the wrapper therefrom. Also, this speed is complicated by the fact that the wrappers are flaccid, light, have a low shape memory, can dry out and are somewhat fragile. The embodiment comprises a device for performing the cutting and transferring operation at speeds necessary for economic adoption of automatic processing equipment for cigar wrappers. This type of machine has heretofore not been available in the tobacco industry. Other industries do not face the problems created by the conversion of the wrapper processing from a manual to a totally automatic procedure.

In accordance with the embodiment of the present invention, there is provided a device for receiving profiles, such as cigar wrappers, cut from a sheet of material, such as a natural tobacco leaf or portion thereof, which material is supported on a generally flat cutting surface at a preselected cut position. The device comprises a transfer element movable in a continuous path intersecting the cut position. This transfer element has alternate clearance portions and profile receiving portions and means are provided for indexing the transfer member above the cutting surface and along the path to successive positions, placing a first clearance portion of the transfer element at the cut position and then an adjacent receiving portion at the cut position. The device also includes means for depositing a captured profile previously cut from the sheet, when the clearance portion is at the cut position, onto the receiving portion of the transfer element when the receiving portion of the element is at the cut position. As the transfer element continues its movement, means are provided for removing the profile or wrapper from the receiving portion of the transfer element at a position spaced from the preselected cut position. In this manner, the wrapper may be cut at the cut position, moved away from the cutter and then deposited downwardly on the transfer element as a profile receiving portion of the transfer element is shifted into the cut position. The continuously moving transfer element, having a clearance for the cutting operation, can receive the wrapper without substantial intermediate movement of the transfer element and cutting surface.

In accordance with another aspect of the embodiment, the device is adapted to be moved in a given path for receiving profiles or cigar wrappers cut from a sheet of tobacco material at a preselected cut position with the path of the device intersecting the cut position. This device comprises a unitary structure having a set of successive, alternate clearance portions and profile receiving portions. The structure is adapted to index with the portions of the device moving along the preselected path to first place the clearance portion of the transfer element or device at the cut position and then a receiving portion of the same element at the cut position. Thus, the cutter used in the cutting operation can pass through the transfer element which subsequently receives a cut profile or cigar wrapper.

In accordance with another aspect of the embodiment, the device as defined above incorporates a circular path which is in a given plane. In this manner, the device can be indexed in a circular manner about an axis orthogonal to the cutting surface and generally parallel to the direction of movement of the cutter.

In accordance with another aspect of the embodiment, the movable structure is generally flat and has upper and lower surfaces separated by a honeycomb core. By using this structure, the honeycomb core is relatively lightweight so that the basic moving element or transfer structure of the mechanism can be lightweight and requires only the necessary strength to suport the transfer operation necessary for transferring a wrapper to the index and transfer element and from the transfer element at a remote location. Thus, the rotating transfer element need not include structural devices necessary to support the transfer element which is supported only at the center and extends outwardly therefrom for performing the function described above.

By providing a transfer element which has cut-away portions or clearance portions at various locations which allow movement of a cutter through the plane of movement of the transfer element two distinct advantages are accomplished. One advantage is that the transfer element is reduced in weight by the clearance portions which overlie the cutting surface during a cutting operation. The other is that the transfer

element can continue to move in a given direction in a preselected path without retracting from the cutting position. The cutting table carrying the leaf and including the actual cutting surface need not be retracted from the preselected cutting position during transfer of the leaf. Consequently, the structure of the present invention allows continuous movement of the transfer element and the transfer operation does not require clearance movement of the cutting table. All of these advantages of the structure defined above are accomplished at the same time that the weight of the transfer element is reduced to allow the necessary speed concomitant with the requirements previously mentioned for automatic processing apparatus of the type to which the invention is directed.

In accordance with another aspect of the embodiment, the cutter used in the device is a reciprocal cutter having a blade with the shape matching the desired shape of the profile or cigar wrapper. The cutting element includes a vacuum holding member within the cutting blade so that when a cut has been made, the cut profile or cigar wrapper is held by vacuum onto the lower portion of the movable cutter. In this manner, as the cutter moves from the cutting surface to provide clearance for the unidirectional transfer element, the wrapper is captured on the cutter. When the unidirectional transfer element is then moved into the cut position, which is also the transfer position, the cutter can then move down a distance less than the movement during a cutting operation to deposit the captured wrapper onto the profile receiving portion of the unidirectional transfer element. The profile receiving portion of the transfer element includes another vacuum system in accordance with one aspect of the embodiment. This second vacuum system is created by a plurality of apertures at the receiving position of the transfer element. By creating a vacuum within the transfer element itself and communicated with the apertures, a positive transfer of the captured wrapper or profile from the cutter to the transfer element is possible. This can be done by having a higher vacuum in the transfer element than the vacuum in the cutter holding the captured wrapper. Also, positive pressure can be created in the vacuum system of the cutter at the moment of transfer.

Thus, in accordance with another aspect of the embodiment, the unidirectional moving transfer element having alternate clearance and receiving portions has an internal vacuum system which can cause transfer of a captured, cut wrapper from the cutter to the transfer element for subsequent indexing or movement to an appropriate position remote to the cutting and transferring position for removal of wrapper from the transfer element and subsequent storage or processing.

In accordance with still a further aspect of the embodiment, the vacuum system on the transfer element includes an interposed valve plate or element for each receiving portion and located between the apertures defining the profile or wrapper receiving portion of the transfer element and the vacuum source communicated to the total transfer element. This valve plate has openings with an area substantially less than the total area of the apertures defining an associated wrapper receiving portion on the transfer element. Consequently, if no wrapper is deposited onto a given wrapper receiving portion of the transfer element, the openings in the valve plate or element restrict the amount of vacuum loss at the uncovered profile receiving portion of the transfer element. When a wrapper is deposited onto the receiving portion, it covers the several apertures so that a vacuum created through the valve plate will hold the wrapper in fixed location on the transfer element until it is released for removal from the transfer element. This aspect of the embodiment reduces the loss of vacuum from the total transfer element so that a single vacuum system can be used in the transfer element. The transfer action is accomplished by controlling the force holding a captured wrapper onto the cutter in relationship to the fixed force on the transfer element.

In accordance with still a further aspect of the embodiment, the cutter is at a preselected position when it transfers a cut, captured wrapper onto the wrapper receiving portion of the transfer element. For that reason, each wrapper is oriented in the same position on the transfer element as it moves from the transfer operation to a subsequent wrapper removing position. In the illustrated embodiment of the invention, the cutter is at a fixed orientation with respect to the transfer element. This orientates the wrapper on the transfer element as it receives a captured wrapper at a given position.

Thus far, the embodiment has been described with respect to a single cutter in a single series of successive clearance portions and wrapper receiving portions. However, in accordance with another aspect of the embodiment a plurality of cutters can be provided for cutting the cigar wrapper. Each of these cutters is located on a given path of movement of the transfer element and in each path there is a series of alternate clearance or cut-away portions and wrapper receiving portions. In the illustrated embodiment, there are four separate concentric paths, each of which includes alternate cut-away, clearance portions for the cutting operation and an adjacent wrapper receiving portion. All of the wrapper receiving portions are part of the single indexing transfer element that moves from position to position to cut and then transfer wrappers. The term "cut-away" is used in a general sense to define a clearance opening. In some of the paths, the cut-away position is defined by an actual opening. In other positions, the cut-away position is defined by removing a portion of the transfer element adjacent its extremity or periphery. In both instances, the cut-away portion reduces the total area of the transfer element without affecting its structural strength which is defined by two sheet materials separated by a honeycomb core. Of course, vacuum passages are provided in the core to direct vacuum from an external source to the various profile receiving portions of the indexing transfer element. Consequently, in accordance with the embodiment, the transfer element is a rotatable table supported at its center. Cut-away portions are provided at various locations so that the cutting operation can take place through the table. The structural integrity of the transfer element is not affected by these cut-away portions in that the honeycomb core provides the vertical supporting structure for the indexing transfer element.

In accordance with another aspect of the embodiment, there is provided a device for cutting and capturing a contoured tobacco leaf profile from a sheet of tobacco material. This device comprises a novel cutting head having a cutting blade with a cutting edge circumscribing the desired

shape of a profile and lying in a given plane. A profile capturing element is positioned within the space circumscribed by the blade edge and has a generally flat surface facing away from the edge and generally parallel to the plane of the edge. Means for defining a chamber behind the capturing element and means for communicating this chamber with the flat surface are also provided so that a vacuum in the chamber will hold a profile cut by said edge against the flat capturing surface. Means are also provided for biasing the capturing element and its surface to an extended position with the flat capturing surface below the edge plane whereby a captured, cut profile can be transferred to an external element without interference with the cutting edge of the blade. By using this type of cutting and capturing element, the cutting head can extend through the transfer element and cut a profile from the tobacco leaf. The profile is then captured onto the capturing surface as the cutter is moved upwardly to a position allowing clearance for movement of the previously described transfer element. When the transfer element is then moved or indexed to position a profile receiving portion of the transfer element at the cut-transfer position, the cutting head is then moved downwardly against the transfer element. The extended capturing surface then engages the transfer element for allowing transfer of a captured, cut leaf from the cutting head to the transfer element. During this transfer action, the captured leaf is below the cutting edge so that the cutting edge does not engage the transfer element during the transferring operation which could cause marring and wear of the transfer element. This type of cutter construction is well adapted for use with the type of transfer element described in previous aspects of the embodiment.

In accordance with another aspect of the embodiment, two cutting heads are employed and the transfer element has two sets of alternate clearance portions and profile receiving portions. As the transfer element is indexed, a clearance portion is adjacent the cut position of one cutter while a receiving portion is adjacent the cut position of the second cutter. Thus, one cutter can perform a cutting operation through a clearance portion while the other cutter can move downwardly a limited amount to deposit a cut and captured

profile onto the adjacent profile receiving portion. A cut and transfer function is possible during one cycle of the machine. This is the preferred type of transfer element in that it can perform two functions simultaneously with a reduction in the cycle time. Such a concept can be used when a whole natural tobacco leaf is being cut. Separate cuts are performed in the two halves of the tobacco leaf since they provide different types of wrappers to be used on different cigars.

One object of the embodiment is the provision of a device and method, and subassemblies therefor, used to cut and transfer a tobacco sheet profile, such as a cigar wrapper, from a sheet of tobacco material, such as a natural tobacco leaf, which apparatus, method and components are adapted for automatic operation at relatively high operating speeds and are positionally accurate in use.

Another object of the embodiment is the provision of a device, method and components as defined above which involve a minimum of moving components and a minimum of motion reversals during use.

Yet another object of the embodiment is the provision of a device and method as defined above which employs moving components which are constructed in a manner that allows reduction in the weight of the components without affecting their positive, accurate operation in cutting the profile from the sheet and transferring the profile to a remote location for subsequent processing.

Still a further object of the embodiment is the provision of a device of the general type described above which can perform a cutting operation and a transferring operation simultaneously to reduce the cycle time of the apparatus.

Another object of the embodiment is the provision of a device for cutting and transferring a contoured tobacco sheet profile from a tobacco sheet supported at a cut-transfer position on a cutting surface which device involves a transfer element having a series of alternate clearance portions and adjacent profile receiving portions, which device allows a cutter to perform a cutting operation through the clearance portion and then a transferring operation when

the transfer element is shifted to the cut-transfer position.

Still a further object of the embodiment is the provision of a device as defined above, which device employs a cutter that has an arrangement for capturing a cut profile so that the cutter itself can perform the transferring action of the transferring element and can be indexed unidirectional to prevent motion reversals.

Still a further object of the embodiment is the provision of a transfer element of the general type described above which is formed from a low weight construction involving two spaced surfaces and an intermediate honeycomb core so that the cut-away portions or clearance portions can be provided without affecting the overall supporting strength of the transfer element.

Another object of the embodiment is the provision of a device utilizing a cutting head for cutting a profile from a tobacco leaf which cutting head cuts the profile, captures the profile in the head, moves the profile from the cutting position and then deposits the profile onto a moving transfer element which moves between the cutting head and the surface supporting the leaf or material being cut.

Another object of the embodiment is the provision of a device as defined above which transfer element is indexed in a rotary direction and involves a generally flat table-like transfer element.

Another object of the embodiment is the provision of a transfer element movable in a plane having spaced profile receiving portions and intermediate clearance portions so that the cutting operation can take place through the plane of the transfer element.

Yet another object of the embodiment is the provision of a method of cutting and transferring a tobacco profile from a sheet of tobacco material supporting on a cutting surface, which method involves cutting a profile, capturing the profile on the cutter, moving the cutter and captured profile from the cutting surface, moving a transfer element in a given direction to a position over the cutting surface and between the cutter and captured profile and the cutting surface and subsequently moving the cutter against the transfer element so the captured profile can be transferred to the

transfer element which continues to move away from the transfer position in the same direction for storage or processing of the profile.

In order that the invention may be well understood, the presently preferred embodiment thereof, which is given by way of example only, will now be described in more detail, reference being made to the accompanying drawings, in which:

Figure 1 is a schematic top view showing an overall machine employing a cutting and transferring device;

Figure 2 is a side elevational view taken generally along line 2-2 of Figure 1;

Figure 3 is an enlarged partial top view of the machine shown in Figure 1 illustrating the interaction of the cutting and transferring device and other components of the illustrated machine of Figure 1;

Figure 4 is a schematic side elevational view taken generally along line 4-4 of Figure 3;

Figure 5 is an enlarged partial view taken generally along line 5-5 of Figure 4;

Figure 6 is an enlarged view similar to Figure 3 illustrating the tobacco leaf in its cut position;

Figure 7 is an enlarged, partially cross-sectioned view taken generally along line 7-7 of Figure 6;

Figure 8 is an enlarged, partially cross-sectioned view taken generally along line 8-8 of Figure 4;

Figure 9 is an enlarged, partially cross-sectioned view taken generally along line 9-9 of Figure 4;

Figures 10, 11, 12 and 13 are enlarged partial views taken generally along line 10-10 of Figure 9 and showing the cutting and capturing head of the device in various operational positions; and

Figures 10A, 12A are partial views showing one type of a selective moving mechanism for moving the cutting and capturing head into the positions shown in Figures 10, 12 respectively.

Referring now to the drawings, Figures 1 and 2 show a machine A for automatically cutting cigar wrappers from natural tobacco leaf B which uses a cutting and transferring device after the machine has located and placed leaf B in the proper position for cutting a wrapper therefrom. Machine A is illustrated as a total processing device of the type controlled by a programmable controller and/or digital computer in accordance with standard machine control practices. Machine A includes schematically represented preferred structures for accomplishing the positioning of the leaf for proper cutting at a cut position. A full description of the arrangement for locating the leaf in the proper position is disclosed in our above-mentioned application.

Machine A includes a leaf spreader 10, a conveyor 12, a scanning mechanism 13 on a support bridge 15, a movable cutting table 14, an appropriate mechanism 20 for positioning the table with the leaf in the proper cutting position, and a cutting and transferring device comprising a cutting mechanism 22 supported on bridge 24 and a transfer element 30. In accordance with machine A, storage spool or bobbin loaders 40, 42, 44 and 46 are positioned around transfer element 30 at appropriate locations to remove cut and transferred cigar wrappers onto appropriate spools for subsequent use in a machine for winding the wrappers around the body of a cigar. To unload cigar wrappers from transfer element 30, there are provided a series of schematically illustrated unloading devices 50. One of these devices is provided for each storage spool or bobbin loader so that a wrapper from a selected location on transfer element 30 will be removed from element 30 and transferred to the appropriate bobbin loader 40-46 for subsequent of the wrapper. In summary, leaf B is fed into the machine A and cut wrappers are removed from the transfer element 30 and placed onto bobbin loaders 40-46.

Before describing the cutting and transferring device, certain illustrated mechanisms for bringing the leaf B to the cutting position for cutting by mechanism 22 will be described generally. As shown in FIGURES 1 and 2, spreader 10 is somewhat standard and includes a plurality of angularly driven belts 60 positioned above and below the plane at which a leaf B is manually fed into machine A. Drive belts 62, 64 drive the angularly disposed belts 60 to spread leaf B in accordance with standard technology for handling tobacco leaves. Rolls 65, 67 drive the lower angularly disposed belts 60. Similar rolls are provided for driving the upper belts. As the leaf passes through the fingered belts 60, it is spread and deposited onto conveyor 12 which, in the illustrated embodiment, includes a flat, transparent, perforated belt 70 driven along a primary vacuum chamber 72 at the upper run of the belt and a secondary vacuum chamber 80 at the lower run of the belt. Cylinders 82, 84 are adapted to move the secondary vacuum chamber 80 in a downward direction to transfer a leaf on belt 70 to the cutting table 14 for subsequent movement into the cutting position in alignment with mechanism 22. A valve conduit 86 communicates the primary and secondary vacuum chambers so that the vacuum may be diminished in chamber 80 during transfer of a leaf B from belt 70 onto the cutting table 14. A standard vacuum drive roll 90 maintains the vacuum on belt 70 to hold the leaf B in its spread condition as the belt carries the leaf from the upper run to the lower run. Belt 70 is driven by roll 90 through an appropriate motor 92 by a chain 94. Guide rolls 100, 102, 104 are adjusted to maintain tension in the perforated, transparent belt 70 as it moves along the path illustrated in FIGURE 2. In summary, the spread leaf on belt 70 passes over roll 90 to the lower run where it is held against the belt by the vacuum in secondary chamber 80. When in the proper position over cutting table 14 with the cutting table in the position shown in FIGURE 1, the secondary chamber is physically moved downwardly by cylinders 82, 84, at which time vacuum is released from the secondary chamber and vacuum applied to table 14 captures the spread leaf in a specific location determined by the position of the cutting table at transfer. As disclosed in the prior application, scanner 13 includes a transversely extending light source 110

within primary vacuum chamber 72 for shining a light through transparent belt 70. An appropriate light sensitive scanning head 112 determines the profile and defects in leaf B being scanned. These defects determine the various orientation of table 14 at the cutting position to obtain useable wrappers during the cutting process. The present invention does not relate to this aspect for orienting the leaf at the cutting position and this operation could be done in various ways. Indeed, it could be done manually; however, this is not anticipated since machine A and the preferred embodiment of the present invention is directed toward concepts which allow rapid processing of a natural tobacco leaf to produce a number of wrappers without the intervention of manual labor. In summary, the scanning or sensing mechanism 13 involves an arrangement for automatically determining the proper orientation of cutting table 14 with respect to cutting position of mechanism 22 during subsequent cutting operations which employ the preferred embodiment of the present invention.

Referring now to the illustrated embodiment of cutting table 14, this table is a flat relatively lightweight structure best shown in FIGURES 3-7 and 9. Table 14 includes a flat body portion 120 formed from aluminum and having an upper cutting plate 122 defining an upwardly facing, flat cutting surface 123 and formed from rigid nylon or another appropriate rigid cutting material. Surface 123 is provided with a number of closely spaced vacuum directing perforations 124 which communicate with vacuum passages 126 in body portion 120 to communicate the surface 123 with the network of vacuum passages 126. These passages are in turn connected to a vacuum conduit 128 so that vacuum can be selectively directed to surface 123 to hold a spread leaf onto this surface after it has been transferred from belt 70. Vacuum in passages 126 can be released to remove a spent leaf after cutting. Table 14 is lightweight and relatively thin. It is slidably mounted on an upper flat surface of a lower anvil 130 which supports cutting table 14 during its sliding and shifting movement in machine A. This anvil also provides the reaction force member for the cutting operation. Thus, cutting table 14 need not have the structural strength to withstand the cutting forces, but need only carry the leaf to the proper oriented

cutting position with respect to cutting mechanism 22. Although a specific structure has been shown for cutting table 14, other structures could be used.

Any number of arrangements could be used for moving table 14 to the proper cutting position determined by the scanning operation. The scanning operation determines the cut position by a computer process which is used to control the moving mechanism 20 to position the leaf on surface 123 in the proper orientation for subsequent cutting. In the illustrated embodiment of machine A, three generally parallel binary controlled motors 150, 152 and 154 are illustrated. In accordance with this concept, after a leaf has been deposited onto surface 123, appropriate binary information is provided to the three binary motors which are then shifted into a position to locate leaf B in the proper orientation for cutting by mechanism 22. Each of the binary motors has essentially the same structure; therefore, only motor 154, best shown in FIGURE 4, will be described in detail. This description applies equally to the other two binary motors. Cylinders 160, 162 and 164 are sized to provide movement in accordance with a binary relationship. Thus, each of the cylinders provides a different amount of movement. This is all standard practice and clearly illustrated in the previous application. Guide rods 170 for each of the motors maintain the motors in alignment and also guide the movement of the output element 172, as best shown in FIGURE 4. Motors 150, 152 and 154, thus, move upstanding pins 180, 182 and 184, respectively, in accordance with the amount of movement of output element 172 of each of the motors. These upstanding pins engage the undersurface of table 14 in grooves 190, 192 and 194. As is clearly illustrated, the height of pins 180, 182 and 184 is less than the depth of the groove. Thus, the pins receive no vertical component of force and serve only to slide table 14 along the upper surface of anvil 130. Grooves 190, 192 are generally aligned and extend transversely across table 14. Groove 194 extends perpendicular to the other grooves and extends longitudinally with respect to table 14. Output elements 172 control the movement of drive plates 200, which actually drive the pins. Pins 180 and 182 are each supported on a drive plate 200. Pin 184 is

driven by a chain 202 having a coupling 204 for joining the chain with the drive plate 200 of motor 154, as best shown in FIGURE 4. Chain 202 drives pin 184 in a groove extending laterally across anvil 130, as best shown in FIGURE 3. Any appropriate arrangement for determining the path of chain 202 can be used. In the illustrated embodiment, sprockets 210-215 are positioned in a manner, best shown in FIGURE 5, to drive pin 184 in accordance with the movement of output element 172 controlled by motor 154. The relationship of the grooves in table 14 and the movement of the pins with respect to these grooves in response to the amount of output movement from binary motors 150-154 determines the actual orientation of table 14 during the cutting operation.

The scanning mechanism 13 for locating the proper cuts to be made in leaf B controls the amount of subsequent movement of the pins 180-184 to locate cutting table 14 in the proper position for cutting a leaf B held onto upwardly facing cutting surface 123.

Referring now to FIGURES 1 and 2, cutting mechanism 22 includes four separate and distinct cutting heads 300, 302, 304 and 306. These heads are used for cutting separate cigar wrappers or profiles P from opposite sides of tobacco leaf B. In the illustrated embodiment, two of the heads are used for each half of the leaf. They have different sizes so that they can cut different types of cigar wrappers from each half of the leaf. The mechanism would operate with a single cutter, with a single cutter for each half of the leaf, or with two or more cutters for each half of the leaf. In practice, each of the cutting heads is for a different shape or leaf half and is deposited subsequently onto one of the four bobbin loaders or storage spool mechanisms 40-46 shown in FIGURE 1. A variety of arrangements could be used for forcing one of the cutters 300-306 against leaf B supported on surface 123 of cutting table 14; however, in the preferred embodiment of the invention there is provided a driving system including an upper pancake cylinder 310, best shown in FIGURE 2. This cylinder receives pneumatic pressure to control the cutting force of cutting heads 300-306. Rod 312 of cylinder 310 is conneted to the upper one of two toggle links

314, 316 which are operable by reciprocation by an appropriate hydraulic cylinder 318. As the cylinder is moved to the right as shown in FIGURE 2, a cutting and/or transfer operation is accomplished at the bottom dead center of the toggle links 314, 316. In the preferred embodiment, both a cut and a transfer is accomplished by toggle links 314, 316. As the toggle links are moved to the left, another operation of the cutting operation is performed. A common, pivoted power or drive plate 320 is oscillated by toggle links 314, 316 to control the downward movement of one of four drive rods 322, each of which is used to control the movement of one of the cutting heads 300, 302, 304 and 306. Each drive rod 322 includes a top cam surface 324 and an intermediate pin 326 which extends diametrically through the rod. Rods 322 are reciprocated in vertical directions by appropriate rod guides 328, one of which reciprocally mounts each of the drive rods 322. The axis of movement of rod 322 determines the cut position for each of the cutting heads, as will be apparent later. The cut position is also the transfer position for each of the cutting heads so that the axis of each of the four rods 322 determines the cut-transfer position for each of the wrappers cut from leaf B by one of the cutting heads.

Referring now more particularly to FIGURES 10A and 12A for more details, drive mechanism 22 includes an interposer or roller 320 for each of the rods 322 of the cutting heads or cutters 300-306. To select one of the cutters to perform a cutting operation during a downward movement of power plate 320, one of the rollers 330 is shifted into the position shown in FIGURE 10A by an appropriate power cylinder 332. Since only one wrapper is cut for each downward cycle of cutting mechanism 22, only one of the four rollers 330 is used at any given time. The selected roller engages its drive rod 322 to activate one of the cutting heads 300-306 for the cutting operation of a wrapper P from leaf B supported on table 14. If a cutting head is not being moved downward to the cutting position by being selected with roller 330, the cutting head is moved downwardly a lesser distance to place the head in a transfer position. This lesser downward movement is controlled by transfer link 334 which engages diametrically extending pin 326 by an appropriate wear plate 336. This action is shown in

FIGURE 12A. Thus, the selected drive rod 322 is moved downwardly a distance determined by roller 330, while the other three drive rods are driven down a lesser distance determined by the movement of link 334 against pin 326. To adjust the downward movement, there is provided an adjustable coupling 338 which determines the downward position of trunnion 339 which controls the movement of link 334 with respect to oscillation of power plate 320. Consequently, when the power plate is moved down during an operation, a selected one of the cutting heads 300-306 is actuated by interposing roller 330 between plate 320 and cam portion 324 (if a cut is to be performed). The other cutting heads are moved downwardly by individual links 334 for controlling each of the other non-selected drive rods 322. Thus, a cut can be made by each downward movement of cutting mechanism 22 and a transfer of a cigar wrapper or profile can also be made by a cutting head not then being used for cutting. This arrangement for moving the cutting head to a cutting position or a transferring position

and its function will be more apparent in relationship to the operation of the transfer element 30.

Referring more particularly to FIGURES 9 and 10, details of each of the heads 300-306 are illustrated. For purposes of simplicity, only cutting head 304 will be described in detail. This description will apply equally to the other cutting heads. Of course, a single cutting head can be used or a plurality of cutting heads with some located on one side of the stem in leaf B and the other located on the opposite side of the stem. If the wrapper sizes desired are the same, only two cutting heads would be employed, one for each side of leaf B. Since the desired shape of the profile or cigar wrapper may be different, two separate cutters for each side of the leaf are illustrated. This is to show that the device is well adapted for a versatile cigar wrapper processing machine, as shown in FIGURES 1 and 2. Cutting head 304 includes a housing 340 supported on a threaded shank 342 at the downward end of rod 322 for controlling the vertical position of this particular cutter. An adjustable stop collar 344 is threadably received on shank 342 and is adjusted in a vertical direction on the shank to limit the

upward movement of cutting head 304, as shown in FIGURES 9, 11 and 13. Mounting hub 346 joins housing 340 with shank 342 by an appropriate bolt 347. To retain the angular orientation of cutting head 304, there is provided a downwardly extending guide pin 348 supported on frame 324, which also reciprocally mounts link 334 and provides the support for the various guide sleeves 328 of cutters 300-306. An aligning bracket 350 extends from hub 346 to guide pin 348 for guiding cutter 304 in a vertical direction during the cutting operation and the transferring operation. An inlet coupling 360 includes a vacuum tube 362 and a pressure or atmosphere tube 364. When pressure is applied through tube 364, this overrides any vacuum in line 362 to provide a positive pressure within the plenum chamber of cutting head 304. Thus, by an appropriate valving arrangement either a vacuum or a positive pressure can be applied to the cutting head for a purpose to be described later. Opposed grooves 370 slidably receive cutting assembly 380 having outwardly extending flanges 382 which engage grooves 370 and allow transverse sliding engagement of the cutting assembly with housing 340. A plurality of set screws 384 extend through the housing and engage cutting assembly 380 to hold the cutting assembly in a position which is determined by engagement of end 383 with stop 385, as shown in FIGURE 9. A port 386 in the upper portion of assembly 380 communicates coupling 360 with the interior of the cutting assembly which includes a cutting blade 390 with a downwardly extending cutting edge 392 circumscribing a desired shape for a cigar wrapper to be cut. As can be seen, edge 392 is in a single plane which is parallel to the cutting surface 123 of cutting table 14.

Within the space circumscribed by blade 390 and its edge 392 there is provided a profile or wrapper capturing element 400 having a downwardly facing flat surface 402 and a plurality of apertures 404 closely spaced around the periphery of element 400 which generally matches the shape of the wrapper to be cut. These apertures 404 which are spaced by a distance not exceeding approximately one-fourth inch are communicated with an internal plenum chamber 406 communicated with port 386 and pressure controlling coupling 360. Thus, when vacuum is directed to tube 362 vacuum is applied at the various aper-

tures 404 for holding a cut cigar wrapper or profile onto downwardly facing holding surface 402 of profile or leaf capturing element 400. Surface 402 is parallel to cutting surface 123 of table 14, as best shown in FIGURE 9. An appropriate biasing means, shown as a thin strip of sponge rubber or plastic, extending around blade 390 biases capturing element 400 outwardly from edge 392 a distance Z. This biasing means is adhesively secured to the upper surface of element 400 and surface 412 of cutting assembly 380. In this manner, the biasing strip defines the inner plenum chamber 406, supports the capturing element 400 and also controls the biasing action of this element in a direction vertically downward toward the cutting surface 123. By this structure, a vacuum can be applied to chamber 406 to hold a cut leaf or profile onto surface 402. To transfer the wrapper or profile P from surface 402 to transfer element 30, a positive pressure can be applied to plenum chamber 406 to facilitate the release and transfer actions. When rod 322 moves head 304 upwardly, as shown in FIGURE 9, capturing element 400 is extended downwardly beyond cutting edge 392 so that the edge does not interfere with the transfer action.

The basic aspect of the embodiment involves the concepts and structure of transfer element 30 and the interaction of this element with respect to the cutting heads for the purpose of cutting wrappers or profiles P from leaf B and depositing them onto transfer element 30 for subsequent storage or processing. In accordance with the preferred embodiment of the present invention transfer element 30, as best shown in FIGURES 6-8, includes an indexing table which indexes through an angle r between each cutting and transferring cycle of machine A. The indexing action is about an axis x which is orthogonal to cutting surface 123 of table 14. A plurality of switch cams 402 are positioned at the indexed positions labeled I-VI in FIGURE 6. These switch cams indicate which section of the transfer element is positioned at the cut and transfer position at any given time. Each of the constructions at positions I, III, and V are generally the same whereas positions II, IV and VI are substantially the same. Table 500 includes a central hub 504 concentric with index axis x communicated with a vacuum conduit 506, best shown in FIGURE 7.

This conduit is supported onto fixed frame 508 which also supports the switches 510, 512 having switch arms 510a, 512a, respectively. These switches indicate which station is positioned adjacent the cutting operation defined by the general position of cutting mechanism 22 for use in controlling sequencing of machine A. In practice, a Ferguson indexing mechanism 520 is used for indexing table 500 repeatedly through angle r by a continuously driven motor 524 and an intermittently actuated clutch 522. This is shown in FIGURE 2. Synchronizing device 526 can be used to indicate the indexing operation of mechanism 520 for timing the operation of elements on machine A. Other arrangements could be used for indexing table 500 between the various angular positions to perform the operation of the preferred embodiment of the present invention.

Referring now more particularly to FIGURE 6, the two basic patterns m, n are provided for elements located on table 500. Each of these patterns has subpatterns ma, mb and na, nb which are circular and concentric with axis x. The patterns are aligned with the cut positions of the various cutting heads 300, 302, 304 and 306. Thus, the patterns or paths of movement of the elements on table 500 are concentric and intersect the particular locations of the cutting heads used for processing a particular type of cut. For instance, a large wrapper on one side of leaf B would be processed by elements on table 500 and moving along path mb. Small wrappers from this same side of the leaf would be processed by elements located on path ma. On the other side of the leaf, the large wrappers are processed in accordance with elements located on path na whereas small wrappers are processed on elements located on path nb. A single path could be used if a single cutter were used. Two paths m and n would be used if one type of cut is to be made in each of the two leaf halves. Thus, the number of paths in the preferred embodiment are dictated by the number of cutters and their relative positions with respect to each other. This is true because the cutting takes place at a position determined by the position of the cutter. This dictates the position of the transfer of a profile P onto table 500 and subsequent removal of the wrapper from the table in an oriented manner determined by its position of the cut and transferred wrapper on the element 30. As shown in FIGURE 6, table 500 includes clearance or cut-away portions

530 of table 500 at positions II, IV and VI. These cut-away portions are in path m which in practice includes two separate subpaths ma, mb. To reduce the weight of table 500 these cut-away portions are defined by a chord cut across the periphery of table 500 at a position close as possible to the adjacent path or pattern n. Thus, the table has a reduced weight caused by the missing portions of table 500, which portions create and are the three spaced clearance or cut-away portions 530. Intermediate cut-away or clearance portions 530 there are provided profile or cigar wrapper receiving portions 532 at positions I, III and V. Thus, progressing around path m there is first a cut-away or clearance portion 530 and then a profile or wrapper transfer portion 532. The clearance portions are shaped to diminish as much as possible the size of table 500 without affecting its static and dynamic balance and its capacity to support the transfer action of a wrapper. On path n, there are also provided alternate clearance or cut-away portions 540 and profile or wrapper receiving portions 542 spaced from each other the rotary indexing distance r. In path or pattern n, the cut-away or clearance portions are actual openings 540 within table 500. As can be seen, the use of two patterns m, n provide a cut-away portion or clearance portion and a transfer portion at the position of mechanism 22 after each index. In this manner, both a cut and a transfer operation for a wrapper can be made at each indexed location of table 500. In operation of table 500, the table is indexed by mechanism 520 to a given position which will locate a clearance portion of table 500 between two cutting heads and surface 123 of table 14 and a transfer portion of table 500 below the other two cutting heads. This process alternates

as table 500 is indexed. Thus, each cutter is first aligned with a clearance portion and then with a transfer portion on table 500 forming the basic structure of transfer element 30.

In accordance with one aspect of the embodiment, table 500 is formed from an upper aluminum sheet 560 which is about 0.03 to 0.040 inches in thickness and a lower similar sheet 562. These sheets are separated by a honeycomb core 564 to import cantilever rigidity to sheets 560, 562. The honeycomb is preferably formed from cardboard. In some instances, the honeycomb can be formed from aluminum foil with a thickness of .003-.005 inch.

Edge strips 566 extend around the peripheral edge of table 500 and strips 568 are positioned around the periphery of the _____

cut-away or clearance portions 540. Thus, the table is a relatively lightweight structure which is supported by an upper ring 570 and a lower support ring 572. Ring 570 is used to mount switch cams 502 at the various indexed positions of table 500. Consequently, the switch cams are not supported directly on the structure forming table 500 but on the supporting structure therefor. By providing this structure for table 500, the various cut-away portions can be formed without interfering with the overall unitary structure of the table and its supporting structural features. Table 500 includes an appropriate internal vacuum passage network 580, best shown in FIGURES 7 and 8. This internal vacuum network is communicated with vacuum conduit 506 through center hub 504. Any appropriate vacuum network can be provided for directing a negative pressure to the various profile receiving portions on table 500.

Each profile receiving portion 532, 542 includes essentially the same structure having two wrapper holding elements 600, 602, one for each of the two cutting heads for a leaf half. Each of these holding elements is substantially the same, except for the difference in the shape of the wrapper being held. Consequently, only holding element 602 will be described in detail. This description will apply equally to holding element 600 as shown in FIGURE 6. Referring now to FIGURES 7, 8 and 11, wrapper or profile holding element 602 includes an upper flat plastic, rigid plate 610 defining a generally flat holding surface 612 parallel with cutting edge 392 of the cutter 304, or the cutting edge of any other cutter. A plurality of closely spaced apertures 614 are spaced along the periphery of a profile to be cut and generally interior of this periphery. This is shown in FIGURE 8 wherein the periphery is illustrated in phantom line and the pattern for apertures 614 is within this circumscribed shape. A peripherally extending spacer plate 616 is positioned between flat plate 610 and the upper surface of table 500 and is held thereon by a plurality of spaced bolts 618. This spacer plate has an internal opening shown in dashed lines in FIGURE 8 and defining an internal plenum chamber 620 communicated with the various apertures 614 of flat plate 610. Three relatively large apertures 622 are provided in upper sheet 560 of table 500 to

intersect plenum chamber 620. These holes form a valving device for each holding element. The total area of holes 622 is substantially less than the total area of the apertures 614 at a given holding element. If a wrapper is held by apertures 614, the holding force extends around the periphery of the wrapper. However, if there is no wrapper on the particular holding element 600, 602 the lesser area of apertures 622 substantially restricts the amount of vacuum lost by sucking air into internal passage vacuum network 580 which is best shown in FIGURE 8.

Referring now to FIGURES 10-13, operating characteristics of transfer element 30 as best shown in FIGURE 6 are illustrated. Position I of table 500 is at the cutting or cut position of cutter 304 determined by the axis of reciprocal rod 322, clearance portion 540 is over leaf B at the cut position. The cycle of the cutting mechanism 22 is preceded by interposing the roller 330 above the rod 322 of cutter 304. Thus, this one rod 322 is forced downwardly to force cutter 304 into cutting engagement with oriented leaf B as shown in FIGURE 10. This cuts a wrapper P from the leaf in the desired position determined by the location of table 14 with respect to the cutting position of head 304. The cutting head extends through table 500 at the aligned clearance portion 540. As toggle links 314, 316 go over center to make the cut, cutting head 304 then retracts to the position determined by collar 344 as shown in FIGURE 11. Thus, one movement of cylinder 318 of cutting mechanism 22 moves cutting head 304 from the position shown in FIGURE 11 to the position shown in FIGURE 10 and back to the position shown in FIGURE 11. When it returns, a cut profile P in the form of a cigar wrapper is captured onto surface 402 by vacuum in chamber 406. This vacuum is greater than the vacuum holding leaf B onto surface 123. When a captured leaf is on surface 402 and cutter 304 is moved to the position shown in FIGURE 11, element 400 is forced outwardly from the edge 392 of blade 390. Collar 344 allows head 304 to move upwardly a distance clearing table 500 for movement. The table can be indexed to the next position where a profile holding element, in this instance element 602, of the profile receiving portion 542 of position II is aligned with the cut position determined by

rod 322 of cutting head 304. This position is shown in FIGURES 12 and 13. On the next cycle of power plate 320 by movement of cylinder 318 in a given direction, cutting head 304 is moved downwardly a transfer distance less than the cutting distance and corresponding to a transfer position as shown in FIGURE 12. The biasing strip 410 forces element 400 against surface 312 with a light force caused by the sponge rubber or strip 410. Vacuum within network 580 is combined with positive pressure in tube 364 of coupling 360 to positively transfer the cut profile from surface 402 to surface 612. This is shown in FIGURE 12. Thereafter, completion of the toggle action raises head 304 from surface 612 and apertures 614 hold a cut profile P onto the upper surface 612 of holding element 602, as shown in FIGURE 13. A single transfer cycle moves cutter 304 from the upper position shown in FIGURE 11, to the transfer position shown in FIGURE 12 and then to the wrapper released position shown in FIGURE 13. Thereafter, table 500 continues to move in the same direction until the cut wrapper is adjacent the desired mechanism 50 for removing the wrapper and depositing it onto one of the storage spools or bobbin loader devices 40, 42, 44 and 46. Of course,

any one of various arrangements could be used for removing the wrapper from transfer device 30 at a position remote from the cut and transfer position. Each successive cutting and transferring operation takes place in accordance with the sequence cutters shown in FIGURES 10-13. FIGURES 10A and 12A are used only to disclose a selecting arrangement for determining whether a rod 322 is performing a cutting stroke or a transfer depositing stroke. Of course, if there is no wrapper captured on surface 402 downward movement of rod 322 of a given cutting head will have no effect and is only an idling action.

As shown in FIGURE 7, in each indexing position both a cutting operation and transfer operation can take place. In this instance, selector roller 330 has selected cutting head 302 for the cutting operation. This cutting head then moves within clearance portion 530 of path or pattern m for cutting a wrapper P from leaf B supported on surface 123. At the same time, and during the same downward movement of power

plate 320, all other cutting heads are moved downwardly a transfer distance determined by the links 334 of the other cutting heads. Since cutter or cutting head 304 was used in the previous cutting operation, it contains a captured leaf B which is deposited onto holding element 602 of profile receiving portion 542 on table 500. The other cutting head 306 was not selected for a cut prior to the indexed position shown in FIGURE 7. Thus, there is no captured wrapper on this cutting head and there is no transfer to the holding device 600 of receiving portion 542. In FIGURE 7 the cutting head 300 idles in a noncutting position as shown. No transfer can be done by this head in this position because it has no wrapper and is not over or on the wrapper receiving portion on table 500.

Vacuum unit 650 is used for withdrawing a spent leaf from cutting table 14 after the cutting operations have taken place and before the table is moved into the position for accepting the next leaf to be cut. A plurality of cuts can be taken from the leaf before it is spent and then withdrawn by unit 650.

As best shown in FIGURE 1, the unloading devices 50 each have a forward portion aligned with a subpattern ma, mb, na or nb and an extended portion aligned with one of the bobbin wrapper receiving units 40-46. Consequently at each indexed position of table 500, one of the unloading devices is in position over table 500 to remove a cut wrapper. In FIGURE 1, the unloading device 50 for each cutting head 300-306 is indicated in parentheses. At the illustrated indexed position, no wrapper is in position to be removed. In the next index position, the unloading device aligned with a transferred cut wrapper will be actuated to remove the cut wrapper or wrappers from table 500.

The relationship between the lower cut position and the lower transfer position of the cutting heads is adjustable by coupling 338. Cylinder 310 controls the downward cutting force and the cutting position is generally dictated by the reaction of the cutting action against this cylinder.

CLAIMS:

1. A device for cutting and transferring a contoured tobacco sheet profile from a tobacco sheet supported at a cut-transfer position on a cutting surface, said device comprising: a transfer element with a cut-away first portion and an adjacent profile receiving second portion; means for moving said transfer element over said cutting surface with said first and second portions moving in a path intersecting said cut-transfer position in succession; cutting means at said cut-transfer position for cutting said sheet profile from said tobacco sheet while said cut-away portion is at said cut-transfer position, said cutting means including at least one cutting element and means for selectively moving said cutting element between a first position on the side of said transfer element opposite to said cutting surface and a second position extending through said cut-away portion and in cutting relationship with a said tobacco sheet on said cutting surface; and means for transferring a cut sheet profile onto said profile receiving portion of said transfer element when said transfer element is moved to a position with said receiving portion at said cut-transfer position.

2. A device as claimed in claim 1, wherein said path is generally circular.

3. A device as claimed in claim 1 or 2, wherein said cutting element includes a cutting blade with a cutting edge matching said profile and extending in a plane generally parallel with a substantially flat cutting surface.

4. A device as claimed in claim 1, 2 or 3, including means for actuating said selectively moving means when said cut-away first portion is at said cut-transfer position.

5. A device as claimed in any one of the preceding claims, including means for selectively moving said cutting element to a third position between said first and second positions for allowing said cutting element to transfer said profile to said profile receiving surface.

6. A device as claimed in any one of the preceding claims, wherein said cutting element includes a vacuum holding member circumscribed by said cutting blade and means for biasing said holding member toward said cutting surface.

7. A device as claimed in claim 6 when appended to claim 5, wherein said vacuum holding surface contacts said profile receiving surface in said third position of the cutting element.

8. A device as claimed in any one of the preceding claims, wherein said transfer element is a movable table having an upper surface defining said profile receiving second portion, apertures being provided in said upper surface at said profile receiving second portion; and wherein a vacuum passage is defined in said table for communicating a vacuum source with said apertures.

9. A device as defined in claim 8, wherein said vacuum passage includes a plenum chamber communicating with said apertures, and a valve plate having opening means therein and interposed in said passage between said vacuum source and said plenum chamber with the combined opening area of said opening means being substantially less than the combined opening area of said apertures.

10. A device as claimed in claim 8 or 9, wherein said table has a lower surface and a honeycomb core between said upper and lower surfaces.

11. A device as claimed in any one of the preceding claims, wherein said transfer element is rotatable about a central axis

12. A device for cutting and transferring a contoured tobacco sheet profile, such as a cigar wrapper, from a tobacco sheet, such as a tobacco leaf, said device comprising: a cutting table; means for supporting said tobacco sheet at a preselected cut-transfer position on an upper surface of said table; a transfer element having a series of spaced cut-away portions and profile receiving portions arranged in a generally circular pattern; means for holding a profile on said profile receiving portions; means for rotating said transfer element over said table and about an axis concentric with said path and generally orthogonal to said upper surface, with said path intersecting said cut-transfer position; a cutter with a cutting blade defining the desired shape for said profile and a means for holding a cut profile within said blade; means for selectively moving said cutter between a first lower cutting position with said blade

engaging said table when one of said cut-away portions is at said cut-transfer position, an upper neutral position with said cutter substantially above said transfer element and a third intermediate profile transfer position engaging one of said profile transfer portions when one of said profile receiving portions is at said cut-transfer position; and means for forcing a profile to transfer from said cutter to a said profile receiving portion when said cutter is in said third intermediate position.

13. A device as claimed in claim 12, including means for removing a profile from said profile receiving portions at a location remote to said cut-transfer position

14. A device for cutting a tobacco profile from a tobacco leaf held on an upper surface of a cutting table, said device comprising: a cutter having a blade with a cutting edge defining the shape of said profile; means for forcing said cutter against said leaf on said table at a given position; means for holding said cut profile in said blade; means for withdrawing said cutter and profile from said table; a transfer element having a profile receiving portion; means for moving said transfer element to position said receiving portion below said cutter and above said cutting table; means for moving said cutter into engagement with said profile receiving portion; means for transferring said profile from said cutter to said receiving portion of said transfer element; means for holding said profile onto said receiving portion; and means for removing said profile from said transfer element at a position remote to said given position.

15. A device as claimed in claim 12, 13 or 14, wherein said cutter includes a vacuum holding member circumscribed by said cutting blade and means for biasing said holding member toward said cutting surface.

16. A device as claimed in any one of claims 12 to 15, wherein said profile holding means includes apertures at said profile receiving portions of said transfer element and means in said transfer element defining a vacuum passage in said transfer element communicating a vacuum source to said apertures.

17. A device as claimed in clain 16, wherein said vacuum passage includes a plenum chamber communicating with said apertures, and a valve plate having opening means therein and interposed in said passage between said vacuum source and said plenum chamber with the combined opening area of said opening means being substantially less than the combined opening area of said apertures.

18. A device for providing a number of cut tobacco profiles from sheets of tobacco material supported on a cutting surface of a cutting table, said device comprising: a cutting head having a cutting blade with a cutting edge defining the desired shape of a profile in a plane; means for orienting said table with one of said sheets in alignment with a cut position; a transfer element; means for moving said transfer element in a single direction and in a path over said cutting surface and intersecting said cut position; said transfer element including a succession of alternate clearance portions and profile receiving portions; operating means for moving said cutting head; said operating means including means for forcing said cutting head through a said clearance portion and

against said cutting surface with said cutting edge cutting a profile from said aligned sheet of tobacco material when said transfer element has been moved to place one of said clearance portions at said cut position; means for capturing a cut profile on said cutting head; said operating means including means for withdrawing said cutting head from said cutting surface with a captured profile before said transfer element has been moved to displace said one clearance portion from said cut position; said operating means including means for moving said cutting head with a captured profile against a said profile receiving portion when said transfer means has moved to a position placing one of the receiving portions at said cut position; means for transferring a captured profile onto said receiving portion when said cutting head is against said one receiving portion; said operating means including means for removing said cutting head from said one receiving portion after transfer of said captured profile; and means for removing said transferred profile from said receiving portion at a selected position remote to said cut position.

19. A device as claimed in claim 18, wherein said path is continuous.

20. A device as claimed in claim 18 or 19, wherein said capturing means includes a perforated plate-like element within said cutting blade; means defining a plenum chamber within said cutting head and behind said perforated plate-like element; and means for directing a vacuum to said plenum chamber to capture said profile on said plate-like element.

21. A device as claimed in claim 18, 19 or 20, wherein said transfer element moving means includes means for indexing said transfer element between positions with one of said clearance portions at said cut position and positioned with one of said receiving portions at said cut position.

22. A device for receiving porfiles cut from a sheet of material supported on a generally flat cutting surface at a preselected cut position, said device comprising: a transfer element movable in a continuous path intersecting said cut position; said transfer element having alternate clearance portions and profile receiving portions; means for indexing said transfer member above said cutting surface and along said path to successive positions placing a first clearance portion and then an adjacent receiving portion at said cut position; means for depositing a profile previously cut from said sheet when a clearance portion is at said cut position onto an adjacent profile receiving portion when said adjacent profile receiving portion is at said cut position; and means for removing a cut profile from said adjacent profile receiving portion at a position substantially spaced from said cut position.

23. A device as claimed in claim 21 or 22, wherein said path is circular about an axis generally orthogonal to said cutting surface and said indexing means includes a drive element for indexing said transfer element, a constantly rotating power device and clutch means for selectively engaging said power device to said drive element.

24. A device as claimed in claim 21, 22 or 23, wherein said clearance portions and profile receiving portions have central portions which central portions are evenly spaced in a circumferential pattern on said transfer element with said pattern matching said path.

25. A device as claimed in claim 24, wherein said successive indexed positions are spaced an angular amount corresponding with the spacing of the central portions of said clearance and receiving portions.

26. A device as claimed in any one of claims 18 to 25, wherein said path is circular about an axis generally orthogonal to said cutting surface.

27. A device as claimed in any one of claims 18 to 26, wherein said transfer element is a generally flat structure and said clearance portions are cut-away portions having at least some edges defined by the periphery of said flat structure.

28. A device as claimed in claim 27, wherein said flat structure has upper and lower generally parallel surfaces and said profile transfer means includes a vacuum system having aperture means at said upper surface for holding said profile at said receiving position and means for directing a vacuum to said aperture means.

29. A device as claimed in claim 27, wherein said transfer element is a generally flat structure having upper and lower surfaces separated by a honeycomb core.

30. A device as claimed in claim 29, wherein said honeycomb core is formed from a paper material having a unit weight substantially less than aluminum.

31. A device as claimed in any one of claims 18 to 30, wherein each said receiving portion comprises a perforated plate-like element and said transfer element includes passage means for directing a vacuum to said perforated plate-like element of said receiving portion with the vacuum level of said passage means being greater than the pressure in said plenum chamber at the time of profile transfer.

32. A device adapted to be moved in a given path for receiving profiles cut from a sheet of tobacco material at a preselected cut position with said path intersecting said cut position, said device comprising: a unitary structure having a set of successive, alternate clearance portions and profile receiving portions; said structure being adapted to be indexed with said portions moving along said path to first place a clearance portion at said cut position and then a receiving portion at said cut position.

33. A device as claimed in claim 32, including a second set of alternate clearance and profile receiving portions arranged in a second path coterminous with said first mentioned path with each clearance portion of said second set aligned with a profile receiving portion of said first mentioned set and each profile receiving portion of said second set aligned with a clearance portion of said first mentioned set.

34. A device as claimed in claim 32 or 33, wherein the or each path is circular.

35. A device as claimed in claim 32, 33 or 34, wherein the or each path is in a given plane.

36. A device as claimed in any one of claims 32 to 35, wherein said structure is generally flat and has upper and lower surfaces separated by a honeycomb core.

37. A method of cutting and transferring a tobacco profile from a sheet of tobacco material supported on a cutting surface at a cut position, said method comprising the steps of:

(a) cutting said profile from said sheet of tobacco material with a cutter;

(b) capturing said profile on said cutter;

(c) moving said cutter and captured profile from said cutting surface at least a given distance;

(d) moving a transfer element in a given direction to a position over said cutting surface at said cut position and between said cutter and captured profile and said cutting surface;

(e) moving said cutter against said transfer element;

(f) transferring said captured profile onto said transfer element; and

(g) moving said transfer element away from said cut position in said given direction.

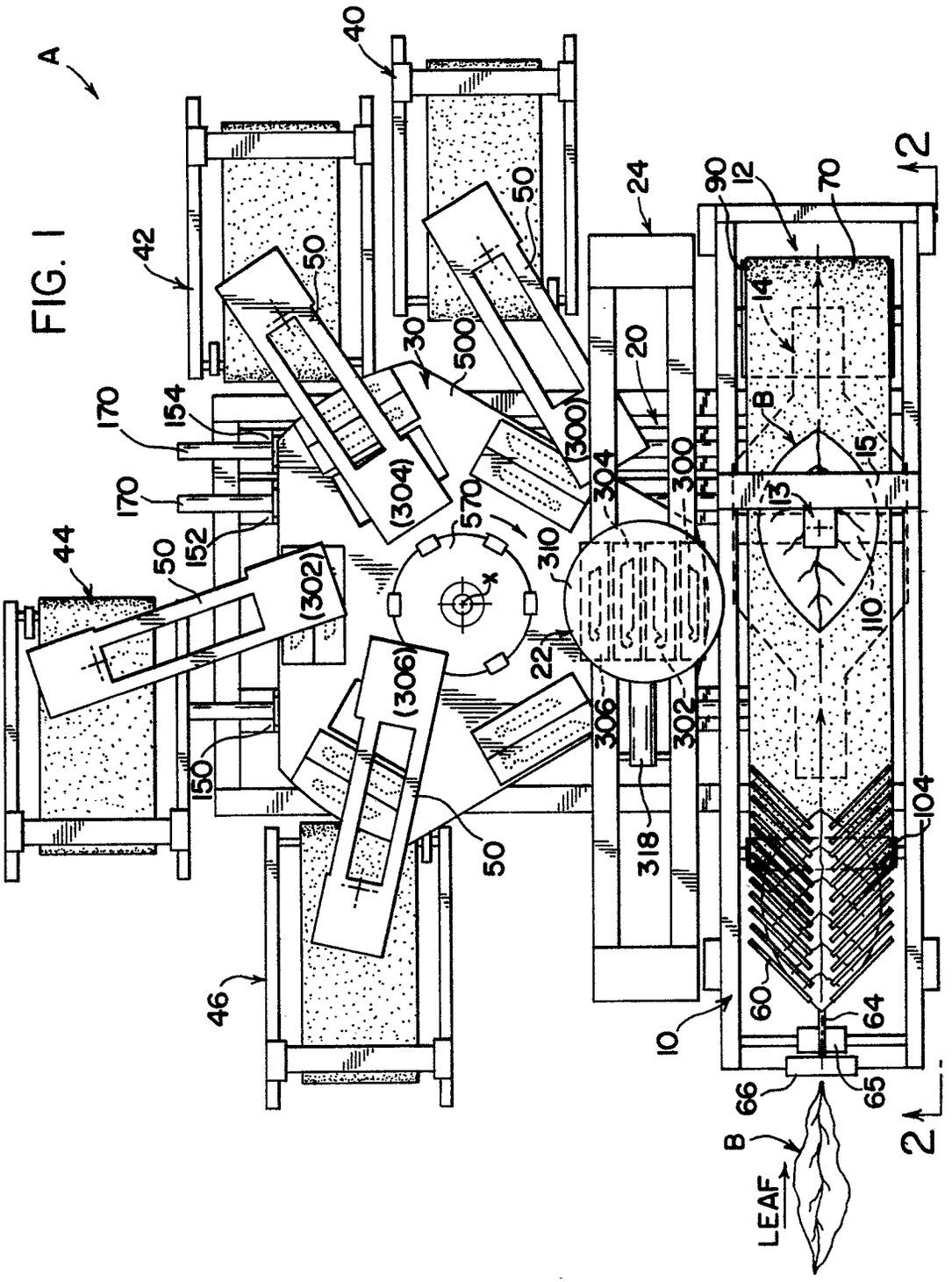
38. A device for cutting and capturing a contoured tobacco sheet profile from a sheet of tobacco material, said device comprising: a cutting head having a cutting blade with a cutting edge circumscribing the desired shape of a profile and lying in a plane; a profile capturing element within the space circumscribed by said blade edge and having a generally flat surface facing away from said edge and generally

parallel with said plane; means defining a chamber behind said capturing element; means for communicating said chamber with said flat surface whereby vacuum in said chamber will hold a profile cut by said edge against said flat surface; and means for biasing said capturing element to an extended position with said flat surface below said edge plane whereby a captured, cut profile can be transferred to an external element without interference by said edge.

39. A device for cutting a number of tobacco profiles for a sheet of tobacco material supported on a cutting surface, said device comprising: first and second cutting heads, each of said heads having a cutting blade with a cutting edge circumscribing a desired shape of a profile and lying in a plane and means within said blade for capturing a profile cut from said sheet by engagement of said edge with said sheet and against said cutting surface; means for locating said first head at a first cut position; means for locating said second head at a second cut position adjacent to said first cut position; a transfer element having a first set and second set of alternate clearance portions and profile receiving portions with a clearance portion of each of said sets adjacent to a profile receiving portion of said other set; means for indexing said transfer element in a path over said cutting surface between a position with said clearance portion of one set at said first cut position and the adjacent profile receiving portion of the other set at said second cut position and a position with said profile receiving portion of said one set of said first cut position and the adjacent clearance portion of the other set at said second cut portion; means for forcing said cutting heads toward said cutting surface, said

means including means for selectively forcing a cutting head against said cutting surface only when a clearance portion is at the cut position of said forced head and means for selectively moving a cutting head to a position above said cutting surface and adjacent said receiving portion of said transfer element when a receiving portion is the cut position of said forced head.

FIG. 1


A
40
42
44
46
50
30
500
(300)
(302)
(304)
(306)
154
170
152
150
570
310
22
20
24
90
12
70
14
B
15
13
110
104
300
302
304
306
318
10
60
64
66
65
2
LEAF

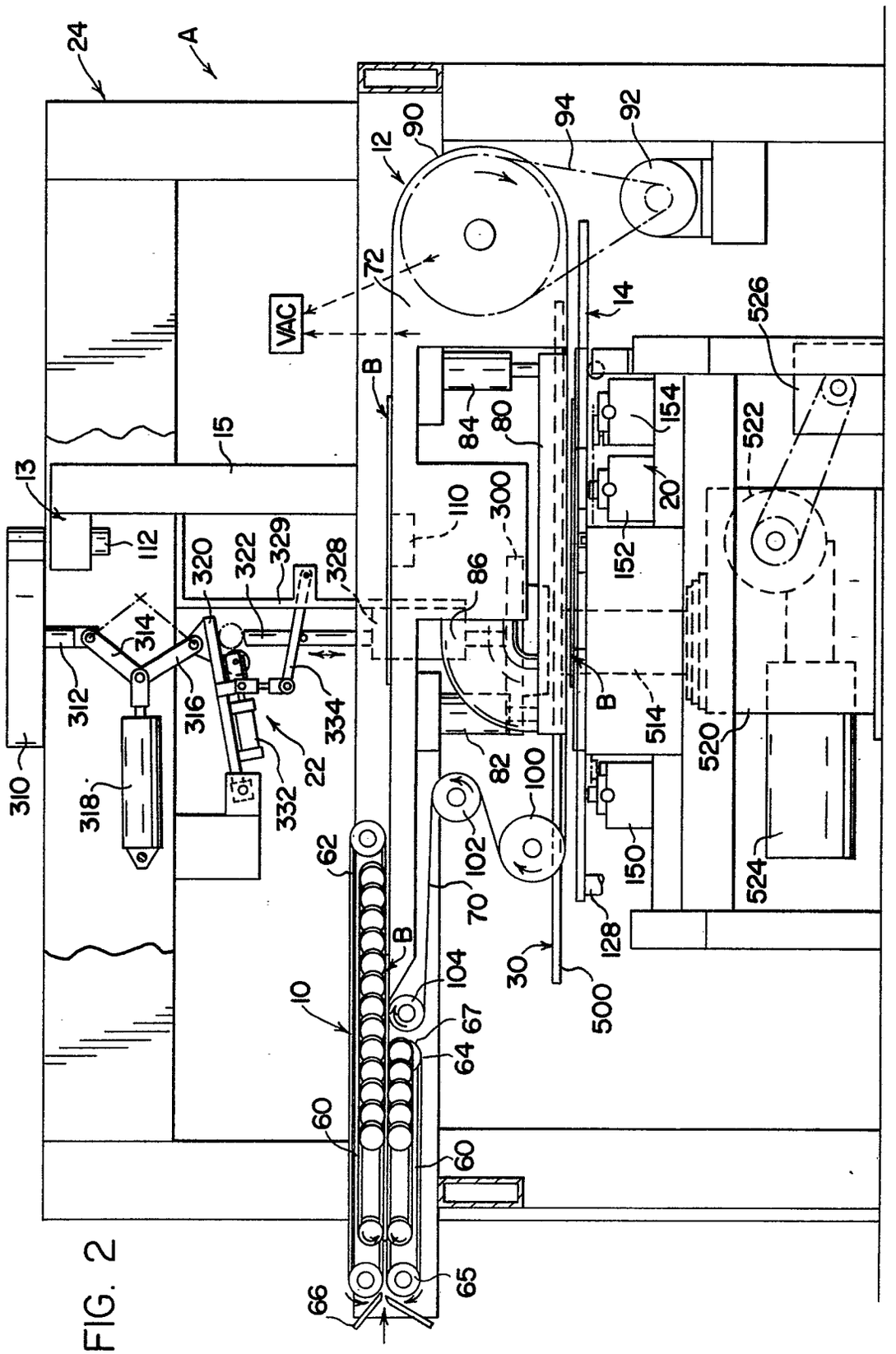
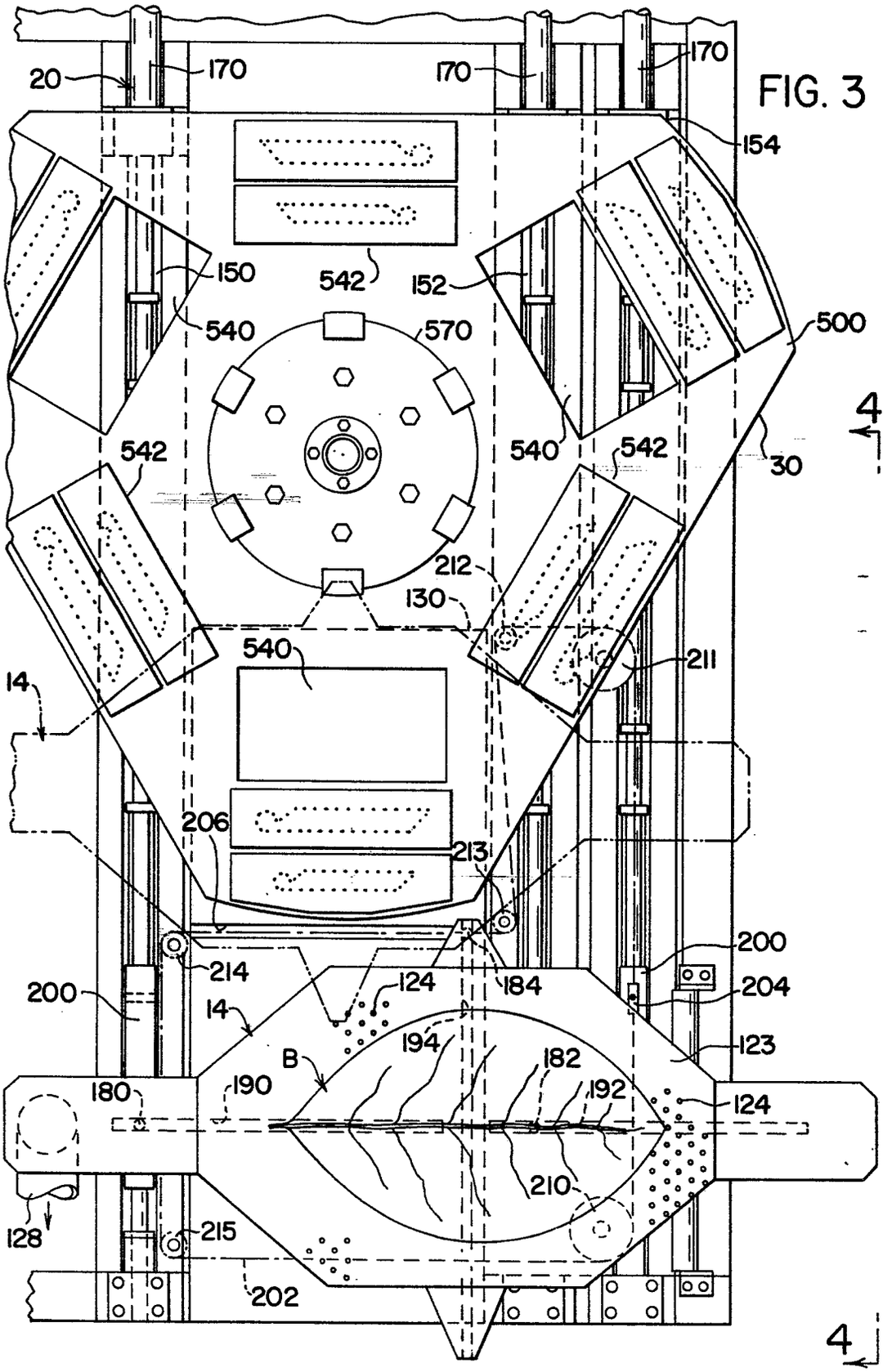

24
A
12
90
94
92
72
VAC
14
526
B
84
80
154
522
15
13
110
300
20
112
320
322
329
328
86
152
314
312
316
334
B
514
520
310
318
332
22
82
100
62
102
150
524
70
128
B
104
30
500
10
67
64
60
60
65
66

FIG. 2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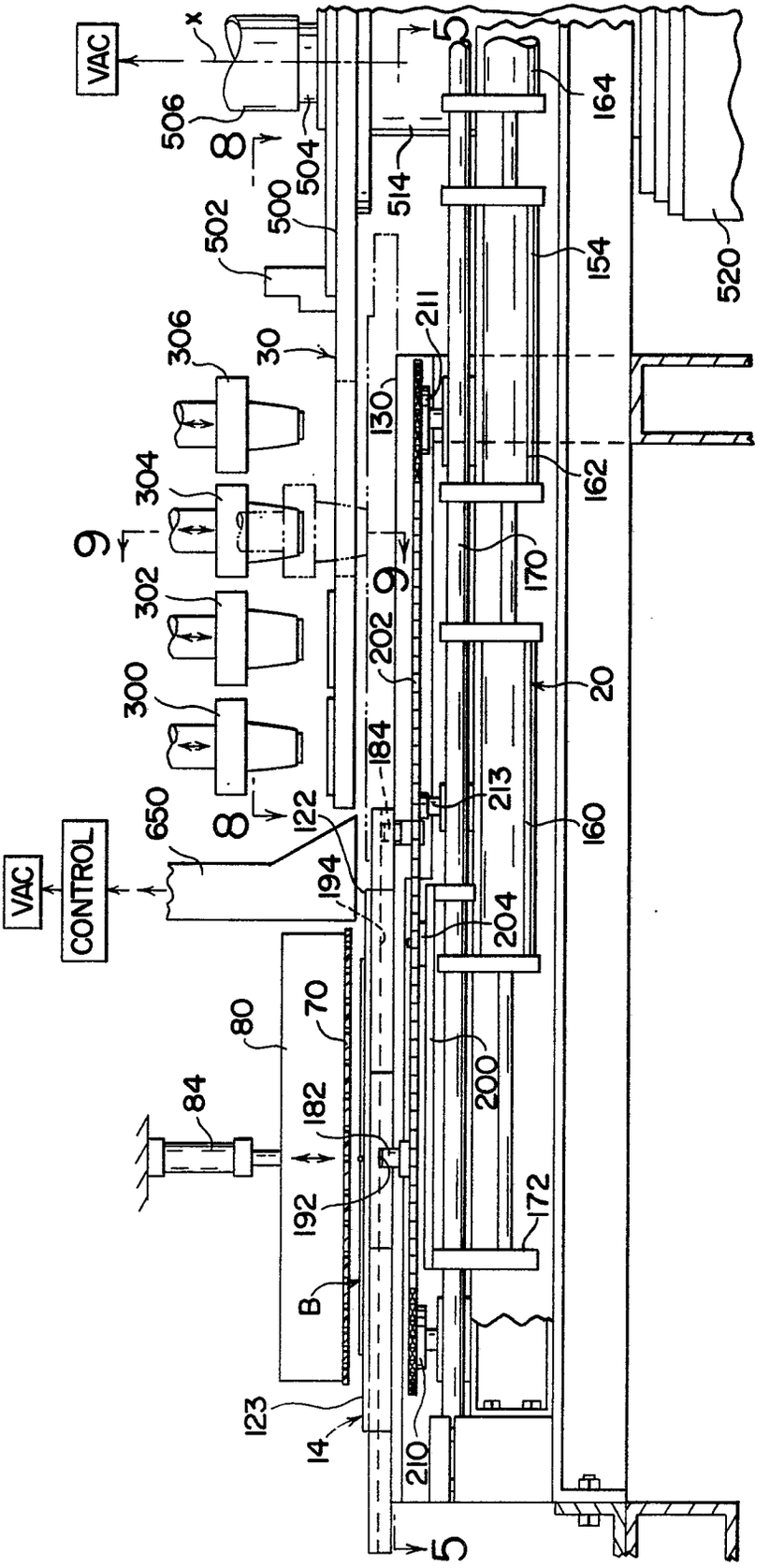
170
170
170
154
150
542
152
540
570
500
542
540
542
30
212
130
540
211
14
206
213
200
214
124
184
204
200
14
194
182
123
B
180
190
192
124
210
128
215
202
4
4

FIG. 3

FIG. 4


VAC
x
506
8
504
500
502
514
164
154
520
306
30
211
130
304
162
9
170
302
202
20
300
184
213
160
650
122
VAC
CONTROL
194
204
80
70
200
84
182
192
172
B
123
14
210
5

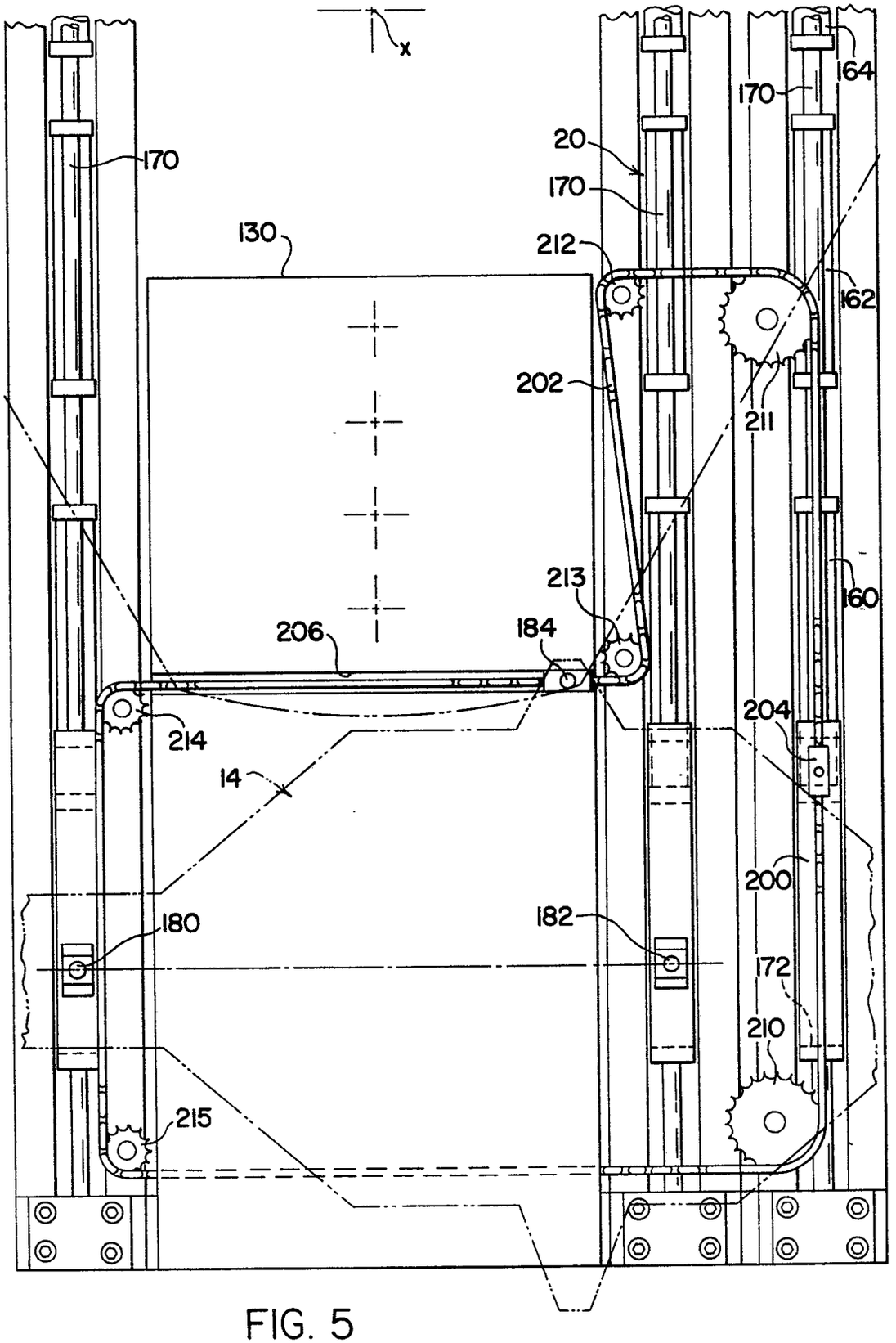
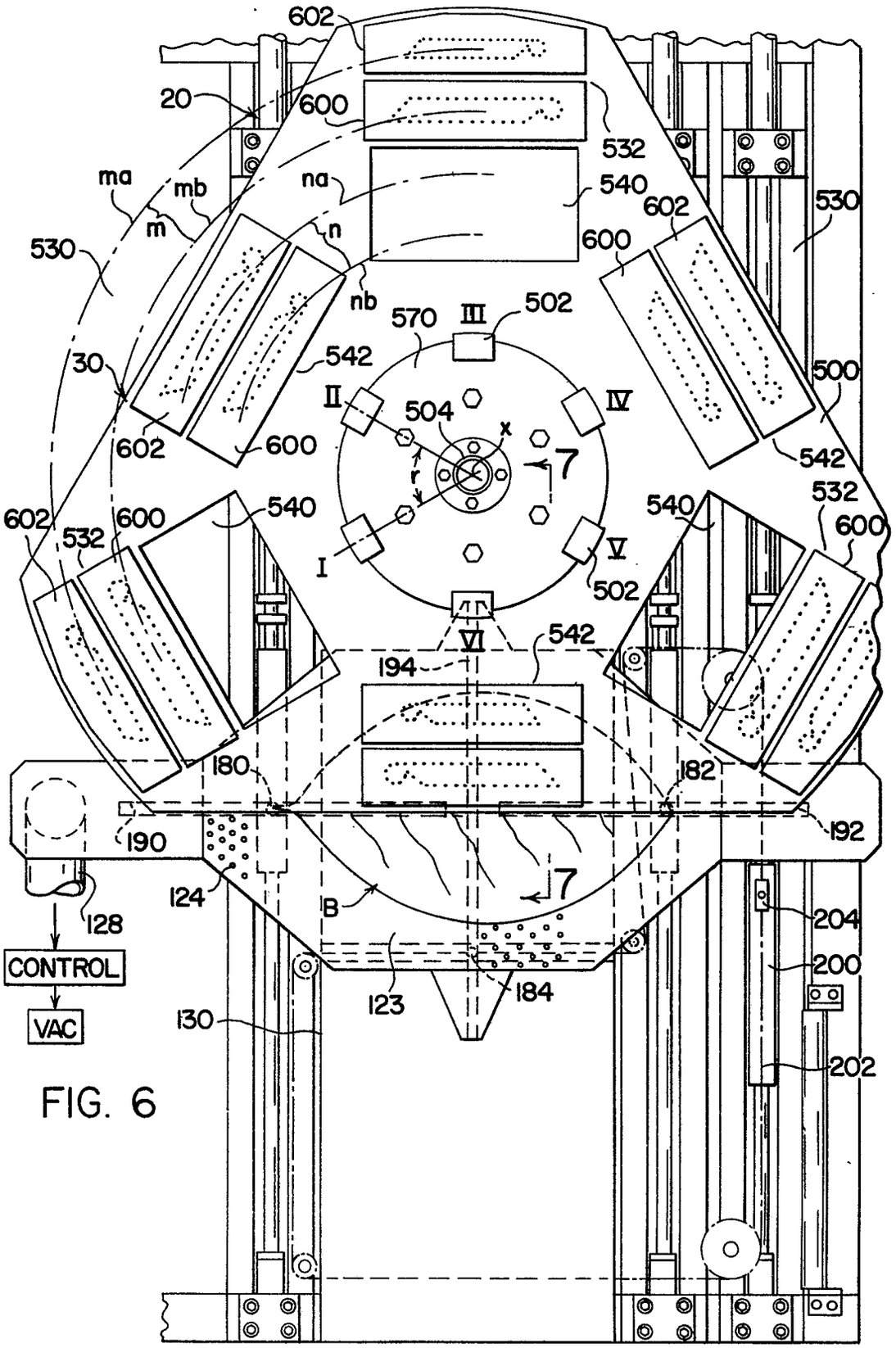

x
164
170
20
170
170
130
212
162
202
211
213
160
206
184
214
204
14
200
180
182
172
210
215

FIG. 5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20
600
532
ma
mb
m
na
n
nb
540
530
570
III
502
542
30
II
504
IV
x
r
7
602
600
500
542
602
600
540
532
I
V
502
VI
542
194
180
182
190
192
124
B
7
128
204
CONTROL
200
123
184
VAC
130
202

FIG. 6

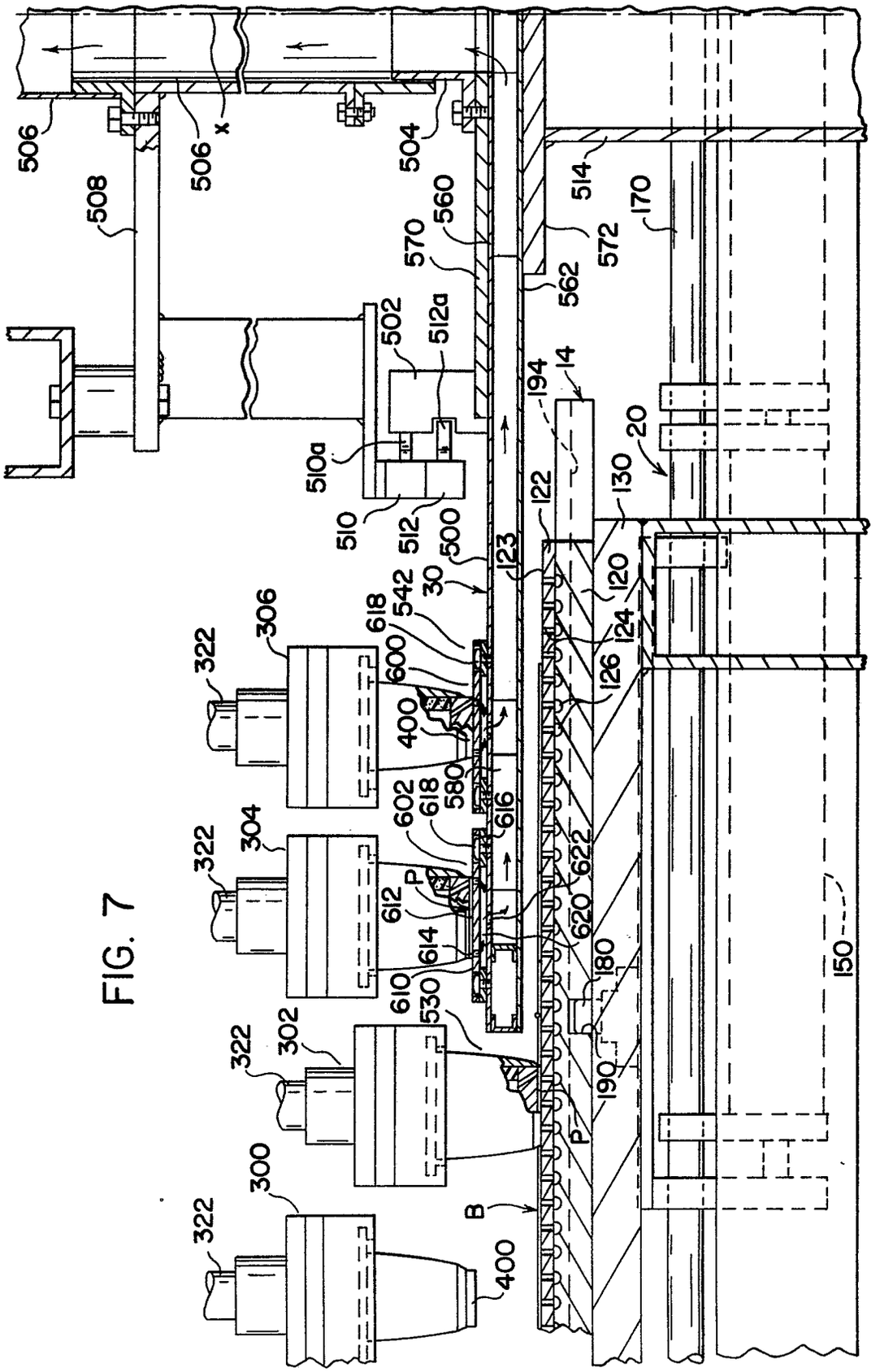

506
506
x
504
508
514
170
560
570
572
562
502
512a
194
14
510a
20
130
122
510
512
500
123
30
120
542
618
306
322
600
124
126
400
580
602
618
616
304
322
622
P
612
620
614
180
610
530
302
322
190
P
300
322
B
400
150

FIG. 7

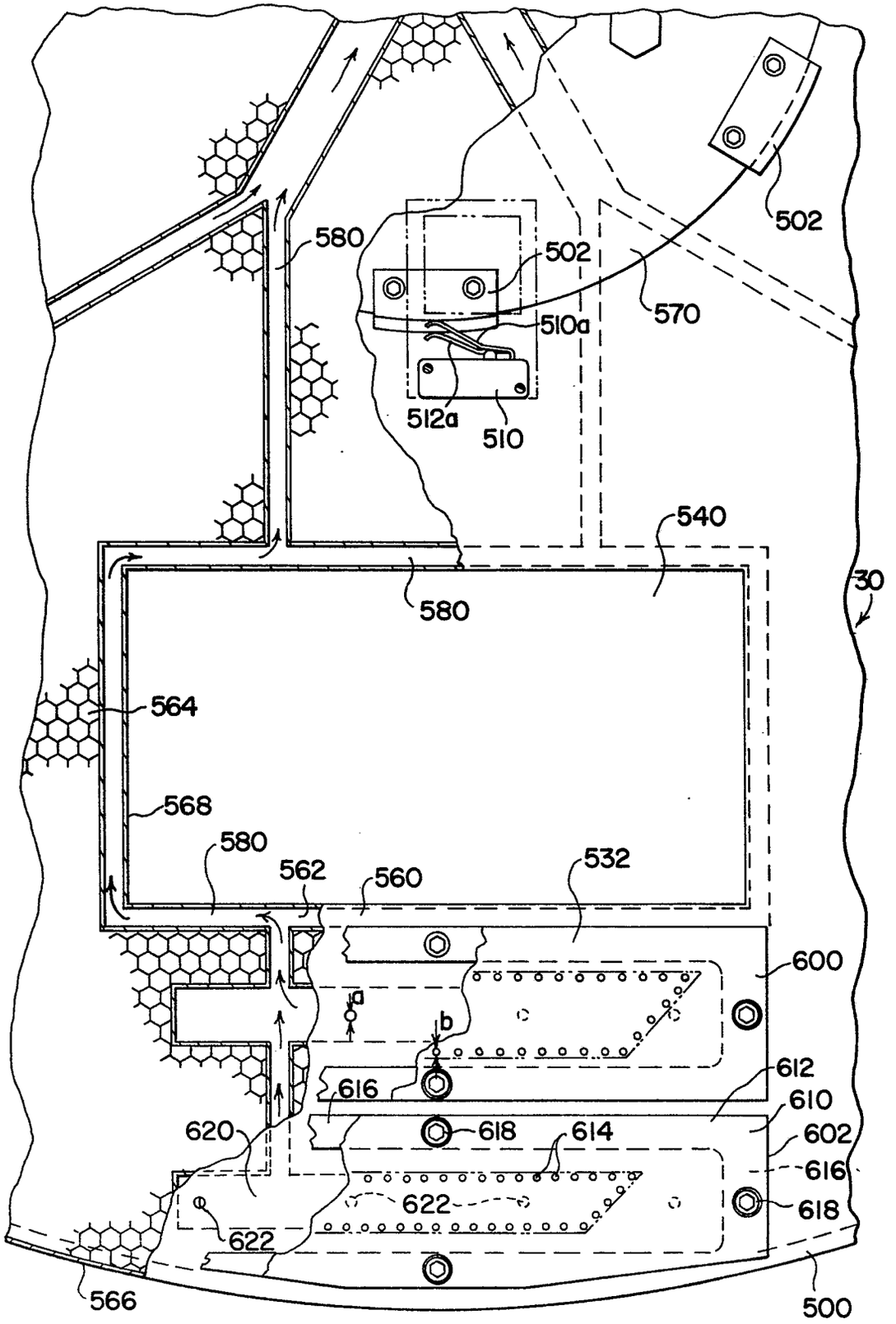

580
502
502
570
510a
512a
510
540
30
580
564
568
580
562
560
532
600
a
b
612
616
610
620
618
614
602
616
622
618
622
566
500

FIG. 8

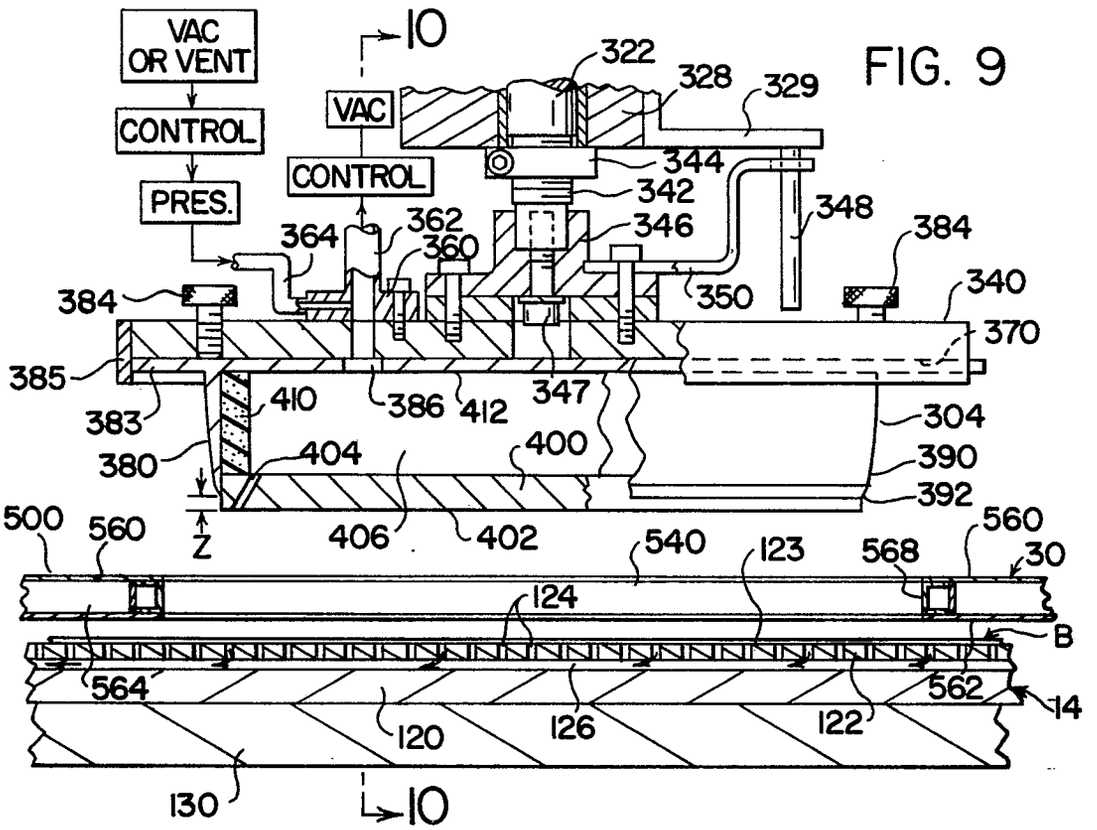


FIG. 9

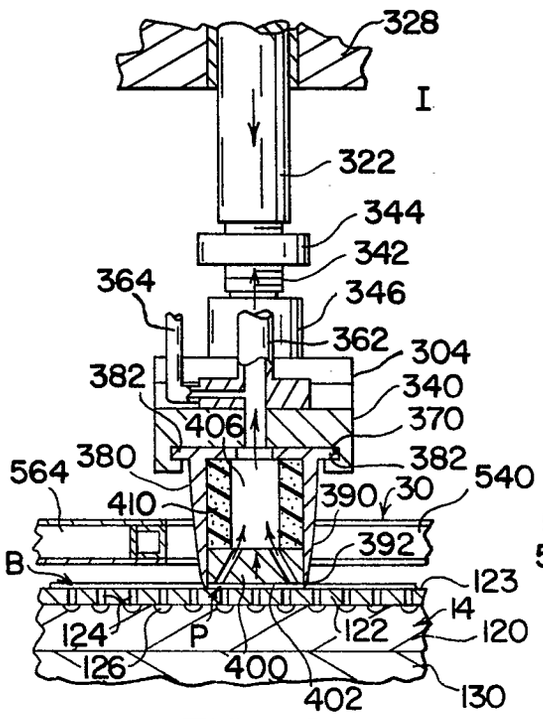


FIG. 10

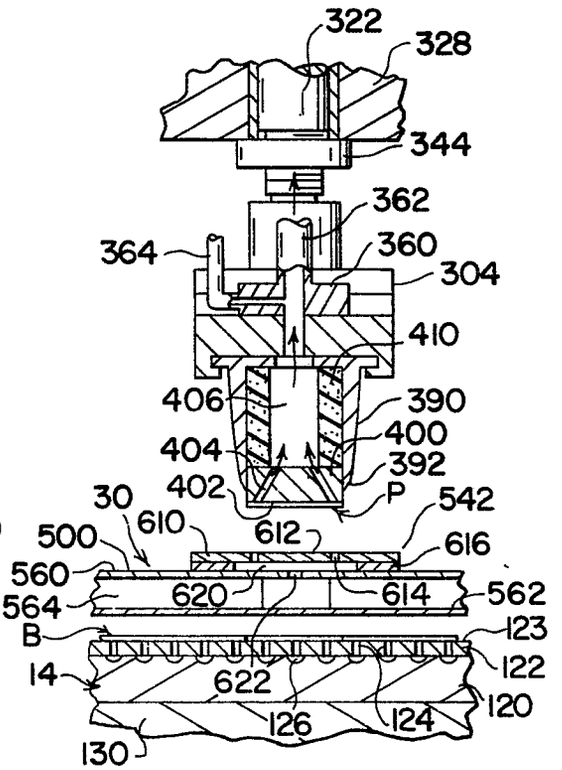


FIG. 11

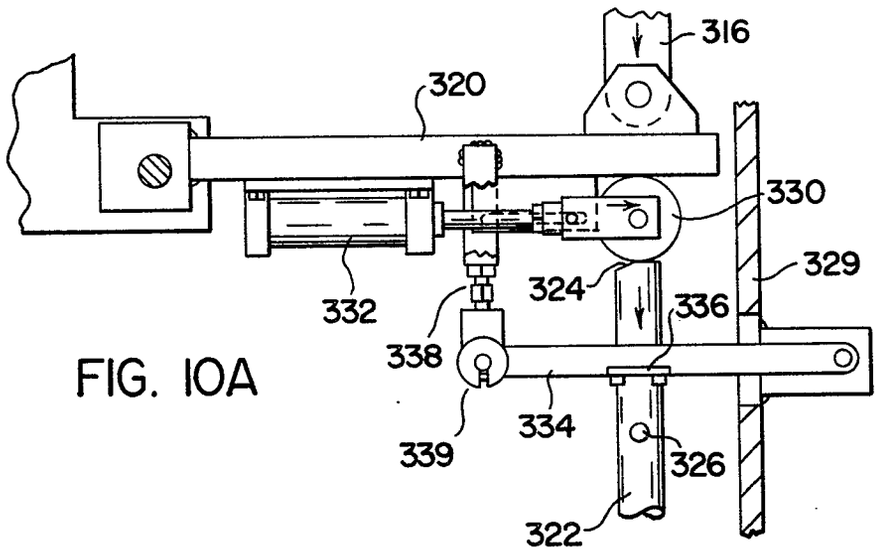


FIG. 10A

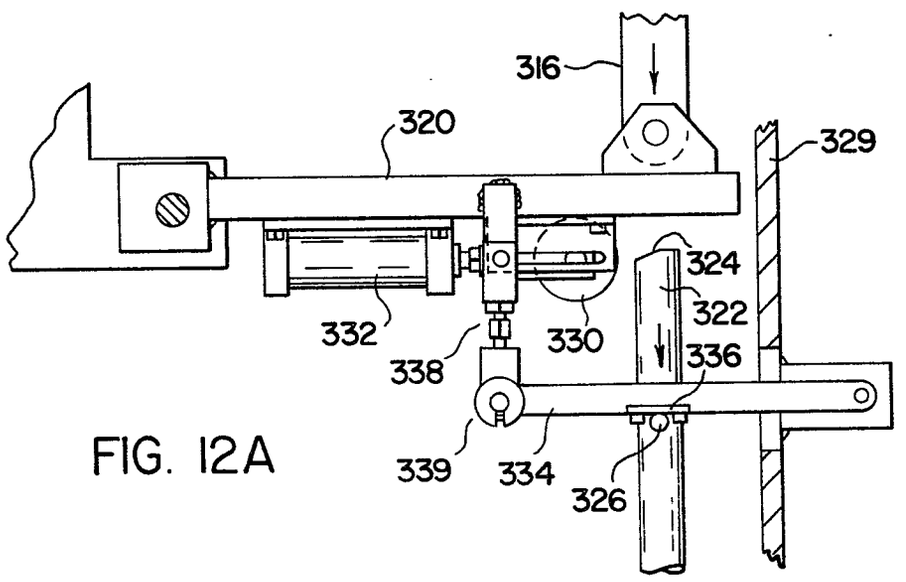
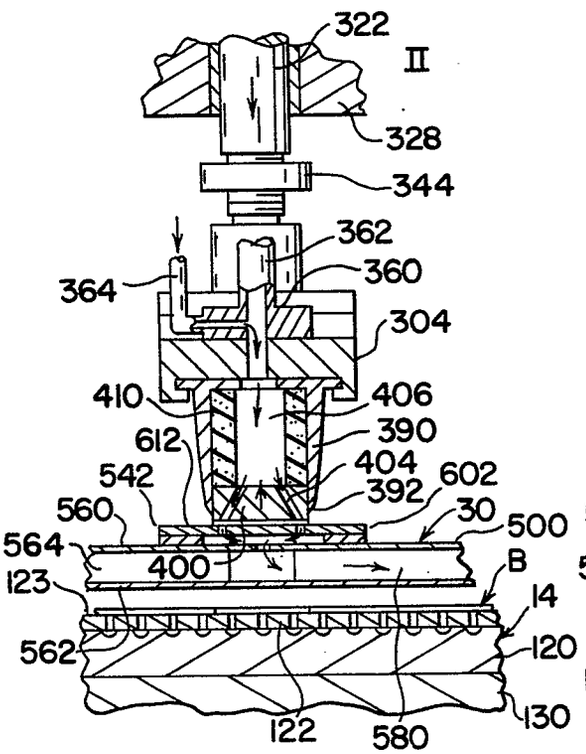


FIG. 12A


322
II
328
344
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500
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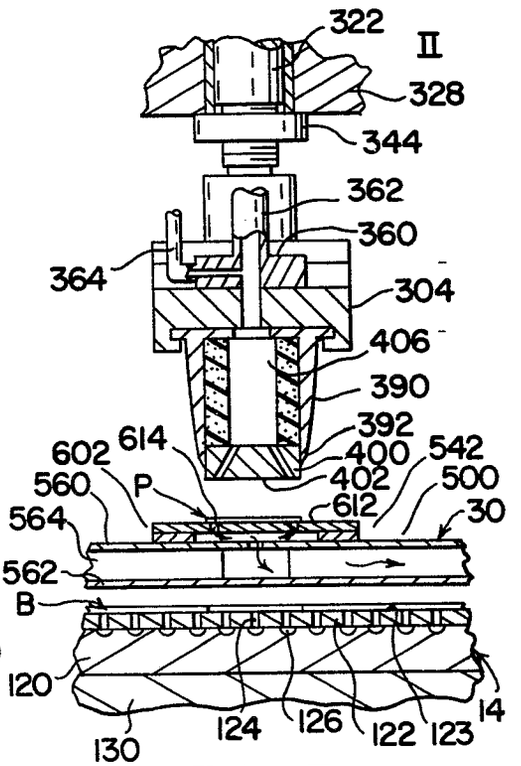
400
B
123
14
562
120
130
122
580

FIG. 12


322
II
328
344
362
360
364
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392
602
614
400
542
560
P
402
500
564
612
30
562
B
120
14
130
124
126
122
123

FIG. 13