(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 045 559**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **81302600.2**

(51) Int. Cl.³: **A 24 C 1/30**

(22) Date of filing: **11.06.81**

(30) Priority: **28.07.80 US 173196**

(43) Date of publication of application:
10.02.82 Bulletin 82/6

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

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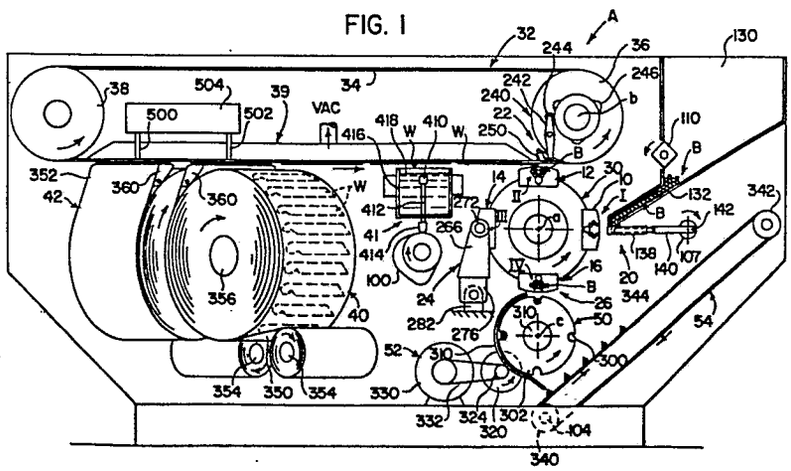
(54) Machine and method for wrapping cigars.

(57) A method and apparatus of wrapping cigar wrappers (W) with leading ends about cigar bunches (B) each having a longitudinal axis, wherein the method and apparatus involves indexing the bunches (B) in succession along a preselected first path by means of a turret (30) having nests (10, 12, 14 and 16), conveying a plurality of successive wrappers (W) on a conveyor (32) along a preselected second path corresponding with the first path at a selected wrapping position II, stopping an indexed bunch at the wrapping position, securing the leading end of one of the wrappers onto the stopped bunch at the wrapping position, rotating the stopped bunch about a fixed axis corresponding with the longitudinal axis of the stopped bunch while the one wrapper is being indexed toward the rotating bunch at least until the one wrapper is wrapped around the stopped bunch and, then, indexing the stopped bunch from the wrapping position while a successive bunch is indexed to the wrapping position for the wrapping operation as previously defined.

FIG. 1



EP 0 045 559 A1

MACHINE AND METHOD FOR WRAPPING CIGARS

The present invention relates to the art of manufacturing cigars and more particularly to an apparatus and method of wrapping cigars.

Our United States Patent Specification No. 4,103,692 and European Patent Applications Nos. 80304450.2 and 80303567.4 relate to automatic cigar wrapping machines and are incorporated by reference herein only for the purpose of general background information.

Background of Invention

The present invention is particularly applicable for wrapping a dual wrapper, or two separate wrappers held in juxtaposition, onto a cigar bunch which is ultimately cut into two separate cigars and it will be described with particular reference thereto; however, the invention has broader applications and may be used for wrapping a single wrapper onto a bunch to be used for a single cigar. In the production of cigars, it is standard practice to provide a spirally wrapped elongated sheet material about a previously formed cigar bunch to produce the normal outer appearance of the cigar to which the public is now accustomed. This elongated sheet material is known as a wrapper and is often formed from a natural tobacco leaf. In some instances, synthetic sheet material having the appearance of a natural tobacco leaf is used as a cigar wrapper to be wrapped around a bunch to produce the desired outer appearance. For many years, the bunches have been wrapped manually by loading a bunch into a nest in which it is rotated and then feeding a single wrapper to the rotating bunch at the wrapping angle to produce a final cigar. This procedure requires substantial manual manipulation of the cigar bunches and also requires a substantial cycle time for each wrapping operation. Because of the low speed and high labor content in these prior wrapping devices, substantial effort has been devoted to automatic wrapping machines wherein the wrappers and bunches are automatically handled and wrapped. Often these automatic machines involve conveying a series of wrappers and bunches through an arcuate wrapping gap wherein the bunches are rotated as

the wrappers progress toward the bunches moving through the wrapping gap. These machines later were improved to incorporate moving nests wherein the bunches were

captured and rotated individually as the bunches progressed through the wrapping gap. In this manner, the wrappers could be pulled from their conveyors around the rotating, translating bunches to provide a tight wrap around the bunches. This concept of a moving nest and a moving wrapper has generally been used in an arcuate wrapping area; however, in Belgium Patent No. 872,750, a machine using this concept and moving the nests in a straight line is illustrated. These prior automatic machines for processing continuously moving bunches and wrappers without manual intervention are continuous in operation so that the bunches and wrappers approach the wrapping areas together at a somewhat uniform speed, which speed is selected for the desired final wrapping operation. By providing the continuously moving bunches and wrappers, relatively low inertia forces are created in the various components and mechanisms utilized in the wrapping machine. Although these machines have obtained wide acceptance in high production manufacturing of cigars, the cost, complexity and production rate have not been completely acceptable to cigar manufacturers who have low production or lower production runs of a particular cigar. Such manufacturers do not have a need for the extremely high speed being developed for automatic cigar wrapping machines. This production speed can be in the neighborhood of two hundred wrapping operations per minute which, in dual cigar bunches, produces four hundred cigars per minute. If such a machine were adopted by smaller manufacturers or used for small run cigars, the machine would remain idle for a prohibitive amount of time. Thus, the main objective of overcoming labor cost by producing high speed cigar wrapping machines would be economically offset by the amount of down time, the initial capital investment and the specialized maintenance personnel required. For these reasons, some cigar manufacturers have not invested in the automatic wrapping machines now being proposed and offered for improvement of the labor overhead in mass production of commercial cigars. These manufacturers have continued to employ the old machinery and wrapping techniques which have a high labor content. There is a substantial need for an automatic wrapping machine that will be relatively inexpensive and will satisfy the need of smaller cigar manufacturers in their quest to reduce labor content in cigar manufacturing cost without prohibitive or economically unjustified

high speed, expensive automatic wrapping machinery.

A preferred embodiment of the present invention provides a fully automatic cigar wrapping machine and method of operating the same which machine and method simplifies the machinery necessary for the wrapping operation and provides less demand on positional requirements of the components in the automatic machine. In the embodiment of the invention, an automatic cigar wrapping machine is provided which employs an intermittent action for both the bunch conveyor and wrapper conveyor so that the wrapper is wrapped about a cigar as it is rotated about a stationary axis. In this manner, the wrapper can be indexed toward the rotating bunch for the wrapping operation while the bunch is held stationary. This greatly simplifies the drive arrangement, synchronization and space criticality of a fully automatic cigar wrapping machine. In accordance with another aspect of the embodiment there is provided an arrangement wherein the inertia forces normally found in an indexing machine are substantially reduced by rotating the bunches in accordance with the indexing speed of the wrapper toward the rotating bunch. In this manner, indexing of the wrapper toward the bunch does not require a constant velocity during the wrapping operation in that there is velocity profile coordination.

In accordance with the preferred embodiment there is provided a machine for wrapping cigar wrappers with leading ends about cigar bunches, each having a longitudinal axis. The machine comprises means for indexing the bunches in succession along a preselected first path, means for indexing a plurality of successive wrappers along a preselected second path corresponding to the first path at a selected wrapping position, means for stopping an indexed bunch at the wrapping position, means for securing the leading end of one of the wrappers onto the stopped bunch at the wrapping position and means for rotating the stopped bunch about a fixed axis corresponding with its longitudinal axis while the one wrapper is being indexed toward the rotating, stopped bunch at least until one wrapper is wrapped around the stopped, rotating bunch.

In accordance with another aspect of the preferred embodiment there is provided a method of wrapping cigar wrappers with leading ends about cigar bunches, each having a longitudinal axis. This

method comprises the steps of indexing the bunches in succession along a preselected first path, conveying a plurality of successive wrappers along a preselected second path corresponding with the first path at a selected wrapping position, stopping an indexed bunch at the wrapping position, securing the leading end of one of the wrappers onto the stopped bunch at the wrapping position, rotating the stopped bunch about a fixed axis corresponding with its longitudinal axis while the one wrapper is being indexed toward the rotating stopped bunch at least until the one wrapper is wrapped around the stopped, rotating bunch and, then, indexing the stopped bunch from the wrapping position while a successive bunch is indexed to the wrapping position. This operation is repeated to wrap each bunch after it has been indexed and stopped at the common wrapping position.

In accordance with another aspect of the preferred embodiment, there is provided an arrangement for indexing the wrappers, which arrangement also rotates the bunches at the wrapping position so that the rotational speed is correlated to the wrapper indexing speed. In this manner, the indexing speed for the wrapper can vary during the wrapping operation while the rotational speed of the bunch being wrapped also varies in the same manner to provide velocity profile coordination.

In accordance with another aspect of the preferred embodiment there is provided an improvement in an apparatus for depositing cigar wrappers at a wrapping angle onto an endless conveyor belt movable in a given longitudinal direction, which apparatus includes a supply spool of parallel wrappers captured by a coiled web, means for unreeling the spool to expose a succession of wrappers on the web and means for transferring the wrappers individually from a web to an endless belt at the wrapping angle at a preselected transfer position. The improvement in this device is the positioning of the wrappers in a direction transverse to the supporting web. The unreeling means directs the supporting web over the conveyor belt at an angle to the longitudinal direction of the belt, which angle corresponds to the wrapping angle. The transferring mechanism includes means for forcing the web and belt together with a wrapper therebetween at the transfer position and means for releasing the wrapper from the web at the transfer position. This aspect of the preferred embodiment relates to a concept wherein the supporting web is

directed at an angle to the conveyor belt so that the transversely disposed wrappers on the web can be directly deposited onto the belt to create a parallel array of wrappers on the belt. This belt is then indexed to a wrapping position where the wrappers will join with rotating bunches. By using this improvement, there is no need for an intermediate transfer mechanism which changes the disposition of the individual wrappers before they are deposited onto the belt from the web. Also, transferring action can be accomplished by a relatively small transfer device having width only substantially greater than the width of an elongated wrapper. The wrapper is released along a direction transverse to the wrapper instead of a direction longitudinal to the wrapper. This provides a more smooth release of the wrapper from the supply or supporting web.

In accordance with another aspect of the preferred embodiment there is provided an arrangement for transferring wrappers to a conveyor belt wherein the web supporting the wrappers can be moved toward a transfer position while the conveyor belt is indexing and the web may be stopped when there is a wrapper available for the next transfer operation. In this manner, empty positions on the wrapper conveyor belt are not caused by gaps in the supply of wrappers from the web of a storage spool.

The primary object of the preferred embodiment is the provision of a machine and method for automatically wrapping elongated cigar wrappers around elongated rotating cigar bunches, which machine and method are fully automatic, require less complicated and less costly mechanisms than prior fully automatic arrangements and employ indexing conveyor systems for both the wrappers and the bunches.

Another object of the preferred embodiment is the provision of a machine and method as defined above, which machine and method are positive in operation, do not require manual intervention and position each bunch and wrapper in a wrapping position or station for individually controlled wrapping.

Still a further object of the preferred embodiment is the provision of a machine and method as defined above, which machine and method involve a single wrapping operation at any given time with other operations of the machine being performed at the same time.

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

FIGURE 1 is a side elevational view showing, somewhat schematically, a cigar wrapping machine;

FIGURE 2 is a side elevational view similar to FIGURE 1 showing the driving arrangements of the machine;

FIGURE 3 is an enlarged partially cross-sectioned, side elevational view showing a drive system of the type to be employed in the structure illustrated in FIGURE 2;

FIGURE 4 is a combined time, velocity and acceleration chart for a single cycle of the machine shown in FIGURES 1-3;

FIGURE 5 is a schematic top, partial view of an endless conveyor employed in the machine; and having superimposed thereon wrapper delivering mechanisms;

FIGURE 6 is a schematic, partial, side elevational view of one of the wrapper transferring mechanisms employed in the machine and schematically illustrated in FIGURE 5;

FIGURE 7 is a view similar to FIGURE 6 illustrating a modification of the wrapper transferring mechanism;

FIGURE 8 is an enlarged, side elevational view illustrating the loading mechanism employed in the machine;

FIGURE 9 is a schematic, side elevational view illustrating an indexable nest contemplated for use in the machine and stopped at the common wrapping station;

FIGURE 10 is a view similar to FIGURE 9 schematically illustrating an indexable nest at the knurling station;

FIGURE 11 is a side elevational view showing a nest similar to the nest of FIGURE 10 at the unloading station;

FIGURE 12 is a partial, schematic diagram illustrating a modification of the machine;

FIGURE 13 is a time, velocity and acceleration graph similar to the graph shown in FIGURE 4 and illustrating an operating characteristic of the modification shown in FIGURE 12; and

FIGURE 14 is a schematic logic diagram and indexing chart for another modification of the machine.

FIGURE 1 shows a machine A for wrapping elongated cigar bunches B with wrappers W, two of which are directed to each bunch B. In accordance with standard cigar making technology bunch B is a dual bunch which is cut into two cigars after wrapping. Bunches B are carried by one of several nests, four of which are shown as nests 10, 12, 14 and 16. Each nest captures a bunch at a common loading station I, rotates the bunch for wrapping at a common wrapping station II, holds the wrapped bunch for mouth piece knurling at station III and moves the wrapped, knurled bunch to a common unloading station IV. Nests 10-16 are identical and are used to capture, index and rotate a bunch. Bunches B are loaded onto a nest at station I by a bunch loading mechanism 20, best shown in FIGURES 1 and 8. A wrapping mechanism 22 performs the wrapping function at common wrapping station II. This mechanism is shown in more detail in FIGURE 9. A mechanism 24 for knurling each end of a bunch B is located at common station III and is shown in FIGURE 10. This mechanism smoothes the flag ends F of the two wrappers W which are wrapped around bunch B at station II. At station IV, an unloading mechanism 26 unloads a wrapped, knurled dual cigar for subsequent cutting and removal from machine A. Individual bunch receiving nests 10-16 are supported onto a turret 30 which is indexable about axis a by an appropriate mechanism, such as the mechanism shown in FIGURE 3. Turret 30 indexes each of the nests in succession between common stations I-IV for processing of a bunch. Timed with respect to the indexed movement of turret 30 there is provided an indexing conveyor 32 for wrappers W. This conveyor includes a perforated belt 34 entrained around driven drum 36 rotatable on axis b and idler drum 38. Drum 36 is indexed by the mechanism schematically illustrated in FIGURE 3 in timed relationship with the index movement of turret 30 in a manner which will be described in more detail. A vacuum box 39 on the inboard side of perforated belt 34 is used to capture and hold wrappers W onto the lower run of belt 34 as the belt is indexed from the left to right in FIGURE 1. During this conveying operation, wrappers W, each of which includes a standard

tuck end T and flag end F as shown in FIGURE 5, are indexed to a position above adhesive applicator 41. At this position, the applicator applies an adhesive to ends F and T of both wrappers W being indexed together as shown in FIGURE 5. When the wrappers are indexed to the common wrapping station II, the tuck ends are raised by a tuck lifting mechanism, which will be described later and is included generally in wrapping mechanism 22. To deliver the wrappers to belt 34 there are provided two wrapper supply spools 40, 42, which are used for transferring the wrappers directly to the lower surface of belt 34 in accordance with a novel concept which will be explained later in connection with FIGURES 5 and 6. After turret 30 has processed a bunch, it is released from one of the nests 10-16 and dropped onto a transfer wheel or spider 50 which is indexed about axis c by the indexing mechanism for turret 30 in a manner to be described later. A cigar mechanism 52 is positioned with respect to transfer wheel 50 for cutting bunch B into two separate cigar halves as illustrated in FIGURE 11. Thereafter, two cigars are deposited by wheel 50 onto conveyor 54 where they are transferred from machine A for subsequent processing. As can be seen, machine A incorporates indexing nests 10-16 which bring a bunch to the wrapping station where a companion wrapper indexing conveyor or carrier 32 indexes the wrapper to the wrapping station for the wrapping operation which is accomplished by rotating a bunch B about its longitudinal axis after the tuck end of a wrapper has been lowered and secured to the outer surface of the bunch. The details of this wrapping operation will be apparent from the following description of the various components forming machine A.

Drive Mechanism (FIGURES 2-4)

As previously described, a bunch B is indexed from loading station I to the wrapping station II where it is stopped. The stopped bunch is then rotated after tuck end or leading end T of a wrapper is adhered to the outer surface of the stopped bunch. As the bunch is rotated about a fixed axis corresponding to its longitudinal axis x, the secured wrapper is advanced by belt 34 toward the rotating bunch. The relative speed of the advancement of the wrapper and the rotation of the bunch determines the amount of tension applied to the wrapper during the wrapping operation. As shown in FIGURE 5, two wrappers W are supported on belt 34 in a generally chevron shape with tuck ends T extending in the

direction of movement indicated by the arrow. The chevron is formed by two of the wrappers W being disposed on belt 34 at a wrapping angle wa, which is determined by the desired spiral configuration of the wrappers on a bunch. Consequently, the rotating bunch peels the two adjacent wrappers from belt 34 as the belt is being indexed past wrapping station II. This operation occurs after each indexing of a loaded nest to the common wrapping station or location. To perform the wrapping function, together with the rotation of several components in machine A, there is provided a drive system which, in the preferred embodiment, takes the form of the drive arrangement schematically illustrated in FIGURES 2 and 3.

Referring now more particularly to FIGURE 3, a two shaft indexing mechanism 60, in practice a Camco indexer, is provided with coordinated indexing shafts 62, 64, labeled N and C respectively. Shaft 62 is indexed in 90° increments about axis a and shaft 64 is indexed approximately 90° about axis b. As schematically illustrated in FIGURE 3 an input drive shaft 66 is used to rotate indexing mechanisms 70, 72 in a manner that shafts N, C are indexed 90° successively in a manner illustrated in FIGURE 4. A worm gear drive mechanism or transmission 80 is driven at a constant speed by D.C. motor 82. The speed of motor 82 is controlled by silicon controlled rectifiers and has a rating of 1.5 horsepower. Gear drive 80 rotates shaft 66 which indexes shafts 62, 64 during each 1.2 seconds as indicated in FIGURE 4. Shaft 66 also rotates sprocket 84 to drive a chain 86 which rotates a counter-shaft 90 having a sprocket 92. This sprocket continuously drives chain 94 around the path shown by a phantom line in FIGURE 2. The speed ratio between shaft 66 and shaft 90 is selected so that shaft 90 rotates fifty revolutions per minute. In the preferred embodiment of the invention, machine A cycles fifty times per minute to produce one hundred cigars per minute. Consequently, shaft 90 can control the timing of various components on machine A to correspond with the indexing cycle of turret 30 and wrapper conveyor or carrier 32. As shown in FIGURE 3, operating cam 100 of adhesive applicator 41 is secured to shaft 90. Thus, cam 100 cycles fifty times per minute. Chain 94 coordinates various other devices to operate in sequence with the applicator; however, this coordination may or may not be required according to the particular characteristics of the various devices being

rotated. As shown in FIGURE 2, chain 94 rotates driving element 102 fixed at common wrapping station II, best shown in FIGURE 9. Thus, driving element 102 rotates at a speed per minute determined by the relationship of the diameters of sprocket 103 and sprocket 92. In a like manner, chain 94 rotates sprocket 104 which is the main drive sprocket for exit conveyor 54 so that the speed of the conveyor is synchronized with the other rotating components of machine A. Sprocket 106 is the main drive sprocket for loading mechanism 20 and is used to rotate wheel 107 at a ratio which will feed a single bunch into a nest at location I. To agitate the bunches in a supply hopper, a sprocket 108 drives an agitator 110. Idler sprocket 112 produces the desired wrapping arcs for chain 94 as it extends about various driven sprockets, as shown in FIGURE 2. A timing belt 120 indexes transfer wheel 50 about axis c in unison with the indexing of turret 30. This description illustrates the drive arrangement for various components on machine A. The transfer mechanism for wrappers W may be driven by chain 94, by a connection, not shown. It will be apparent that the cigar cutting mechanism and wrapper supplying spools have independent drive mechanisms which will be described in connection with these particular components of mechanism A.

Referring now to FIGURE 4, the relationship between the indexing of turret 30 and wrapper conveyor 32 is schematically illustrated. A cycle, in the preferred embodiment, is 1.2 seconds. Curve C is a velocity curve for conveyor 32. The dashed curve N is the velocity curve for the indexing turret 30. After approximately .1 seconds, the turret is stopped with a bunch located at wrapping station II. Thereafter, belt 34 has a constant velocity until approximately .6 seconds. This constant velocity is shown in the portion of curve C labeled WRAP in FIGURE 4. Thus, as a nest is stopped, belt 34 moves past the nest at a constant velocity for a time at least equal to the time to wrap a selected wrapper. At the same time, the bunch is being driven at a constant velocity by chain 94 as previously described. Thus, a constant velocity of the wrapper being wrapped and a constant rotational velocity of the bunch being wrapped are obtained. The differential between the two velocities determines the amount of stretch applied to the wrapper during the wrapping operation. In practice, this is approximately 3%. As can be seen in FIGURE 4,

the acceleration of the belt and its drive mechanism is quite high in order to bring the belt to a constant velocity and then back to a stopped position for each index movement of the belt, which movement occurs between zero and .7 seconds in the cycle length. As will be explained later, in accordance with another aspect of the embodiment, the velocity of the belt during the wrapping operation may be varied if the rotational velocity of the bunch within the nest at the wrapping station is varied with a matching or coordinated velocity profile. Curve N is the velocity curve for turret 30. As is shown in FIGURE 4, the turret is stationary during the WRAP portion of a cycle. After this, the turret immediately begins to accelerate until it reaches a constant velocity which is maintained until the end of the cycle. During the start of the next cycle turret 30 is stopped and belt 34 is started. Belt 34 increases in velocity while turret 30 decreases in velocity. These relationships can be controlled by indexer 60 as previously described. The indexing relationship between the wrapper conveyor and the turret can be obtained by various drive arrangements, only one of which is illustrated in FIGURE 3.

Bunch Loading (FIGURES 1 and 8)

When turret 30 is in an indexed position, such as shown in FIGURE 1, a bunch B is loaded onto the nest at common loading station I. In this illustration, nest 10 as shown schematically in FIGURE 8 is in the loading position I. Bunch loading mechanism 20, in the preferred embodiment of the invention, includes hopper 130 having an angled chute 132. Bunch agitator 110 is rotated as previously described, which aligns and feeds bunches B, in succession, through chute 132. Below the chute there is provided a feed bar 134 which is reciprocated in an elongated slot 136 of housing 138. When the bar is retracted, a bunch B drops into slot 136 for feeding into nest 10 by forward movement of bar 134. The timed movement of bar 134 is effected by link 140 connected to pin 142 of the constantly rotating wheel 107. Pin 142 is eccentric and causes the reciprocated movement of link 140, which is pivotally mounted to bar 134 by pin 135. Thus, in a timed fashion, bar 134 pushes a bunch toward nest 10. Nest 10 is the same as nests 12-16 and has a somewhat standard design. Consequently, the nests are only schematically illustrated in the drawings as including bunch engaging, elongated, serrated rolls or

rods 160, 162, 164 and 166 connected to appropriately meshed gears driven by pinion gear 170 which is the driven element for the nest. Rotation of gear 170 causes rotation of rolls 160-166 and thus rotation of a bunch B captured within the nest. In FIGURE 8, there is schematically illustrated intermediate gears 172, 174 for causing the elongated bunch engaging rolls or rods to rotate in the same direction. Also, gears 172, 174 allow outward pivoting movement of rolls 160, 162 for opening nest 10 to allow loading and unloading of a bunch. As can be seen in FIGURES 9 and 11, rolls or rods 160, 162 have central gap 168 which provides clearance for the tuck lifter during the wrapping operation and for the cutting mechanism 52. Push rods 180, 182 are interconnected with the support structure of rolls 160, 162 so that inward movement of the push rods opens rolls 160, 162. To accomplish this, loading station I and unloading station IV each includes reciprocal rams 184, 186. When these rams are moved toward a nest, they engage the push rods for opening rolls 160, 162. In some instances, only one of the rolls may be opened. In addition, a cam at the loading and unloading position can be used to reciprocate push rods 180, 182.

In practice, when a nest, such as nest 10, is indexed to the loading position, rams 184, 186 open rolls 160, 162. In a timed fashion, link 140 drives bar 134 forward. This opens cover 154 of a shutter 150 pivoted on housing 138 at pin 152. As cam pin 158 moves over cam surface 156, shutter 150 moves downwardly as shown in FIGURE 8 and a bunch B is pushed by bar 134 into the nest. Thereafter, rods 160, 162 are released by retracting rams 184, 186 and bar 134 is withdrawn. This captures a bunch within the nest to accomplish the loading operation which occurs after each index of turret 30.

Wrapping (FIGURES 1, 5 and 9)

When a station is indexed and stopped at the wrapping station II, a captured bunch B is rotated by rods 160-166 about a fixed axis corresponding to the longitudinal axis x of the bunch, as shown in FIGURE 9. To accomplish this, driven element 200 is secured onto gear 170 and moves with the nest. A clutch 202 selectively engages rotatable driving element 102 with driven element 200 so that gear 170 is rotated by sprocket 103 driven by timing chain 94. At the wrapping station, standard header

blocks 204, 206 are selectively shifted inwardly into their operative position around the mouth ends of bunch B by an appropriate mechanism, schematically illustrated as solenoids 210, 212, respectively. Of course, a camming arrangement or other arrangement could be used for shifting the blocks into their operative position after a nest has been indexed into the wrapping position at station II. The blocks center bunch B and assist in forming the flag ends F around the ends of bunch B. To control the final reverse flag wrap, conical flag wheels 220, 222 are shifted into operative position with respect to bunch B by any mechanism, schematically illustrated as solenoids 224, 226, respectively. Thus, a nest is indexed into the position shown in FIGURE 9. Thereafter, header blocks 204, 206 are moved inwardly into their operative position and clutch 202 engages elements 102,200. In this manner, bunch B is rotated at a constant velocity. It is necessary to connect tuck ends T of two wrappers onto bunch B. To do this, belt 34, including a plurality of vacuum directing perforations 230, is provided with a series of longitudinally spaced clearance slots 232. Each set of slots 232 is spaced from the next set by the indexed distance of belt 34 which is indicated in FIGURE 5. These slots coincide with the tuck ends or leading ends T of the two wrappers W. At wrapping station II, a tuck lifter 240 is provided. A variety of known structures could be used for lifting the tuck ends of the wrappers from belt 34 and forcing them against the outer surface of bunch B. In the illustrated embodiment of the invention, a rocker arm 242 includes an upper roller 244 operated by evenly spaced cam lobes 246. A pivoted lifter 250 having two downwardly extending fingers or ribs which will extend through slots 232 is pivoted by rocker arm 242 at the start of the wrapping cycle so that tuck ends T are secured to the outer surface of bunch B near its mid-point. As will be described later, applicator 41 places an adhesive onto the downwardly facing portion of the tuck ends to facilitate the bunch securing action. After the tuck ends have been secured, bunch B continues to rotate while belt 34 indexes across the top of the nest. The indexing speed is slightly less than the surface speed of the rotating bunch so that there is a slight amount of tension applied to the wrappers as they are wrapped spirally in opposite directions around the rotating bunch. As the flag ends F reach header

blocks 204, 206, the header blocks form the flags about the two mouth ends of bunch B. At an appropriate time, flag wheels 220, 222 are moved downwardly to change the direction of wrapping of the flag end to smooth out the wrapping operation in accordance with standard practice in automatic wrapping machines. In practice, the indexing distance of belt 34 as shown in FIGURE 5 is greater than the distance required for the wrapping operation so that the belt can be driven at a constant velocity during the wrapping operation and stopped thereafter. Also, by providing a certain amount of over travel in the indexing distance, the length of the wrapper can be varied and complete wrapping is assured. It is possible to use a single wrapper instead of two wrappers as shown in the preferred embodiment. In this instance, a bunch having the desired length of a cigar could be used without requiring subsequent cutting. It is possible to use a synthetic wrapper wherein the two wrappers W are secured together in a continuous chevron shape having an outline corresponding to the two wrappers formed into a chevron in FIGURE 5. In some instances, it may be advisable to provide an elongated wrapper which is wrapped continuously around a long bunch having two spaced mouth ends. Thereafter, the bunch is separated into two cigars. In this instance, since a single wrapper is used, one cigar is wrapped tightly while the other is overwrapped. An adhesive is applied along at least a majority of the length of the wrapper being wrapped in an overwrapped fashion. This prevents unraveling of the cigar wrapped during smoking. Other wrapping elements could be fixed at station II.

Knurling (FIGURE 10)

In accordance with standard practice, automatic wrapping machines include knurling heads for smoothing out the mouth ends of the cigar covered by the flag ends of the wrappers. A variety of structures could be used in the present invention to accomplish this standard operation. In accordance with the illustrated embodiment of the invention, knurling mechanism 24, as shown in FIGURE 10, includes spaced knurling heads 260, 262 supported on plates 264, 266, respectively. Motors 270, 272 secured also onto plates 264, 266 are used to rotate heads 260, 262 when they are in contact with the opposite mouth ends of bunch B. To move the heads inwardly, plates 264, 266 are supported on mounting brackets 274, 276 reciprocated by appropriate

mechanisms, schematically illustrated as solenoids 280, 282. After indexing, rotating heads 260, 262 are moved inwardly into engagement with the mouth ends of bunch B to knurl the mouth ends.

Unloading and Cutting (FIGURES 1 and 11)

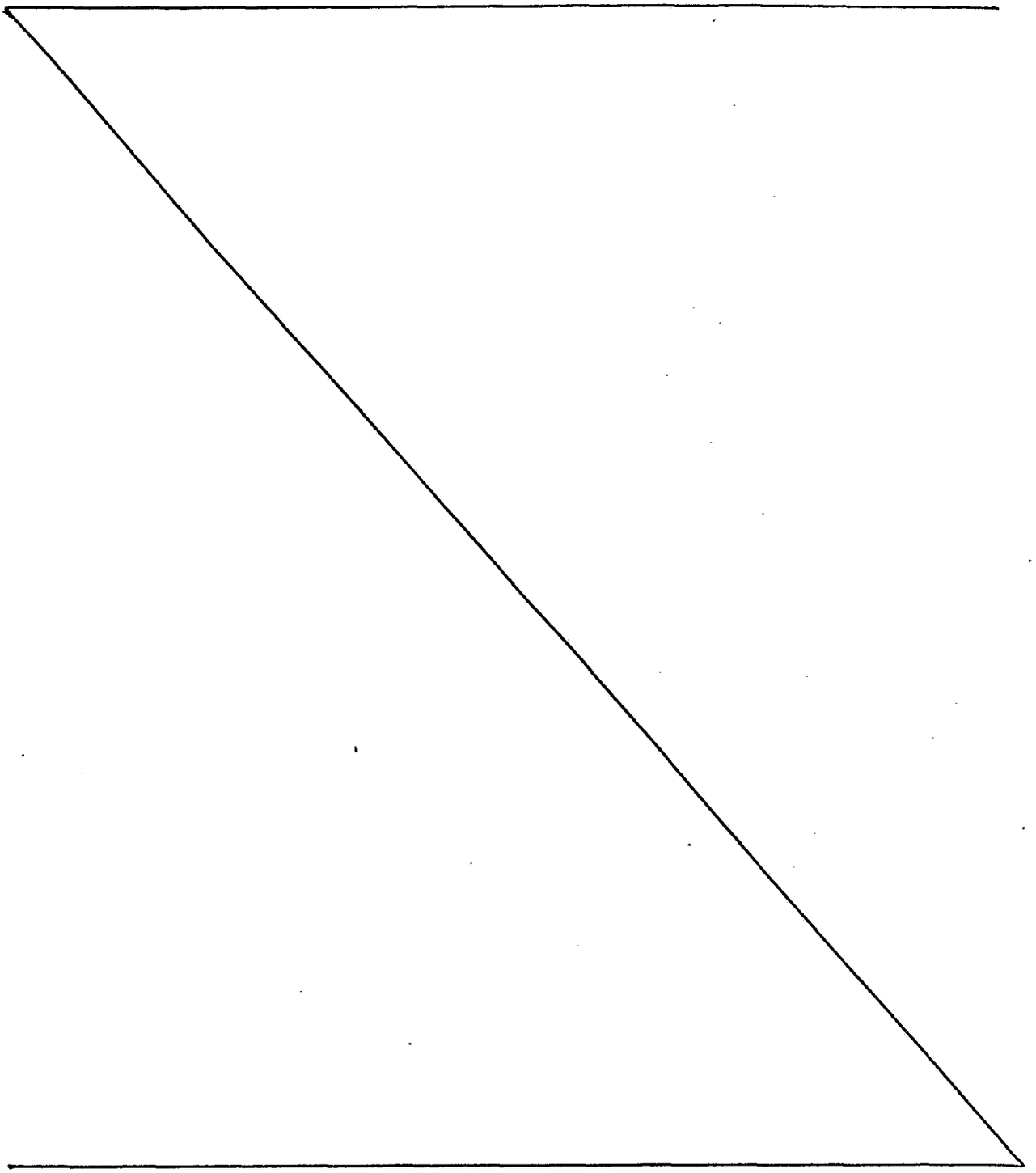
After the cigar bunch has been wrapped and knurled, it is transferred from the nest to the transfer wheel or spider 50 at unloading station IV. Rams 184, 186 open rods 160, 162 to allow the bunch to be dropped into circumferentially spaced nests 300 on wheel 50. The nests are defined by recesses in axially spaced plates 302, 304 rotatably mounted on shaft 310. As previously described, wheel 50 is indexed in unison with turret 30. Thus, an empty nest 300 is below station IV after each index movement of the turret. During indexing action, guides 310, 312 hold the bunches on wheel 50 until a nest 300 is at the lower portion above conveyor 54. Then guides 310, 312 direct a bunch dropped from wheel 50 onto exit conveyor 54. During the indexing action, bunch B is cut in its center to define two separate cigars. To accomplish this, cutting mechanism 52 includes circular knives 320, 322 rotatably mounted on shaft 324 and constantly driven by an electric motor 330 through a belt 332, as shown in FIGURE 1. Thus, two cigars are dropped from wheel 50 onto conveyor 54. To accept these cigars, the conveyor is driven in a timed relationship by sprocket 104 attached to a drive drum 340. Idler drum 342 guides the conveyor which includes outwardly extending shoulders 344. These shoulders are spaced on the conveyor behind a pair of cigars that are dropped from wheel 50. After the dropping action, the two cigars ride down the inclined conveyor until they are engaged by a shoulder 344 for conveying of the cigars from machine A. Of course, other exiting arrangements could be used for removing and cutting the cigars. The cutting action could take place while the cigars are still in one of the nests 10-16 on turret 30.

Wrapper Transporting (FIGURES 1, 5, 6 and 7)

As previously discussed in connection with FIGURE 5, wrappers W are secured onto indexing belt 34 at spaced locations matching the indexing distance for the belt. In accordance with another aspect of the embodiment the wrappers are deposited onto the belt by angularly disposed spools 40, 42. Each of these spools contains a series of parallel wrappers W trapped between convolutions

in the supporting web material forming the spool, through which web material a vacuum can be transmitted to the wrappers. Such supply spools are often used in cigar wrapping machines. In this embodiment of the invention, the wrappers are positioned transversely of the web which means that they are perpendicular to the directions m, n of movement of the webs during the unwinding and wrapper removing operations. Webs 350, 352 of the spools 40, 42 are moved along directions m, n, which allows the wrappers W to be deposited directly onto the under surface of belt 34 at the wrapping angle. Thus, the angular relationship between directions m, n is correlated with the wrapping angle wa and the alignment of the wrappers on support webs 350, 352. Spools 40, 42 are generally the same and are indexed by a central shaft 354 of a take-up spool. Rotation of spools 40, 42 is about a support shaft 356 so that webs 350, 352 follow the pattern shown for web 350 in FIGURE 6. Pinch rolls 355 can be used to give the web constant linear speed. This pattern allows a direct transfer from the webs onto the vacuum capturing surface of belt 34. To accomplish this direct transfer, which means a surface to surface transfer, vacuum shoe 360 having a selectively controlled vacuum line 362 is pivoted by a link 364 supported by a pin 366 on a rotating wheel 368. This wheel is rotated by chain 94 in a manner not shown. Shoe 360 has an upwardly facing transfer surface 400 which engages the under surface of belt 34 when shoe 360 is pivoted upwardly by link 364. Vacuum box 39 has a constant vacuum and includes an outwardly facing belt support plate 401 having large vacuum communicating openings 402. After transfer surface 400 brings a wrapper W against the lower surface of belt 34,vacuum is removed from surface 400. Thus, the wrapper is transferred to and captured on belt 34. Thereafter, the belt is indexed and shaft 354 indexes spool 40 to bring another wrapper W onto the downwardly pivoted transfer surface 400 for a subsequent transferring operation. The spools 40, 42 in Figure 5 are schematic in nature and are used only to show the relative disposition of wrapper W on webs 350, 352 as they are transferred onto the under surface of belt 34. After the wrappers have been captured by the under surface of belt 34, the belt is indexed to bring tuck ends T to

a position directly above a pad 410 of adhesive applicator 41. This pad is reciprocated by a rod 412 having a lower cam follower 414. Container 416 contains a liquid adhesive having an upper layer 418. Rod 412 is first moved by the cam to a



position with pad 410 above level 418. Adhesive drains from pad 410. Thereafter, the high portion of cam 100 moves pad 410 upwardly into engagement with ends F and T of the wrappers above pad 410. This applies the desired amount of adhesive to the ends preparatory to subsequent winding at common winding station II. Other arrangements could be provided for dabbing or applying adhesive to ends F and T preparatory to such wrapping.

Referring now to FIGURE 7, a modification of the structure shown in FIGURE 6 is illustrated wherein shoe 420 is stationary and includes a selectively controlled vacuum line 422. Above stationary transfer surface 423 there is provided a movable vacuum box 424 reciprocally mounted in guides 426 and having a vacuum line 428. Cam 430 forces box 424 downwardly so that belt 34 engages a wrapper W supported on fixed transfer surface 423. Cam 430 operates push rod 432 and is driven by an indexing motor or other drive arrangement 434 to provide the periodic reciprocation of box 424 to allow transfer of the angularly disposed wrappers onto belt 34 without reciprocation of the vacuum shoe. Other arrangements could be provided for transferring wrappers to belt 34 in a direct fashion so that the angular disposition of spools 40, 42 dictates the ultimate angular relationship of wrappers W supported on the lower surface of perforated, indexable belt 34.

Velocity Profile Coordination (FIGURES 12 and 13)

In the preferred embodiment of the invention, bunch B is rotated at a fixed velocity as a wrapper is indexed at a constant velocity for the wrapping operation at station II. As shown in FIGURE 4, this provides relatively high acceleration forces for indexing conveyor 32. To reduce these forces and in accordance with a modification of the embodiment, the drive arrangement for belt drum 36 is used to rotate a nest driving element schematically illustrated as dashed line 450 and stationary at station II. This element is driven directly through a transmission 452 having an input 454 driven by drum 36 or its drive mechanism, such as shaft 64 of FIGURE 3. The ratio of transmission 420 is adjusted to select the desired amount of stretch by any arrangement schematically illustrated as box 456. A clutch 460 engages the driving element 450 at station II with driven element 200 carried by an indexing nest. Element 200 moves with the nest 12 and is used to rotate gear 170. By using this arrangement, the velocity

profile of gear 170 is matched with the velocity profile of drum 36. Thus, as shown in FIGURE 13, curve C can have a variable speed during the wrapping cycle between .1 seconds and .6 seconds. Since belt 34 during its indexing operation need not have a constant velocity, the conveyor acceleration curve is somewhat flat as indicated in the lower portion of FIGURE 13. The velocity profile of the rotating bunch B driven by clutch 460 matches curve C in FIGURE 13. Thus, the only differential between the surface speed of the bunch and the advancing indexing speed of the wrapper is the amount of stretch programmed into transmission 452. Other arrangements could be used for accomplishing this goal. Curve N could also have a variable speed profile to reduce acceleration and deceleration of turret 30 during indexing.

Compensation for Missing Wrapper (FIGURES 1, 5 and 14)

In some instances, wrappers on spools 40, 42 are missing or there is a space on the web which is greater than the normal spacing between wrappers. Machine A incorporates a mechanism for sensing this condition and bringing the wrapper to transfer position shown in FIGURE 5 before the wrapper transfer operation is initiated. As shown in FIGURE 4, belt 34 is stopped for 0.5 seconds. This time is used to transfer the two wrappers W. As the belt is moving, spools 40, 42 are driven to bring the next wrapper to the transfer position. A variety of structures could be used to make sure that the spools are driven until a wrapper is present, instead of being driven for only a selected distance which should present a wrapper to the transfer position. In the illustrated embodiment vacuum sensors 500, 502 extending from a standard vacuum sensor control box 504 are positioned at the wrapper transfer positions or locations, as schematically illustrated in FIGURES 1 and 5. When sensor 500 senses the existence of a wrapper, spool 40 is stopped. In a like manner, when sensor 502 senses the existence of a wrapper, spool 42 is stopped. The advancing operation of the spools takes place during the indexing of belt 34 so that the wrappers are in position for transfer when the belt ultimately stops at the end of an index movement in a cycle. In the preferred embodiments, the indexing cycle is fixed; therefore, the spools are stopped when a transfer is to take place even if a wrapper is not in place. This should occur only infrequently.

The circuit in FIGURE 14 shows a modification wherein the next index cycle is initiated after there is a wrapper at each of the two transfer positions. To accomplish this, a variety of circuits could be used. In the illustrated embodiment, lines 500a, 502a represent the activated outputs of sensors 500, 502, respectively. These outputs are directed to an AND gate 510 having an output when both sensors have been actuated. This output toggles OR gate 512 to produce a logic 1 at the input of gate 520. If conveyor 32 is stopped, the other input to gate 520 is inverted to produce a logic 1. Thus, circuit 522 indicates that machine A can be cycled in accordance with its normal fashion. A reset timer 514 is reset after an index cycle of conveyor 32. If the timer times out before gate 510 allows a new cycle, light 515 is actuated indicating that there may be difficulties with respect to the supply of wrappers. Timer 514 triggers gate 512 to allow cycling of the machine A. As shown in the lower graph, after belt 34 has been indexed, it awaits a signal from gate 512 to initiate or allow the next index movement. Using the modification illustrated in FIGURE 14, it is necessary to change the driving mechanisms of machine A so that timing of chain 94 is coordinated with the index.

CLAIMS:

1. A machine for automatically wrapping elongated cigar wrappers spirally around elongated cigar bunches at a preselected wrapping angle, each of said wrappers having a leading end and each of said bunches having a central axis, said machine comprising: a plurality of bunch receiving nests, each of said nests including means for capturing a bunch in said nest and means for rotating said captured bunch about its central axis, means for indexing said nests together in a closed path with said nests following each other successively from a common loading station, to a common wrapping station, to a common unloading station and back to said common loading station; means for conveying to said common wrapping station a succession of wrappers disposed in parallel relationship and at said wrapping angle; means for applying an adhesive to said leading ends of said wrappers being conveyed; means for securing a leading end of a conveyed wrapper onto a rotating bunch at said wrapping station; and means for actuating said bunch rotating means at least after said wrapper is secured and while said conveying means is moving past said wrapping station whereby said wrapper is pulled from said conveying means and wrapped about said rotating bunch.

2. A machine as defined in claim 1, wherein said bunch rotating means includes a rotatable driven element carried by each of said indexing nests, a common, rotating driving element at said wrapping station and said actuation means includes means for coupling said driven element on said nests and said common driving element at said wrapping station.

3. A machine as defined in claim 1 or 2, including means indexing said conveying means past said wrapping station after a given nest has been indexed to said wrapping station whereby a wrapper is wrapped onto a bunch

in said given nest.

4. A machine as defined in claim 1 or 2, including means for indexing said conveyor means past said wrapping station as a wrapper is being wrapped about a bunch at said wrapping station.

5. A machine as defined in claim 3 or 4, when appended to claim 2 including connecting means for driving said driving element of a nest by said means for indexing said conveying means.

6. A machine as defined in claim 5, wherein said conveyor indexing means includes means for indexing said conveyor means at a variable velocity during wrapping of a wrapper around the bunch at said wrapping station.

7. A machine as defined in claim 3 or 4 when appended to claim 2 including means for rotating said driven element by said means for indexing said conveyor means whereby said bunch is rotated at a velocity corresponding to the indexing velocity of said conveyor means.

8. A machine as defined in claim 2 or 3 or 4 when appended to claim 2 including drive means for rotating said driving element continuously.

9. A machine as defined in claim 8, wherein said drive means includes means for rotating said driving element at a generally constant velocity.

10. A machine as defined in any one of the preceding claims, wherein said conveying means includes an endless belt carrying said parallel wrappers,

11. A machine as defined in claim 10, including means

for depositing said wrappers onto said endless belt, said depositing means including a supply spool of parallel wrappers captured by a coiled web, means for unreeling said spool to expose a succession of said wrappers on said web and means for transferring said wrappers individually from said web to said endless belt at said wrapping angle at a transfer position.

12. A machine as defined in claim 11, wherein said wrappers are transverse to said web, said unreeling means directs said web to said endless belt at said wrapping angle, and said transferring means transfers said wrappers directly from said web to said endless belt.

13. A machine as defined in claim 11 or 12, including means for driving said unreeling means with said web carried wrappers moving toward said transfer position and sensing means for stopping said drive means when a wrapper is at said transfer position.

14. A machine for depositing cigar wrappers at a wrapping angle onto an endless conveyor belt movable in a given longitudinal direction, said machine including a supply spool of parallel wrappers captured by a coiled web; means for unreeling said spool to expose a succession of said wrappers on said web; and, means for transferring said wrappers individually from said web to said endless belt at said wrapping angle at a transfer position, characterised by said wrappers being transverse to said web, said unreeling means directing said web over said belt at an angle to said longitudinal direction corresponding to said wrapping angle and said transferring means includes means for forcing said web and belt together with a wrapper therebetween at said transfer position and means for releasing a wrapper from said web at said transfer position and means for releasing a wrapper from said web at said transfer position.

15. A machine as defined in claim 14, including means for driving said unreeling means with said web carried wrappers moving toward said transfer position and sensing means for stopping said drive means when a wrapper is at said transfer position.

16. A machine for wrapping an elongated wrapper spirally around an elongated bunch having a central axis, said machine comprising: carrier means for supporting a number of spaced, parallel cigar wrappers; means for indexing said carrier in a given direction along a given path at a selected indexing velocity; a plurality of bunch supporting nests, a carrier for said nests; means for indexing one of said nests with a bunch therein to a wrapping position on said given path; means at said wrapping position for rotating a bunch in said one nest as said wrapper carrier is indexed past said wrapping position; and means for securing a wrapper on said carrier onto said rotating bunch whereby said wrapper is wrapped onto said rotating bunch and is pulled from said indexing wrapper carrier.

17. A machine as defined in claim 19 wherein said bunch rotating means is driven by said carrier indexing means and said indexing velocity is variable as said wrapper is being wrapped onto said rotating bunch.

18. A machine as defined in claim 16 or 17, wherein said bunch rotating means includes a driven element movable with said nests, a rotatable driving element secured at said wrapping position and means for coupling said driving element with a driven element of a nest indexed into said wrapping position.

19. A method of wrapping cigar wrappers with leading ends about cigar bunches, each having a longitudinal axis, said method comprising the steps of:

(a) indexing said bunches in succession along a preselected first path;

(b) conveying a plurality of successive wrappers along a preselected second path corresponding with said first path at a selected wrapping position;

(c) stopping an indexed bunch at said wrapping position;

(d) securing the leading end of one of said wrappers onto said stopped bunch at said wrapping position;

(e) rotating said stopped bunch about a fixed axis corresponding with said longitudinal axis of said stopped bunch while said one wrapper is being indexed toward said rotating stopped bunch at least until said one wrapper is wrapped around said stopped, rotating bunch;

(f) then, indexing said stopped bunch from said wrapping position while a successive bunch is indexed to said wrapping position; and,

(g) repeating steps (c), (d), (e) and (f) successively.

20. A method as defined in claim 19 including the additional step of rotating said stopped bunch at a variable velocity corresponding to the velocity at which said one wrapper is indexed toward said wrapping position.

21. A machine for wrapping cigar wrappers with leading ends about cigar bunches, each having a longitudinal axis, said machine comprising: means for indexing said bunches in succession along a preselected path; means for indexing a plurality of successive wrappers along a preselected second path corresponding with said first path at a selected wrapping position; means for stopping an indexed bunch at said wrapping position; means for securing the leading end of one of said wrappers onto said stopped bunch at said wrapping position; and means for rotating said stopped bunch about a fixed axis corresponding with

said longitudinal axis of said stopped bunch while said one wrapper is being indexed toward said rotating stopped bunch at least until said one wrapper is wrapped around said stopped, rotating bunch.

22. A machine as defined in claim 21 wherein said bunch rotating means includes a driven element movable with said stopped bunch; a driving element fixed at said wrapping position; means fixed at said wrapping position for rotating said driving element; and means for coupling said elements in driving relationship at said wrapping position.

23. A machine as defined in claim 22 including drive means for driving said wrapper indexing means and means for driving said driving element by said drive means whereby said bunch is rotated at a velocity corresponding to the indexing velocity of said one wrapper.

24. A machine for depositing cigar wrappers at a wrapping angle onto an endless conveyor belt movable in a given longitudinal direction, said machine including a supply spool of parallel wrappers captured by a coiled web; means for unreeling said spool to expose a succession of wrappers on said web; and, means for transferring wrappers individually from said web to said endless belt at a transfer position, characterised by means for indexing said belt; sensing means for stopping said unreeling means when a wrapper on said web is at said transfer position; and, means for starting said belt indexing means after said unreeling means has been stopped.

25. A machine for wrapping an elongated cigar wrapper with a leading end spirally around an elongated cigar bunch having an elongated axis, said machine comprising

nest means for capturing and rotatably mounting said bunch for rotation about its axis, said nest means including a driven element for rotating said bunch upon being rotated; drive means at a given location for rotating a drive element at said location; means for moving said nest means to and from said location; means for connecting said drive element and said driven element only when said nest means is at said location; means for conveying a wrapper to said location at a wrapping velocity; and means for securing said leading end of said wrapper to said bunch preparatory to wrapping by rotation of said bunch by said driven element.

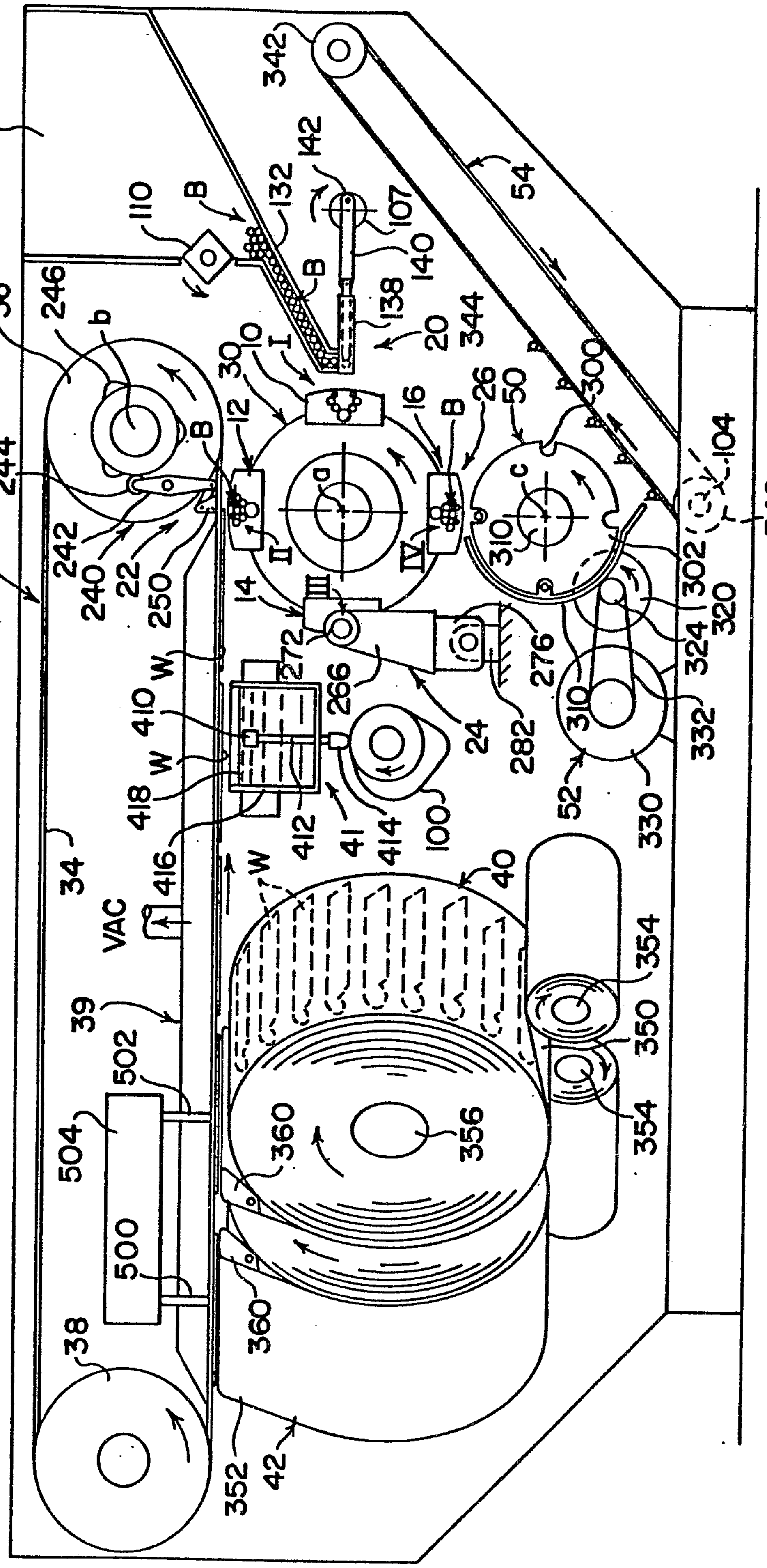

A
130
110
B
132
142
107
140
138
B
20
344
54
10
30
I
12
16
B
26
50
300
104
340
36
246
b
244
242
240
22
250
a
II
IV
c
310
302
320
324
14
272
266
276
282
24
310
332
330
52
32
34
W
410
418
416
412
414
41
100
VAC
40
354
350
354
356
360
360
39
502
504
500
38
352
42

FIG. 1

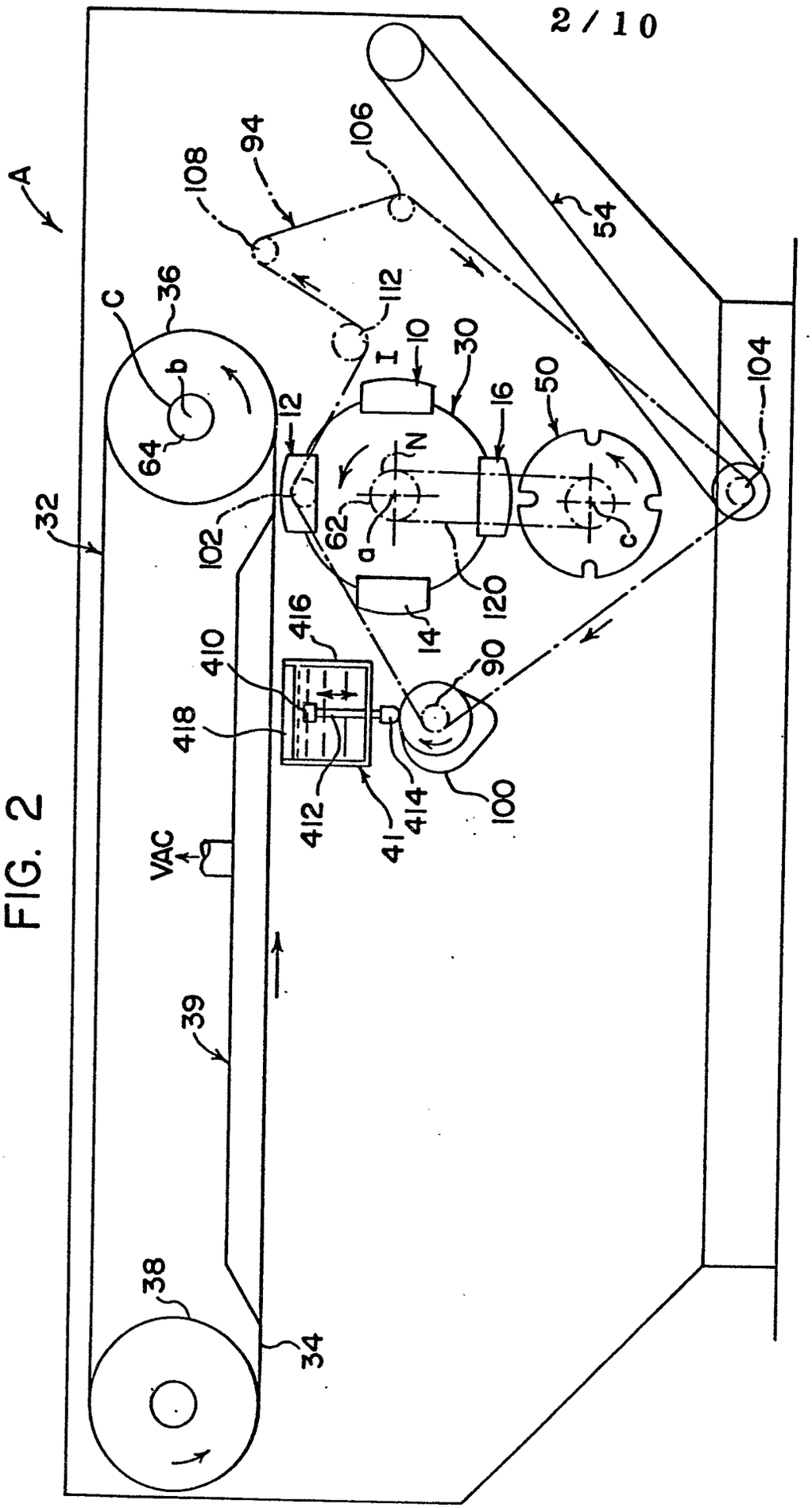

A
C
36
b
64
108
94
106
54
112
I
10
30
104
12
16
50
N
62
a
c
102
32
120
14
416
410
90
418
412
414
41
100
VAC
39
38
34

FIG. 2

FIG. 3

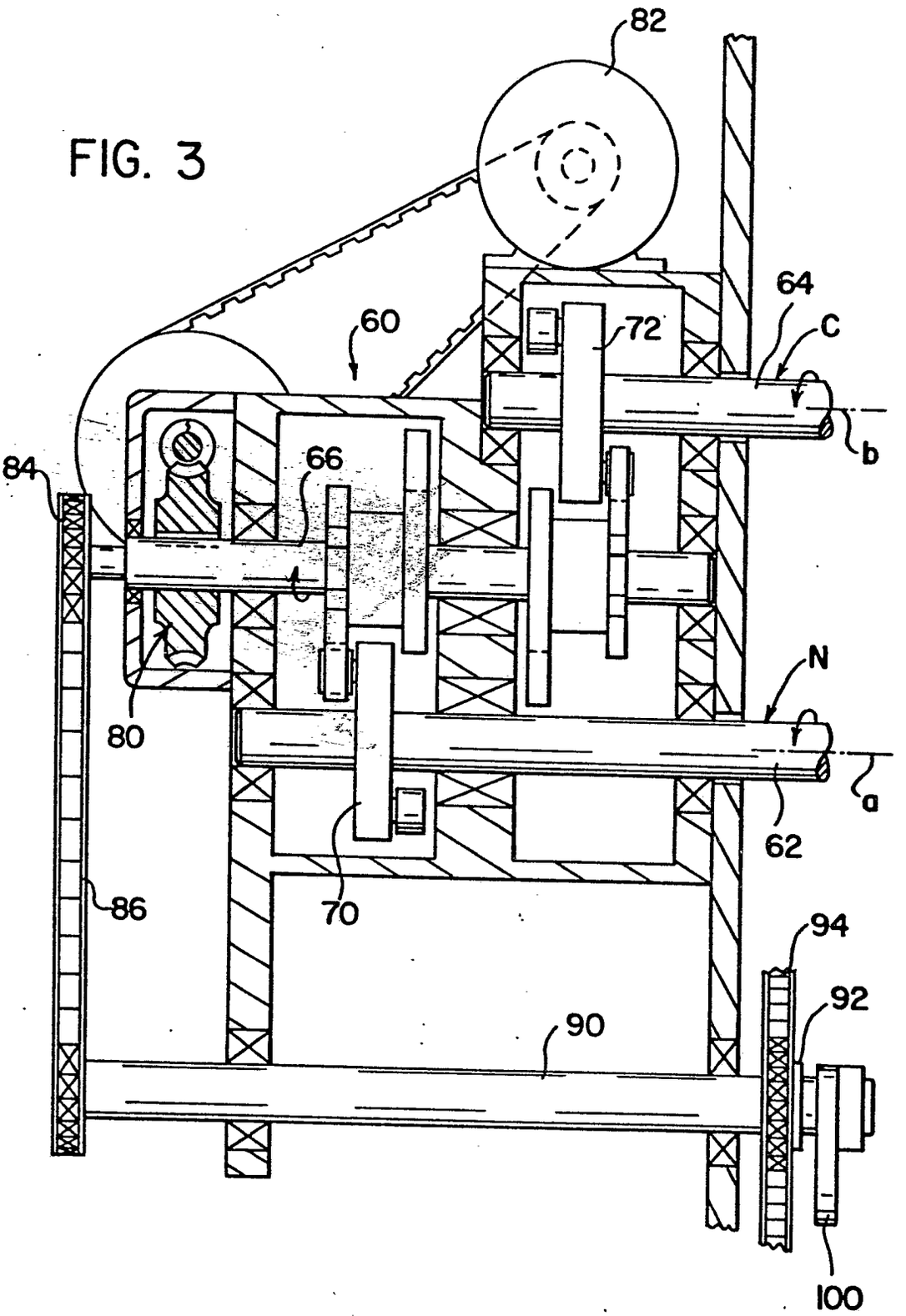


FIG. 4

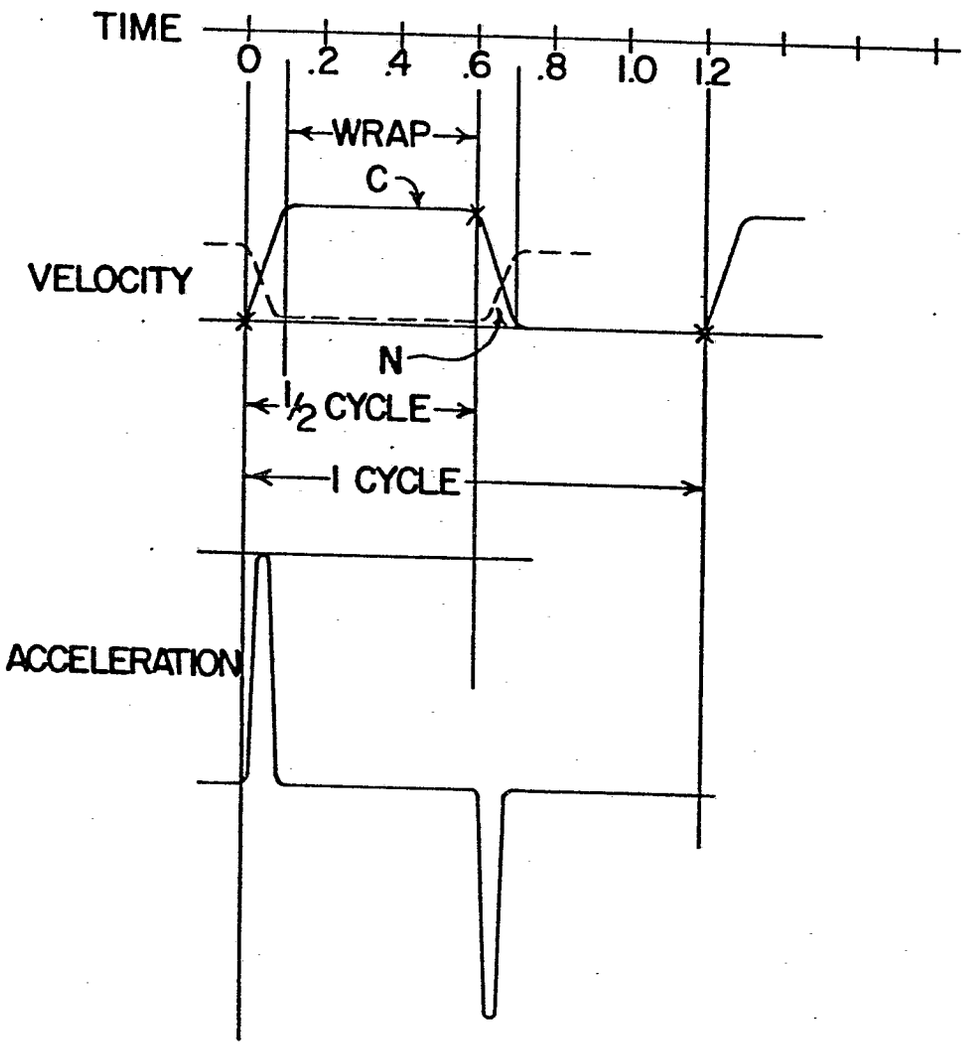
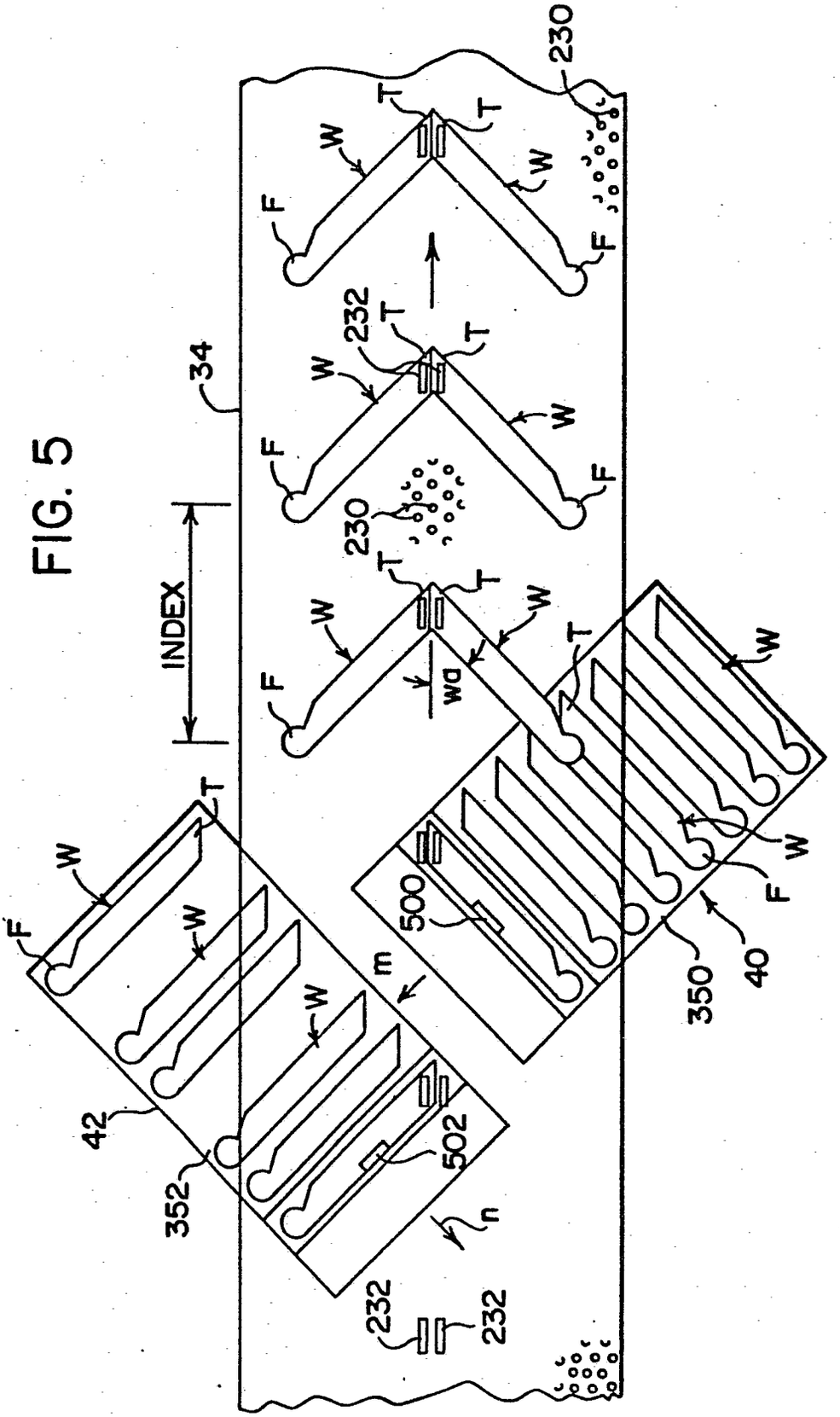

TIME
0
.2
.4
.6
.8
1.0
1.2
WRAP
C
VELOCITY
N
½ CYCLE
1 CYCLE
ACCELERATION

FIG. 5



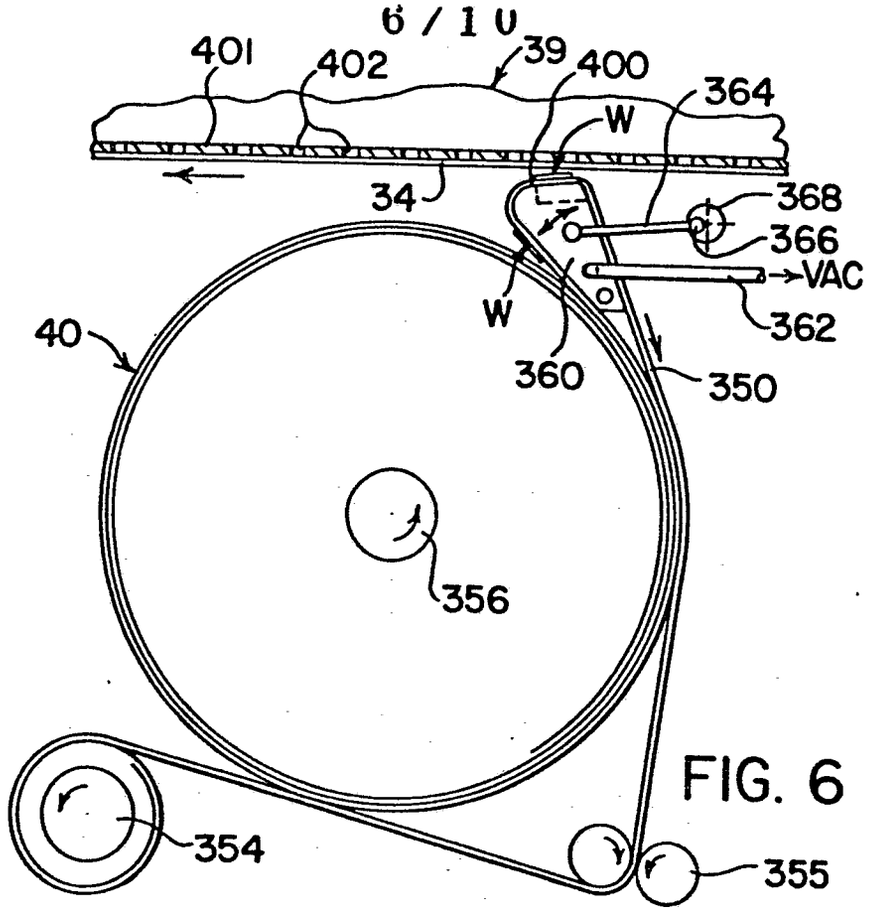

401
402
39
400
364
W
34
368
366
VAC
362
W
360
350
40
356
354
355

FIG. 6

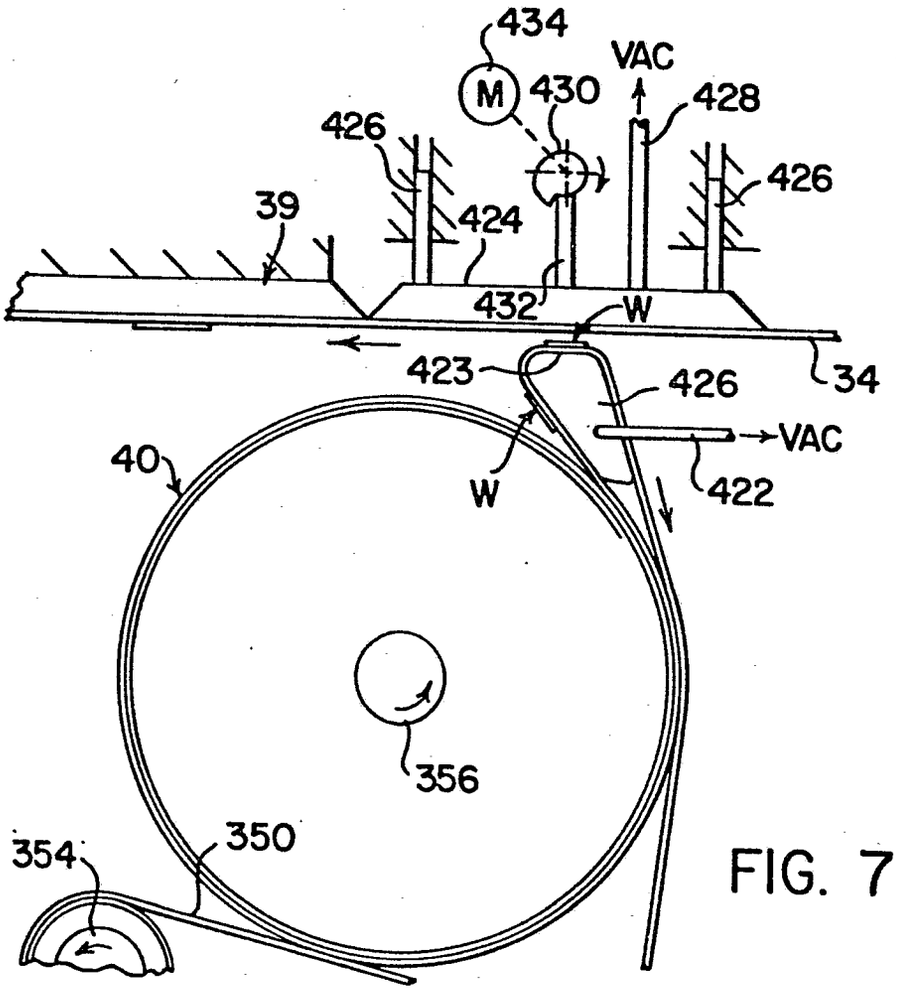
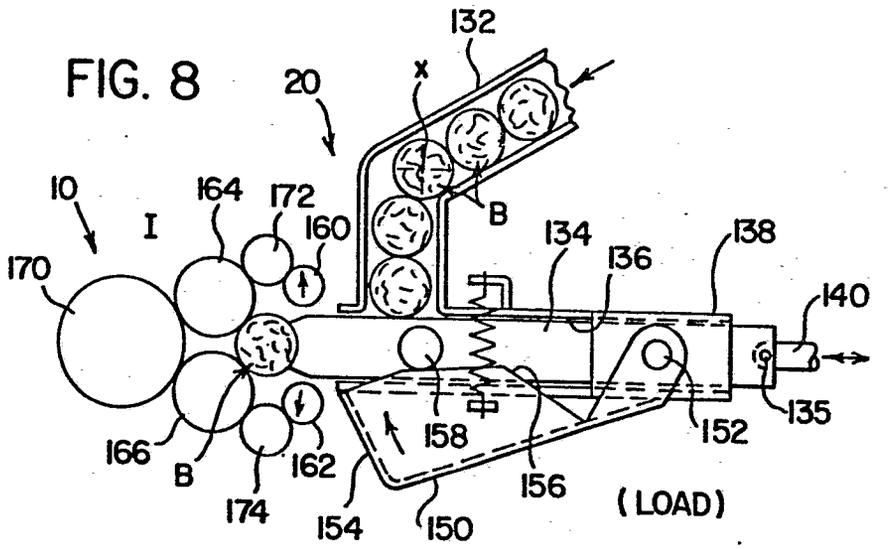

434
M
430
VAC
428
426
426
39
424
432
W
34
423
426
VAC
422
W
40
356
350
354

FIG. 7

FIG. 8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X
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I
164
172
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B
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170
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162
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150
158
156
152
135
(LOAD)

FIG. 9

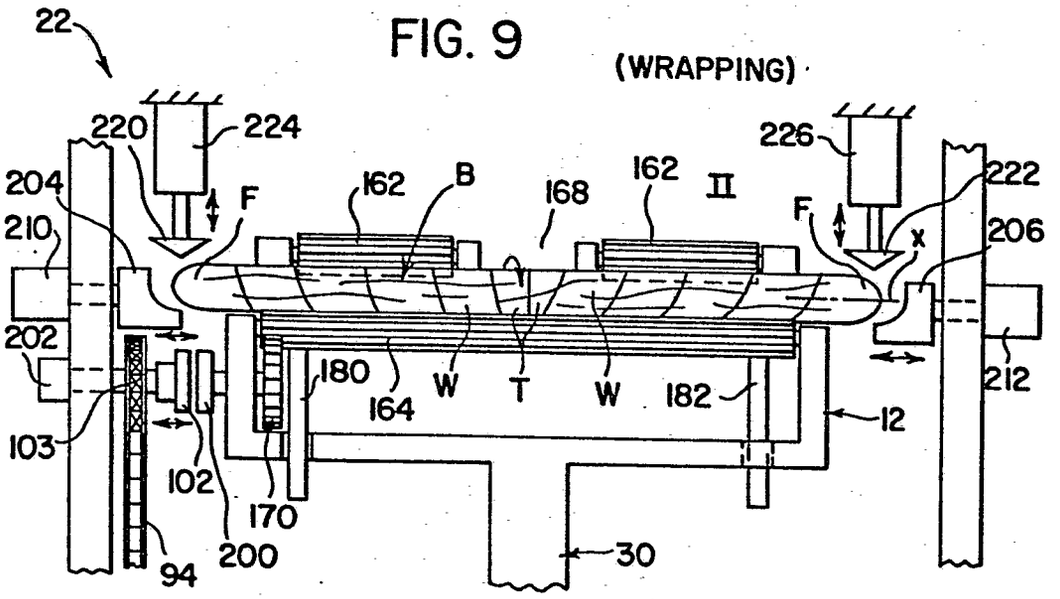

22
(WRAPPING)
220
224
226
222
204
F
162
B
168
162
II
F
X
206
210
202
180
164
W
T
W
182
12
212
103
102
170
200
94
30

FIG. 10

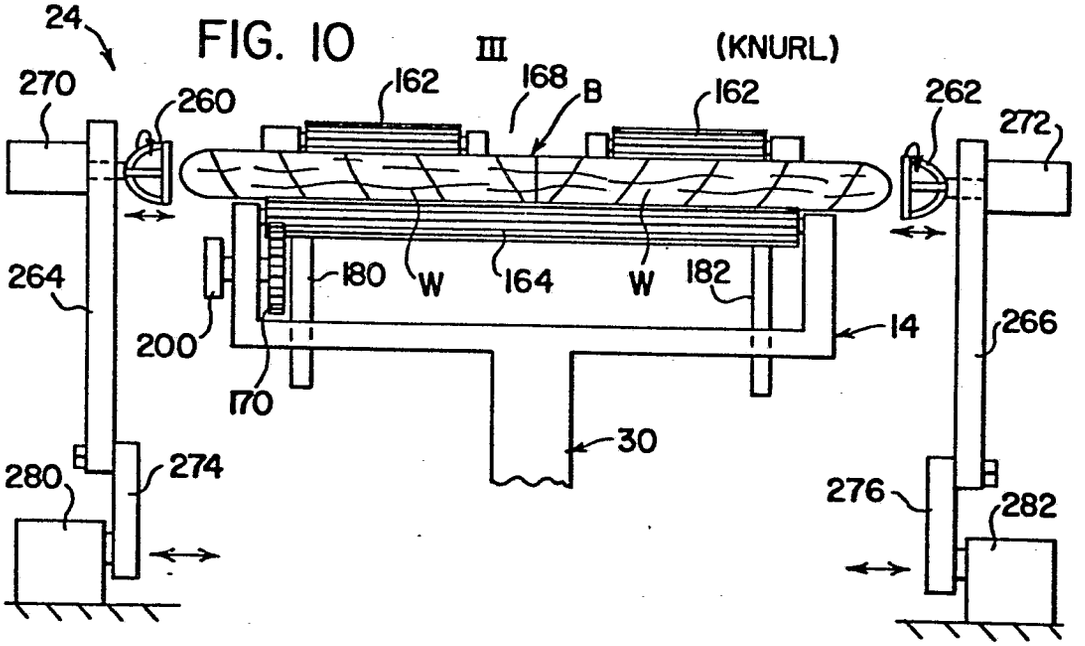
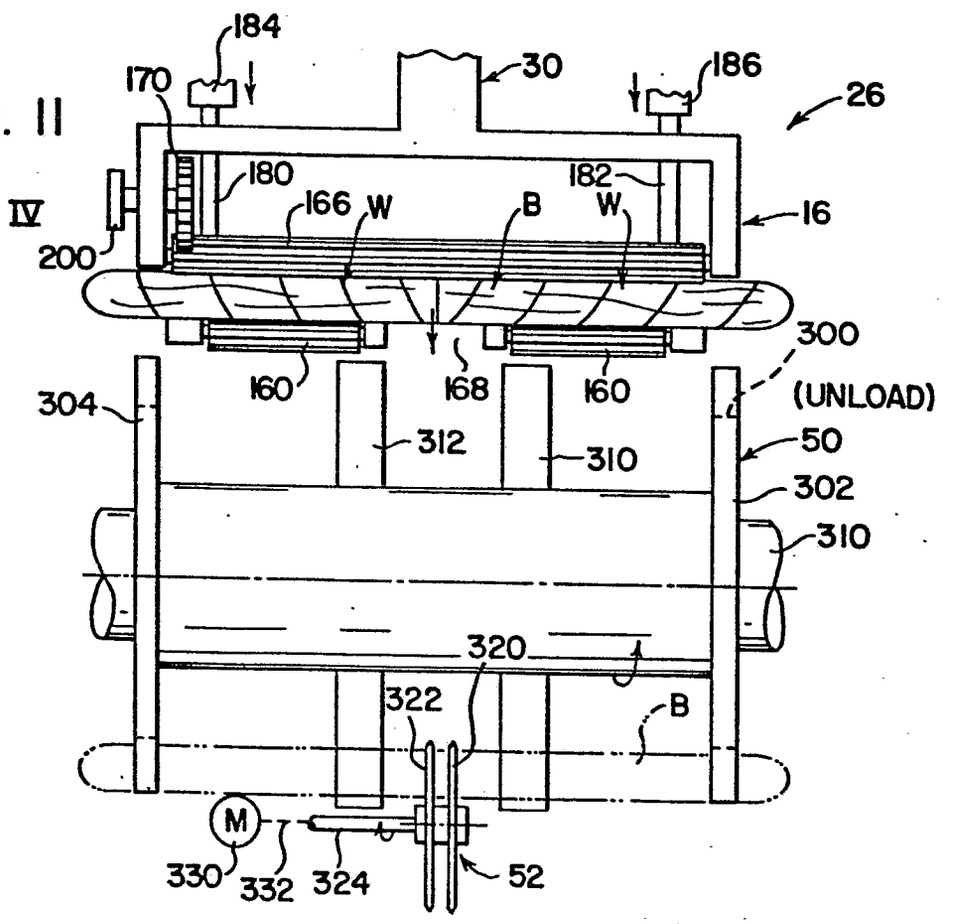

24
270
260
III
(KNURL)
162
168
B
162
262
272
264
180
W
164
W
182
14
266
200
170
30
280
274
276
282

FIG. 11


184
170
30
186
26
180
182
IV
166
W
B
W
16
200
300
160
168
160
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302
310
320
322
B
M
330
332
324
52

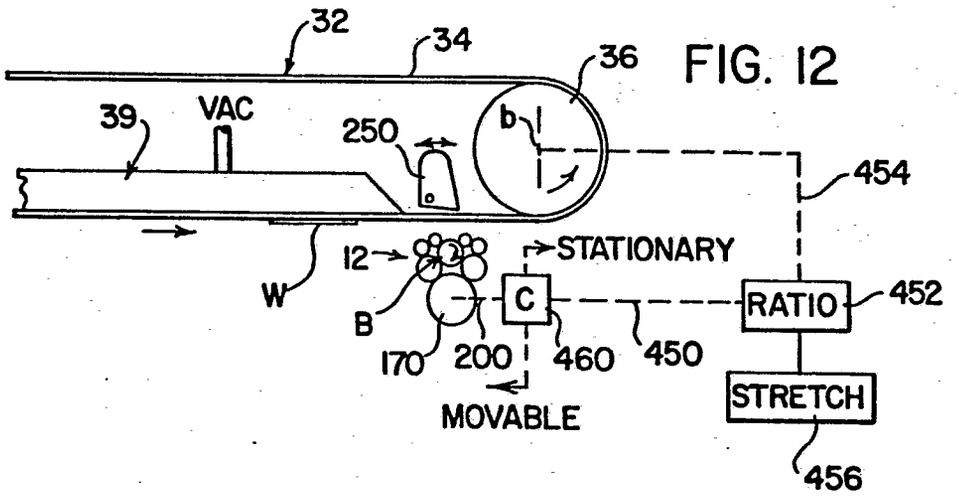
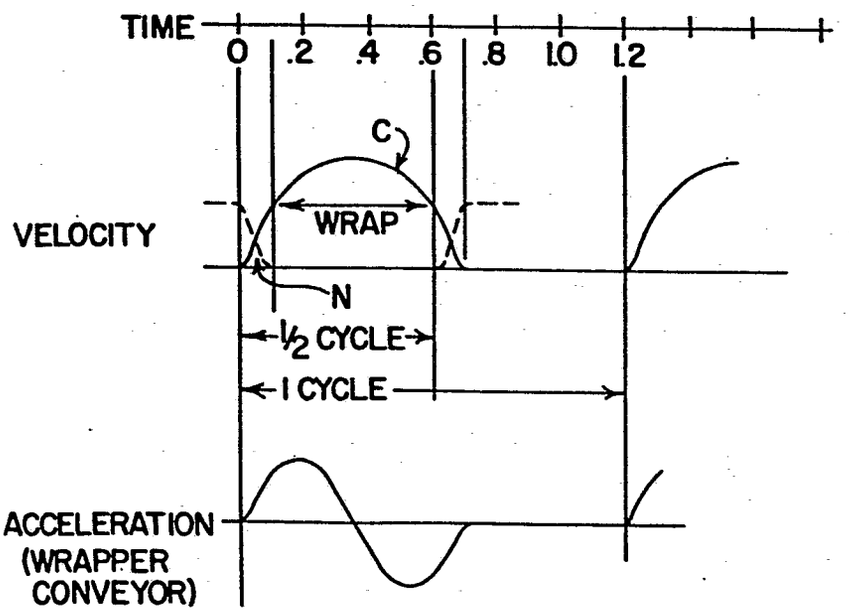

32
34
36
39
VAC
250
b
454
12
STATIONARY
W
B
C
RATIO
452
170
200
460
450
MOVABLE
STRETCH
456

FIG. 12

FIG. 13


TIME
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.2
.4
.6
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1.2
C
VELOCITY
WRAP
N
½ CYCLE
1 CYCLE
ACCELERATION
(WRAPPER
CONVEYOR)

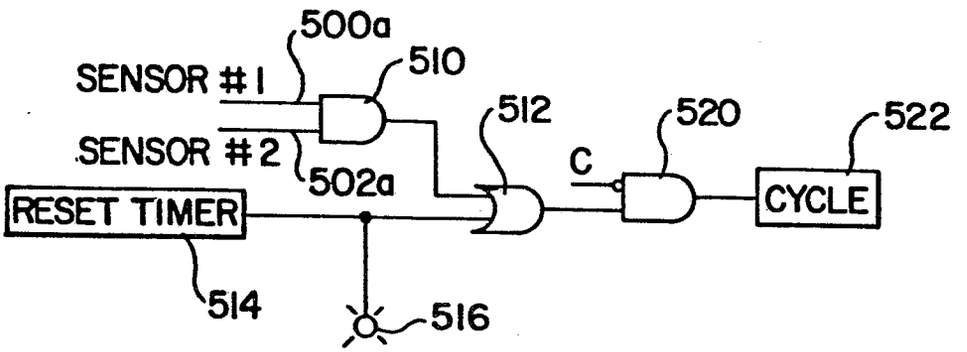
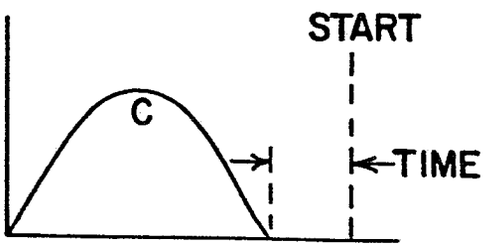

500a
SENSOR #1
510
SENSOR #2
502a
512
C
520
522
CYCLE
RESET TIMER
514
516

FIG. 14


START
C
TIME

European Patent Office

0045559

Application number
EP 81 30 2600

EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
DA	US - A - 4 103 692 (BAIER) * Figures 37-39; column 29, line 7 to column 30, line 31 *	1
	GB - A - 668 667 (N.V. VEREENIGDE TABAKSINDUSTRIEEN MIGNOT & DE BLOCK) * Figure 1; page 1, line 81 to page 2, line 52 *	1,19
	DE - C - 908 836 (VERHAPPEN) * Whole document *	1

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

A 24 C 1/30

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

A 24 C

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	05-11-1981	RIEGEL