United States Patent

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[54] **METHOD AND APPARATUS FOR INDICATING GROUPS OF ARTICLES**
16 Claims, 7 Drawing Figs.

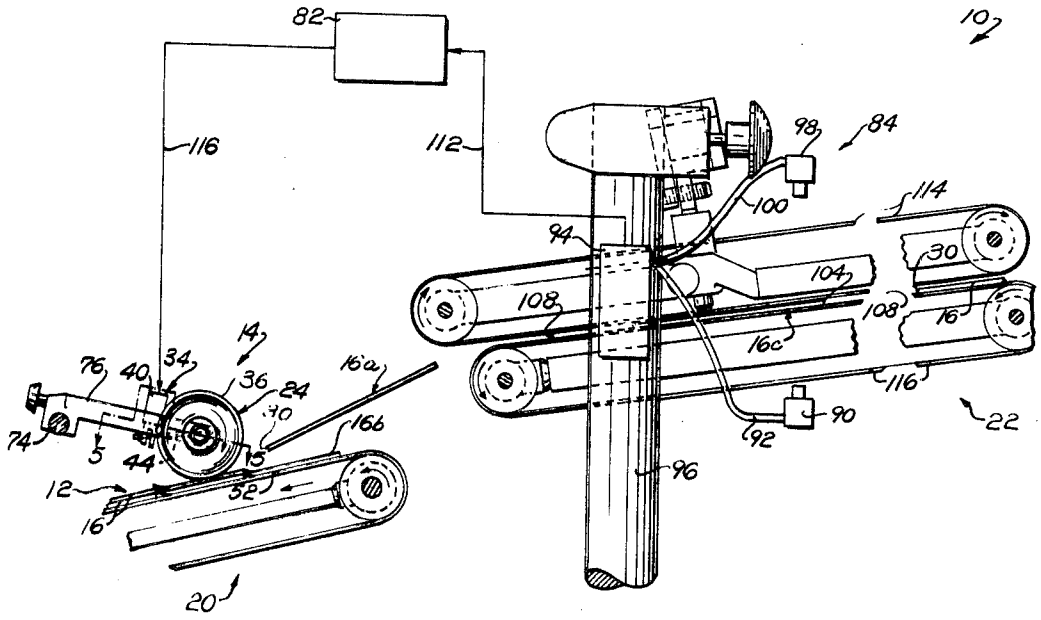
[52] U.S. Cl. **93/93,** 198/40
[51] **Int. Cl.** **B65h 33/00**
[50] **Field of Search** 93/93, 93.2; 198/40

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ABSTRACT: In a method and apparatus for indication groups of sheetlike articles or carton blanks in a stream of articles moving along a conveyor assembly the carton blanks are skewed to thereby indicate the last carton blank of a group of carton blanks. The carton blanks are skewed upon rotation of a roller which accelerates a portion of a carton blank. The roller is rotated in response to a counter assembly receiving a predetermined number of signals or pulses from a photoelectric sensor assembly which detects the passage of the carton blanks along the conveyor assembly.



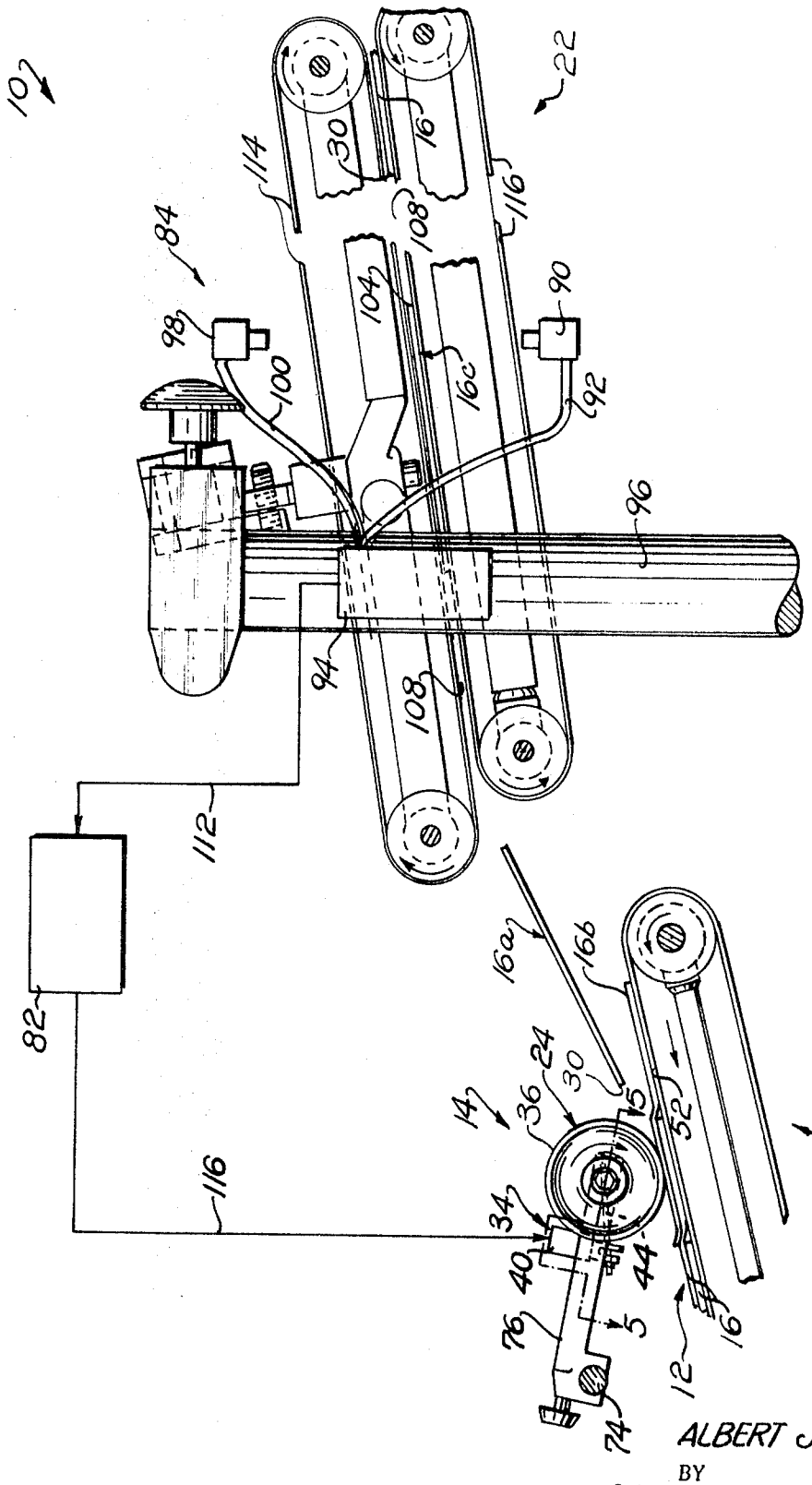


FIG. 1

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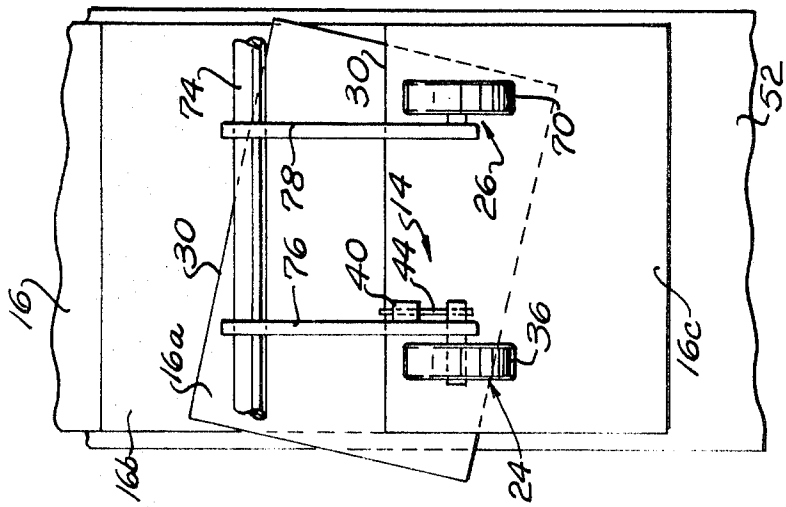


FIG. 4

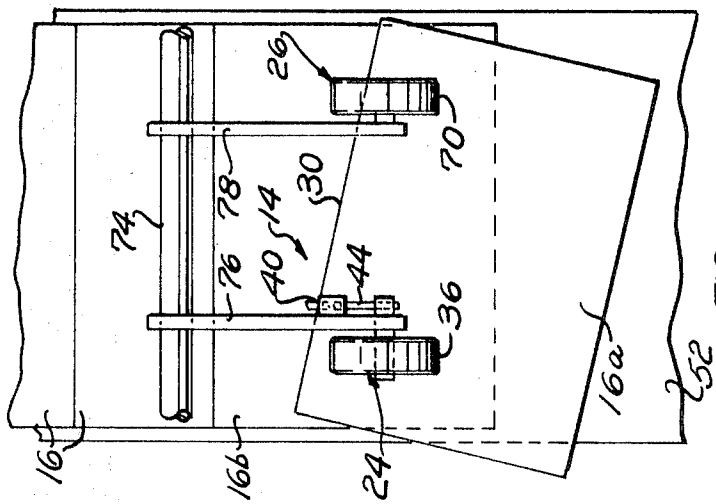


FIG. 3

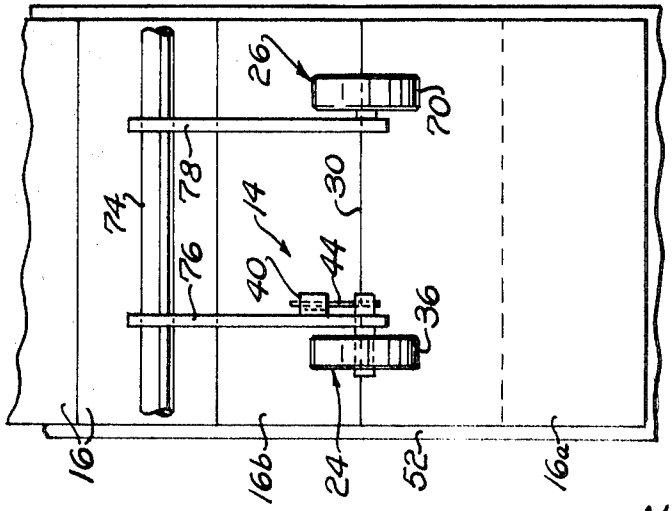


FIG. 2

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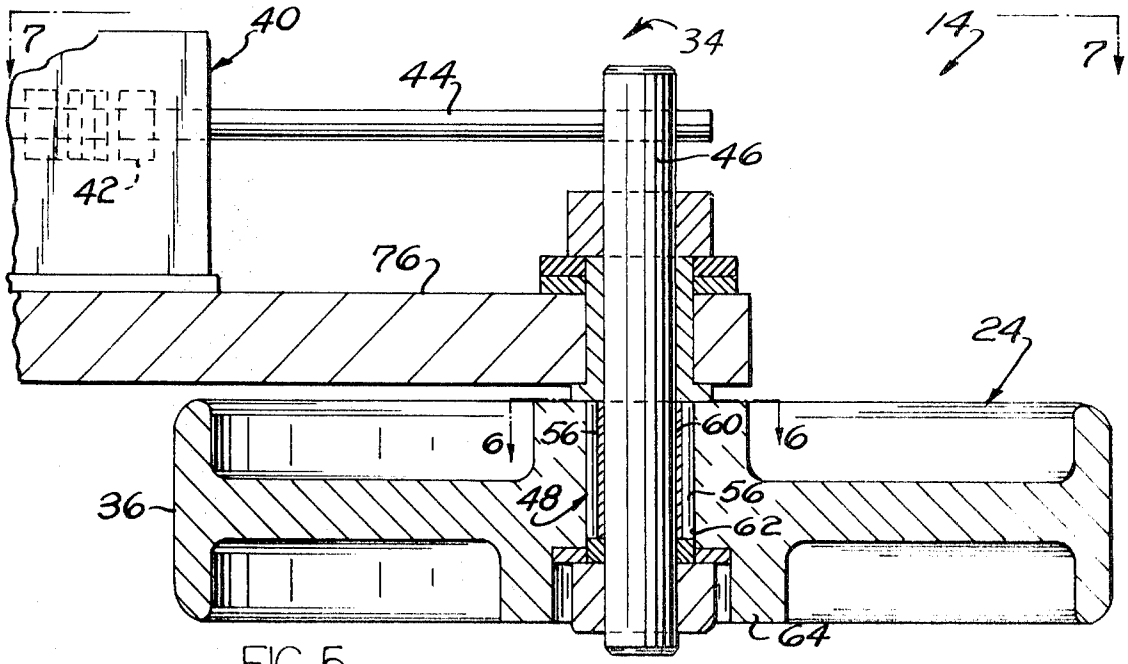


FIG. 5

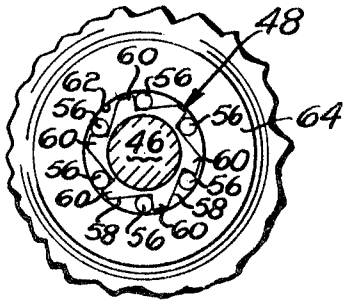


FIG. 6

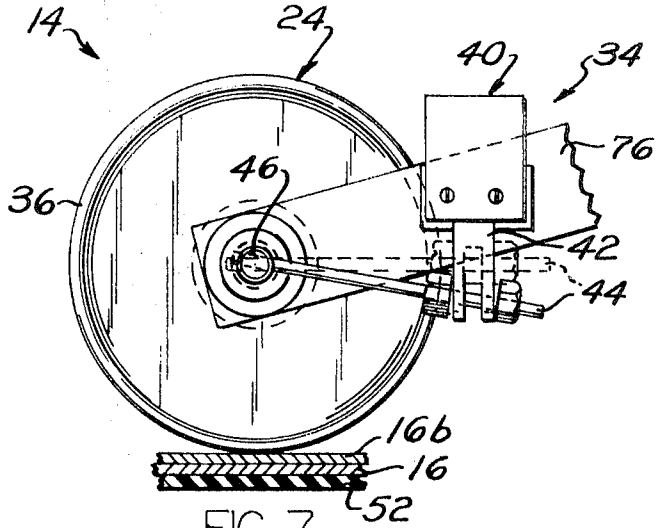


FIG. 7

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METHOD AND APPARATUS FOR INDICATING GROUPS OF ARTICLES

The present invention relates to a method and apparatus for indicating groups of a predetermined number of sheetlike articles in a stream of sheetlike articles.

A known machine cuts relatively large sheets of material into a number of sheetlike articles or carton blanks which are discharged in a stream from the machine. These carton blanks are often stored in stacks before being assembled into cartons. The formation of stacks of a desired size is facilitated by providing, in the stream of carton blanks, an indication of groups of a predetermined number of carton blanks. The subsequent removal of a desired number of carton blanks from any given stack is facilitated by placing several groups of carton blanks in each of the stacks and maintaining the indication of the groups of carton blanks.

Accordingly, it is an object of this invention to provide a new and improved apparatus for indicating groups of a predetermined number of sheetlike articles or carton blanks in a stream of articles or carton blanks moving along a conveyor assembly by skewing articles to indicate the groups of articles.

Another object of this invention is to provide a new and improved apparatus for indicating groups of a predetermined number of sheetlike articles or carton blanks in a stream of articles or carton blanks including sensor means for detecting the passage of the articles, selectively operable drive means to skew one of the articles relative to an adjacent article, and counter means for actuating the drive means in response to the detection by the sensor means of the predetermined number of articles.

Another object of this invention is to provide a new and improved apparatus for indicating groups of a predetermined number of sheetlike articles or carton blanks in a stream of articles or carton blanks including selectively operable drive means for engaging a portion of one of the articles and accelerating that portion of the one article forwardly relative to an adjacent article to thereby skew the one article to provide the indication of the group of articles.

Another object of this invention is to provide a new and improved apparatus for indicating groups of a predetermined number of sheetlike articles or carton blanks in a stream of articles or carton blanks including rollers which engage the articles and actuating means for rotating one of the rollers relative to another of the rollers to skew one article relative to an adjacent article to provide an indication of a group of articles.

Another object of this invention is to provide a new and improved method of indicating groups of a predetermined number of articles in a stream of sheetlike articles moving along a conveyor including skewing one of the articles to provide the indication by accelerating a portion of the article relative to an adjacent article.

Another object of this invention is to provide a new and improved method of indicating groups of a predetermined number of articles in a stream of sheetlike articles moving along a conveyor including rotating a first roller engaging one of the articles relative to a second roller engaging the one article to skew the one article relative to an adjacent article.

These and other objects and features of the invention will become more apparent upon a consideration of the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a schematic illustration of an apparatus for indicating groups of a predetermined number of articles in a stream of sheetlike articles by skewing the last article in each of the groups of articles;

FIG. 2 is a schematic illustration depicting the position of an article relative to a drive roller and an idler roller immediately before the article is skewed relative to an adjacent article by accelerated rotation of the drive roller;

FIG. 3 is a schematic illustration depicting the article immediately after it has been skewed by the drive roller to thereby indicate the last article of a group of articles;

FIG. 4 is a schematic illustration depicting a relationship between the skewed article and the first article of the next succeeding group of articles;

FIG. 5 is a sectional view, taken on an enlarged scale along the line 5–5 of FIG. 1, illustrating the structure of an actuating mechanism for rotating the drive roller to skew the last article of a group of articles;

FIG. 6 is a schematic illustration, taken along the line 6–6 of FIG. 5, illustrating the structure of a one-way clutch assembly for connecting the drive roller to a drive shaft; and

FIG. 7 is a schematic illustration, taken on a reduced scale along the line 7–7 of FIG. 5, further illustrating the structure of the drive roller and the actuating mechanism.

The present invention provides an apparatus for indicating groups of a predetermined number of sheetlike articles in a stream of articles moving along a conveyor by skewing articles to indicate the last article in each of the groups of articles. The apparatus includes a sensor assembly for detecting the passage of the articles and sending signals to a counter assembly. Upon receiving a predetermined number of signals from the sensor assembly, the counter assembly actuates a drive assembly to thereby indicate a group of articles by accelerating a portion of the last article of the group to cause the last article to rotate and become skewed relative to an adjacent article. To this end, the drive assembly includes a drive roller and an idler roller which engage the articles and an actuator means for rotating the drive roller relative to the idler roller. This relative rotation between the rollers skews the last article of a group of articles by causing a portion of the last article engaged by the drive roller to accelerate.

Although an apparatus **10** constructed in accordance with the present invention and illustrated in FIG. 1 can be used in association with many different types of sheetlike articles, the apparatus is particularly well suited for use in association with a stream of carton blanks from a known stripper or cutter assembly (not shown). The apparatus **10** indicates groups of carton blanks in a stream **12** of carton blanks by skewing the last carton blank of each group of carton blanks relative to an adjacent carton blank. The groups of carton blanks are then placed in stacks or piles for handling or storage.

The last carton blank of a group of carton blanks is skewed relative to the adjacent carton blanks by a drive assembly **14** which engages carton blanks **16** immediately after they are deposited in an overlapping relationship on a downstream conveyor assembly **20** by a faster operating upstream conveyor assembly **22**. The drive assembly **14** skews a carton blank by accelerating one portion of the carton blank to rotate or twist the carton blank as it is being moved at a substantially constant velocity in a downstream direction by the conveyor assembly **20**. Accordingly, the carton blank **16***a* is skewed by increasing the rate of rotation of a drive roller **24** of the drive assembly **14** (see FIG. 2) to accelerate an engaged portion of the carton blank **16***a*. This acceleration rotates the carton blank **16***a* about an axis extending through an area of contact of an idler roller **26** with the carton blank and moves the side of the carton blank **16***a* engaged by the drive roller **24** forwardly relative to a next adjacent downstream carton blank **16***b* (see FIG. 3). The first carton blank **16***c* of the next succeeding group of carton blanks (see FIG. 4) is then deposited on the skewed carton blank **16***a*. Since the skewed carton blank **16***a* projects transversely outwardly relative to the adjacent carton blank **16***b* of the same group and the adjacent carton blank **16***c* of the next succeeding group, the end of one group of carton blanks and the beginning of the next group of carton blanks is clearly indicated by skewing the last carton blank **16***a* of the first group of carton blanks.

In view of the foregoing description it can be seen that the carton blank **16***a* is transferred from the upstream conveyor assembly **22** to the downstream conveyor assembly **20** in such a manner that a leading edge portion **30** of the carton blank **16***a* enters into the nips of the drive roller **24** and idler roller **26** (see FIG. 1). At this time the freely rotatable drive and idler rollers **24** and **26** are both being rotated at substantially the same speed by engagement with the carton blanks **16**. After the leading edge **30** of the carton blank **16***a* has just moved past the axis of rotation of the rollers **24** and **26** (see FIG. 2), the drive roller **24** is positively accelerated relative to

the idler roller 26 to accelerate one side of the carton blank to thereby skew the carton blank by rotating it about an axis extending through the idler roller 26 (see FIG. 3). After the carton blank 16*a* has been skewed, the drive and idler rollers 24 and 26 are both again rotated at the same speed by engagement with the carton blanks 16. The next succeeding carton blank 16*c* is then transferred from the upstream conveyor assembly 22 to the downstream conveyor assembly 20 and into an overlapping relationship with the skewed carton blank 16*a* (see FIG. 4).

The drive roller 24 is positively rotated relative to the idler roller 26 by an actuator mechanism 34 to accelerate one side of the carton blank 16*a* relative to the side engaged by the idler roller 26. In order to enable the drive roller 24 to accelerate the one side portion of the carton blank 16*a*, the actuator mechanism 34 must rotate the drive roller 24 so that the velocity of an outer peripheral surface 36 is, for a short time at least, greater than the constant velocity at which the conveyor assembly 20 moves the carton blanks 16. To this end the actuator mechanism 34 includes a solenoid 40 (see FIGS. 5 and 7) having a plunger 42 which is connected by a rod 44 to a drive shaft 46. Upon energization of the solenoid 40, the plunger 42 is quickly retracted from the position shown in solid lines in FIG. 7 to the position shown in dashed lines, and the rod 44 pivots the drive shaft 46 to increase the velocity of the peripheral surface 36 of the roller 24 by rotating the roller 24 through a one-way clutch assembly 48 (FIGS. 5 and 6). The one-way clutch assembly 48 is normally in a disengaged condition so that the drive roller 24 is freely rotatable in much the same manner as is the idler roller 26 and presses the carton blanks 16 toward a belt 52 of the conveyor assembly 20 (see FIG. 1).

Upon energization of the solenoid 40 (see FIGS. 5 and 7) the one-way clutch assembly 48 is operated from a disengaged condition (shown in FIG. 6) to an engaged condition in which roller elements 56 lock the drive shaft 46 to the roller 24 by interfering engagement with a ramp or surface 58 of clutch teeth 60 and an internal surface 62 of a hub portion 64 of the roller 24. This interfering engagement between the roller elements 56 and the hub portion 64 connects the roller 24 to the drive shaft 46 in a known manner so that the rotation or pivoting movement of the drive shaft 46 by the operation of the solenoid 40 accelerates the peripheral surface 36 of the drive roller 24. Acceleration of the peripheral surface 36 skews the carton blank 16*a*, in the manner previously explained, while the carton blank is being transported at a substantially constant velocity by the conveyor assembly 20.

In addition to skewing the last carton blank of a group of carton blanks to thereby provide an indication of where one group ends and the next group begins, the drive roller 24 and idler roller 26 position the carton blanks 16 relative to the conveyor assembly 20 as they are received from the upstream conveyor assembly 22. The leading edge 30 of the carton blanks 16 engage and are moved downwardly by the peripheral surface 36 of the drive roller 24 and the peripheral surface 70 of the idler roller 26 as the carton blanks move onto the conveyor assembly 20 from the conveyor assembly 22 (see FIGS. 1 and 2). The conveyor assembly 22 is operated at a faster speed than the conveyor assembly 20 so that carton blanks 16 are deposited in an overlapping relationship on the conveyor assembly 20. The engagement of the leading edge 30 of the carton blanks 16 with the transversely or axially aligned peripheral surfaces 36 and 70 of the drive roller 24 and idler roller 26 positions the carton blanks relative to the conveyor belt 52 before the leading edge of the carton blank enters into the nips of the rollers. Once the carton blank has entered into the nips of the drive and idler rollers 24 and 26 these rollers press the carton blanks downwardly against the conveyor belt 52 to hold the carton blanks in position on the conveyor belt. To this end the drive and idler rollers 24 and 26 are pivotally connected to a transversely extending support shaft 74 by brackets or arms 76 and 78.

To facilitate handling and the removal of a desired number of carton blanks from a stack of carton blanks, the same predetermined number of carton blanks is included in each group of carton blanks. In order to provide the predetermined number of carton blanks in each group of carton blanks it is necessary to operate the actuator mechanism 34 to skew the last carton blank of a group of carton blanks when that last carton blank is preceeded by a number of carton blanks which is one less than the predetermined number. To this end, the operation of the actuator mechanism 34 is controlled by a counter assembly 82 (of known construction) and sensor assembly 84 (FIG. 1). The counter assembly 82 energizes the solenoid 40 of the drive mechanism 34 only after one less than the predetermined number of carton blanks have preceeded the carton blank engaged by the drive roller 24 (that is the carton blank 16*a* of FIG. 2) so that the last carton blank of a group of a predetermined number of carton blanks is skewed by the operation of the actuator mechanism 34.

The sensor assembly 84 detects the passage of each carton blank 16 and sends a pulse or signal to the counter assembly 82 to thereby indicate the passage of each of the carbon blanks. In the illustrated embodiment of the invention, the sensor assembly 84 is of the well known photoelectric type and includes a light source 90 connected by a lead 92 to a control box or apparatus 94 mounted on a support shaft 96 for the conveyor assembly 22. A light sensitive photoelectric cell 98 is mounted directly above the light source and is connected to the control apparatus 94 by a lead 100. A beam of light from the light source 90 to the photocell 98 is interrupted by the passage of each of the carton blanks 16. When a trailing edge 104 of a carton blank is moved past the light source 90, the beam of light is transmitted through a space 108 between adjacent carton blanks in the stream of carton blanks to activate the photocell 98 in a known manner and provide for a pulse or signal from the control apparatus 94 to the counter 82 through suitable connections indicated schematically at 112 in FIG. 1. Although the carton blanks 16 are illustrated in FIG. 1 as being spaced the same distance 108 apart, it is contemplated that the spacing will be varied depending upon the rate at which opposing drive belts 114 and 116 of the conveyor assembly 22 are driven and the rate at which carton blanks are fed to the conveyor assembly 22 from a cutting and/or creasing apparatus.

The counter assembly 82 energizes the solenoid 40 to skew a carton blank when sufficient carton blanks have been transported to the conveyor assembly 20 to form a group with the skewed carton blank being the last carton blank of the group. To this end, the counter assembly 82 is responsive to pulses or signals, from the sensor assembly 84, which indicate the movement of a carton blank past the photoelectric cell 98. When a number of pulses corresponding to the predetermined number of carton blanks have been received by the counter assembly 82, the counter assembly energizes the solenoid 40 of the actuator mechanism 34 through a suitable electrical connection, indicated schematically at 118 in FIG. 1. The actuator assembly 34 then increases speed of rotation of the drive roller 24 to skew the carton blank 16*a* beneath the drive roller in the manner illustrated schematically in FIGS. 2—4. Since the photoelectric cell 98 is located upstream relative to the drive roller 24, a suitable delay must be provided to enable the carton blank which is to be skewed to travel the distance between the photoelectric cell 98 and the drive roller 24. This delay can be suitably provided in the counter assembly 82 and adjusted in accordance with the speed of the conveyor assemblies 20 and 22.

Since the last carton blank of each group of carton blanks is skewed relative to the adjacent carton blanks, when the carton blanks 16 are placed in stacks the last carton blank of each group of carton blanks in the stack provides a clear indication of where one group of carton blanks ends and the next group begins. Each of the groups contains the same predetermined number of carton blanks. Therefore, when it is desired to remove from the stack a number of carton blanks which is an

even multiple of the predetermined number of carton blanks in each of the groups, it is merely necessary to count the skewed carton blanks from the top of the stack to locate a point on the stack above which there is the desired even multiple of the predetermined number of carton blanks. For example, if there were 20 carton blanks in each of the groups and 80 carton blanks were to be removed from the stack, it would merely be necessary to count down four skewed carton blanks from the top of the stack and remove all of the carton blanks above the fifth skewed carton blank. Of course, each group of carton blanks can consist of any desired predetermined number of carton blanks.

In view of the foregoing description it can be seen that the present invention provides an apparatus for indicating groups of a predetermined number of sheetlike articles or carton blanks **16** in a stream **12** of articles or carton blanks moving along the conveyor assembly **20** by skewing the last article or carton blank in each of the groups of articles or carton blanks. The apparatus **10** includes a sensor assembly **84** which detects the passage of the articles or carton blanks and sends a signal or pulse to the counter assembly **82**. Upon receiving a predetermined number of signals or pulses from the sensor assembly **84**, the counter assembly **82** activates the drive assembly **14** to skew the last article or carton blank of the group relative to the next preceeding and succeeding articles or carton blanks to indicate the end of one group of articles or carton blanks and the beginning of the next succeeding group.

The drive assembly **14** skews the last article or carton blank of a group of articles or carton blanks by rotating the drive roller **24** relative to the idler roller **26**. The relative rotation between the drive roller **24** and the idler roller **26** accelerates a portion of the article or carton blank to rotate it about an axis extending through the idler roller. It should be noted that the article or carton blank is skewed while being moved forwardly in a downstream direction at a substantially constant speed by the conveyor assembly **20**.

The skewed articles or carton blanks clearly indicate the groups of articles or carton blanks in the stream **12** moving along the conveyor assembly **20**. The articles or carton blanks **16** are then advantageously formed into stacks while maintaining the skewed relationship between the last article or carton blank of each group to thereby provide an indication of each of the groups in the stack of articles or carton blanks. Of course, the size of the stack of articles or carton blanks can be readily determined by merely counting the number of skewed articles or carton blanks and multiplying this number by the predetermined number of articles or carton blanks in each group. In addition, the removal of a desired number of articles or carton blanks from a stack is facilitated by the maintenance of the skewed relationship of the last article or carton blank of each group relative to the other articles or carton blanks of the group.

I claim:

1. Apparatus for indicating groups of a predetermined number of articles in a stream of sheetlike articles moving along a conveyor assembly said apparatus comprising sensor means for detecting passage of the articles, means for skewing one article relative to an adjacent article to provide the indication including selectively operable drive means for engaging a portion of the one article and accelerating that portion of the one article forwardly relative to the adjacent article while the adjacent article is moving forwardly at a substantially constant speed, said drive means including a roller having a peripheral surface which engages the one article and means for rotating the peripheral surface of said roller at a speed greater than the speed of downstream movement of the adjacent article to thereby accelerate the one article relative to the adjacent article, said means for rotating the peripheral surface of said roller including clutch means for connecting said roller with a drive shaft and actuator means for rotating said drive shaft, said clutch means being operable between a disengaged condition in which said roller is rotatable relative to said drive shaft and an engaged condition in which said roller is drivingly connected to said drive shaft, and counter means operatively connected to said drive means and said sensor means for actuating said drive means in response to the detection by said sensor means of the predetermined number of articles, said actuator means being selectively operable by said counter means to rotate said drive shaft and operate said clutch means to said engaged condition to thereby accelerate the peripheral surface of said roller and the portion the one article engaged by said roller to skew the one article.

2. Apparatus for indicating groups of a predetermined number of articles in a stream of sheetlike articles moving along a conveyor assembly, said apparatus comprising sensor means for detecting passage of the articles, first and second rollers for engaging at least one of the articles, actuating means for rotating the first roller relative to the second roller to skew the one article relative to an adjacent article to provide an indication of a group of articles, said actuating means including a shaft, a one way clutch assembly mounted on said shaft and connected to said first roller, and a solenoid operatively connected to said shaft for pivoting said shaft to cause said one-way clutch assembly to rotate said first roller relative to said second roller to skew the one article, and means operatively connected to said actuating means and said sensor means for operating said actuating means to rotate said first roller in response to the detection by said sensor means of the predetermined number of articles.

3. Apparatus for indicating groups of a predetermined number of articles in a stream of sheetlike articles moving along a conveyor assembly and for maintaining the articles in a predetermined relationship with the conveyor assembly, said apparatus comprising surface means disposed in continuous engagement with at least some of the articles of the stream of articles for urging the articles into the predetermined relationship with the conveyor assembly, means for accelerating said surface means and a portion of an article engaged by said surface means forwardly relative to an adjacent article while the adjacent article is moving forward at a substantially constant speed to skew the engaged article relative to the adjacent article and thereby provide the indication, sensor means for detecting the passage of articles, and counter means operatively connected to said means for accelerating said surface means and to said sensor means for effecting operation of said means for accelerating said surface means in response to the detection by said sensor means of the predetermined number of articles.

4. Apparatus as set forth in claim **3** wherein said surface means includes a roller having a peripheral surface which is maintained in continuous engagement with the stream of articles, and said means for accelerating said surface means includes means for rotating the peripheral surface of said roller at a speed greater than the speed of downstream movement of the adjacent article to thereby accelerate the engaged article relative to the adjacent article.

5. Apparatus for indicating groups of a predetermined number of articles in a stream of sheetlike articles moving along a conveyor assembly, said apparatus comprising sensor means for detecting passage of the articles, idler and drive rollers for engaging at least one of the articles, actuating means for accelerating the drive roller relative to the idler roller to drive the one article forwardly into a skewed relationship with an adjacent article to provide an indication of a group of articles, and means operatively connected to said actuating means and said sensor means for operating said actuating means to accelerate said drive roller in response to the detection by said sensor means of the predetermined number of articles.

6. Apparatus as set forth in claim **5** wherein said actuating means includes clutch means which is operated from a disengaged condition to an engaged condition to transmit a driving torque to said drive roller upon operation of said actuating means.

7. Apparatus for indicating groups of a predetermined number of articles in a stream of sheetlike articles moving along a conveyor assembly, said apparatus comprising a drive

roller having a peripheral surface disposed in engagement with the stream of articles, clutch means operable between an engaged condition and a disengaged condition in which said drive roller is free to rotate at a first speed under the influence of forces transmitted to said drive roller by the stream of articles, actuating means for effecting operation of said clutch means to the engaged condition and for driving the engaged clutch means to rotate said drive roller at a second speed which is greater than the first speed to thereby skew an article engaged by said drive roller relative to an adjacent article to provide an indication of a group of articles, sensor means for detecting the passage of the articles, and means operatively connected to said actuating means and said sensor means for operating said actuating means to effect operation of said clutch means to the engaged condition and rotation of said drive roller at the second speed in response to the detection by said sensor means of the predetermined number of articles.

8. Apparatus as set forth in claim 7 further including an idler roller having a peripheral surface disposed in engagement with the same side of the stream of sheets as the peripheral surface of said drive roller, said drive roller being operable to effect a pivoting movement of the article engaged by the drive roller relative to said idler roller upon operation of said actuating means.

9. An apparatus comprising first conveyor means for transporting sheetlike articles in a spaced apart relationship at a first speed, second conveyor means for receiving articles from said first conveyor means and transporting the articles in an overlapping relationship at a second speed which is slower than the first speed, photoelectric means for detecting the passage of the articles along said first conveyor means, drive means for engaging a portion of one of the articles on said second conveyor means when said one article is in an overlapping relationship with an adjacent article on said second conveyor means and for accelerating the engaged portion of the one article forwardly relative to the adjacent article which is overlapped by said one article to thereby skew said one article relative to said adjacent article while the articles on said second conveyor means are being transported in the overlapping relationship at said second speed, and counter means responsive to signals produced by said photoelectric means and operable in response to a predetermined number of such signals to operate said drive means to skew an article on said second conveyor means to thereby provide an indication of a group of articles being transported by said second conveyor means.

10. An apparatus as set forth in claim 9 wherein said drive means includes a roller having a peripheral surface which engages each of the articles in turn as the articles are transported by said second conveyor means.

11. An apparatus as set forth in claim 10 wherein said drive means further includes means for imparting rotational movement to said roller to thereby accelerate the portion of an article engaged by the peripheral surface of said roller.

12. A method of indicating groups of a predetermined number of article in a stream of sheetlike articles on a conveyor, said method comprising the steps of continuously engaging the stream of sheetlike articles with a drive roller and an idler roller, detecting the passage of the predetermined number of articles, and accelerating said drive roller relative to said idler roller in response to the detection of the predetermined number of articles to drive an article engaged by said drive roller forwardly into a skewed relationship with an adjacent article to thereby provide the indication of a group of articles.

13. A method of indicating groups of a predetermined number of articles as set forth in claim 12 further including the step of rotating said drive and idler rollers at a first surface speed under the influence of forces transmitted to said rollers from the stream of articles prior to the detection of the passage of the predetermined number of articles, said step of accelerating said drive roller relative to said idler roller including the method step of increasing the rate of rotation of said drive roller relative to the rate of rotation of said idler roller to drive the article engaged by said drive roller forwardly.

14. Apparatus as set forth in claim 1 wherein said clutch means is a one-way clutch and said actuator means is a solenoid, said solenoid being energized by said counter means to rotate said drive shaft for at least part of a revolution to engage said one-way clutch.

15. Apparatus as set forth in claim 2 further including a support shaft extending transversely to said conveyor assembly, and bracket means pivotally connected to said support shaft for supporting said first and second rollers and said drive means.

16. Apparatus as set forth in claim 9 wherein said drive means includes a first roller for engaging the one portion of the one article, a second roller for engaging another portion of said one article and an actuating means which is operated by said counter means to rotate said first roller relative to said second roller to thereby skew said one article.