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Fernandez-Rana et al.

[11] **3,842,719**

[45] **Oct. 22, 1974**

[54] **METHOD AND APPARATUS FOR FORMING A DENSE SHINGLED ARRAY OF SIGNATURES**

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[73] Assignee: **Harris-Intertype Corporation,** Cleveland, Ohio

[22] Filed: **May 7, 1973**

[21] Appl. No.: **358,124**

[52] **U.S. Cl.** ..... **93/93 M,** 93/93 DP, 214/7, 214/16.4 R, 271/64, 271/216

[51] **Int. Cl.** **B31b 1/96**

[58] **Field of Search** ..... 93/93 R, 93 DP, 93 M; 271/64, 173, 214, 215, 216; 198/35; 214/7, 16.4 R

[56] **References Cited**

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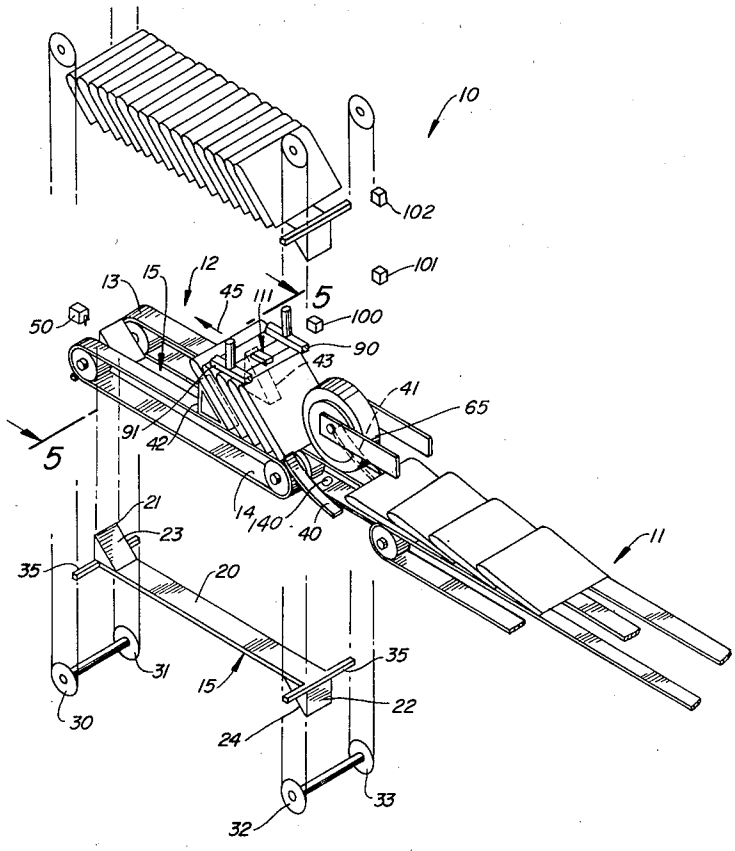
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Primary Examiner—Roy Lake
Assistant Examiner—James F. Coan

[57] **ABSTRACT**

A dense shingled array of signatures is formed on a pair of spaced conveyor belts from a loose shingled stream of signatures delivered to the belts directly as they come from the printing press. Once the dense shingled array is formed, an elevator moves a tray between the belts to pick up the dense shingled array from the belts so that the dense shingled array is located on the tray. The dense shingled array is formed from the loose shingled array by causing the leading edge of the signatures as they are conveyed to the belts to engage the inclined surface of a member which is attached to the belts. This causes the leading edge of the signatures to be deflected in an upward direction with the result being that the signatures are supported on the inclined surface of the member and are formed into the dense shingled relationship. As the signatures are formed in the dense shingled array the member having the inclined surface as well as the signatures are moved in a retracting direction until the full dense shingled stack of signatures is formed.

33 Claims, 12 Drawing Figures



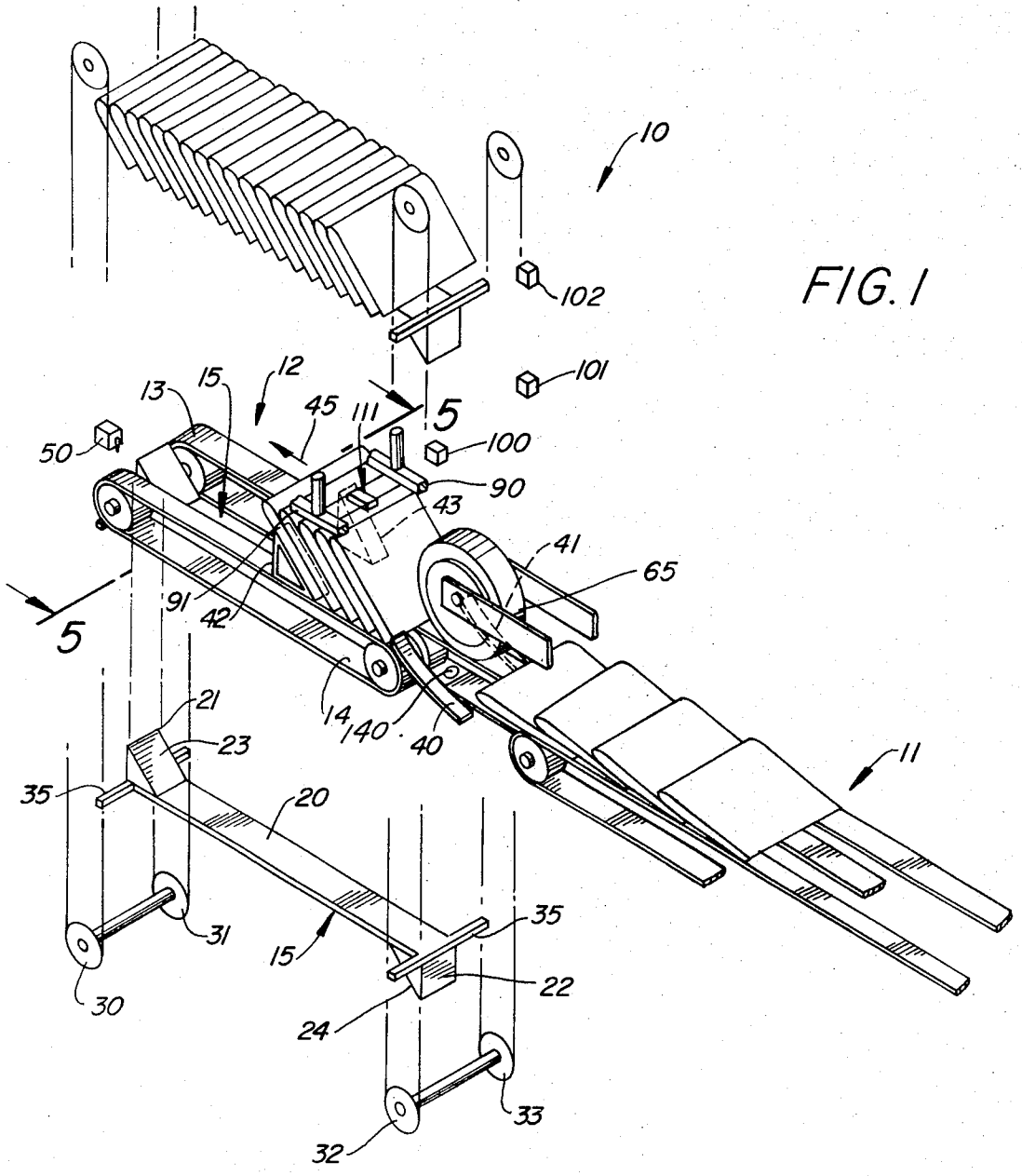


FIG. 1

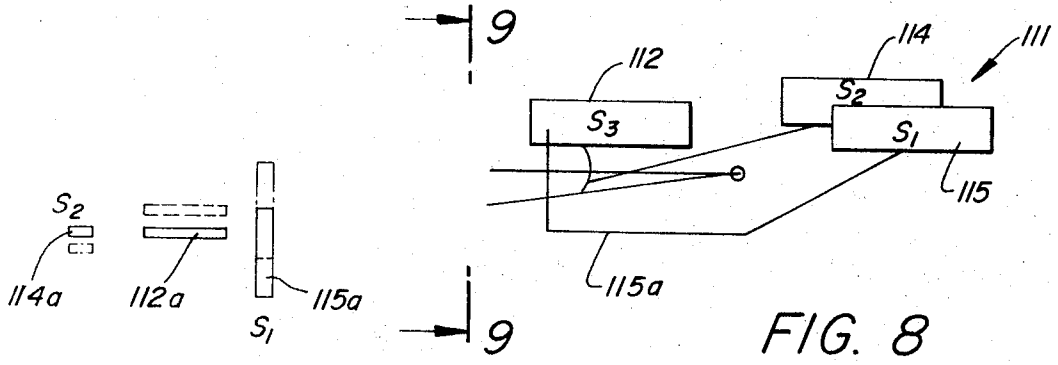


FIG. 8

FIG. 9

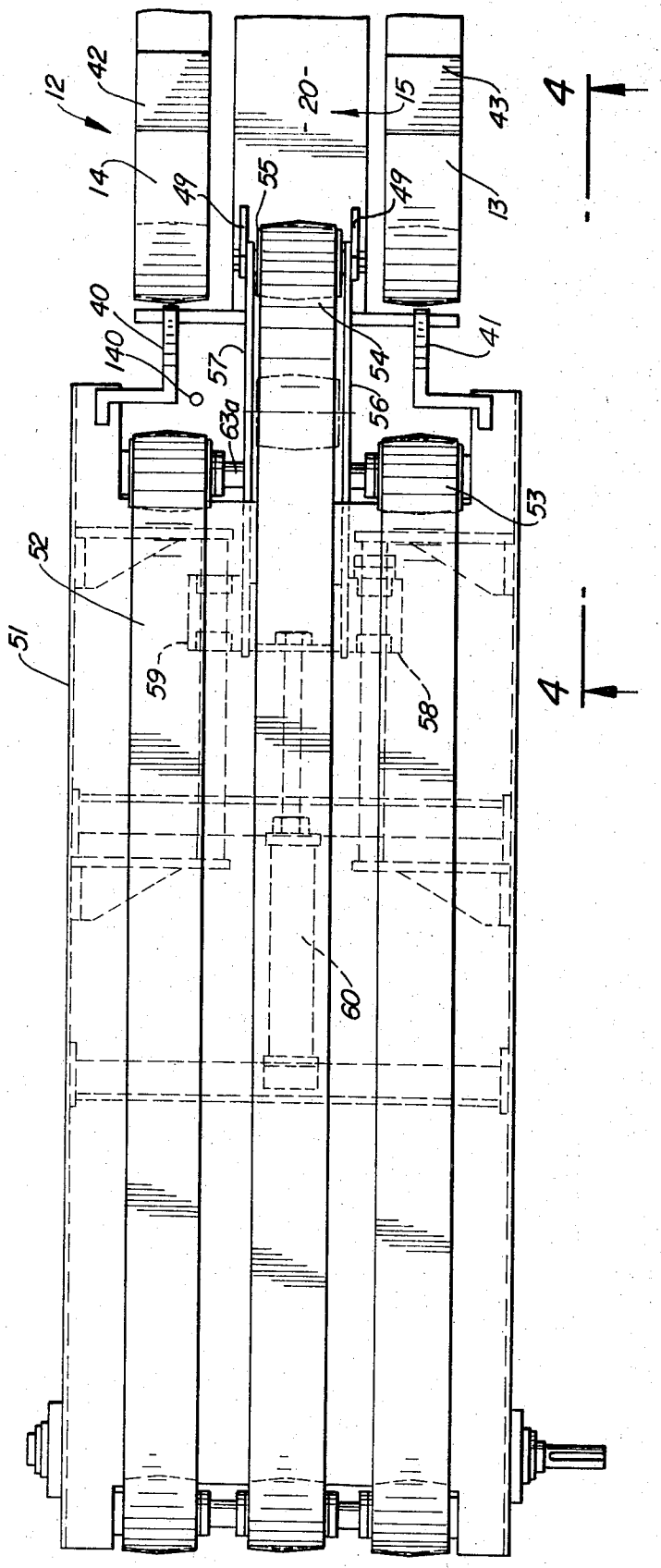


FIG. 2

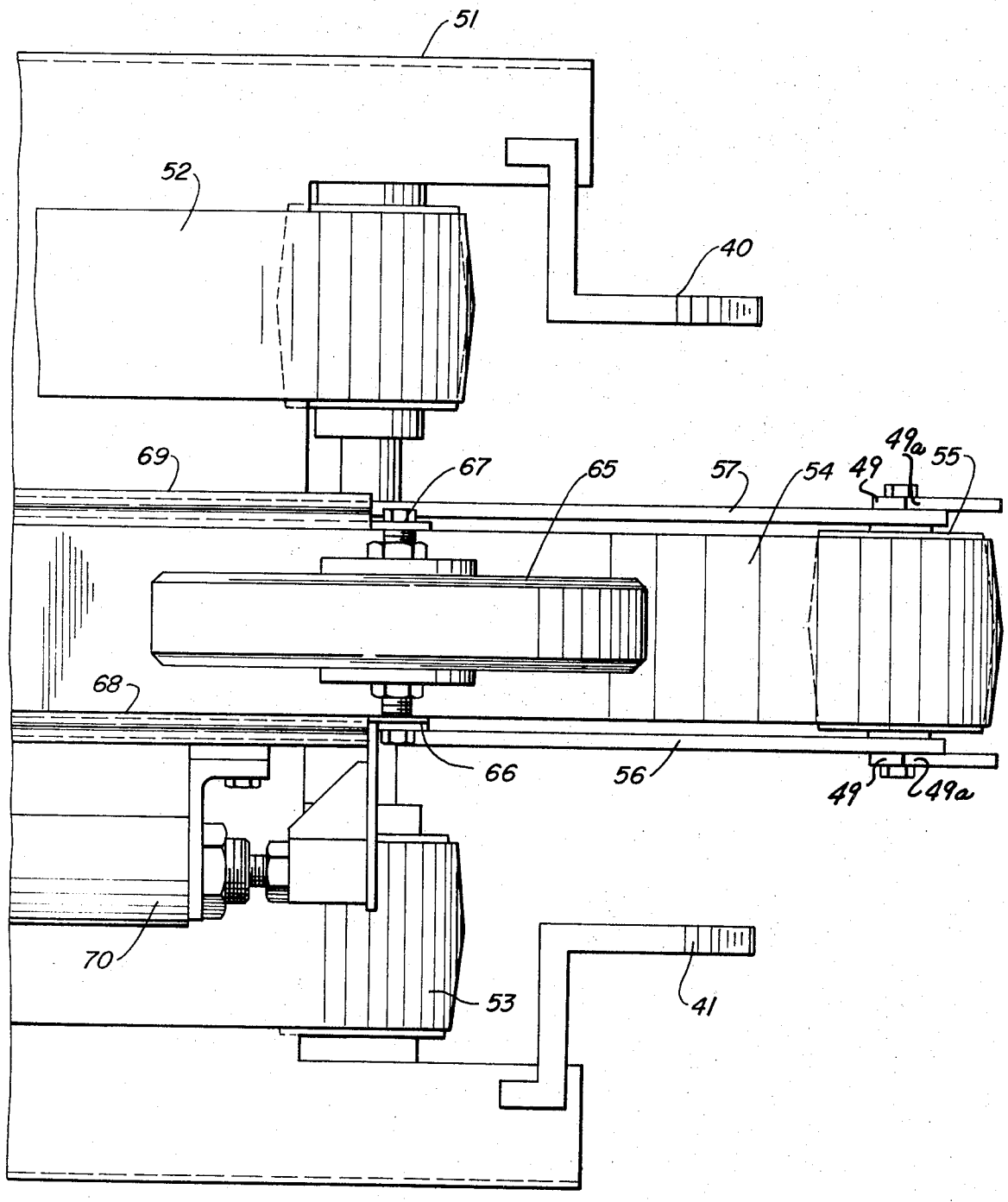


FIG. 3

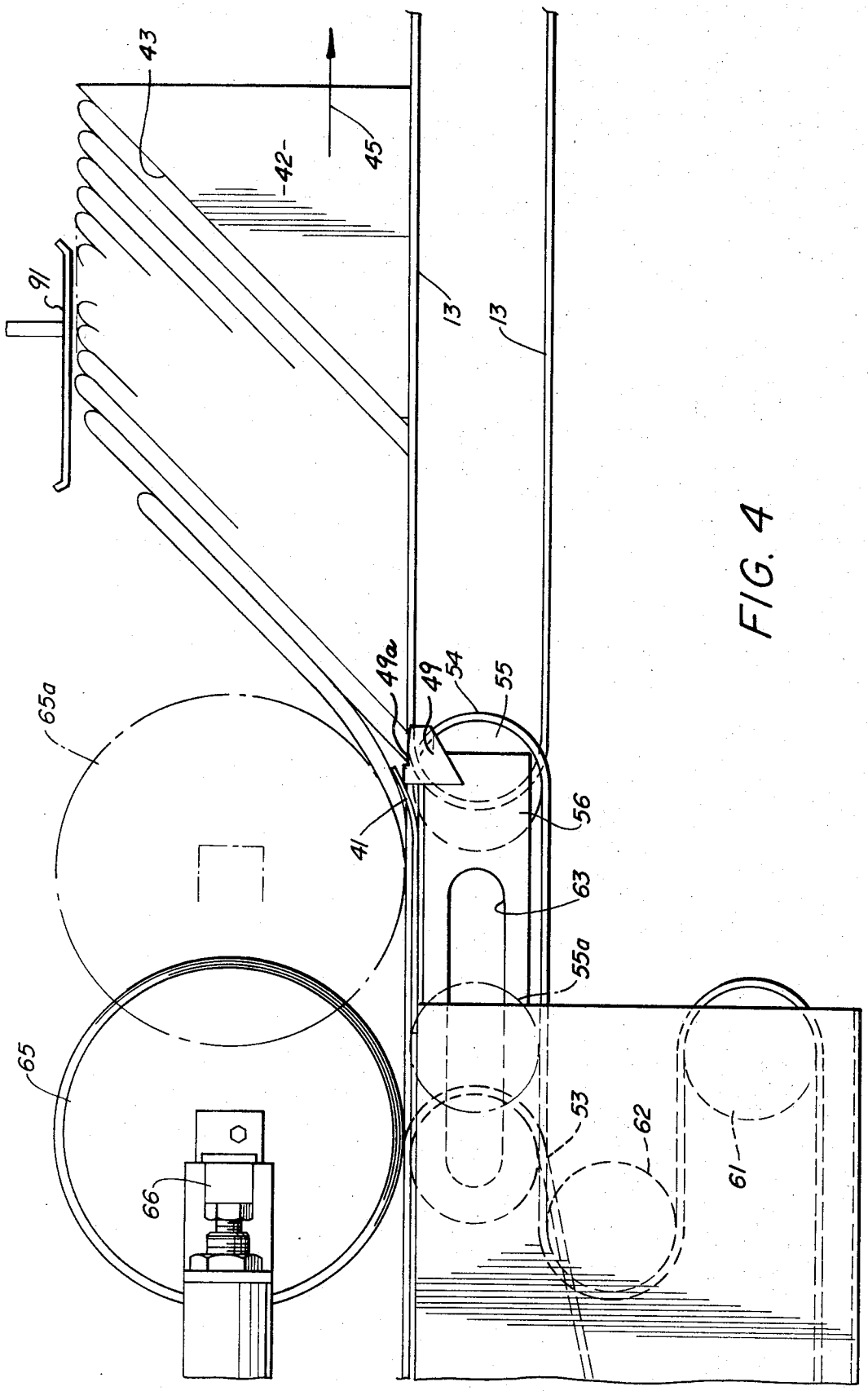


FIG. 4

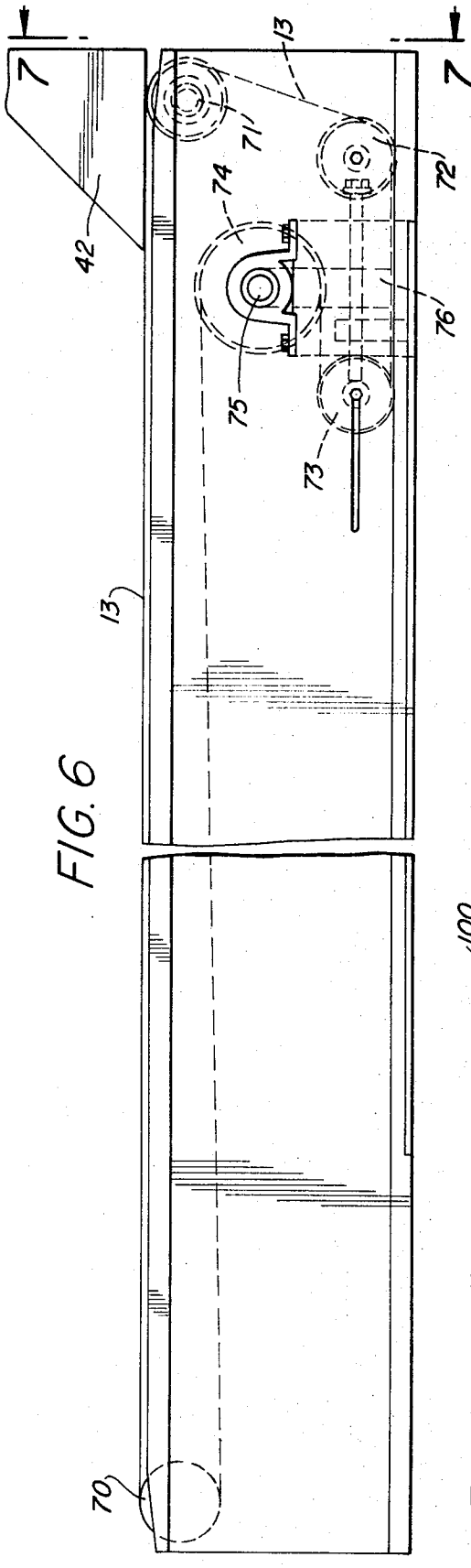


FIG. 6

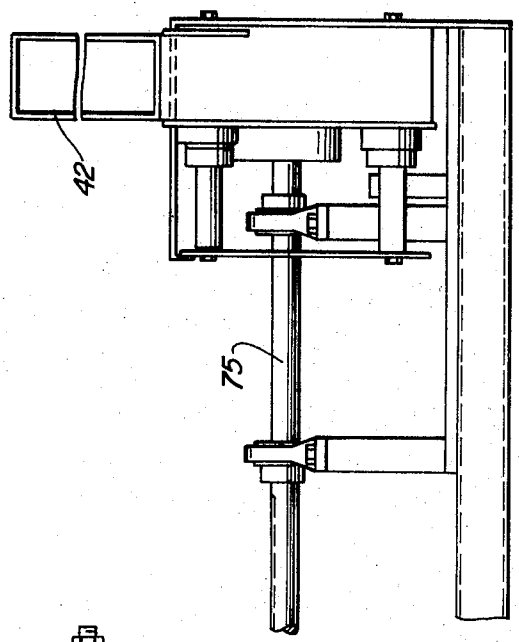


FIG. 7

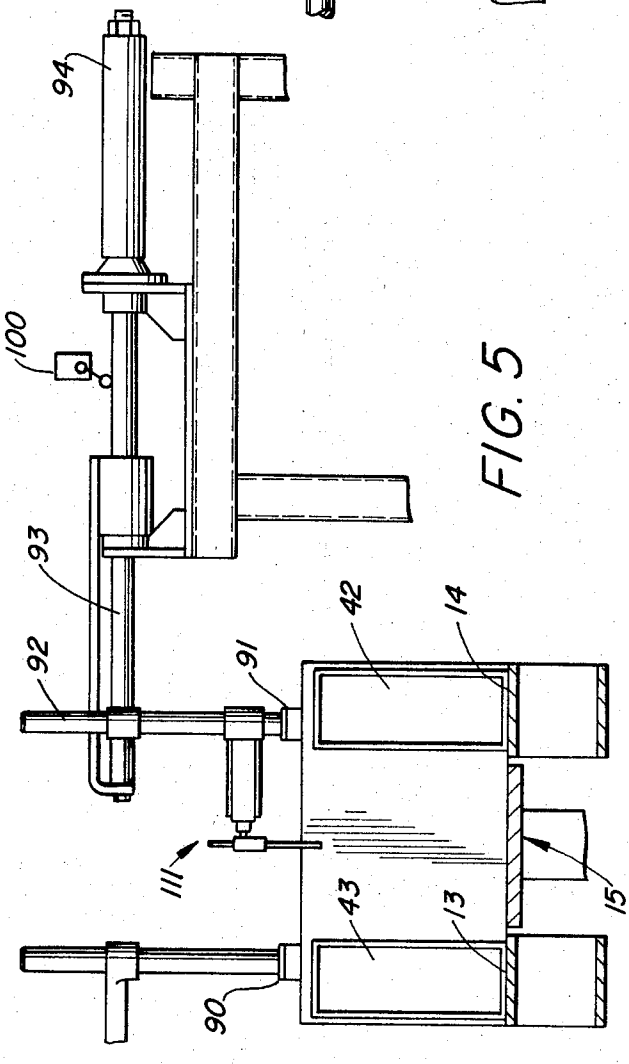


FIG. 5

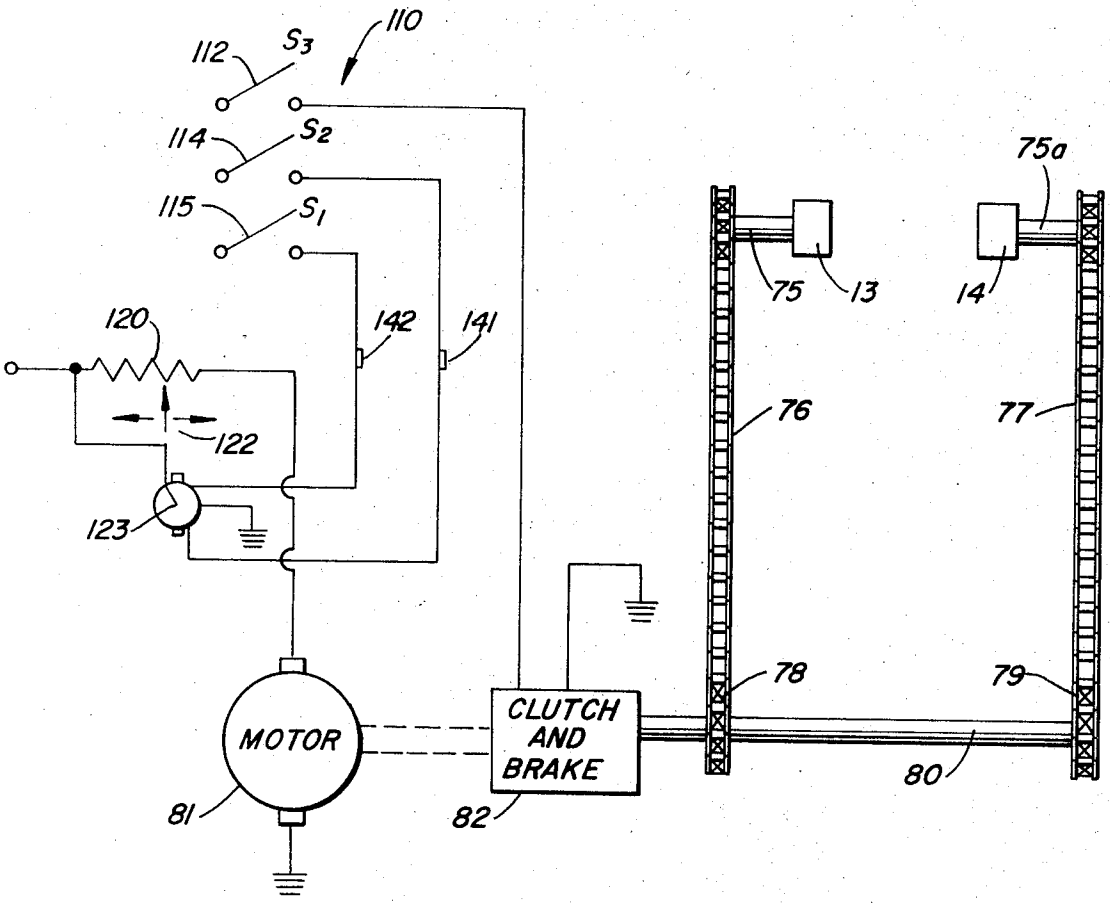

110
112
S3
114
S2
115
S1
120
122
123
142
141
75a
75
13
14
76
77
78
79
80
MOTOR
CLUTCH AND BRAKE
81
82

FIG. 10

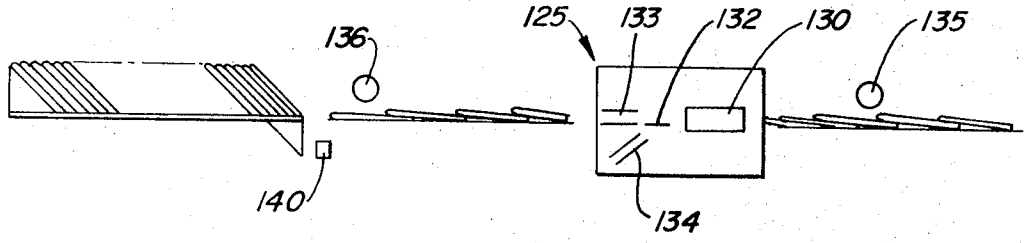

125
133
132
130
135
136
140
134

FIG. 11

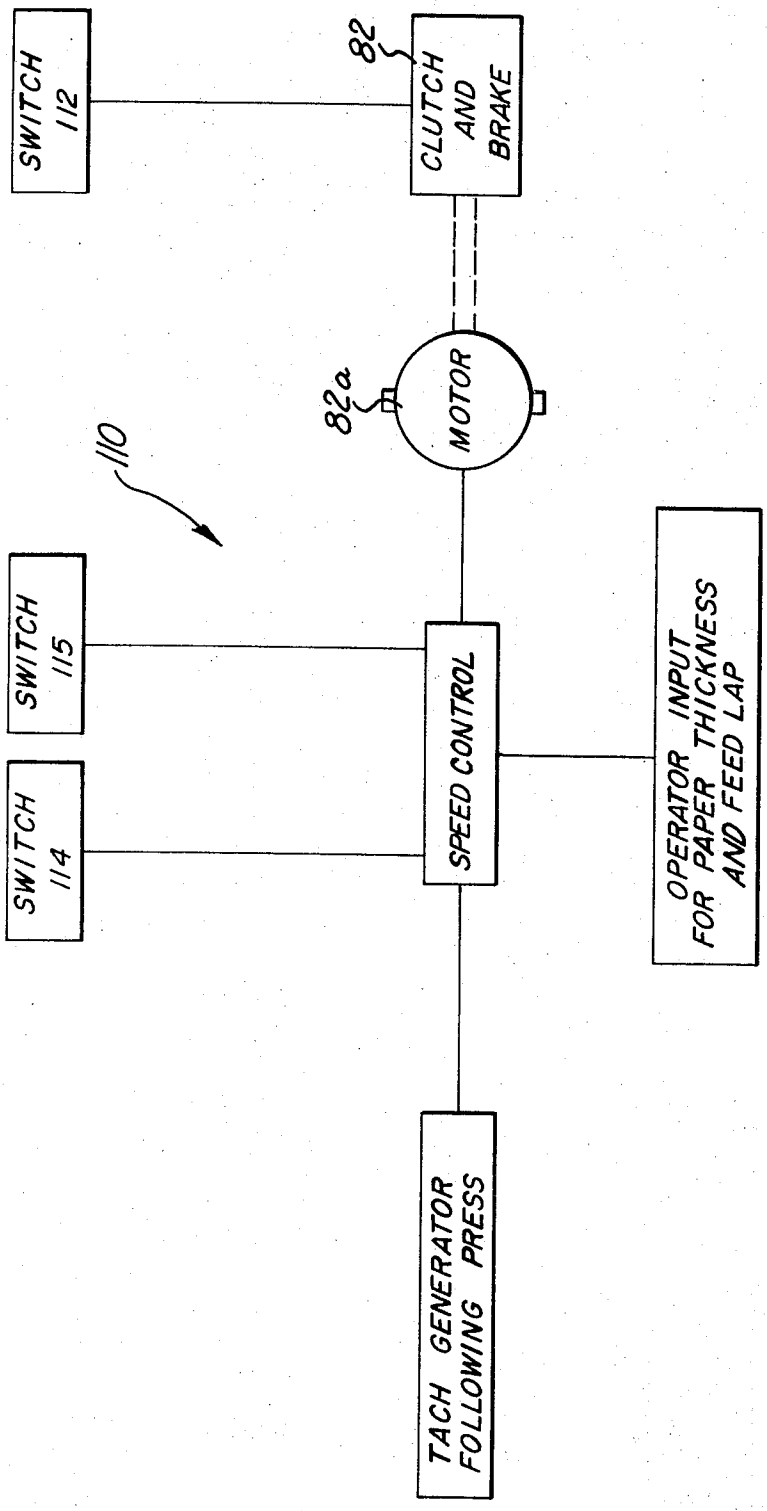

SWITCH 112
82
CLUTCH AND BRAKE
82a
MOTOR
110
SWITCH 115
SWITCH 114
SPEED CONTROL
OPERATOR INPUT FOR PAPER THICKNESS AND FEED LAP
TACH GENERATOR FOLLOWING PRESS

FIG. 12

METHOD AND APPARATUS FOR FORMING A DENSE SHINGLED ARRAY OF SIGNATURES

BACKGROUND OF THE INVENTION

Presently, work is being done in the area of automating a newspaper plant. Conventionally, newspaper plants have operated so that newspaper sections (preprinted sections) are printed prior to the time that the current news sections are printed. These preprinted sections are conventionally stacked and stored in a suitable storage. They are removed from that storage for assembly with the current news sections. The assembly of the preprinted sections along with the current news sections occurs in a stuffing machine of a conventional construction. Without going into the specific details of such operation, a large amount of manual handling of the newspaper sections occurs primarily in the area of manually stacking the newspapers on pallets for storage and in manually unloading the pallets for assembly in the stuffing machine.

SUMMARY OF THE PRESENT INVENTION

The present invention is directed to a system and mechanism in which the preprinted newspaper sections may be stacked automatically for storage. The system and mechanism of the present invention, as will be apparent, is applicable to the stacking of all types of signatures, not only newspaper sections or inserts.

In accordance with the present invention, the signatures are stacked in a dense shingled relationship on a tray. A suitable mechanism is provided for moving empty trays into position for stacking and full trays out of stacking position. The mechanism is designd to operate continuously without operator intervention and is provided with suitable controls to provide a dense stack with the proper number of signatures in each stack.

Specifically, the mechanism includes a conveyor for feeding signatures in a loose shingled relationship to a dense shingling or stacking location. As the first signature reaches the stacking location, its leading edge engages an inclined surface of a member which directs the signature to an inclined position. The leading edge of subsequent signatures engage the previously delivered signature and the signatures are thereby also directed to an inclined position.

As the dense array is being formed by the continuous delivery of signatures to the stacking location, the member having the inclined surface, as well as the signatures which have been formed into a dense array, is moved in a retracting direction. This is accomplished by suitable mechanism which not only supports the signatures when in the dense array, but also supports the inclined member. In the present embodiment, this mechanism comprises a pair of conveyor belts which are spaced laterally apart. When the member having the inclined surface has been moved to its fully retracted position, a tray is moved by an elevator mechanism in the space between the conveyor belts and the tray picks up the stacked array from the conveyor belts. After this operation occurs, the conveyor belts are actuated in order to return the inclined member back to its initial position for the forming of another dense shingled array.

Suitable controls are provided to control the speed of the retracting movement of the inclined member. These controls include means which senses the absence of signatures being delivered to the stacking location to thereby either slow down or stop the retracting movement of the inclined member, as well as means for sensing the delivery of signatures to the stacking location at too great a rate causing an increase in the speed of the retracting movement of the inclined member and the signatures which have already been formed into the dense array.

DESCRIPTION OF THE FIGURES

Further features and advantages of the present invention will be apparent to those skilled in the art to which the present invention relates from the following detailed description made with reference to the accompanying drawings in which:

FIG. **1** is a schematic perspective view of an apparatus embodying the present invention;

FIG. **2** is an enlarged view illustrating a portion of the apparatus of FIG. **1**;

FIG. **3** is a further view illustrating still another portion of the apparatus of FIG. **1**;

FIG. **4** is a somewhat schematic side view of the apparatus shown in FIG. **2** looking at the apparatus as indicated by the line **4—4** thereof;

FIG. **5** is a fragmentary sectional view taken approximately along the line **5—5** of FIG. **1**;

FIG. **6** is a view of another portion of the apparatus of FIG. **1**;

FIG. **7** is a view taken approximately along the line **7—7** of FIG. **6**;

FIGS. **8** and **9** are schematic views illustrating a control mechanism embodied in the apparatus of FIG. **1**;

FIG. **10** is a schematic circuit diagram for controlling a drive mechanism embodied in the apparatus of FIG. **1**;

FIG. **11** is a schematic illustration of the conveyor mechanism for conveying signatures to the stacking mechanism of FIG. **1**; and,

FIG. **12** is another schematic control diagram.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As noted hereinabove, the present invention provides for the stacking of signatures in a dense shingled relationship. The signatures may be in the form of a preprinted newspaper or magazine sections, inserts therefor, or the like. The present invention is preferably utilized in an overall system in which signatures coming directly from a printing press are stacked in the shingled relationship and these signatures are then stored. The invention may, of course, be used in any system to form signatures in a dense shingled relationship regardless of whether the signatures are delivered from a printing press, trimmer, stuffer delivery or other structure. When the signatures which have been stored are to be collated or assembled with other signatures, the preprinted signatures are removed from storage and conveyed to a suitable gathering or stuffing machine for feed into that machine where the preprinted signatures along with other signatures are finally collated to form a completed newspaper, magazine, etc. The present invention to be described hereinbelow incorporates many detailed structural features but it should be apparent from the description that the invention may be embodied in a variety of constructions and modifications can be made therein.

As representative of a preferred embodiment of the invention, the drawings illustrate a mechanism for forming a dense shingled array of signatures and which mechanism is generally designated **10.** In general, the mechanism **10** includes a conveyor system **11** which feeds signatures toward a stacking or dense shingling location **12.** At the location **12,** there is a pair of belts **13** and **14** which are spaced laterally apart, and a tray **15** on which the signatures are stacked is located between the belts **13** and **14.** The signatures as delivered from the printing press are in a rather loose overlapped shingled stream and are conveyed by the conveyor mechanism **11** toward the dense shingling location **12** while in that stream relationship. Suitable means, to be described, are located at the dense shingling location **12** to form the signatures into a dense shingled array and preferably one where the signatures are inclined at a 45° angle on the tray **15.**

The tray **15** on which the dense shingled array is supported is described in copending application, Wise and Rana, filed Nov. 1, 1972, Ser. No. 302,848, assigned to the assignee of the present invention, and the specific description thereof in the aforementioned application is incorporated herein by reference. In essence, a tray **15** includes a main support portion **20** and a pair of opposite end pieces **21, 22.** The end pieces **21, 22** have an angled or wedge-shaped construction and have tapered or inclined surfaces **23, 24,** respectively. The surface **23,** of course, is at a 45° angle, since the signatures when in their final stacked relationship will engage the surface **23** and, in effect, lean thereagainst.

A suitable mechanism in the form of an elevator mechanism is provided for conveying empty trays **15** into position for receiving signatures at the dense shingling location **12** and for conveying full trays from the dense shingling location **12** for removal from the apparatus **10.** The elevator mechanism includes a pair of chains **30, 31** at one end of the belts **13, 14** and a second pair of chains **32, 33** at the other end of the belts **13, 14.** The chains **30–33** have suitable means thereon which cooperate with a part **35** on the trays **15** to thereby support the trays **15** on the elevator mechanism. Of course, any suitable structural arrangement may be utilized for supporting the trays on chains **30–33.** On indexing movement of the chains **30–33,** of course, the trays **15** are moved in an upward direction as viewed in FIG. **1.** The elevators are actuated by a suitable drive mechanism in an indexing manner, as will be described in detail hereinbelow. In essence, when a full array of signatures is formed on the belts **13, 14** at location **12,** the elevator mechanism is indexed upwardly to cause a tray located immediately adjacent the belts **13, 14** to pick up the signatures from the belts **13, 14** and to move the full tray to a position for removal from the elevator mechanism. In addition, the elevator mechanism positions an empty tray adjacent the belts **13, 14** so as to receive the next full array of signatures. For purposes of the present invention, any suitable mechanism may be used for placing the empty trays on the elevator and for removing the full trays from the elevator mechanism, and for purposes of the present invention, those operations could be performed manually.

As noted above, the signatures as they are delivered by the conveyor mechanism **11** to the conveyors **13** and **14** are in a very loose shingled relationship with the folded edge leading just as they come off the printing press. Alternatively, the folded edge could be the trailing edge. The signatures, as noted above, are formed in a dense shingled relationship on the belts **13, 14.** This, in the present embodiment, is accomplished through the use of suitable guide fingers **40, 41** and a guide and support mechanism **42** which also guides and supports signatures. The guide fingers **40, 41** are interposed between the output end of the conveyor mechanism **11** and the input or signature receiving end of the conveyors **13, 14.** The guides **40, 41** tend to direct the leading edge of the signature upwardly. The leading edge of the first signature delivered to the dense shingling location engages the mechanism **42** which is carried on the belts **13, 14** and movable therewith. The guide and support mechanism **42** comprises a pair of wedge-shaped members, each of which is secured to a respective belt **13, 14.** The guide and support mechanism **42** has a surface **43** (see FIG. **4**) which engages the lead edge of the signature and deflects in upwardly. The signature then comes to rest lying on the surface **43** and being inclined to the belts **13, 14** and the support portion **20** of the tray **15,** although the support portion **20** of the tray **15** is spaced below the belts **13, 14** on which the signature rests. The lead edge of further signatures delivered engage the previously delivered signature which acts just like the wedge mechanism **42.** As a result, each signature in turn is moved to an inclined position and the signatures rest on each other. The angle of the surface **43** relative to the horizontal or relative to the support portion **20** of the tray or belts **13, 14** may vary but a 45° angle has been found to provide satisfactory results.

From the above, it should be apparent that a continuous build-up of a dense shingled array of signatures is provided. In order to enable this build-up to continue, the guide and support mechanism **42** is moved rearwardly in the direction of the arrow **45,** in FIGS. **1** and **4,** as the signatures are delivered on the conveyors **13, 14.** A suitable driving mechanism is provided, as will be described in detail hereinbelow, to provide for the retracting movement of guide and support mechanism **42.** A suitable electrical control for that drive mechanism is provided to control the retracting movement of the guide and support mechanism **42** so that in the event that there is an excessive build-up of signatures, the retracting movement of the guide and support **42** would increase in speed.

The retracting movement of the guide and support **42** continues as signatures are delivered onto the conveyors **13** and **14** until the guide and support mechanism **42** has been withdrawn rearwardly to a position where a switch **50** is tripped (shown schematically in FIG. **1**). When the switch **50** is tripped and an electric eye **140** (FIGS. **1** and **11**) located in advance of the belts **13, 14** senses a gap in the stream of signatures, the elevator mechanism **30–33** is indexed in order to take the full tray out of position and bring a new tray **15** into position for receiving signatures. Details of this operation will be described hereinbelow in connection with the description of the overall operation of the mechanism.

The conveyor mechanism **11** which delivers the signatures to the stacking location **12** may take a variety of different forms. The printed signatures are delivered by any suitable conveyor mechanism to a conveyor section **51** (see FIG. **2**). The conveyor section **51** includes a pair of conveyor belts **52, 53** which are spaced laterally. Interposed between the conveyor belts **52, 53** is a

third conveyor belt **54**. The conveyor belts **52, 53**, and **54** are trained around suitable drive sprockets so as to effect a drive of the belts upon rotation thereof. The conveyor belt **54** which is interposed between the belts **52** and **53** has a portion which is extensible toward and away from the stacking location **12** and specifically toward and away from the belts **13** and **14**.

The belt **54** is trained around a movable roll **55**. The roll **55** is supported on a pair of support plates **56** and **57**, (see FIGS. **2** and **4**). The support plates **56** and **57** have slide blocks **58** and **59**, respectively, supported on the interior ends thereof. The slide blocks **58, 59** slide along interior support and guide portions of the conveyor section **51**. The slide blocks **58** and **59** are connected by a suitable mechanism to a pneumatic motor **60**. Upon energization of the motor **60**, it should be apparent that the slide blocks **58, 59** as well as the support plates **56, 57** and the roll **55** move horizontally toward the conveyor belts **13** and **14** or away from the belts **13, 14**, depending upon the direction of energization of motor **60**. This movement is enabled due to the fact that the belt **54** is trained around rolls **61** and **62** (see FIG. **4**) which move in order to maintain the length of the path of the belt constant, even though the roll **55** is moved or extended outwardly toward the conveyor belts **13** and **14**. Moreover, the support plates **56, 57** are provided with an opening **63** through which a drive or support shaft **63***a* for the rolls around which the belts **52** and **53** are trained extends. This slot **63** in the support plates **56** and **57** permits movement of the support plates **56, 57** upon actuation of the air motor **60** without interference with the shaft **63***a*. While belts **52, 53** are not extensible as is the belt **54**, they could be so constructed and guide fingers **40, 41** likewise could be movable toward and away from the belts **13, 14**.

As best shown in FIG. **4**, associated with the belt **54** is an upper guide roll mechanism which includes a forward or front roller **65** which engages the upper surface of the signatures as they move along the belt **54** and applies a downward force thereon. The roller **65** maintains the signatures on the conveyor belt **54** and assists in guiding the signatures to the belts **13, 14**. Any suitable mechanism or roller construction may be utilized. In the present embodiment, the roller **65** preferably is mounted for extensible movement with the belt **54**. To this end, the roller **65** is supported on suitable supports **66, 67** (see FIG. **3**). The supports **66, 67** are telescopically received in fixed supports **68, 69**. A suitable air motor **70** is provided and which is connected to the supports **66, 67**. Upon energization of the air motor **70** and depending upon the direction of actuation thereof, the supports **66, 67** telescope inwardly or outwardly to effect a movement of the roller **65** inwardly or outwardly in an extensible manner along with the conveyor belt **54**. As best shown in FIG. **4**, the two positions of the roll **65** and roll **55** are illustrated. The extensible position of the roll **65** is designated **65***a*, while the retracted position of the roll **55** is designated **55***a*.

The roller **65** provides a positive control over the signature and pressures the signatures into position. The roller **65** urges the signatures into the inclined position. As an alternative to the roller **65**, driven tapes may be used or a combination of tapes and a roller such as **65**.

The retracting and extensible action of the roll **55** and the conveyor belt **54** are desired in order to maintain a control of the signatures as they traverse the distance between the conveyor belts **52, 53** and the belts **13** and **14**. As noted hereinabove, the trays **15** are indexed in a vertical manner and in order to provide for space for the trays to clear the conveyor belt section **51**, it is necessary to retract or provide a retracted position of the conveyor **54**. However, in order to maintain the proper control of the signatures as they are delivered onto the belts, it is necessary to extend the conveyor **54** so that the signatures are directed in a proper manner onto the belts **13, 14** and onto the tray **15**. In fact, the roll **55** when in its extended position is coextensive with the support rolls which support belts **13, 14**, as shown in FIG. **2**. Also, as shown schematically in FIG. **2**, the tray **15** extends beneath the roll **55**.

As noted hereinabove, as the signatures leave the conveyor section **51**, the lead edge thereof engages with guides **40, 41** which tend to deflect the lead edge of the signature upwardly. As a result, the lead edge of the signature engages either the surface **43** of the wedge **42** or other signatures which have already been delivered to the belts **13, 14**. This action further tends to deflect upwardly the lead edge of the signatures which are moving at a high rate of speed. As a result, the signatures take the position inclined at preferably **45** degrees, as illustrated in FIG. **4**. To maintain the signatures in the inclined position and prevent any possibility of their sliding down relative to the other signatures, cams **49** are provided. There are two cams **49** located on the supports **56, 57** and move therewith. When the cams **49** are extended, as shown in FIG. **4**, small notches **49***a* on the upper surface thereof are located to receive the lower edge of the last signature delivered and prevent its sliding down relative to the other signatures.

As the signatures, as noted above, are delivered onto the belts **13, 14** the guide and support **42** moves in a retracting direction in the direction of the arrow **45**. In order to effect this retracting movement, the conveyor belts **13, 14** are provided with a suitable drive mechanism. Referring to FIG. **6**, only one conveyor belt is illustrated, namely, conveyor belt **13**. Conveyor belt **13** is trained around a plurality of rolls **70, 71, 72, 73** and **74**. Roll **74** provides the drive into the conveyor belt **13**. Roll **74** is mounted on a drive shaft **75**. Associated with the rolls **72, 73** is a suitable mechanism **76** which is adjustable to control the tension in the belt **13**. As best shown and schematically illustrated in FIG. **10**, the drive shaft **75** is driven by a chain **76**, whereas the corresponding drive shaft **75***a* for the belt **14** is driven by a chain **77**. The chains **76, 77** are trained around sprockets **78, 79**, respectively, on a drive shaft **80**. Upon rotation of the drive shaft **80**, it should be obvious that the belts **13, 14** are driven through the chains **76, 77**.

The drive shaft **80**, as shown schematically in FIG. **10**, is driven from a reversible motor **81** through a clutch and brake mechanism **82**. The motor **81** is reversible so as to reverse the direction of rotation of the conveyor belts **13** and **14**, and the clutch and brake mechanism **82** is energizable in order to control rotation of the shaft **80** and thereby the drive to belts **13** and **14**. A description of the circuitry for controlling energization of the motor **81** and the clutch and brake mechanism **82** will follow hereinbelow For the moment, it should be understood that as the signatures are delivered onto the belts **13, 14**, the belts are driven by

actuation of the clutch and brake **82** and through the various drive mechanisms hereinabove described to effect the proper retracting action of the guide and support mechanism **42.**

As the signatures are directed onto the belts **13, 14,** the lead edge of the signatures may engage upper guides **90** and **91** (see FIG. **5**). The guides **90, 91** are retractable laterally of the machine by suitable retracting mechanism and only the retracting mechanism for the guide **91** will be described in detail. The guide **91** is carried on a vertically extending support **92,** which support **92** is carried on a horizontally retractable support bar **93.** The support bar **92** is suitably connected with a motor **94** which upon energization will effect movement of the bar **93** and a lateral retracting movement of the guide **91.** The guides **90, 91** provide a guiding action on the upper edge of the signatures as they are received on the belts **13, 14** and assist in providing that the upper edges of all the signatures lie in a common plane. THe guides **90, 91** are suitably supported for vertical adjustment for bundling different length signatures, lateral adjustment for proper width, and front to back for properly receiving the signatures and to position switch mechanism **111** (to be described in detail hereinbelow) if the switch mechanism **111** is supported thereon.

As noted hereinabove, when the guide and support mechanism **42** is retracted to its full extent and the belts **13, 14** have received a full array of signatures, the switch **50** is tripped. When the switch **50** is tripped and only after electric eye **140** indicates a gap in the paper stream, the top guides **90, 91** and switch assembly **111** are retracted due to energization of the motor **94** with which they are associated. Simultaneously, the roll **55** of the conveyor section **51** is retracted along with the guide roll **65.** Retraction of the guides **90, 91** results in the tripping of a switch **100,** best shown in FIG. **5.** The tripping of the switch **100** energizes the motor (not shown) for indexing the elevator mechanism, namely chains **30–33,** in an upward direction. As the elevator rises, the full array of dense shingled signatures are picked up from the belts **13, 14** by the tray on the elevator. The upward movement of the elevator chains **30–33** continues until the elevator trips the switch **101.** When the switch **101** is tripped, the guide and support mechanism **42** is returned to its original or initial position by actuation of the belts **13, 14** in a reverse direction, that is, reverse from the direction that the belts were driven during formation of the shingled array. Also actuation of switch **101** returns top guides **90, 91** and switch assembly **111** into operative position.

On further raising movement of the elevator mechanism, a further switch **102** is energized which stops the raising movement of the elevator and triggers the extension of the belt **54** and guide roll **65** for further delivery of signatures to the stacking location **12.** Of course, the amount of the movements and the location of the switches are controlled so that the new tray or empty tray is received in the stacking position at this point and the full tray has been raised out of the stacking position for easy removal from the machine and is in a position where it will not interfere with operation of the mechanism in the machine. Since the various switches described hereinabove comprise limit switches which are of known construction, they will not be described. Moreover, the specific circuitry incorporating the switches is within the domain of one skilled in the art and, likewise, will not be described herein in detail or illustrated.

The apparatus **10** is further provided with a control circuitry, generally designated **110** in FIG. **10,** for controlling the retracting movement of the belts **13, 14,** so as to control the speed of retracting movement in the event of an excessive build-up of signatures delivered to belts **13, 14,** or a slowdown in the delivery of signatures to the belts **13, 14.** Of course, in the event of an excessive build-up of the signatures on the belts **13, 14,** it is desirable to speed up the retracting movement of the guide and support mechanism **42** and of the belts **13** and **14** in order to compensate for the excessive build-up. Also, it should be obvious that in the event of a slowdown in delivery of signatures to the conveyor belts **13, 14,** it is desirable to slow down the retracting movement of the guide and support mechanism **42** so that the shingled array if provided with a uniform array of signatures.

In order to accomplish the proper control of the retracting movement of the belts **13, 14,** the switch assembly **111** as noted above is supported on guide **91.** The switch assembly **111** includes three switches, see FIGS. **8, 9,** and **10.** One of the switches **112** is a start switch for starting the retracting movement of the belts **13, 14,** and is also a switch which, when triggered, maintains the clutch and brake mechanism **82** operative to transmit drive from the motor **81** to the belts **13, 14** so that when the switch **112** is energized, the cutch and brake mechanism **82** is energized in order to cause the belts **13, 14** to move in a retracting direction.

The switch **114** is a slowdown switch which, when triggered, effects a slowing of the motor **81.** This, of course, is triggered when the feed of signatures onto the belts **13, 14** is reduced. The switch **115** is a speed-up switch which is triggered or tripped when there is an excessive build-up of signatures on the belts **13** and **14,** and triggers an increase in speed of the motor **81** to increase the speed of movement of the belts **13, 14.**

The operation of the switches **112, 114** and **115** should be apparent to those skilled in the art from the circuit of FIG. **10.** As illustrated in FIG. **10,** the motor **81** is energized through a circuit which includes a variable resistor **120.** The amount of resistance in the circuit for energizing the motor **81** is controlled by the position of a resistance element **122** which places into the circuit for the motor **81** a variable amount of resistance depending upon its position. A suitable motor **123** is connected with the resistance element **122** and, when energized, the motor **123** will move the resistance element **122** in one direction or another in order to place into the circuit for the motor **81** a different amount of resistance and thereby change the output speed thereof. Accordingly, it whould be apparent that upon energization of the motor **123** in one direction the motor **81** will be slowed, while upon energization of motor **123** in the opposite direction, the motor **81** will be increased in speed.

The switches **114** and **115** are in the circuit for controlling eneergization of the motor **123.** When the switch **115** is closed, the motor **123** is energized in a direction to effect movement of the resistance element **122** in a direction to increase the speed of the motor **81.** Closing the switch **114** causes the motor **123** to move in the opposite direction, namely, one where the resistance element **122** is moved in a direction in order to slow down the output speed of the motor **81.** The

switch **112** when energized controls the clutch and brake mechanism **82** and when closed energizes the clutch mechanism in order to effect the transmission of drive from the motor **81** to the conveyors **13, 14.** If the switch **112** is open, then the brake mechanism of the clutch and brake mechanism **82** is energized so that, even though the motor **81** is driving or being driven, the brake mechanism does not transmit any such movement or drive to the belts **13** and **14.**

The switches **112, 114, 115** have actuator arms **112***a*, **114***a*, **115***a* spaced laterally from each other, as shown in FIG. **9.** When the actuator arm **112***a* is in its full line position in FIG. **9,** the switch **112** is open. The switch is closed by upward movement of the actuator arm **112***a* to the dotted position thereof in FIG. **9.** This movement results due to the leading edge of a signature striking the actuator arm **112***a*. The arm **112***a* is located so that each signature in turn will engage the arm **112***a* so that the clutch and brake mechanism **82** is maintained energized. The switch arm **114***a*, when in its full line position shown in FIG. **9,** maintains the switch **114** open. The switch arm **114***a* rides on the signatures in the array and the switch is maintained open thereby. In the event the arm **114***a* rides off the signatures, the arm drops to the dotted position shown in FIG. **9,** at which position switch **114** is closed. The switch arm **115***a* is normally in the full line position shown in FIG. **9** out of engagement with the signatures. In this position the switch **115** is open. The arm **115***a* is moved upwardly to close switch **115** in the event of an excessive build-up of signatures delivered to the belts **13, 14** which results in the signatures moving arm **115***a* upwardly.

From the above, it should be apparent that as signatures move onto the belts **13, 14,** the leading edges thereof trip the actuator member for the switch **112.** This effects closing of the switch **112** and energization of the clutch and brake mechanism **82** in order to transmit the drive from the motor **81** to the belts **13, 14** to effect the retracting movement of the belts **13, 14.** In the event that an excessive build-up occurs where too many signatures are being delivered to the belts **13, 14,** the switch **115** senses the excessive build-up by its feeler finger **115***a* which causes closing of the switch **115.** This results in a speed-up of the motor **81,** as described above. In the event that there is a slowdown in the number of signatures delivered to the belt, the switch feeler **114***a* closes the switch **114.** This, of course, causes a slowdown in the retracting of the belts **13, 14.** Accordingly, it should be clear that as signatures are being delivered to the belts **13, 14** the speed of retracting movement of the belts **13, 14** may vary depending upon the flow of signatures onto the belts **13, 14.**

The circuit of FIG. **10** obviously is not a complete circuit for the entire machine and does not, for purposes of simplicity, illustrate the reversible nature of reversible switch on the motor **81** for returning the guide and support mechanism **42** to its initial position. It should be obvious that the circuit would be to effect reversing of the motor **81,** at which time, of course, the switches **114 115** are inoperative. Also, the switch **112** is bypassed in order to effect energization of the clutch mechanism **82** to transmit the drive from the motor **81** to the conveyor belts **13, 14.**

In accordance with the present invention, it should be apparent that the signatures are being delivered from the output of the press in an overlapped continuous stream. As a result, it is necessary to make provision for the signatures which are continuing to move toward the station **12** from the printing press during the indexing movement of the elevator when a new tray **15** is being moved into position for receiving signatures thereon. Of course, such provision may take a variety of different forms.

In one form, a clamp or suitable diverter mechanism may be utilized for engaging and clamping the signatures prior to the station **12** and for an instant of time for allowing the operations at the stacking station **12** to occur, which operations include removal of a full tray and readying for the formation of a new dense shingled array. Of course, once these occur, the clamping mechanism would allow the stream of signatures to again be fed and directed to the station **12** for formation into the desired shingled array.

In addition, however, and preferably, a stream switch **125** may be utilized for directing the signatures to another location where operations occur in precisely the same manner as they occur at station **12.** The stream switch may be of any conventional construction and as illustrated in FIG. **11** may take the form of a switch **125** which has a suitable type of gap-maker mechanism **130** and diverter **132** which operates when the gap is formed to divert the signatures between output paths **133, 134.** As viewed in FIG. **11,** the gap-maker **130** operates to form a sufficient gap in the signatures being delivered to allow the gate **132** to be moved between its two positions. In the embodiment illustrated, the path **133** is directed to the stacking mechanism **12** described and disclosed in FIG. **1,** and the stream or path **134** may be directed to a second mechanism similar to that shown in FIG. **1.** Of course, the gap-maker and stream switch may take a variety of different constructions and such are known in the art.

In the schematic embodiment illustrated in FIG. **11,** assume that N number of signatures are desired in the completed dense shingled array on the tray **15.** This, of course, means that N number of newspapers must pass the stream switch **125** before the stream switch operates. Accordingly, a suitable counter **135** may be utilized which counts the signatures which are delivered to the stream switch, and along with a suitable delay mechanism, not shown, would actuate the gap-maker **130** and gate mechanism **132** when the proper count has passed the stream switch. Also, a suitable counter **136** may be utilized adjacent location **12** in order to determine that the precise number of signatures has been delivered to the tray **15.** These counters can be utilized to also control raising movement of the elevator mechanism so that not only is it necessary for the guide and support mechanism **42** to be fully retracted, but it is also necessary for the proper count of signatures to have been fed to the belts **13, 14** before the elevator mechanism can raise.

In addition to the above, the electric eye **140** located adjacent the entry end of the belts **13, 14,** is utilized for purposes of sensing a gap in the signatures as they are delivered onto the belts **13, 14.** The electric eye is primarily for the purpose of sensing the gap and providing a signal for controlling the belts **13, 14** and for raising the elevator (as described). In the preferred embodiment, as illustrated in FIG. **10,** the electric eye controls contacts **141, 142** in the circuits connecting the switches **114, 115** to the motor **123.** These contacts **141, 142** open when the electric eye senses a gap. As

a result, the belts cease being operated under the control of the switches **114, 115** and speed compensation of the motor **81** ceases. Also, since no signatures are delivered onto the belts, the switch **112** opens and the clutch and brake mechanism **82** is actuated so as to prevent the transmission of torque from the motor **81** to the belts **13, 14.** Accordingly, when a gap is sensed in the stream of signatures, the speed compensation on the belts **13, 14** ceases and the belts likewise cease to move.

FIG. **12** illustrates the controls and shows that speed control circuit receives signals from a tachometer generator driven by the press and also from operator controls set in accordance with paper thickness and signature feed lap. These signals along with switches **112, 114,** and **115** provide for the proper operation of the mechanism and at the appropriate speed.

In view of the above, it whould be apparent that applicant has provided a substantially improved, novel and unique structure for forming signatures in a dense shingled array on a tray directly as the signatures are delivered from the printing press.

What is claimed is:

1. Apparatus for providing a dense shingled array of signatures on a tray with the signatures inclined relative to the surface of the tray on which they are supported, said apparatus comprising means for supporting a tray at a dense shingling location, conveyor means for delivering signatures in a loose shingled stream to said dense shingling location, means at the dense shingling location for forming the dense shingled array and for locating same on the tray, and means for removing said tray from said dense shingling location with said shingled array of signatures thereon.

2. Apparatus as defined in claim **1** wherein said means for forming the dense shingled array comprises a guide member having an inclined surface which when the guide member is in an initial position engages the leading edge of the first signature which is conveyed to the dense shingling location and guides it to a position resting thereagainst inclined to the support surface of the tray, the lead edge of further signatures conveyed to the dense shingling location engaging the previously positioned signature and being guided to an inclined position thereby with said guide member comprising at least a part of a means supporting said signatures in the inclined position.

3. Apparatus as defined in claim **2** further including means for moving said guide member and said signatures in a retracting direction relative to the surface of the tray and said conveyor means as additional signatures are conveyed to said dense shingling location.

4. Apparatus for providing a dense shingled array of signatures on a tray with the signatures inclined relative to the surface of the tray on which they are supported, said apparatus comprising means for supporting a tray at a dense shingling location, conveyor means for delivering signatures in a loose shingled stream to said dense shingling location, means at the dense shingling location for forming the dense shingled array and for locating same on the tray comprising a guide member having an inclined surface which when the guide member is in an initial position engages the leading edge of the first signature which is conveyed to the dense shingling location and guides it to a position resting thereagainst inclined to the support surface of the tray, the lead edge of further signatures conveyed to the dense shingling location engaging the previously positioned signature and being guided to an inclined position thereby with said guide member comprising at least a part of a means supporting said signatures in the inclined position, means for moving said guide member and said signatures in a retracting direction relative to the surface of the tray and said conveyor means as additional signatures are conveyed to said dense shingling location, said last mentioned means comprising a pair of conveyor belts to which said guide member is secured and which are located on opposite sides of the tray and which support the signatures thereon and drive means for moving said belts.

5. Apparatus for providing a dense shingled array of signatures on a tray with the signatures inclined relative to the surface of the tray on which they are supported, said apparatus comprising means for supporting a tray at a dense shingling location, conveyor means for delivering signatures in a loose shingled stream to said dense shingling location, means at the dense shingling location for forming the dense shingled array and for locating same on the tray comprising a guide member having an inclined surface which when the guide member is in an initial position engages the leading edge of the first signature which is conveyed to the dense shingling location and guides it to a position resting thereagainst inclined to the support surface of the tray, the lead edge of further signatures conveyed to the dense shingling location engaging the previously positioned signature and being guided to an inclined position thereby with said guide member comprising at least a part of a means supporting said signatures in the inclined position, means for moving said guide member and said signatures in a retracting direction relative to the surface of the tray and said conveyor means as additional signatures are conveyed to said dense shingling location, said last mentioned means comprising a drive mechanism connected to said guide member and which moves said guide member when actuated and means for sensing the receipt of a signature at said dense shingled location for actuating said drive mechanism.

6. Apparatus for providing a dense shingled array of signatures on a tray with the signatures inclined relative to the surface of the tray on which they are supported, said apparatus comprising means for supporting a tray at a dense shingling location, conveyor means for delivering signatures in a loose shingled stream to said dense shingling location, means at the dense shingling location for forming the dense shingled array and for locating same on the tray comprising a guide member having an inclined surface which when the guide member is in an initial position engages the leading edge of the first signature which is conveyed to the dense shingling location and guides it to a position resting thereagainst inclined to the support surface of the tray, the lead edge of further signatures conveyed to the dense shingling location engaging the previously positioned signature and being guided to an inclined position thereby with said guide member comprising at least a part of a means supporting said signatures in the inclined position, means for moving said guide member and said signatures in a retracting direction relative to the surface of the tray and said conveyor means as additional signatures are conveyed to said dense shingling location, said last mentioned means comprising a drive mechanism connected to said guide member and which moves said guide member when actuated, and means for sens-

ing the rate of receipt of signatures at said dense shingling location for controlling the speed at which said guide member moves in said retracting direction.

7. Apparatus as defined in claim 5 wherein said means for moving said guide member comprises a drive mechanism connected to said guide member and which moves said guide member when actuated, and means for sensing the rate of receipt of signatures at said dense shingling location for controlling the speed at which said guide member moves in said retracting direction.

8. Apparatus as defined in claim 7 wherein said drive mechanism comprises electrically operated elements and circuit means for controlling said electrically operated elements and said means for sensing the receipt of a signature comprises a first switch in said circuit means mounted above the tray and which is actuated by the leading edge of a signature after it has engaged either the inclined surface of the guide member or previously delivered signature.

9. Apparatus as defined in claim 8 wherein said means for controlling the speed at which said guide member moves comprises a second switch means in said circuit means and for sensing an excessive build-up of signatures at the dense shingling location and a third switch means in said circuit means and for sensing the absence of signatures delivered to the dense shingling location, said circuit means and drive mechanism including means responsive to said second switch means for increasing the speed of retracting movement of said guide member and means responsive to said third switch means for slowing the speed of retracting movement of said guide member.

10. Apparatus for providing a dense shingled array of signatures on a tray with the signatures inclined relative to the surface of the tray on which they are supported, said apparatus comprising means for supporting a tray at a dense shingling location, conveyor means for delivering signatures in a loose shingled stream to said dense shingling location, means at the dense shingling location for forming the dense shingled array and for locating same on the tray, said means for supporting said tray comprising an elevator mechanism movable to position an empty tray at said dense shingling location and to remove a full tray therefrom.

11. Apparatus as defined in claim 10 wherein said conveyor means for delivering signatures has a retractable and extensible portion which delivers signatures to the dense shingling location and means for extending said portion toward said dense shingling location after an empty tray is positioned thereat and for retracting said portion prior to movement of a full tray therefrom by actuation of said elevator mechanism.

12. Apparatus for providing a dense shingled array of signatures on a tray with the signatures inclined relative to the surface of the tray on which they are supported, said apparatus comprising means for supporting a tray at a dense shingling location, conveyor means for delivering signatures in a loose shingled stream to said dense shingling location, means at the dense shingling location for forming the dense shingled array and for locating same on the tray comprising a guide member having an inclined surface which when the guide member is in an initial position engages the leading edge of the first signature which is conveyed to the dense shingling location and guides it to a position resting thereagainst inclined to the support surface of the tray, the lead edge of further signatures conveyed to the dense shingling location engaging the previously positioned signature and being guided to an inclined position thereby with said guide member comprising at least a part of a means supporting said signatures in the inclined position, means for moving said guide member and said signatures in a retracting direction relative to the surface of the tray and said conveyor means as additional signatures are conveyed to said dense shingling location, said means for supporting said tray comprising an elevator mechanism movable to position an empty tray at said dense shingling location and to remove a full tray therefrom, said conveyor means for deliverying signatures having a retractable and extensible portion which delivers signatures to the dense shingling location and means for extending said portion toward said dense shingling location after an empty tray is positioned thereat and for retracting said portion prior to movement of a full tray therefrom by actuation of said elevator mechanism.

13. Apparatus as defined in claim 12 further including switch means actuated by said guide member reaching the end of its retracting movement and means responsive to said switch means for actuating retracting movement of said portion of said conveyor means.

14. Apparatus as defined in claim 13 further including means responsive to positioning of an empty tray at said dense shingling location by said elevator means for extending said portion of said conveyor means.

15. Apparatus as defined in claim 13 further including means responsive to the removal of a full tray from said dense shingling location for returning said guide member to its initial position.

16. Apparatus as defined in claim 1 wherein said means for forming the dense shingled array comprises a guide member having an inclined surface which when the guide member is in an initial position engages the leading edge of the first signature which is conveyed to the dense shingling location and guides it to a position resting thereagainst inclined to the support surface of the tray, the lead edge of further signatures conveyed to the dense shingling location engaging the previously positioned signature and being guided to an inclined position thereby with said guide member comprising at least a part of a means supporting said signatures in the inclined position, and vertical guides for engaging the leading edge of a signature advanced thereto above said support surface and for guiding the stacked array as said guide member retracts.

17. Apparatus as defined in claim 16 further including means supporting said vertical guides for vertical and lateral adjustment.

18. Apparatus as defined in claim 1 wherein said means for forming the dense shingled array comprises a guide member having an inclined surface which when the guide member is in an initial position engages the leading edge of the first signature which is conveyed to the dense shingling location and guides it to a position resting thereagainst inclined to the support surface of the tray, the lead edge of further signatures conveyed to the dense shingling location engaging the previously positioned signature and being guided to an inclined position thereby with said guide member comprising at least a part of a means supporting said signatures in the inclined position, and means for engaging the lower edge of a signature in the array to prevent its sliding down relative to the other signatures therein.

19. Apparatus for providing a dense shingled array of signatures on a tray with the signatures inclined relative to the surface of the tray on which they are supported, said apparatus comprising means for supporting a tray at a dense shingling location, conveyor means for delivering signatures in a loose shingled stream to said dense shingling location, means at the dense shingling location for forming the dense shingled array and for locating same on the tray, said means for forming the dense shingled array comprising a guide member having an inclined surface which when the guide member is in an initial position engages the leading edge of the first signature which is conveyed to the dense shingling location and guides it to a position resting thereagainst inclined to the support surface of the tray, the lead edge of further signatures conveyed to the dense shingling location engaging the previously positioned signature and being guided to an inclined position thereby with said guide member comprising at least a part of a means supporting said signatures in the inclined position, and means for engaging the lower edge of a signature in the array to prevent its sliding down relative to the other signatures therein comprising a pair of cam members having notches which receive the lower edge of the signature.

20. Apparatus for forming a dense shingled array of signatures from a loose shingled array of signatures comprising,

conveyor means for feeding the loose shingled array to a dense shingling location,

means for supporting signatures in a dense shingled relationship at said location including a member having an inclined support surface and against which a side surface of the signatures rests and a support for engaging the lower edge of the signatures,

said member having an initial position for engaging and supporting the first signature delivered thereto and being movable therefrom as additional signatures are fed to said location, and

means for moving said member and the signatures formed into a dense shingled array as the additional signatures are fed to said location, said means for moving said member comprising a support to which said member is connected and drive means for moving said support and said member.

21. Apparatus for forming a dense shingled array of signatures from a loose shingled array of signatures comprising,

conveyor means for feeding the loose shingled array to a dense shingling location,

means for supporting signatures in a dense shingled relationship at said location including a member having an inclined support surface and against which a side surface of the signatures rests and a support for engaging the lower edge of the signatures,

said member having an initial position for engaging and supporting the first signature delivered thereto and being movable therefrom as additional signatures are fed to said location,

means for moving said member and the signatures formed into a dense shingled array as the additional signatures are fed to said location, said support comprising conveyor means to which said member is attached, said means for moving said member and the signatures comprising said conveyor means and drive means for driving said conveyor means.

22. Apparatus as defined in claim 21 wherein said conveyor means comprises a pair of belts spaced laterally apart and said signatures bridge the space therebetween when in said dense shingled relationship and elevator means for moving a tray through the space to pick up the shingled array of signatures from said belt means.

23. Apparatus as defined in claim 20 wherein the lead edge of the first signature delivered to the location engages the inclined support surface, said support surface comprising a means for deflecting the lead edge of the signature upwardly to at least assist in forming the dense shingled array.

24. Apparatus as defined in claim 20 further including vertical guides for engaging the leading edge of the signature above said inclined support surface and for guiding the stacked array as said member moves.

25. Apparatus as defined in claim 24 further including means supporting said vertical guides for vertical and lateral adjustment.

26. Apparatus as defined in claim 20 wherein said means for forming the dense shingled array comprises a guide member having an inclined surface which when the guide member is in an initial position engages the leading edge of the first signature which is conveyed to the dense shingling location and guides it to a position resting thereagainst inclined to the support surface of the tray, the lead edge of further signatures conveyed to the dense shingling location engaging the previously positioned signature and being guided to an inclined position thereby with said guide member comprising at least a part of a means supporting said signatures in the inclined position, and means for engaging the lower edge of a signature in the array to prevent its sliding down relative to the other signatures therein.

27. Apparatus for forming a dense shingled array of signatures from a loose shingled array of signatures comprising,

conveyor means for feeding the loose shingled array to a dense shingling location,

means for supporting signatures in a dense shingled relationship at said location including a member having an inclined support surface and against which a side surface of the signatures rests and a support for engaging the lower edge of the signatures,

said member having an initial position for engaging and supporting the first signature delivered thereto and being movable therefrom as additional signatures are fed to said location, and

means for moving said member and the signatures formed into a dense shingled array as the additional signatures are fed to said location, said means for forming the dense shingled array comprising a guide member having an inclined surface which when the guide member is in an initial position engages the leading edge of the first signature which is conveyed to the dense shingling location and guides it to a position resting thereagainst inclined to the support surface of the tray, the lead edge of further signatures conveyed to the dense shingling location engaging the previously positioned signature and being guided to an inclined position thereby with said guide member comprising at least a part of a means supporting said signatures in the

inclined position, and means for engaging the lower edge of a signature in the array to prevent its sliding down relative to the other signatures therein comprising a pair of cam members having notches which receive the lower edge of the signature.

28. The method of forming a dense shingled array of signatures on a tray with the signatures inclined relative to the surface of the tray on which they are supported comprising the steps of,

supporting a tray at a dense shingling location,

feeding signatures to said location in a loose shingled stream,

forming a dense shingled array of signatures from the loose shingled stream at the dense shingling location,

locating said dense shingled array of signatures on the tray, and removing said tray from said dense shingling location with said dense shingled array thereon.

29. A method as defined in claim **28** wherein the step of forming the dense shingled array includes the steps of,

positioning a member having an inclined surface in the path of the lead edge of the signatures,

deflecting the signatures upwardly due to the location of the member so that the signatures become inclined at an angle corresponding to the incline of said surface.

30. A method as defined in claim **29** further including the step of moving said member and signatures formed into a dense array in a retracting direction as additional signatures are advanced to the dense shingling location.

31. The method of forming a dense shingled array of signatures on a tray with the signatures inclined relative to the surface of the tray on which they are supported comprising the steps of,

supporting a tray at a dense shingling location;

feeding signatures to said location in a loose shingled stream;

forming a dense shingled array of signatures from the loose shingled stream at the dense shingling location including the steps of supporting a member having an inclined surface on spaced conveyor belts, positioning said member in the path of the lead edge of the signatures and deflecting the signatures upwardly due to the location of the member so that the signatures become inclined at an angle corresponding to the incline of said surface;

moving said conveyor belts to move said member and said dense array of signatures in a retracting direction as additional signatures are advanced to the dense shingling location; and

supporting said dense shingled array of signatures on the tray.

32. The method of forming a dense shingled array of signatures on a tray with the signatures inclined relative to the surface of the tray on which they are supported comprising the steps of,

supporting a tray at a dense shingling location;

feeding signatures to said location in a loose shingled stream;

forming a dense shingled array of signatures from the loose shingled stream at the dense shingling location including the steps of supporting a member having an inclined surface on spaced conveyor belts, positioning said member in the path of the lead edge of the signatures and deflecting the signatures upwardly due to the location of the member so that the signatures become inclined at an angle corresponding to the incline of said surface;

moving said conveyor belts to move said member and said dense array of signatures in a retracting direction as additional signatures are advanced to the dense shingling location;

supporting the tray between the belts; and moving the tray between the belts to pick up the dense shingled array of signatures from the belts.

33. The method of forming a dense shingled array of signatures on a tray with the signatures inclined relative to the surface of the tray on which they are supported comprising the steps of,

supporting a tray at a dense shingling location;

feeding signatures to said location in a loose shingled stream;

forming a dense shingled array of signatures from the loose shingled stream at the dense shingling location including the steps of positioning a member having an inclined surface in the path of the lead edge of the signatures, and deflecting the signatures upwardly due to the location of the member so that the signatures become inclined at an angle corresponding to the incline of said surface;

moving said member and signatures formed into a dense array in a retracting direction as additional signatures are advanced to the dense shingling location; controlling the speed of movement of said member in accordance with the speed at which signatures are fed to the location; and supporting said dense shingled array of signatures on the tray.

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