April 1, 1969 N. CHRISTMAS 3,436,073

STACKER

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Fig. 2

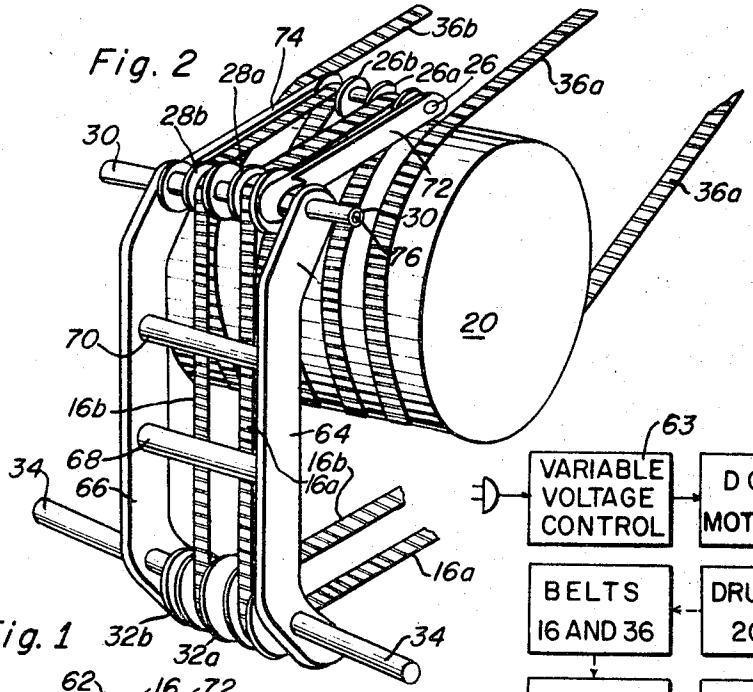
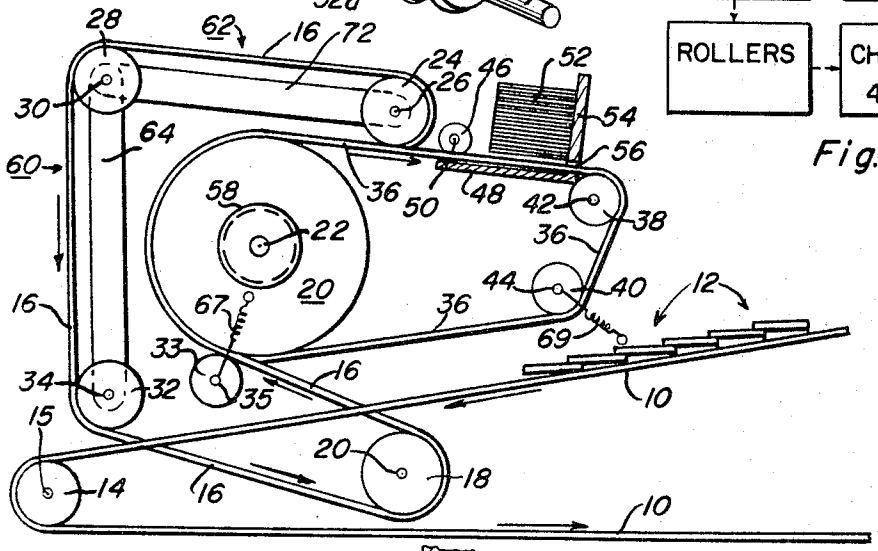


Fig. 1



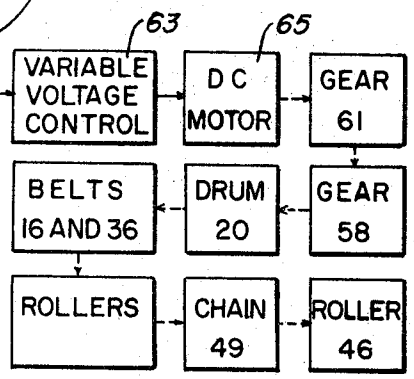


Fig. 6

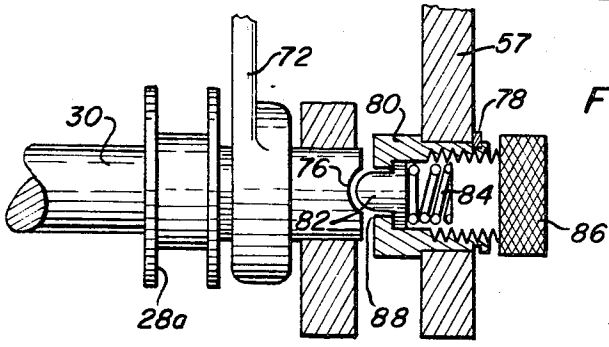


Fig. 3

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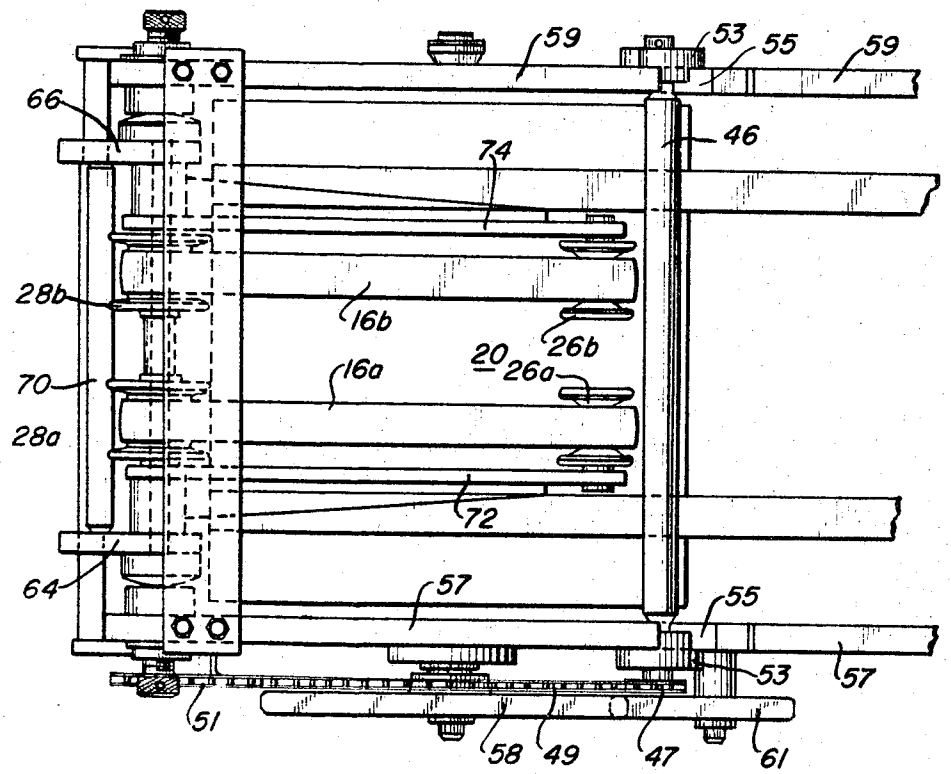
ATTORNEYS

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Fig. 4



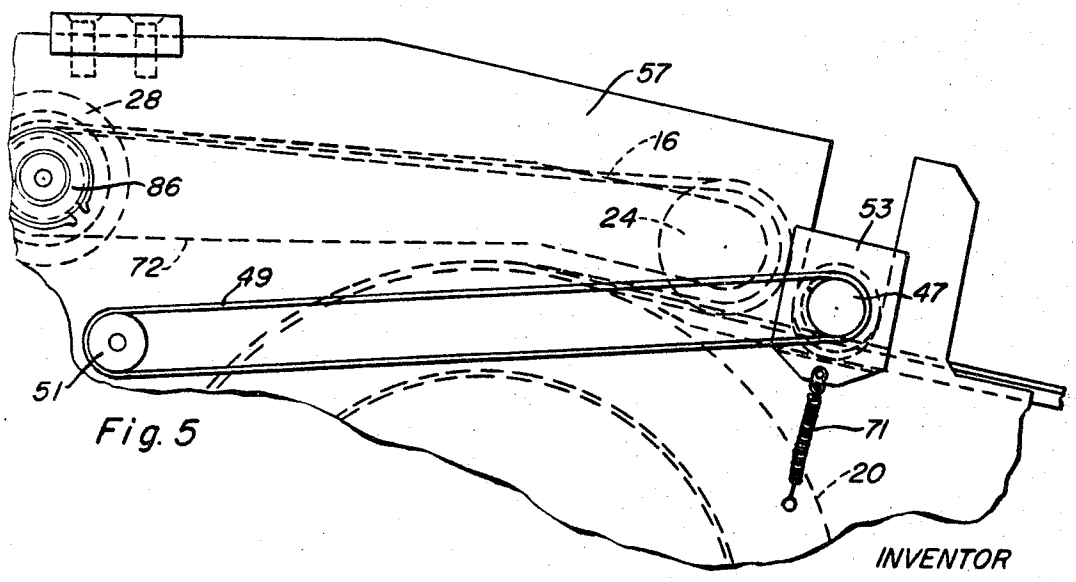


Fig. 5

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3,436,073

STACKER

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Int. Cl. B65h 29/12
U.S. Cl. 271—76 8 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to a stacker for stacking successive signatures of printed material as they issue from a web offset press. The stacker incorporates a break-away type release for disengaging the feed belts which normally function to carry the signatures around a turn-around drum. The release mechanism may be set to function when a predetermined tension on the belts is exceeded during a jammed condition, thereby protecting such belts and permitting manual correction of the jammed condition. The stacker is provided with a variable speed drive, which controls the speed of all of the conveying functions of the stacker.

The present invention is particularly adapted for use at the output of a web offset press in which successive signatures issue from the press in shingled relationship. That is, the leading edge of each signature rests on top of the preceding signature, and the trailing edge of each signature is beneath the following signature. In this condition, the signatures may be stacked by restraining movement of the forwardmost signature while allowing the following signatures to continue their forward motion until they become vertically aligned with the forwardmost signature.

Stackers of this general description have been known in the prior art but have been subject to a number of deficiencies which are overcome by the stacker of the present invention. Firstly, the condition of the signatures as they issue from the press is not controllable by the stacker mechanism, and, accordingly, there may be a variation in the thickness of the shingled signatures from the optimum value of this dimension for most efficient operation of the stacker. When the thickness of the shingled signatures exceeds the maximum for which the stacker is designed, a jam occurs which may result in breaking the feed belts of the stacker, necessitating a relatively long shut down, not only of the stacker, but also of the printing press, for the purpose of repairing the feed belts. This difficulty is overcome in the stacker of the present invention by providing means for disabling the feed mechanism of the stacker at a predetermined value of tension on the feed belts selected below that at which damage can occur to the stacker mechanism. The stacker of the present invention is also equipped with a variable speed capability, which permits the speed of the stacker to be matched to any combination of speed and thickness of signatures issuing from the printing press.

It is therefore the principal object of the present invention to provide a stacker adaptable to various conditions of speed and thickness of shingled signatures issuing from a printing press with which the stacker is associated.

Another object of the present invention is to provide a stacker having a variable speed drive.

A further object of the present invention is to provide means for automatically disabling the feed belts of the stacker in response to a condition in which a predetermined tension on the feed belts is exceeded.

These and other objects of the present invention will become manifest upon an examination of the following description and the accompanying drawings in which:

FIG. 1 is a functional diagram illustrating the arrangement of some of the major portions of apparatus forming an illustrative embodiment of the present invention;

FIG. 2 is a perspective view of a portion of the apparatus illustrated in FIG. 1;

FIG. 3 is a vertical cross section of a portion of the apparatus illustrated in FIG. 2;

FIG. 4 is a plan view of a portion of the apparatus illustrated in FIGS. 1 and 2;

FIG. 5 is an elevation of a portion of the apparatus illustrated in FIG. 4; and

FIG. 6 is a functional block diagram of the variable speed drive apparatus.

Referring now to FIG. 1, a belt **10** supports a plurality of shingled signatures **12** issuing from a web offset printing press (not shown). The belt **10** passes around a roller **14** supported for rotation on a shaft **15** in fixed relationship to the press. The belt **10** is driven by the drive mechanism of the printing press, and supports the signatures **12** on its top surface, moving rectilinearly along the downwardly sloping plane defined by the top surface of the belt **10** toward the roller **14**. The belt **10**, although illustrated in FIG. 1 as being a single belt, is preferably a plurality of narrow strips of web material spaced apart longitudinally along the roller **14**. The spaces between successive strips allow for the passage through the plane of the belt **10** of a plurality of strips forming another belt **16**. The belt **10** is conducted around the roller **14** in the direction of the arrows illustrated in FIG. 1.

The belt **16** is formed by a plurality of spaced apart strips **16***a* and **16***b* (FIG. 2) similar in construction to those making up the belt **10**, and advances in the direction indicated by the arrows in FIG. 1 about a roller **18**, mounted for rotation on a shaft **19** disposed below the signatures **12** supported on the belt **10**. From the roller **18**, the strips **16***a* and **16***b* pass upwardly between the strips forming the belt **10**, and proceed around a drum **20** supported for rotation on a shaft **22**. The belt **16** passes around slightly less than half of the drum **20** and proceeds from there to a roller **24** supported for rotation on a shaft **26**. After passing around the roller **24**, the belt **16** proceeds to a roller **28**, supported for rotation on a shaft **30**, and then proceeds downwardly around a roller **32** and from there returns to the roller **18**, passing again through the spaces between successive strips forming the belt **10** in the process. The roller **32** is supported for rotation on a shaft **34**.

As above described, the belt **16** is arranged to pass around the drum **20**, which will hereinafter be referred to as a turn-around drum, and is maintained in its relationship to the turn-around drum **20** by virtue of the rollers **18**, **24**, **28** and **32**. A further roller **33**, mounted for rotation on a shaft **35**, is provided near the bottom of the drum **20** to urge the belt into contact with the drum. By virtue of the strips **16***a* and **16***b*, and especially their position relative to the strips forming the belt **10**, the signatures **12** issuing from the printing press are transferred from the belt **10** to the belt **16** at the location where the two belts intersect, as viewed in FIG. 1, and are thereafter carried upwardly by the belt **16** toward the turn-around drum **20**. Upon reaching the turn-around drum **20**, the signatures **12** are compressed between the belts **16** and the turn-around drum **20**, and by the roller **33**, and are then turned with the drum **20** until the top of the drum **20** is reached, where the belt **16** leaves the drum **20**.

A third belt **36**, formed of a pair of strips **36***a* and **36***b*, similar to the belts **10** and **16**, passes around the drum **20**, the strips **36***a* and **36***b* being spaced outwardly from the strips **16***a* and **16***b* of the belt **16**. The belt **36** moves in the direction of the arrows illustrated in FIG. 1 and, in addition to passing around the turn-

around drum **20**, also passes around rollers **38** and **40** supported for rotation, respectively, on shafts **42** and **44**.

When the signatures **12** reach the top of the turn-around drum **20**, they are held with the belt **36** interposed between the signatures **12** and the drum **20**, and with the belt **16** over the signatures **12**. The signatures then travel rightwardly as viewed in FIG. 1, compressed between belts **16** and **36**.

When the roller **24** is reached, the belt **16** passes upwardly around the roller **24** and leaves the signatures **12**. However, before each signature passes out of contact with the belt **16**, its leading edge is inserted into the nip between a feed roller **46**, mounted for rotation on a shaft **50**, and a stacking plate **48**. The stacking plate **48** is fixed in position, and the belt **36** passes over the stacking plate **48** parallel thereto to reach the roller **38**.

The feed roller **46** is driven by the drive means in a direction such as to feed successive signatures **12** along the stacking plate **48** toward alignment with a stack **52**, resting on the stacking plate **48**.

As each signature reaches the feed roller **46**, the pressure between the roller **46** and the stacking plate **48** compresses each signature individually thereby to remove any air which may have been entrapped among the pages of the signature. Each signature is thereby rendered as flat as possible while passing the feed roller **46**.

A stop plate **54** is fixed to the stacking plate **48** at the rear thereof, and is provided with apertures **56** for passing the strips **36***a* and **36***b*. The leading edges of the successive signatures **12** contact the surface of the stop plate **54** and are thereby prevented from traveling further with the belt **36** as it proceeds through the apertures **56** and around the roller **38**.

As each signature reaches the stop plate **54**, it is added to the stack **52** at the bottom thereof, and the result is that the stack **52** gradually grows upwardly. The uppermost signatures in the stack **52** may be removed manually or otherwise without affecting the operation of the stacker.

The entire apparatus of the stacker of the present invention may be disposed directly above the output belt **10** from the printing press, so that the combination of printing press and stacker requires no more floor space than would be required by the printing press alone, with its output belt. This saving of space is partly accomplished by means of the turn-around drum **20**, which permits the stacking plate **48** to be positioned on the side of the drum **20** nearer the printing press, rather than on the opposite side.

Both the belts **16** and **36** proceed around the turn-around drum **20**, and may be driven by the drum, thereby avoiding the need for separate drive means for the two belts. The shaft **22** is provided with a gear **58** by which the turn-around drum **20** and both of the belts **16** and **36** are driven in synchronism. The feed roller **46** is driven (FIGS. 4 and 5) by means of a sprocket **47** and a chain **49**. The chain **49** is mechanically coupled to the gear **58** via a linkage including another sprocket **51**, so the peripheral speed of the roller **46** is directly related to the speed of translation of the belts **16** and **36**. The sprocket **51** is spaced generally horizontally from the feed roller **46** so that it may move generally vertically to accommodate varying thicknesses of signatures. For this purpose the feed roller **46** is supported at its ends in brackets **53** which slide generally vertically in guide grooves **55** cut into the side walls **57** and **59** of the frame of the machine. The interconnection between the sprocket **51** and the gear **58** is preferably made by means of a further sprocket and chain connection to the shaft **34**, which is turned by movement of the belt **16**. The particular manner of connection, however, is not shown as it forms no part of the present invention. The gear ratios and/or the relative number of sprocket teeth is such as to give the required ratio of tangential velocity of the roller **46** to the tangential velocity of the drum **20**, the latter being the same as the speed of the belts **16** and **36**. It has been found that a slightly greater tangential speed is desirable for the feed roller **46**, to break the static friction between successive signatures, and propel each signature forcefully into registry with the stack **52**.

A DC motor **65** (shown diagrammatically in FIG. 6) has a gear **61** engaging the gear **58** so that the entire assembly is driven from the motor, via its several interconnecting assemblies. The power circuit of the motor is provided with a speed regulating device **63** which is a variable voltage control and may conveniently employ one of the silicon-controlled rectifier circuits, well known in the art, for controlling the speed of a DC motor. By adjusting the speed of the motor **65**, the velocity of both the belts **16** and **36**, and the identical tangential velocity of the turn-around roller **20**, in addition to the proportional speed of the feed roller **46**, may be controlled to any desired value, thereby to accommodate any speed of the feed belt **10**, or thickness of the signatures **12** supported on the belt **10**. Higher speeds of the feed belt **10**, or greater thickness of the signatures **12** (occasioned, for example, by the signatures **12** being spaced closer together along the belt **10**) may be accommodated by increasing the speed of the motor connected to the turn-around drum **20** via the gear **58**, so that more rapid arrival of the signatures **12** at the intersection of the belt **10** and **16** may be translated into a constant spacing between the leading edges of successive signatures.

The breakaway release feautre of the present invention will now be described, specifically with reference to FIGS. 1 and 2.

Referring first to FIG. 1, most of the parts of the stacker there illustrated are mounted in fixed relationship to the frame, which has the side walls **57** and **59** (FIG. 4). This includes the shaft **22** upon which is mounted the drum **20**, and the shafts **14**, **34** and **42** which support various rollers. The shafts **35** and **44**, which support the rollers **33** and **38**, respectively, are slidable relative to the frame, and are urged into operative position by springs **67** and **69**, respectively. The arrangement is similar to that illustrated in FIG. 5 relative to the shaft **46**, which is urged toward operative position by the spring **71**. The remote ends of each of the springs is fixed to the frame. The shafts **26** and **30** are not fixed relative to the frame of the machine, but instead are rendered adjustable thereto by virtue of being mounted on a mechanical linkage including a lower arm **60** composed of members **64** and **66** and a forward arm **62** composed of members **72** and **74** (FIG. 2). The members **64** and **66** are interconnected by means of rods **68** and **70**, which function to hold the members **64** and **66** rigid with respect to each other. The lower ends of the members **64** and **66** are pivotally supported on the shaft **34**, which is one of those fixed in relationship to the frame. The shaft **30** is supported between the upper ends of the members **64** and **66**, and the forward arm **62** is rotatably mounted on the shaft **30**. The members **72** and **74** of the forward arm **62** both have an aperture at their rearward ends for receiving the shaft **30**, and are rigidly connected at its forward end to the shaft **26**. The roller **24** preferably comprises a pair of pulleys **24***a* and **24***b* disposed on the shaft **26**, and the roller **28** comprises a pair of pulleys **28***a* and **28***b* disposed on the shaft **30**. Similarly, the roller **32** comprises pulleys **32***a* and **32***b* on the shaft **34**. Each of the aforementioned pulleys accommodate one of the strips of which the belt **16** is formed.

With the mechanism as thus far described, it will be apparent that the lower arm **60** may be swung rearwardly away from the turn-around drum **20**, and the forward arm **62** may be swung downwardly, thereby permitting the strips **16***a* and **16***b* to loosen in relation to the turn-around drum **20**. This is in fact what occurs when the release mechanism has been triggered in response to

greater than a predetermined amount of tension on the belt **16**.

The release mechanism incorporates a portion of the side walls **57** and **59** of the frame, and both ends of the shaft **30**, one end of which is illustrated in FIG. 3.

The ends of the shaft **30** are each provided with a depression **76** which is concentric with the axis of the shaft **30**. As the mechanism at both ends of the shaft **30** is identical, only one end will be described. A portion of the frame **57** adjacent one end of the shaft **30** is provided with an aperture into which is inserted a plug **80**, held in place by a C ring **78** disposed in a peripheral groove in the plug **80**. The plug **80** is provided with an internal circular bore accommodating a detent member **82**, a spring **84**, and a closure plug **86**. The closure plug **86** has a shaft threadably engaged with threads formed on the interior surface of the bore and the spring **84** is disposed between the plug **86** and the detent member **82**, thereby urging the forward portion of the detent member **82** through an opening **88** in the plug **80** and into contact with the depression **76** in the shaft **30**. The position of the plug **86** may be varied by manually screwing it inwardly or outwardly, by means of a knurled wheel at the outer end of the plug **86**. A specific amount of force is required to dislodge the detent member **82** from its cooperative relationship with the depression **76** in the end of the shaft **30**, and the magnitude of this force may be readily adjusted by screwing the plug **86** inwardly or outwardly, thereby adjusting the compression of the spring **86**. By this means, the arms **60** and **62** are maintained in the position illustrated in the drawings during normal operation of the stacker.

When a jamming condition occurs, wherein a greater than normal thickness of signatures attempts to pass around the turn-around drum **20** between the belts **16** and **36**, the tension on the belt **16** is considerably increased, the belt **16** attempting to stretch about the greater thickness of the signatures. The increased tension in the portion of the belt **16** extending between the turn-around drum **20** and the roller **24** produces a force on the forward arm **62**, urging the same backwardly, away from the turn-around drum **20**. When this force is sufficient to dislodge the detent member **82** from cooperative relationship with the depression **76**, the lower arm **60** is free to swing away from the turn-around drum **20**, and the forward arm **62** is free to travel rearwardly with the lower arm **60**, thereby shortening the path about which the belt **16** must travel, reducing the tension on the belt **16**, and increasing the space between the belt **16** and the turn-around drum **20**. This increased space accommodates the greater thickness of signatures, and also reduces the friction between the signatures **12** and the belts **16** and **36**, to permit manual removal of the signatures from this portion of the stacker if necessary.

A stop means (not shown) secured to the frame is positioned to block movement of the lower arm **60** backward so far that the strips **16***a* and **16***b* are likely to become dislocated from the pulleys **24***a*, **24***b*, **28***a* and **28***b*. When the jammed condition is corrected, the lower arm **60** is simply pushed forward manually until the detents again become engaged.

With the arrangement illustrated in the drawings, the forward arm **62** extends above the drum **20** and is free to pivot about the shaft **28**. The weight of the arm **62** forces it downwardly, and tends to increase the length of the path traversed by the belt **32** by increasing the length of contact between the belt **16** and the drum **20**. By this means the appropriate operating tension is maintained on the belt **16** without the use of any resilient means such as the springs **67** and **69**.

What is claimed is:

1. In a stacker for stacking a series of relatively flat articles in shingled condition, the combination comprising conveyor means for supporting said articles, a turn-around drum for conveying said articles from said conveyor means around a turn of about a half-circle, means for receiving said articles from said drum and orienting them into an orderly arrangement, and selectively releasable means for urging said articles into juxtaposition with said drum during said turn, said last named means including a belt, support means for supporting said belt to entrap said articles between said drum and said belt, detent means for holding said support means in fixed relationship to said drum, and presettable means for causing said detent to release when the tension in said belt exceeds a predetermined value.

2. Apparatus according to claim **1**, including drive means for rotating said drum and means for selectively adjusting the speed of said drive means.

3. Apparatus according to claim **1**, wherein said support means comprises a shaft fixed in position relative to said drum and parallel to the axis thereof, a first arm supported for rotation on said shaft, and a first roller for supporting said belt, said roller being mounted on said arm, said roller pivoting with said arm about said shaft away from said drum when said detent releases.

4. Apparatus according to claim **3**, including a second arm connected to said first arm to pivot coaxially with said first roller, and a second roller for supporting said belt, said second roller being mounted on said second arm, said second arm being movable away from said drum with said first arm when said detent releases.

5. Apparatus according to claim **4**, wherein said drum is disposed with its axis horizontal and with the beginning and end of said turn being generally horizontal, said detent means holds said first arm in fixed relationship relative to said frame and allows said second arm to pivot freely about said first arm, and said second arm is disposed above the center portion of said drum, whereby downward movement of said second roller lengthens the path of said belt about said drum, as supported by said first and second rollers, whereby the weight of said second arm regulates the tension on said belt while said detent is in its engaged condition.

6. Apparatus according to claim **1**, including a frame for supporting said drum, said detent means comprising a depression on said support means and a detent member on said frame engageable with said depression, and said presettable means comprises a spring for urging said detent member into engaging relation with said depression, and manually manipulatable means for adjusting the force between said spring and said detent member.

7. Apparatus according to claim **1**, including a plurality of belt strips forming an input belt for presenting said articles in seriatim, said conveying means comprising a plurality of belt strips forming a conveyor belt, said conveyor belt intersecting with said input belt to receive said articles from said input belt.

8. Apparatus according to claim **1**, wherein said means for receiving and orienting said articles comprises a generally horizontal stacker plate, an end plate secured to said stacker plate and adapted to define one side of a stack formed with said articles overlying each other in a generally vertical pile, a feed roller supported above said stacker plate and in generally vertical sliding relationship relative to said stacker plate, means urging said feed roller downwardly relative to said stacker plate, and means for driving said feed roller at a slightly higher tangential velocity than said drum.

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RICHARD E. AEGERTER, *Primary Examiner.*

Dedication

3,436,073.—*Newton Christman*, Mount Prospect, Ill. STACKER. Patent dated Apr. 1, 1969. Dedication filed Jan. 14, 1974, by the assignee, *Industrial Design & Engineering, Inc.*

Hereby dedicates to the Public the entire term of said patent.

[*Official Gazette March 12, 1974.*]