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Dutro et al.

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[54] **BATCH STACKER**

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[52] **U.S. Cl.** ..... **93/93 C,** 93/93 DP, 214/6.5, 271/88

[51] **Int. Cl.** **B65h 33/00**

[58] **Field of Search** ..... 93/93 C, 93 DP, 93 R; 198/35; 214/6 H, 6.5; 271/76, 88, 89

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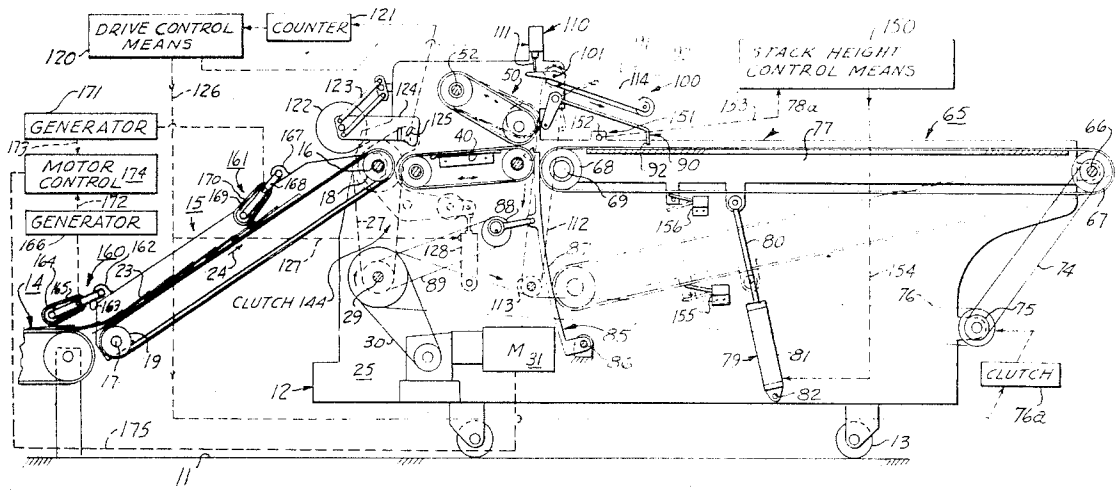
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[57] **ABSTRACT**

A batch stacker for converting a downstream moving stream of overlapping articles into stacks of said articles. The articles are fed to the stacker in a continuous and overlapped stream by an infeed conveyor and carried away in stacks by an outfeed conveyor. A batcher feeds the overlapped articles to the outfeed conveyor on which the stack is formed. Intermittent drives drive the batcher and the outfeed conveyor in alternate relationship so that the outfeed conveyor stops to receive a stack while the outfeed conveyor takes the stack away, both without requiring stoppage of the infeed conveyor. The batcher acts as a gate, stopping flow to the outfeed conveyor while a completed stack is moved away and accommodating and accumulating incoming flow during the removal operation. A preferred but optional feature of the invention includes a counter which causes actuation of the intermittent drive means so that scacks of predetermined count are delivered. Another preferred but optional feature of the invention is means for driving the batcher in the reverse direction while the outfeed conveyor is driven in its forward direction to carry away a stack so as to provide a more positive separation in the stream.

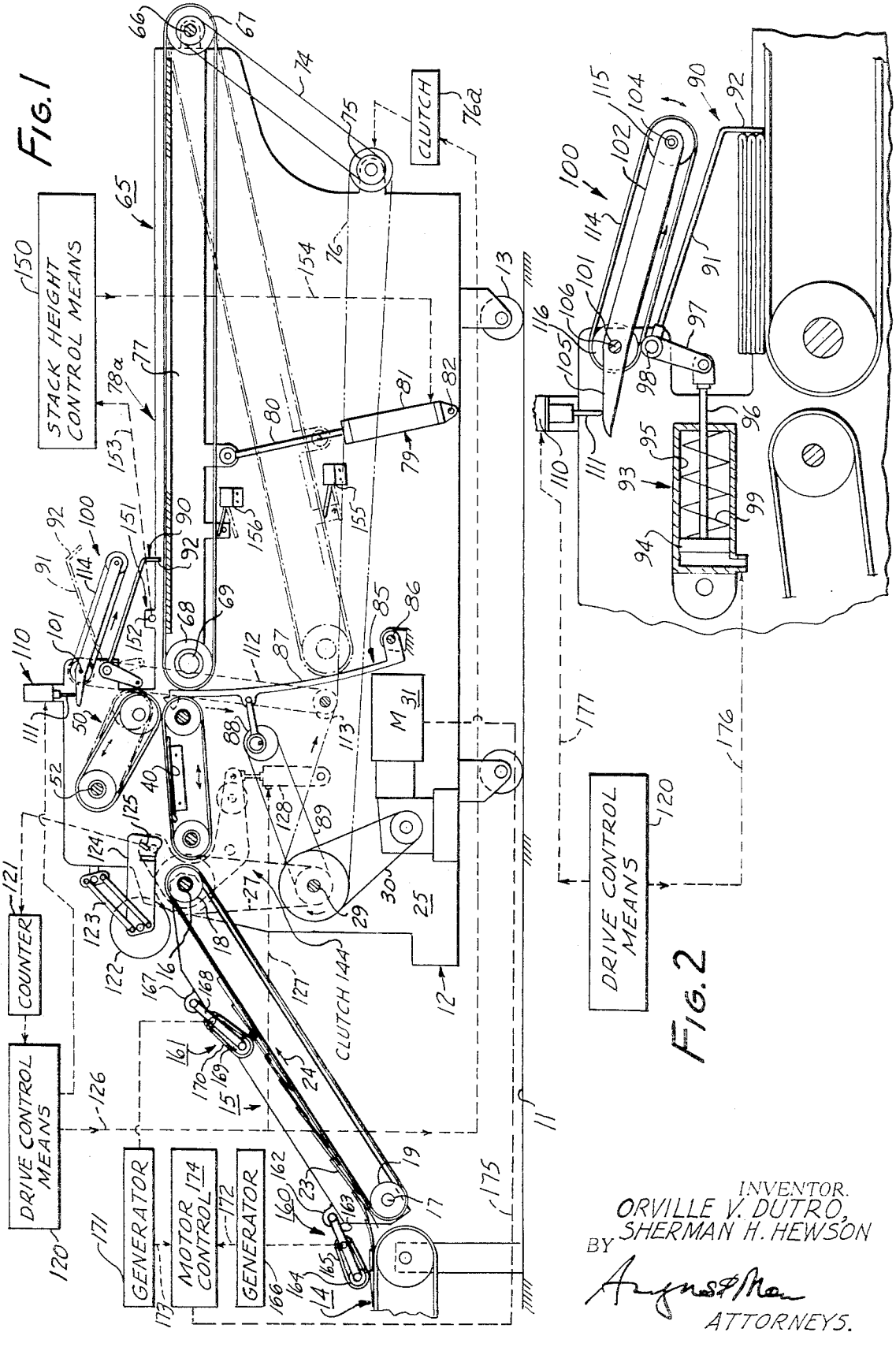
26 Claims, 4 Drawing Figures



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SHEET 1 OF 3



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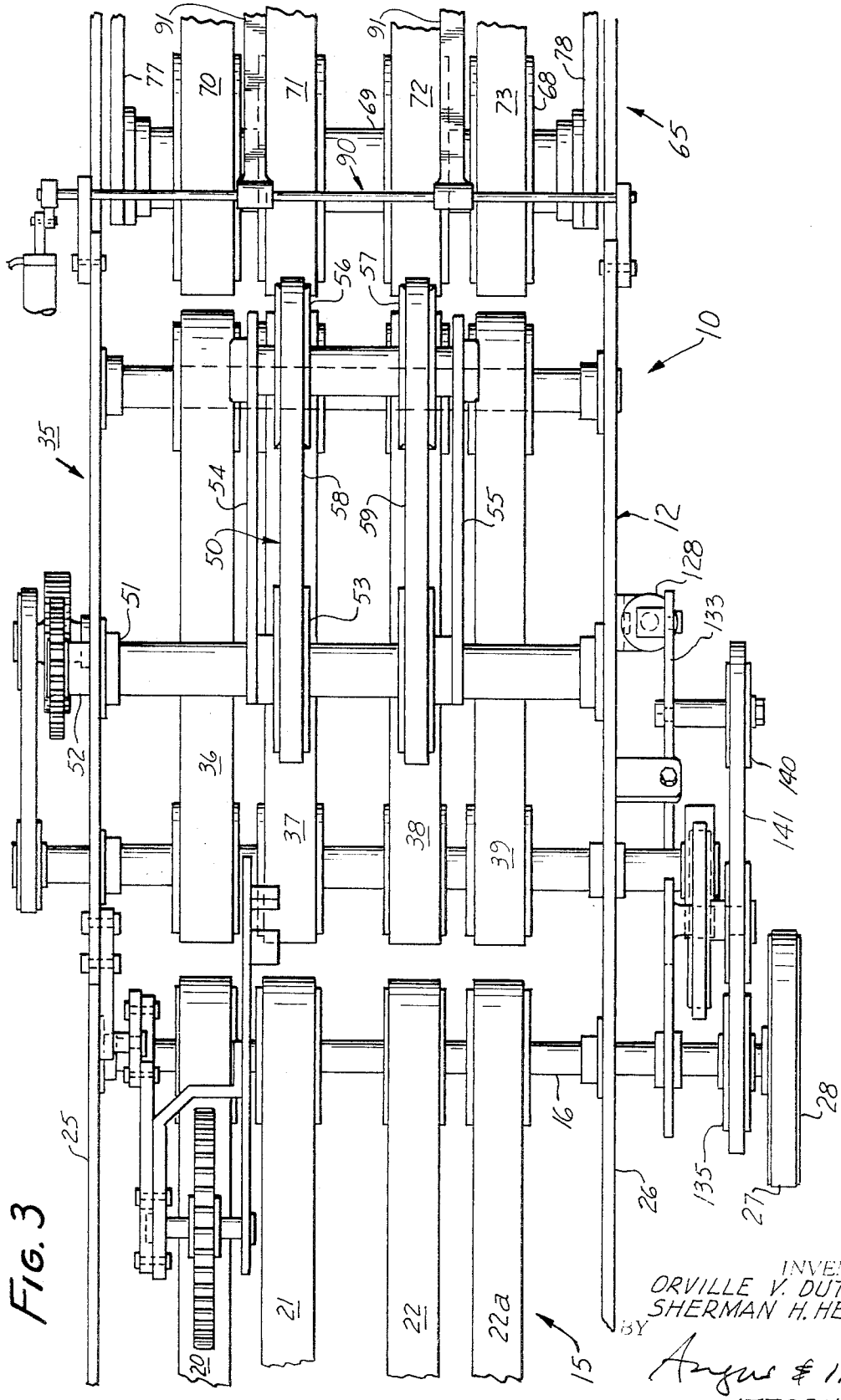
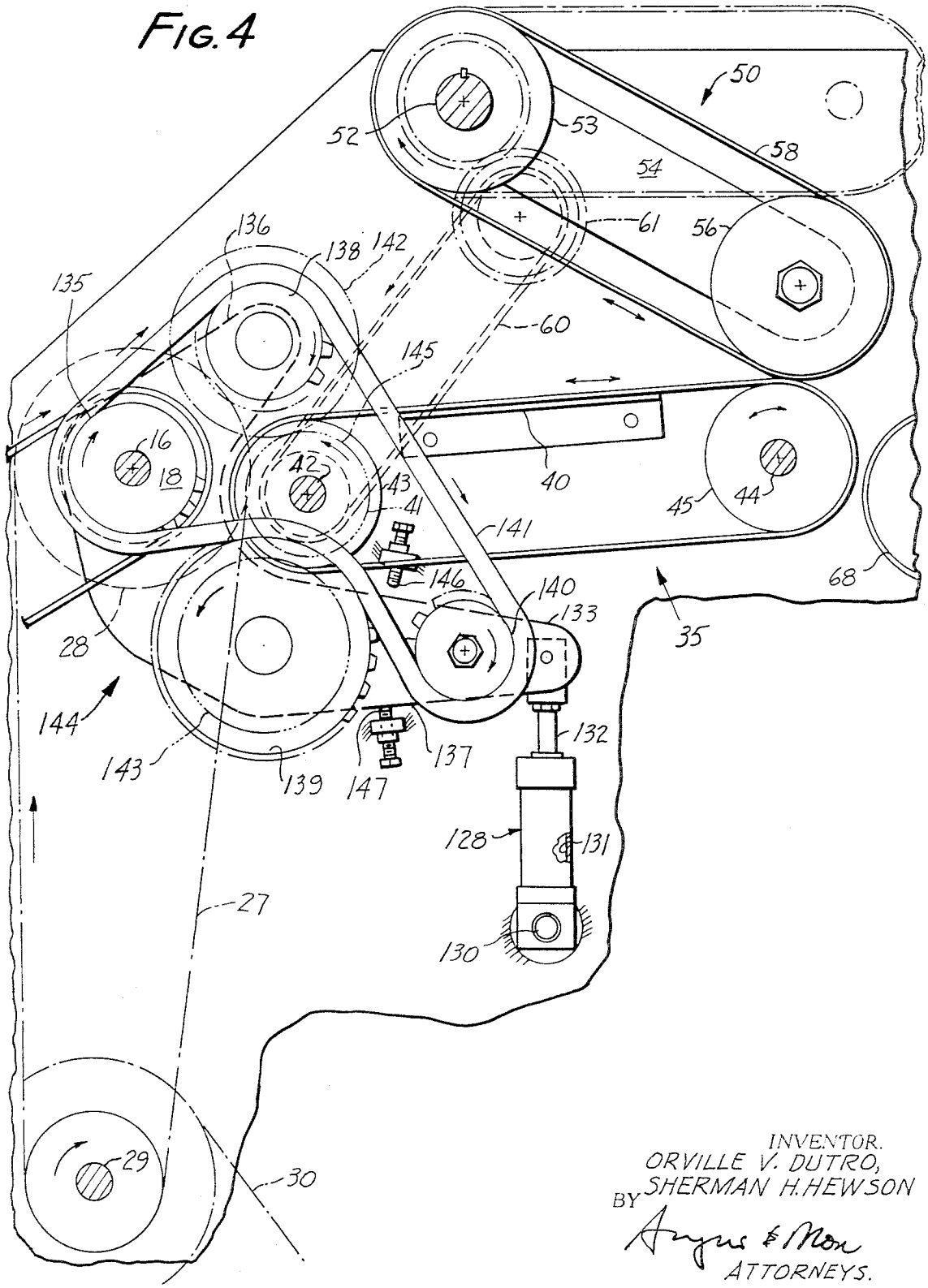


FIG. 3

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FIG. 4



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BATCH STACKER

This invention relates to a batch stacker which converts a stream of overlapped articles into separate vertical stacks.

The conversion of the steady flow output of newspaper presses and the like into bundles is a necessary part of the distribution process. The producing machinery operates at a high rate, and cannot be interrupted, so the machinery which produces a corpuscular product such as separate stacks must be adaptable to work on a steady stream of articles. Suitable machinery for stack batching must be rugged and reliable, simple in concept, and elementary in its operating techniques. Furthermore, it must be amenable to rapid operation, and to the reliable division of the articles in the stream into bundles of accurate count.

Interruption in the operation of a stacking means at the output of a press can cause a heavy cost in downtime and missed schedules. Further as to cost, if it is frequently a contractual requirement that the stacks be accurately counted, or at least not be short in count. The division of articles into stacks whose count is uncertain or which varies from stack to stack is therefore costly because of the penalties involved, and it is not unusual for extra copies to be put in stacks simply to avoid the penalties of short counts. It is, of course, possible to provide expensive machinery of great complexity to meet these needs, but such machinery is beyond the financial capacity of small and medium sized printing operations. It is these very operations which have the most pressing need for accuracy in count, and for economical and reliable stacking means.

It is an object of this invention to provide a reliable stacker for converting a steady stream of articles into stacks, which stacker is relatively inexpensive, very rugged and reliable, and which has a substantial throughput capacity.

It is also an object of this invention to provide a batch stacker which does not rely for its operation on the assumption that the stream is uniform. It is customary for printers to pull test specimens from the stream to ascertain the correctness of the printing, and these articles represent short counts in stacks produced by many known stackers. The device of this invention operates in response to the papers as delivered to it, and does not assume uniformity of flow.

A batch stacker according to this invention receives a continuous and overlapped stream of individual articles such as signatures or newspapers from an infeed conveyor (which may constitute the outfeed of a printing press or other source of articles) and produces stacks of the articles on an outfeed conveyor. A batcher feeds overlapped articles to the outfeed conveyor where the stack is formed. Intermittent drive means drive the batcher and the outfeed conveyor in alternate relationship so that the outfeed conveyor stops to receive a stack while the batcher feeds the articles to it, and the batcher stops feeding and acts as a gate and accumulator while the outfeed conveyor carries a stack away, both without requiring stoppage of the infeed conveyor, whatever it is.

A preferred but optional feature of the invention resides in means for driving the batcher in the reverse direction while the outfeed conveyor is driven in its forward direction to carry away a stack so as to provide a more positive separation in the stream of articles.

According to still another preferred but optional feature of the invention, the elevation of the outfeed conveyor is adapted to be lowered adjacent to the batcher as the height of the stack increases, whereby to maintain the top of the stack at a level at or beneath the elevation at which the batcher delivers the articles to the outfeed conveyor, and also to provide an optional means for determining the number of articles in a stack.

According to still another preferred but optional feature of the invention, the stacker carries a feed speed sensor wheel which rides in contact with the stream upstream of the stacker to generate a signal indicative of the speed of the articles. A stacker speed sensor generates a signal indicative of the rate of operation of the stacker, and motor control means responsive to these two sensors controls the motor which drives the stacker and thereby causes the stacker to run at the speed of its supply source.

The above and other features of this invention will be fully understood from the following detailed description and the accompanying drawings, in which:

FIG. 1 is a side elevation of the presently preferred embodiment of the invention;

FIG. 2 is an enlarged fragmentary portion of FIG. 1 augmented to show certain additional details;

FIG. 3 is a top view of FIG. 1; and

FIG. 4 is an enlarged fragment of the side elevation of FIG. 1.

In FIG. 1 there is shown a batch stacker **10** according to the invention. It rests upon a floor **11** and can be made freestanding by means of a frame **12** mounted to casters **13** in order that it may be moved to various locations. It is a desirable feature of this invention that it is fully self-contained, including means for causing its speed to be identical to that of its supply source.

The batch stacker is intended to be placed next to a delivery device **14**, which might be the outfeed from a press or other supply, production, or secondary treatment mechanism such as a stuffer. It includes an infeed conveyor **15** which has a drive shaft **16** and an idler shaft **17**, to which wheels **18, 19** are pinned. Conveyor belts **20, 21, 22, 22*a*** are wrapped around the wheels and are driven by drive shaft **16** so as to move a stream **23** of overlapped articles in the direction shown by arrow **24**.

In the embodiment shown, the infeed conveyor is integral with the stacker, and provides a transition element for receiving articles, from the outfeed of a press or the like. The outfeed conveyor need not be integral with the stacker. The downstream elements could instead receive articles directly from the delivery device in which event the delivery device itself would constitute the infeed conveyor. The inclusion of an infeed conveyor in the batch stacker as an integral part thereof provides a far more versatile device. However, wherever the term "infeed conveyor" is used, devices not integral with the batch stacker are also contemplated and included.

FIG. 3 shows drive shaft **16** journaled in side plates **25, 26** of the frame so as to support the infeed conveyor as shown. A drive belt **27** drives the drive shaft **16** through a drive wheel **28** which is pinned to the drive shaft. As best shown in FIG. **1**, drive belt **27** is engaged to a power shaft **29** which is driven through belt **30** by motor **31**. Motor **31** is the central source of power for the entire stacker, so that the stacker is completely self-

contained, and does not rely for its power on another machine, but only on the building power supply.

The stacker includes a batcher **35**, which batcher includes a group of gating belts **36, 37, 38, 39**, between which there are disposed underlying supports **40** as a supplementary slide support for articles carried on the gating belts. As can best be seen in FIG. **4**, a drive gear **41** drives a drive shaft **42**, there being a drive wheel **43** keyed to the drive shaft. An idler shaft **44** is journaled to the side plates and carries freely revolving wheels **45**. The gating belts are wrapped around wheels **43** and **45** and convey the articles received from the infeed conveyor.

There is also provided a first top drive means **50** which is pivoted to the side frames at journal **51**. A drive shaft **52** drives drive wheels **53**. Arms **54, 55** are pivoted to the drive shaft so as to rotate freely around it. These arms extend outwardly and support idler wheels **56, 57** on a shaft which extends between them. Drive belts **58, 59** are wrapped around wheels **53, 56** and **57**. This top drive means is biased downwardly by its own weight toward and against articles which travel through the batcher so that, when the drive and gating belts drive from the top and the bottom, the stack will positively be delivered through the batcher with little or no slippage.

The gating belts act as a gate by stopping and permitting previously passed articles to move onto the outfeed conveyor, and retain upstream articles by not moving them toward the outfeed conveyor. The upstream articles continue to move upon the batcher, but merely accumulate there until the batcher again provides forward movement. When the top drive belts also bear against the articles, a closely defined gate is provided between their nearest approach to the gating belts and the gating belts themselves. At this "gate" the articles are pinched, and when the batcher stops, the tariling end of the article just behind the last article for a given stack is restrained against moving onto the outfeed conveyor.

First top drive means **50** is driven by a belt **60** through a transfer gear **61**. Belt **60** is engaged to drive shaft **42** so as to be driven simultaneously therewith. The linear speeds of the belts in the top drive means, and beneath the articles are equal, so no shear motion between articles in the stream is caused by the driving forces. The reaches of the gating belts **36–39** and the upper belts **58, 59** adjacent to the stream of articles will therefore be driven in the same direction relative to the flow direction of the articles, and at the same time and speed.

The articles are delivered by the batcher to an outfeed conveyor **65**, which includes a drive shaft **66** journaled to the side plates, to which drive wheels **67** are pinned. Idler wheels **68** are mounted to an idler shaft **69**, which is journaled between two arms **77, 78** so as to connect their free ends. Conveyor belts **70, 71, 72, 73** are wrappPd around the drive wheels and idler wheels so as to convey a stack of articles which rest thereon. A drive belt **74** is driven by wheel **75**, and drives wheel **67**. Wheel **75** is driven by drive belt **76** (or drive chain) which is engaged to power shaft **29**. A clutch **76***a* is interposed between the drive shaft **66** and the motor so as to cause intermittent driving of the output conveyor. Further details of this feature will later be provided.

Support arms **77, 78** are journaled around drive shaft **66**. The two shafts and the side arms form a tiltable The table **78***a* has a receiving end (the left-hand end in FIG. **1**) adjacent to the batcher and a delivery end (the right-hand end in FIG. **1**). In FIG. **1**, the top of the receiving end is shown disposed at the elevation of the discharge end of the batcher. This elevation is sometimes called the "reference elevation," and the receiving end moves in an arc up and down below the reference elevation, moving down as the stack height grows. The conveyor belts, as a unit, can pivot around shaft **66** so that the elevation of that end of the outfeed conveyor which is adjacent to the batcher can be changed. This change in elevation is accomplished by motive means **79** which comprises a piston-cylinder actuator with a rod **80** extending from cylinder **81**. The rod is shown in its extended position in FIG. **1**, holding the table in the upper, solid line position of FIG. **1**. When the rod is retracted in the cylinder, the table will tilt downwardly toward the lowermost position shown in dashed line. Controlling the actuator, such as by metering out hydraulic fluid from the cylinder enables the table to assume positions intermediate between the two which are illustrated. The cylinder is mounted at pivot **82** to one of the side plates of the frame.

A jogger **85** is pivotally mounted at pivot **86** to the side walls of the stacker. It comprises a plurality of arms **87** which extend between the belts **70–73** at an elevation beneath the level at which the feeder delivers its articles. The arms move in an oscillating arc, and are driven by an eccentric link **88** that is powered by belt **89** from power shaft **29**. This creates an oscillating, "patting", movement which tends to impel the articles on the outfeed conveyor in a downstream direction. As the stack grows, it leans toward the jogger, which aids in supporting it and maintaining it as a straight stack.

A stabilizer **90** is pivotally mounted to the side frame. It comprises an arm **91** which has a downwardly depending finger **92** at its free end. The stabilizer can assume two positions. The first position is shown in solid line in FIG. **1**, where the finger stands in the path of articles being stacked on the outfeed conveyor, and prevents them from spilling off the stack. It also acts as a stop for arresting motion of the articles which is caused by the jogger. The other stabilizer position is shown in dashed line. The finger in this portion is out of the path of a stack to be removed in this position.

The means for moving the stabilizer is shown in FIG. **2**. This means is a fluid motor **93** comprising a piston **94**, a cylinder **95**, and a rod **96** projecting from the piston. The rod is linked to another arm **97** which is pinned to arm **91** to form a crank rotatable around pivot **98**. Extension of rod **96** will cause the arm **91** to lift. Retraction of the rod occurs when the fluid pressure is relieved in the cylinder and is caused by spring **99**. This lowers the arm so the finger again is in the path of the stack.

A second top drive means **100** is shown in FIGS. **1** and **2**. It is pivotally mounted to the side frames and overhangs the outfeed conveyor. Top drive means **100** comprises a drive shaft **101**, a pair of arms **102, 103**, an idler shaft **104** joining the arms at their free ends, and a tongue **105** extending on the opposite side of the pivot **106** from the arms. Rotation is around the pivot. Motive means **110** is mounted to the side frame. This motive means is a piston-cylinder actuator with a piston rod **111** that bears against tongue **105** so as to lift the

top drive means **100** off the stack when the rod is extended.

Top drive means **100** is driven by a drive belt **112** which receives its power from a transfer gear **113** driven by belt **76** from power shaft **29.** This means is operated concurrently with the outfeed conveyor and its belts **114** have the same linear speed. The belts are wrapped around wheels **115** and **116** which are mounted to the drive shaft and the idler shaft, respectively. The belts bear against the top of a stack when not held off of it by motive means **110.** While the stack is being formed, the rod will be extended, and means **110** will be lifted up out of the way of the growing stack. The rod will be retracted, and the belts brought against the top of the stack when the stack is to be removed from the outfeed conveyor.

The outfeed conveyor and the batcher will be operated in inverse driving relationship to each other. The batcher will stop feeding while the outfeed conveyor is moving stacks of articles away, and the belts of the outfeed conveyor will stand still while the batcher is feeding articles to the outfeed conveyor. All this is accomplished without having to interrupt the flow of the input to the device or of interrupting the flow on the infeed conveyor.

Drive control means **120** is provided to cause this intermittent and alternate motion. The drive control means is shown only schematically for the reason that it may be made of many types of conventional devices and with many different standard circuits. It is their function, rather than its detailed construction, which is important to the invention.

Preferably, although not necessarily, the drive control means is under control of a counter **121,** which counter includes a bogey wheel **22** that rides along and in rolling contact with the top of the stream of articles. It is located at the end of a parallelogram movement **123** which is based on the side frames. At the end of an arm **124,** there is a sensor **125** which is adjacent to the stream and senses the passage of individual articles beneath it. The sensor feeds data respective to the count of individual articles to the counter.

The counter has means for receiving the data, processing it and providing a signal to the drive control means indicative of a particular count having been reached. When a given count is reached, the drive control means applies a signal to line **126** which applies a control signal to clutch **76***a*, which engages the clutch and drives the outfeed conveyor for a predetermined distance which will remove a stack. Such a control might be a single revolution clutch, or a clutch set for a given number of revolutions, or determined by a switch contacted downstream by the displaced stack. These are obvious means for accomplishing the function of the invention. When this stack displacement is concluded, the clutch operation will cease, and a signal will be provided to the control means indicating the completion of that portion of the cycle.

Similarly, the drive control means is adapted to provide a signal through line **127,** which is a branch of line **126,** to a motive means **128** that acts as a clutch for engaging and disengaging the drive means on the batcher which actuates the batcher while the outfeed conveyor is idle, and idles the batcher (or may even reverse it) while the outfeed conveyor is actuated. The motive means and power transmission means for the batcher will now be described in greater detail, with initial reference to FIG. **4.**

Motive means **128** is shown mounted by pivot **130** to one of the side plates. It includes a cylinder **131** and a rod **132** which is attached to a piston (not shown) in the cylinder. The rod is connected to a swivel plate **133.**

The swivel plate swivels about shaft **16,** and shaft 16 carries the drive wheel **135,** the center of which does not shift. The swivel plate includes arms **136, 137** to which there are journaled clutch wheels **138, 139,** respectively. Arm **137** also carries an idler wheel **140** for the purpose of guiding a belt **141.** This belt drives both of wheels **138** and **139** as a consequence of its engagement with drive wheel **135.** The peripheries of all of the four wheels are shown toothed, and the belt itself is shown as a gear-toothed belt for positive engagement purposes. In this belt, as in the case of all other power transmission belts herein, the belt may be a flat friction type, or a gear type, or may be substituted for by chains if desired. A conventional wire reinforced toothed belt, however, has been found to be of particular utility throughout the device, except for the lighter power transmission, where a chain is preferable.

Clutch wheels **138, 139** carry friction surfaces **142, 143,** respectively, and it is the function of the devices mounted to the swivel plate to act as a clutch **144** by virtue of their alternate contact with a friction surface **145** on wheel **41.** Also, there is an alternate intermediate position which may be assumed where neigher is in such contact. This can provide for a dwell between the functions if such is desired. The period of time the swivel plate takes to transfer contacts also constitutes a dwell in the driving cycle.

In the example given it is possible for the direction of the feeder belts to be reversed so as to pull back toward the batcher articles which might otherwise be fed onto the outfeed conveyor in order to provide for a more positive separation in the flow of articles. However, the mere stoppage of the feeder has been found to be sufficient for this purpose, and reversal of the batcher is an optional feature.

Drive wheel **135** is the power for the gating belts and also for the top feed drive **50,** belt **60** being the source of power for the top feed means, which in turn derives its power through wheel **41.**

Limit stops **146, 147** are mounted to a side plate of the stacker in order to engage arm **137** at opposite extremes of their movement so that the wheel engagements will be precise. In the reverse direction shown, wheel **138** is driving wheel **43** and wheel **139** is out of contact with wheel **43.** Arm **137** engages stop **147.** Were the setting of motive means **128** reversed and rod **132** extended, the arm would move up to strike stop **146,** at which time wheel **139** would have come into contact with wheel **43,** and clutch wheel **138** would have moved out of contact with it, thereby driving the belt in a forward direction, the opposite direction from that which is illustrated in the drawings. Were only forward and stop motions to be desired, then stop **147** would be adjusted to prevent contact of clutch wheel **138** with wheel **43,** and limit stop **146** would be left as shown.

As heretofore stated, the operation of clutch means **76***a* and **144** are alternative to each other. Preferably, clutch operation is under the control of a counter, but it may be controlled as a consequence of any other type

of actuation, such as a timer, manual actuation of drive control means **120**, or by limit switches responsive to the position of the table on the outfeed conveyor. In every case, the alternative effect of the drive control means is attended to by signal line **126** and its branch signal line **127** such that, when clutch **76***a* is engaged, the outfeed conveyor is actuated, and clutch **144** is set in either a stop or a reverse condition (both of these being non-feeding conditions as to the batcher), or clutch **144** may be engaged to drive the batcher forwardly and clutch **76***a* disengaged to stop movement of the belts on the outfeed conveyor. The term "clutch" has been utilized as a shorthand expression for means to apply or not to apply power to respective elements of this device. A clutch is especially suitable in this stacker where the entire device is run from a single power source. It will also be understood that switch means controlling individual motor drives would fall within the scope of the invention and of the said terminology.

In the operation just described, it should be noted that, regardless of the switching condition of the drive control means, there is no interruption of the infeed conveyor, and that even when the batcher is operated in reverse, oncoming articles which have passed the counter will simply accumulate on the batcher for the short period of time in which the batcher does not supply articles to the outfeed conveyor. When the outfeed conveyor returns to its receiving condition, there with be a tetporary flow of an extra number of papers which has been held in reserve on the batcher as a consequence of the continuing supply to it. The first top drive means, when used, simply rolls up over the resultant transient bulge in the stream of articles.

Stack height control means **150** is provided for maintaining the top of the stack at an elevation sensibly close to that of the outfeed end of the batcher. For this purpose, there is provided a height sensor **151**, preferably in the form of a light beam directed at a photoelectric sensor **152**, the objective being to keep the beam unbroken by the top of the stack. Accordingly, when papers stack up and interrupt the beam, a signal passes through signal line **153** to the stack height control means, which stack height control means produces an output signal through signal line **154** to motive means **79**, which will cause the rod **80** to retract into a cylinder **81**, perhaps by bleeding out hydraulic fluid, by a sufficient distance so that the top of the stack will no longer impede the height sensor's reception of the light beam. This may be an intermittent or continuous motion. Other sensor type devices may obviously be substituted for this purpose. Switches **155** and **156** can slso be provided with other useful attributes. For example, they can be used as override means for the drive control means. Should the table reach the bottom of its arc and the outfeed conveyor not yet be actuated, there is the obvious risk of a continued supply from the batcher, and the machine would choke. Similarly, if the batcher could feed articles to the outfeed conveyor before the table reached its upper position after a stack was moved away, the articles could fall in disarray, be damaged, and not form a stack.

Accordingly, switch **155** may be connected to the drive control means to start the cycle of operation to remove the stack, stopping the feeder, and raising the table, as a safety switch at some predetermined table level. Of course, the counter would ordinarily start the cycle before the limit switch is contacted, but this arrangement assures that the machine will not be clogged up. It follows that when a counter controls the device, switch **156** will be used only in an emergnecy.

Switch **156** signals that the table is at its upper position, and will provide a signal to the drive control means which will enable the feeding cycle to start again. In fact, this switch may be used as the start and cycling signal source if desired. Suitable circuitry for use with switches **155** and **156** is obvious to a person skilled in the art, the purpose of it simply being to control the actuation of motive means **69** to return the table to its upper position at the conclusion of the completion of each stack and to start and stop the batching and outfeed motions as stated.

Switch **155** may also be used instead of the counter to determine the content of the stacks. There are many applications wherein the number of articles is sufficiently proportional to stack height that height, instead of count, can be relied on. Therefore, switch **155** may be adjustably set at some elevation, and when the table contacts switch **155**, it will actuate the drive control means to stop the batcher and start the outfeed conveyor. Stacks of equal height and presumably equal count are thereby produced without requiring a counter, and without having to assume that the stream is uniform. Suitable circuitry for use with switches **155** and **156** is obvious to a person skilled in the art, the purpose of the circuitry simply being to control the actuation of motive means **79** to return the table to its upper position at the conclusion of the completion of each stack, and to start and stop the batching and outfeed motions as stated.

Another feature of this invention resides in means for controlling the speed of motor **31** so as to drive the batch stacker at a rate which is proportional to the infeed rate without requiring an operative connection with the infeed mechanism. In FIG. **1**, there is shown a feed speed sensor **160** and a stacker speed sensor **161**, both mounted to the frame. The feed speed sensor is journaled to the frame, and a pivotable arm **163** bridges the gap between the batch stacker and the supply mechanism **14**. Again it is emphasized that the supply source is an infeed conveyor and could be adapted to supply articles directly to the batcher. Infeed conveyor **15** is a conveyor that acts as a transition element carried by the frame, and makes the batch stacker more versatile in use, because it can be adjusted to fit next to any supply means to receive its output. However, the term "infeed conveyor" is not limited to a device carried on the frame of the batch stacker.

Arm **163** carries a wheel **164** which rests upon and rides along the top of the stream of articles so that a belt **165**, wrapped around the wheel, has the same linear velocity as the stream of articles. This belt in turn drives a tachometer generator **166** which produces a signal proportional to the linear speed at which the articles are fed.

Similarly, a stacker speed sensor **161** is mounted to the frame at a journal **167**. The journal pivotally mounts an arm **168** which supports a wheel **169** that drives a belt **170** at the same linear speed as the stream of articles on the infeed conveyor. This belt in turn drives a tachometer generator **171**.

Generators **166** and **171** provide signals through signal lines **172, 173**, respectively, to a motor control **174** which in turn, through signal line **175**, controls the

speed of motor **31**. The motor control might, for example, be a zero balancing wheatstone bridge circuit whose objective is to balance out the signals from the two generators by appropriate energization of the field of a shunt-wound motor (motor **31**). Many controls suitable for this purpose are known to persons skilled in the art and require no description here. What should be noted, however, is that, by virtue of the contact of the feed speed sensor with the oncoming stream and the feedback of the stacker speed sensor **161**, the batch stacker is caused to operate at precisely the same speed as that of its infeed mechanism without requiring any electrical or physical interconnection between the mechanisms themselves.

While the tachometer generators are shown being driven by belts, it is evident that either or both, but especially the stacker feed sensor, could operate off of a shaft instead.

In FIG. **2**, drive control means **120** is shown also controlling second top drive means **100** and stabilizer **90**. As to stabilizer **90**, it will be operated by the drive control means at the same time that clutch **76** is actuated by providing a signal such that pressure is exerted in cylinder **95** so as to extend rod **96** and lift arm **91**. On the other hand, when the drive control means **120** drives the feeder, then it will relieve pressure in the cylinder and permit spring **99** to retract the rod, dropping arm **91** to where it will stand in the path of the advancing articles so as to stabilize them in a stack. All the while the jogger mechanism is patting the articles to form a growing vertical stack.

The signal to the stabilizer passes through signal line **176**, while there is another line **177** operated concurrently but alternatively which, when the stabilizer arm is lifted, will vent cylinder **110** and permit the second top drive means **100** to drop onto the top of the stack to aid in driving away the stack. When the stabilizer arm is lowered by venting pressure in the cylinder **95**, pressure is exerted positively in cylinder **110** so that plunger **111** presses down on tongue **105** to lift the second top drive means **100** off the stack.

It will now be seen that there is a completely free standing batch stacking device capable of a broad general application which is simple and rugged in concept and construction. All that is required is to wheel the batch stacker up to its infeed mechanism in such a position that the stream of articles will flow from one to the other. The feed speed sensor will generate a signal which starts motor **31** in operation, and as it does so, the stacker speed sensor **161** will sense whether or not the correct speed is attained by the stacker, and when their signal agrees the correct speed will have been reached. The stacker can operate at any speed, or can stop, along with its input as a consequence of these signals. The stacker is therefore a slave to its supply.

When the stream is received and carried through the infeed conveyor on the frame, it passes the counter where the articles are counted and flows to the batcher. From the batcher, the articles pass to the outfeed conveyor where they are restrained by the stabilizer to grow in a stack, and as the stack grows, the height sensor causes the table to drop so as to maintain the top of the stack at a sensibly constant elevation so the articles do not tumble. After the desired number of articles has passed the counter, it provides a signal to the drive control means which either stops or reverses the batcher (in either event stopping its forward feeding) and at the same time starts the outfeed conveyor in operation which has been standing still during the feeding operation. Simultaneously, the stabilizer arm swings up out of the way, and the second top feed drive **100** lowers into place to aid in stabilizing and driving the stack away to the conveyor. After the stack has traveled a desired distance, which can be sensed by contact either with a switch or by appropriate controls over the clutches, the drive control means, which is responsive to such travel, will reverse the settings of the intermittent drive means, stopping the outfeed conveyor and starting the feeder again while at the same time dropping the stabilizer and raising the first top drive means **100**. During this changeover, the motive means **79** will have raised the table again to the position illustrated in solid line in FIG. **1**. The jogger is permitted to operate continuously, and the top feed drive **50** operates only with the batcher.

When only stack height is used to control the content of the stacks, the counter will be disabled, and the signal of switch **155** substituted for that of the counter.

The length of the batcher is such that backing or stopping of its feed to the output conveyor will not impede the continuing flow of articles from the infeed conveyor. All speeds are coordinated to this objective.

It should also be noted that it is possible to adjust the output signal from the motor control **174** by amplifying or de-amplifying it so as to provide a proportional speed for the batch stacker might be greater or less than the speed of the incoming articles. Such an arrangement could cause a linear stretch or shrink in the stream, which may be a dimensionally desirable situation.

It will further be noted that this device is adaptable to wide ranges of thicknesses of the articles being stacked, to a wide range of control signals and techniques, and may be made of simple and readily obtainable standard components.

This invention is not to be limited by the embodiment shown in the drawings and described in the description, which is given by way of example and not of limitation, but only in accordance with the scope of the appended claims.

I claim:

1. A batch stacker which converts a downstream moving stream of overlapping articles into stacks of said articles, said articles being fed to the stacker from an infeed conveyor, said stacker comprising: an outfeed conveyor; first intermittent drive means in driving connection with said outfeed conveyor adapted to drive said outfeed conveyor forwardly to remove articles from the stacker, and to stop to enable the outfeed conveyor to receive articles to be stacked; a batcher receiving articles from the infeed conveyor and delivering the articles to elevation outfeed conveyor at a reference elevation second intermittent drive means in driving connection with said batcher adapted to drive said batcher forwardly to deliver articles to the outfeed conveyor, and to cease its forward drive to stop delivering articles to said outfeed conveyor; and drive control means operatively connected to the drive means which alternates the forward driving of the batcher and of the outfeed conveyor, the outfeed conveyor being stopped when the batcher is driving forwardly, and driving forwardly when the batcher is not said outfeed conveyor having a receiving end and a delivery end, and comprising a table pivoted at the deliv-

ery end so that its receiving end can move up and down in an arc below the reference elevation and adjacent to the batcher, whereby the elevation of the receiving end can be lowered as a stack deposited on it grows in height, whereby to maintain the top of the stack at a level at or beneath the reference elevation.

2. A batch stacker according to claim 1 in which the second intermittent drive means drives the batcher in the reverse direction while the outfeed conveyor is driven in the forward direction.

3. A batch stacker according to claim 1 in which counter means is included in said control means so as to cause the control means to cause the second intermittent drive means to stop the delivery of articles from the batcher to the outfeed conveyor when a given count is reached.

4. A batch stacker according to claim 3 in which a feed speed sensor is mounted to the stacker which projects from the stacker in order to sense the velocity of the supply of articles and to supply a signal to a motor control controlling the velocity at which the batcher and infeed conveyor move the articles so as to equalize said last named velocity to that of the supplied articles.

5. A batch stacker according to claim 3 in which a movable stabilizer is disposed downstream of the intended location on the outfeed conveyor of a stack to be formed so as to restrain the members of the stack from spilling forwardly while the stack is being formed, and to move away out of the path of the completed stack while the outfeed conveyor is carrying the stack away from the batcher.

6. A batch stacker according to claim 5 in which a top drive means is adapted to engage the top of the completed stack and drive it at the same rate as the outfeed conveyor while the outfeed conveyor is carrying the stack away from the batcher.

7. A batch stacker according to claim 1 in which means responsive to an elevation of the receiving end which is indicative of a stack of given height is connected to said drive control means so as to cause the drive control means to cause the second intermittent drive means to stop the delivery of articles from the batcher to the outfeed conveyor.

8. A batch stacker according to claim 1 in which a movable stabilizer is disposed downstream of the intended location on the outfeed conveyor of a stack to be formed so as to restrain the members of the stack from spilling forwardly while the stack is being formed, and to move out of the path of the completed stack while the outfeed conveyor is carrying the stack away from the batcher.

9. A batch stacker according to claim 8 in which a top drive means is adapted to engage the top of the completed stack and drive it at the same rate as the outfeed conveyor while the outfeed conveyor is carrying the stack away from the batcher.

10. A batch stacker according to claim 1 in which a top drive means is adapted to engage the top of the completed stack and drive it at the same rate as the outfeed conveyor while the outfeed conveyor is carrying the stack away from the batcher.

11. A batch stacker according to claim 1 in which a jogger is provided adjacent to the receiving end to impel the member articles of the stack toward the stabilizer.

12. A batch stacker according to claim 1 in which the batcher includes conveyor means upon which the stream of articles rests as it is moved toward the outfeed conveyor, and also includes a top drive means resting upon the top of the stream in driving relationship with the articles thereof at the same linear speed as the said conveyor means, whereby the stream is driven by the batcher from both its top and bottom.

13. A batch stacker according to claim 12 in which means responsive to an elevation of the receiving end which is indicative of a stack of given height is connected to said drive control means so as to cause the drive control means to cause the second intermittent drive means to stop the delivery of articles from the batcher to the outfeed conveyor.

14. A batch stacker according to claim 12 in which counter means is included in said control means so as to cause the control means to cause the second intermittent drive means to stop the delivery of articles from the batcher to the outfeed conveyor when a given count is reached.

15. A batch stacker according to claim 14 in which a feed speed sensor is mounted to the stacker which projects from the stacker in order to sense the velocity of the supply of articles and to supply a signal to a motor control controlling the velocity at which the batcher and infeed conveyor move the articles so as to equalize said last named velocity to that of the supplied articles.

16. A batch stacker according to claim 15 in which a stacker speed sensor senses the velocity of the articles along the stacker to verify that their velocity is that of the supply of articles.

17. A batch stacker according to claim 12 in which a height sensor senses the top of the stack and causes adjustment of the elevation of the receiving end to maintain the top of the stack at or below the reference elevation.

18. A batch stacker according to claim 17 in which said sensor is a photoelectric cell responsive to a light beam directed across the stack.

19. A batch stacker according to claim 17 in which the drive control means includes a clutch adapted selectively to engage the drive means.

20. A batch stacker according to claim 17 in which a movable stabilizer is disposed downstream of the intended location on the outfeed conveyor of a stack to be formed so as to restrain the members of the stack from spilling forwardly while the stack is being formed, and to move out of the path of the completed stack while the outfeed conveyor is carrying the stack away from the batcher.

21. A batch stacker according to claim 20 in which the stabilizer is a pivoted arm, and in which motive means is connected to said arm to move it out of the path of the stack while the outfeed conveyor is moving a stack away from the batcher.

22. A batch stacker according to claim 1 in which the drive control means includes a clutch adapted selectively to engage the drive means.

23. A batch stacker according to claim 1 in which a feed speed sensor is mounted to the stacker which projects from the stacker in order to sense the velocity of the supply of articles and to supply a signal to a motor control controlling the velocity at which the batcher and infeed conveyor move the articles so as to equalize said last named velocity of articles to that of the supplied articles.

24. A batch stacker according to claim 23 in which a stacker speed sensor senses the velocity of the articles

along the stacker to verify that their velocity is that of the supply of articles.

25. A batch stacker according to claim **1** in which the outfeed conveyor, batcher, and an infeed conveyor are all mounted to the same frame.

26. A batch stacker according to claim **1** in which a feed speed sensor is mounted to the stacker which projects from the stacker in order to sense the velocity of the supply of articles and to supply a signal to a motor control controlling the velocity at which the batcher and infeed conveyor move the articles so as to equalize said velocities to that of the supplied articles.

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