

United States Patent

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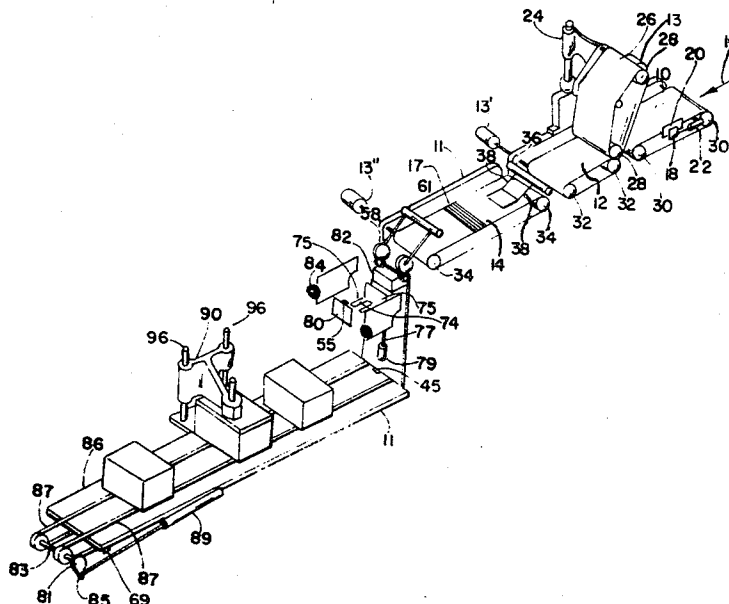
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[54] **JOGGER STACKER MACHINE**
11 Claims, 7 Drawing Figs.

[52] U.S. Cl. **271/89,**
214/6 H
[51] Int. Cl. **B65h 31/34**
[50] Field of Search 271/89, 47,
88, 87, 86; 214/6 H

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ABSTRACT: A method and machine for receiving a continuous stream of signatures from a printing press and producing vertical stacks of accurately aligned signatures wherein the signatures are first aligned in the direction of conveyance, individually curved to increase their rigidity and projected into a supporting collector to align their leading edges. Each signature is maintained in alignment with the others while the stack is forming by means of continuous jogging and rotating brushes continuously depressing the side and back edges of the uppermost signatures. The completed stack is discharged to a compressor and binder.



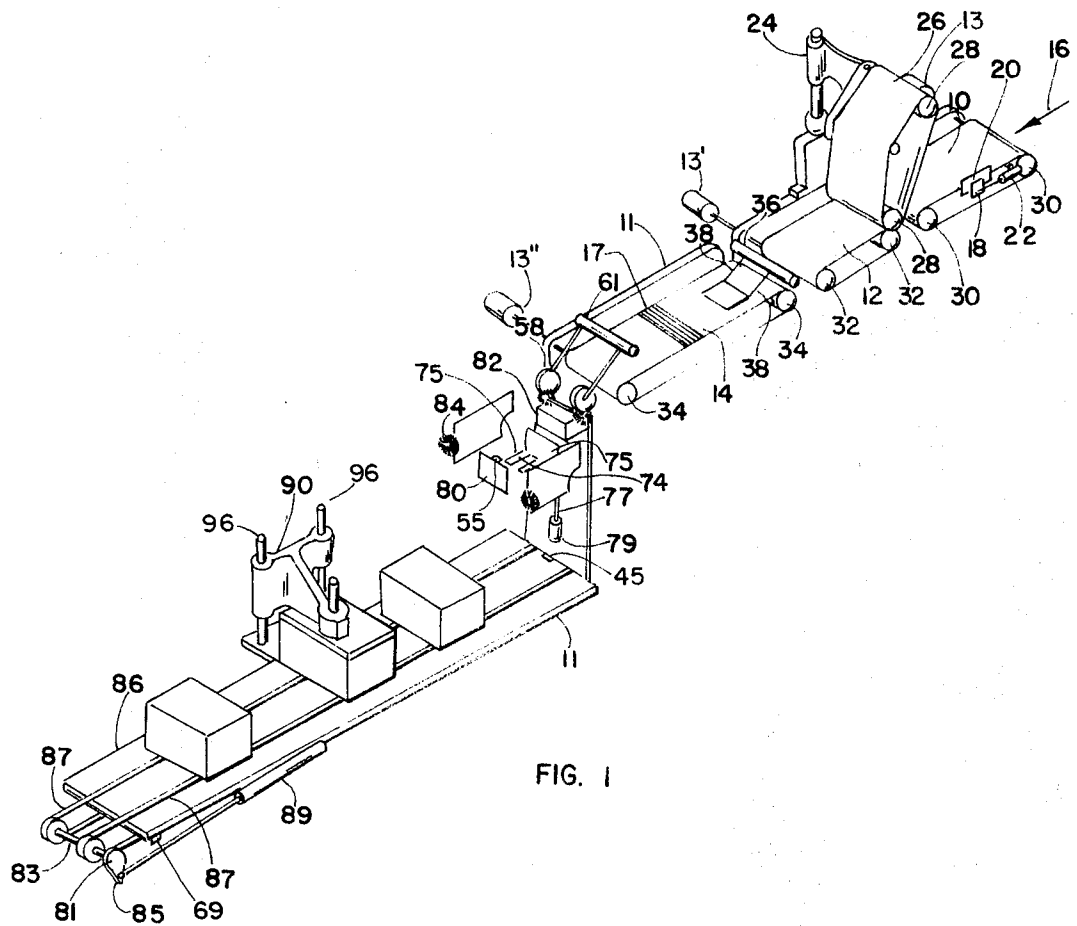


FIG. 1

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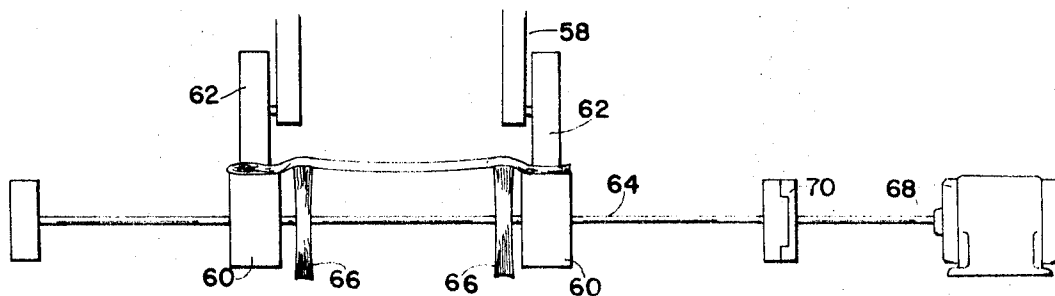


FIG. 2

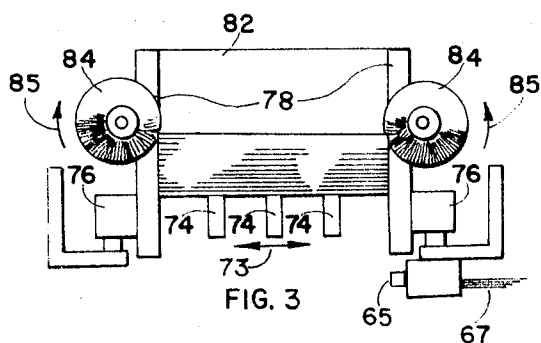


FIG. 3

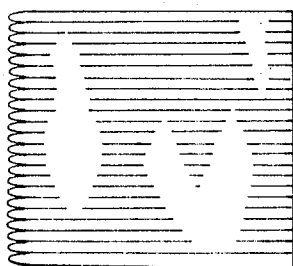


FIG. 4

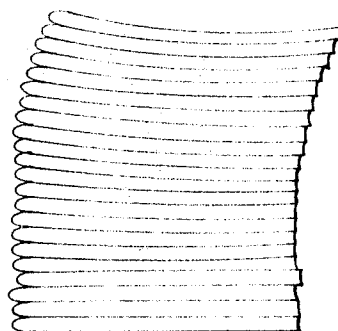


FIG. 5

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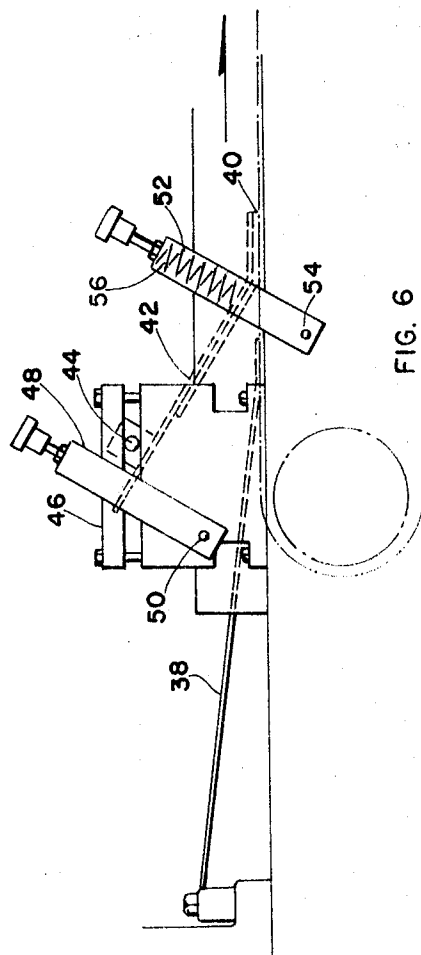


FIG. 6

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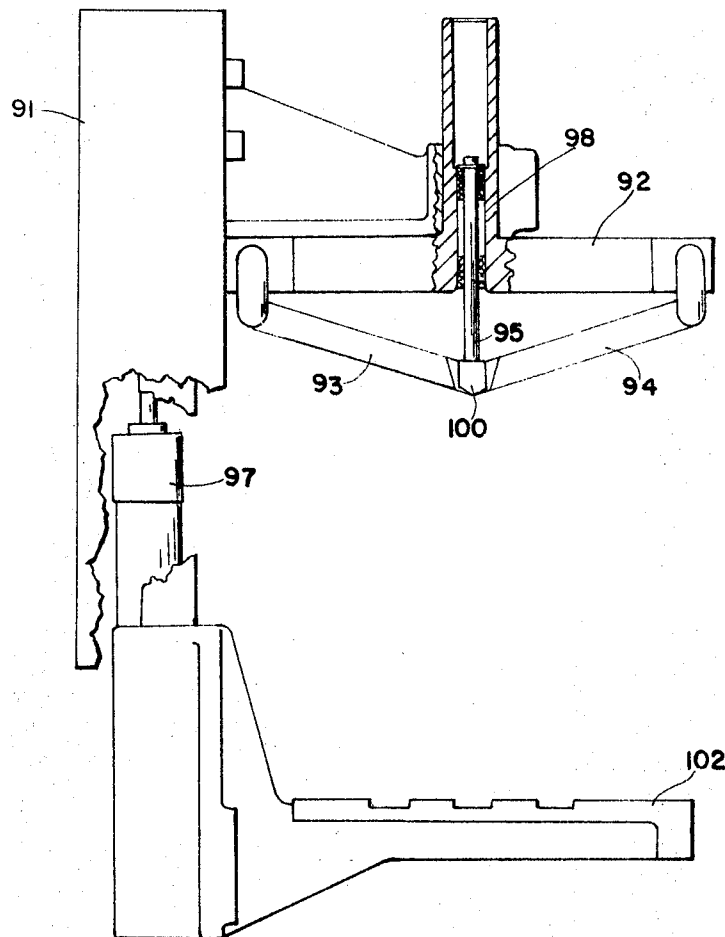


FIG. 7

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JOGGER STACKER MACHINE

BACKGROUND OF THE INVENTION

This invention relates generally to conveyors and, more specifically, to an apparatus and method for continuously converting a stream of signatures emerging from a printing press into accurately aligned stacks suitable for delivery directly into a binder machine without realignment or adjustment of any kind. A signature is a plurality of once folded sheets. Several signatures are generally bound together to form a book or magazine.

Heretofore, signatures have been collected by some semimechanical apparatus or by hand and the stacks required by the binder machine were never consistently formed in an alignment sufficiently accurate to allow continuous operation. Generally, a number of laborers were required solely to reshape stacks by hand and remove the signatures whose trailing edges were sticking out. Any misalignment in a stack of signatures easily can cause the binder machine to jam necessitating costly delays while the machine is stopped and jammed material removed. A frequent cause of misalignment is the tendency of the top signatures in a stack to slide slightly away from their folded edge. Another source of misalignment manifests itself when collecting signatures having holes in the edges of the sheets, such as newspapers. Such signatures, when stacked, tend to align with their trailing edges butting the protrusions of the pinholes on the preceding signature. The stack so formed tends to slant from the vertical and resist straightening, even by hand.

SUMMARY OF THE INVENTION

The problems associated with prior methods and apparatus for continuously producing uniform stacks of vertically aligned signatures have been obviated by this invention. Despite pinholes or irregularities in the stream of signatures received from the printing press, uniform stacks of signatures are continuously produced without human intervention of any kind. Furthermore, the signatures can be handled regardless of whether they are received with their leading, trailing or side edges first.

Accurate formation of the stacks begins by directing the incoming stream of signatures into the first of two successive conveyance zones, the speed of each being independently controlled to vary between complete halt and a speed which is generally equal to the rate of the printing press producing the signatures.

In the first zone, the side edges are jogged to align them in the direction of conveyance. The folded edge which is usually—but not necessarily one of the side edges, is precompressed to impart more stability which is useful later when the signatures are handled individually while forming the stack. The signatures are spread out further in the second zone. They are then curved into an arc about an axis extending in the direction of conveyance and discharged from the second zone. The signatures are discharged unsupported through the air and collected to form a vertical stack. This eliminates any tendency of contiguous signatures containing pinholes to become misaligned when the horizontal stream is converted to a vertical stack. Curving the signatures provides a momentary rigidity which has been found useful in positioning and initially aligning each signature at the top of the stack. It also facilitates operation at higher speeds and eliminates the necessity of receiving the signatures folded edge first from the printing press since, at high speeds (around 2,000 FPM on a printing press), signatures which have not been curved tend to flutter when discharged with any nonfolded edge leading.

The stack is maintained under continuous slight compression on at least two sides as it is being formed by means of rotating soft brushes brushing downwardly on the edges of the uppermost signatures. In addition, the forming stack is continuously being jogged. These two operations combine to initiate the formation of an aligned stack and maintain the accu-

rate alignment as it is being formed and becomes larger. After formation, the entire stack is compressed and conveyed to the next operation which is usually a binder machine.

It is an object of this invention to provide a method and apparatus for continuously producing stacks of accurately aligned signatures without human intervention.

It is another object of this invention to provide a method and apparatus for forming aligned stacks of signatures even when the signatures contain pinholes.

It is still another object of this invention to provide a method and apparatus for handling signatures directly from a high-speed printing press.

A feature of this invention is the ability to form accurate stacks of signatures regardless of whether the signatures are received with their folded edge leading, trailing or on one side.

These and other objects, features and advantages of the invention will become readily apparent to those skilled in the art when the following description of the preferred embodiment is read in conjunction with the accompanying drawings which form a part hereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the entire jogger stacker machine.

FIG. 1 is an end view of the signature discharge equipment.

FIG. 3 is an end view of the signature collecting apparatus showing the rotating brushes and side joggers.

FIG. 4 is an end view of a stack of signatures as made with this invention.

FIG. 5 is an end view of a stack of misaligned signatures which are unacceptable for processing in a binder machine.

FIG. 6 is a side view of the stripper assembly.

FIG. 7 is an end view of the compressor assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, three conveyors, 10, 12 and 14 are shown in position to successively receive signatures from a printing press (not shown) in the direction of conveyance indicated by arrow 16. For convenience, conveyors 10, 12 are said to reside in a first zone and conveyor 14 in a second zone. In order to identify the various component parts more clearly, the main frame-mounting conveyors 10, 12, 14 is shown broken away and schematically as 11. Each of these conveyors is driven by a variable speed motor 13, 13', 13'' connected in any suitable well known manner. Conveyors 10, 12 are usually driven at the same speed. Mounted on either side of conveyor 10 on the frame is a jogger unit 18 essentially comprising a substantially flat, vertically extending plate 20 which is spring loaded for limited movement transversely to the direction of conveyance 16. Each jogger unit is adjustably mounted on the frame so that plates 20 can be moved inwardly or outwardly according to the width of the signatures being conveyed. A motor 22 drives each jogger unit via a cam moving against the spring to rapidly oscillate plate 20 to jog the side edges of the oncoming stream of signatures. The side edges so jogged are aligned to extend parallel to the direction of conveyance 16 and the leading and trailing edges refer to the oncoming and offgoing sides of each signature, respectively.

The signatures are usually received from the printing press with the leading edge overlapping the trailing edge of the preceding signature.

Mounted to the frame 11 above the oncoming end of conveyor 12 is a stand 24 supporting a continuous belt 26 rotatably mounted on rollers 28 having axes parallel to the rollers 30, 32, 34 supporting conveyors 10, 12, 14, respectively.

Belt 26 is spaced vertically above conveyor 12 a distance sufficient to allow the stream of signatures to pass beneath undisturbed while depressing each signature to sharpen its folded edge. If the signature is relatively thin, the folded edge may be quite sharp as it comes from the printing press and further compression by belt 26—called precompression—is unnecessary and can be omitted.

Conveyor 12 is completely separate from conveyor 10, despite the fact that they are driven at the same speed, because the jogging operation performed on conveyor 10, called prejogging, requires the side edges of the signatures to extend beyond the edges of the conveyor belt so they can be contacted by jogger plates 20 without interference. However, the signatures are frequently received with their folded edge on one side and that side must be supported to allow precompressor belt 26 to depress that edge to sharpen the crease. The belt on conveyor 12, therefore, is wider than the width of the signatures to provide such support.

The belt on conveyor 14 preferably has a surface serrated transversely to the direction 16 of conveyance, shown as lines 17, to facilitate signature traction thereon. Near the oncoming end of conveyor 14 is a stripper assembly 36 comprising a flexible blade 38 mounted on, and extending downwardly from, a bar extending across the conveyor. The lowermost extension of the blades, with respect to the conveyor belt surface, can be adjusted so that a single signature can pass beneath undisturbed, but overlapping signatures are spaced further apart a distance which is a function of the force urging the stripping blade against the conveyor belt. The serrations in the belt surface assist this procedure by resisting movement of the signature on the conveyor belt. As seen in FIG. 6, adjustment of gap 40 is accomplished by means of a pair of resilient blades 42 mounted on a rod 44 extending transversely across conveyor 14 above blade 38. Each end of rod 44 is mounted on a bracket 46 on either side of the conveyor for horizontal sliding movement therein. An adjustable length arm 48 is mounted on each side of the conveyor with one end pivoted at 50 to the corresponding bracket 46 and the other end biased against the upper end of a corresponding blade 42.

The lower ends of blade 38 and resilient blades 42 are attached, so horizontal movement of rod 44 in bracket 46 about pivot 50 is translated into approximately vertical adjustment of gap 40. A second pair of adjustable length arms 52 are mounted near the lower end of blades 38, 42. The lower ends of arms 52 are pivotally attached to the frame at 54 and their upper ends biased against the lower ends of blades 42 by means of springs 56 to vary the force resisting upward enlargement of gap 40 by the passage of overlapping signatures on conveyor 14.

Immediately downstream of conveyor 14 is a signature-handling apparatus 58 comprising a pair of guide wheels 60 which provide a supporting surface for the stream of signatures leaving conveyor 14. Mounted directly above conveyor wheels 60, about a pivoted shaft 61 which is in turn mounted onto the main frame, are a pair of correspondingly aligned depression wheels 62 which would ride on guide wheels 60 if no signatures were in between. Inwardly of each guide wheel 60, mounted on the same shaft 64, is a forming wheel 66 which has a diameter greater than guide wheel 60. It has been found that greater guidance control of the signatures is possible when forming wheels 60 have a radially extending brushlike surface.

The configuration just described imparts a concave downwardly facing arc to each signature about the axis parallel to the direction of conveyance 16 as it passes between wheels 60, 62. Motor 68 drives shaft 64 through coupling 70 at a speed which may be slightly faster than the speed of signatures on conveyor 14. This causes the signatures to be accelerated slightly as they pass through. It will be appreciated that mounting forming wheels 66 outside guide wheel 60 will cause the signatures to be curved concave upwardly. This may be done when it is desired to impart rigidity to a relatively thin signature.

The signatures passing through handling apparatus 58 are discharged thereby into a signature collector 72 shown in FIGS. 1 and 3. Collector 72 comprises a plurality of lower support bars 74, three in this embodiment, which support the stack of signatures as it is being formed. Support bars 74 are cantilevered from a movable elevator frame 75 on the oncoming side of collector 72. On each side of the support bars, a

jogger unit 76 is mounted on the main frame 11 in much the same manner as the prejogger units 18 are mounted near conveyor 10. Each jogger 76 supports and moves a vertical plate 78 which forms the sidewalls of collector 72 in the direction of arrows 73. An adjustable front wall 80 is mounted to the frame transversely to the direction conveyance 16. It is adjustable by simple threaded fittings (not shown) to move back and forth in the direction of conveyance.

A jogger unit also is connected to a rear wall 82 which, with walls, 78, 80, form the collection box while receiving the signatures. The side joggers are adjustably mounted on the main frame to allow the width of the collection box to be changed. The front wall 80 is adjustable to change the collection box length according to the size of the signatures being handled.

Frame 75 is movable vertically by means of two drive screws 77 mounted on either side thereof and driven by a motor 79 which is connected to each screw by reduction gearing (not shown).

On either side of collector 72, a wire brush 84 is mounted to the main frame to rotate about an axis parallel to the direction of conveyance 16. Brushes 84 extend inwardly a distance sufficient to intercept the side edges of the top few signatures forming the stack and rotate in a direction 85 to gently depress the signatures and thereby assist in aligning and maintaining them in a fixed location.

A conveyor 86 extends downstream from below support bars 74. The carrying belts 87 on conveyor 86 intermesh with support bars 74 to allow the stack formed thereon to be smoothly deposited onto conveyor 86 without disturbing the alignment of the stack. A suitable power source, such as hydraulic cylinder 89, has one end mounted to the main frame and the other pivotally connected to an arm 85 extending from a one-way clutch 81 mounted on the downstream turning shaft 83 of conveyor 86. Actuation of cylinder 89 indexes conveyor 86 a distance slightly greater than the length of a stack of signatures. Movement is intermittent as the conveyor is required to move only when a newly formed stack of signatures is deposited on the upstream end.

At a point several index intervals downstream on conveyor 86, a compressor 90 is mounted directly over the stack at that location. Compressor 90 comprises a frame 91 on which a split face platen 92 is mounted with its two faces 93, 94 pivoted in the center and at either edge to swing about axes parallel to the movement along the conveyor. Platen 92 moves vertically along two slide rods 96, as seen in FIG. 1 and is powered by a hydraulic cylinder 97. A shaft 98, guided by pin 95, extends vertically into the center of platen 92 and is linked to the center pivoted joint 100 of faces 93, 94. Joint 100 normally extends slightly downwardly from other sides of faces 93, 94 under the influence of gravity so it is the first contact with a stack of signatures as platen 92 moves downward. This ensures against accidental contact of platen 92 with a higher side of a stack (the side having folded edges) and thereby skewing the aligned signatures. A grooved base 102 provides support for the compressive force exerted by platen 92 as well as guidance for conveyor belts 87.

In operation, a steady stream of signatures emerging from a printing press, which may be running at a web speed of about 2,000 feet per minute, is directed onto conveyor 10. The signatures are usually overlapping, but this equipment can operate even if they come intermittently or are spaced one at a time. Joggers 18 are tamping the side edges to maintain them in straight lines as the stream continues onto conveyor 12. If desired, precompressor belt 26 is brought into contact with the stream to sharpen the folded edge of each signature as it passes beneath. Generally, the signatures are traveling with their folded edge on one side, but this equipment will operate satisfactorily regardless of whether the folded edge is leading, trailing or on one side. It is contemplated that belt 26 may be driven if desired by a motor mounted on stand 24.

The stream of signatures continues onto conveyor 14 which normally is running at the same speed as conveyors 10, 12.

Gap 40 on the stripper assembly 46 is adjusted to spread the signatures so that the overlapped portion is about half the length of a signature as measured in the direction of conveyance 16.

The signatures are directed into the handling apparatus 58 where they are continuously curved and discharged under the impetus of forming wheels 66 which are usually driven slightly faster than the speed of conveyors 10, 12, 14. Curvature of the signatures imparts a momentary stiffness or rigidity to them during the brief period they are unsupported until they land in collector 72. Front wall 80 defines a vertical plane and is positioned to intercept each signature and arrest its forward motion to form the leading edge of a vertical stack of signatures.

Depending on the speed of emerging stream of signatures being discharged from handling apparatus 58, front wall 80 is positioned to intercept the stream well before it would otherwise contact bottom support bar 74. As the stack begins to form in collector 72, support bars 74 are lowered very slowly to maintain brushes 84 in optimum operating position near the top of the stack. The lowering operation is activated by a detector switch 55 mounted on front wall 80 which detects the presence of a small number of signatures on support bars 74 and then activates motor 79 driving screws 77 to lower support bars 74 a predetermined distance equal to the height of the portion of signatures just collected.

When frame 75 has been incremented downward several times necessary to form a complete stack on bars 74, it contacts an adjustable pile height switch 65 mounted on the main frame and connected to signal hydraulic cylinder 97 and the drive motors on conveyors 10, 12, 14 and movable frame 75 through wires 67. This switch causes the motor driving conveyor 14 to stop and the motors driving conveyors 10, 12 to simultaneously slow down. The slow speed of conveyors 10, 12 is a function of their normal operating speed, but it has been found that a slow speed equal to about one-fifth of the normal speed is satisfactory for most operating conditions. At the end of a 2 second delay from the activation of the pile height switch 65, frame 75 is rapidly driven to its lowermost level where the oncoming end of conveyor belts 87 intermesh with support bars 74 and gently remove the stack of signatures. At its lowermost position, frame 75 activates conveyor sensing switch 45 which deactivate motor 13 driving conveyor 10 to prevent additional signatures from piling up in stripper assembly 36. Frame 75 containing support bars 74 dwells briefly at its lowermost level before being returned to its upper position after a load of signatures is deposited on conveyor 86. When it has reached its upper position, motors 13, 13', 13'' on conveyors 10, 12, 14 are once again activated by switch 65 to operate at full normal speed.

Stripper assembly 36 operates to collect signatures on its upstream sides during periods when conveyor 14 is stopped. When conveyor 14 is started again, stripper 36 serves to regulate the flow of backup signatures onto conveyor 14 in an orderly manner to assure continuous uninterrupted operation.

As a stack of signatures is placed on conveyor 86, a conveyor sensing switch 45 detects its presence and activates hydraulic cylinder 89 to extend its piston and index the stack downstream a predetermined distance. With each index of conveyor 86, a new stack is positioned beneath compressor 90. The furthestmost extension of cylinder 89 activates limit switch 69 on frame 11 which activates cylinder 97 on compressor 90 to drive platen 92 downwardly with a force of about 170 p.s.i. to compress the stack. Activation of switch 55 operates cylinder 97 to raise platen 92. Compressed stacks are either discharged onto another conveyor not forming a part of this invention or are stacked onto pallets for storage until they are delivered to a binder machine.

The operation and construction of the cam actuated jogger devices and various sensing switches are well known as is the manner in which the sending switches are connected to the drive motors and hydraulic cylinders. They, or their equivalent, are available commercially so no detailed description of them has been made here other than to relate their function in connection with the other components.

Thus it will be seen that a method and apparatus have been set forth which incorporate the features and achieve the objects above stated. While a detailed embodiment of this invention has been described, it will be understood that various modifications and alterations can be effected without departing from the spirit and scope of the appended claims.

We claim:

1. In a method of continuously forming stacks of accurately aligned signatures comprising the steps of:

- a. conveying a line of signatures into and through a first zone;
 - b. prejogging the line of moving signatures within the first zone transversely to the direction of conveyance to align the side edges of the signatures extending in the direction of conveyance;
 - c. discharging each signature from the oncoming line of remaining signatures in the direction of conveyance;
 - d. curving each signature about an axis extending in the direction of conveyance as it is discharged;
 - e. halting the conveyance movement of each discharged signature with its edge at a predetermined location;
 - f. collecting a stack of halted signatures with their leading, trailing and side edges aligned, the improvements comprising;
 - g. jogging the forming stack of signatures as they are being collected;
 - h. intermittently conveying the line of signatures through the first zone by selectively varying the speed therein between complete halt, a top speed and an intermediate speed;
 - i. interposing a second zone between said first zone and step e) above, and conveying the signatures through said second zone, both zones normally conveying at the same top speed;
 - j. increasing the distance between leading edges of adjacent signatures within the second zone;
 - k. intermittently conveying the line of signatures through said second zone by halting the conveyance of signatures in said second zone when a predetermined number of them has been collected;
 - l. slowing the rate of conveyance of signatures through said first zone simultaneously with the halting of conveyance in said second zone;
 - m. removing the stack of collected signatures a predetermined time after the conveyance has been slowed in said first zone;
 - n. halting the conveyance of signatures in said first zone simultaneously with the removal of a stack of collected signatures;
 - o. resuming conveyance of signatures through said first and second zones at the same speed as in step i) above.
2. The method as set forth in claim 1, wherein: said slow rate of conveyance through said first zone is about 1/5 the regular conveyance through said first zone.
3. The method as set forth in claim 1, wherein: said signatures are overlapping during conveyance through at least the first zone.
4. The method as set forth in claim 5, wherein: the leading edges of said overlapping signatures in said second zone are spaced apart about half the distance between the leading and trailing edge of a signature.
5. The method as set forth in claim 1, further including the step of:
- continuously depressing the edges of at least two sides of a stack of signatures as they are being collected.
6. The method as set forth in claim 1, further including the step of:
- precompressing the folded edges of said signature prior to their being discharged.
7. The method as set forth in claim 1, further including the step of:
- compressing the stack of collected signatures to make the stack more compact and acceptable to process into a binder machine.

8. In apparatus for continuously forming stacks of accurately aligned signatures comprising:
 a frame having a plurality of independently operable conveyor means mounted substantially horizontally successively thereon, said frame having first and second zones;
 first conveyor means within said first zone for receiving a continuous line of signatures as from a press;
 first power means connected to drive said first conveyor means;
 pre-jogging means mounted on said frame within said first zone to assist in aligning the sides of the signatures;
 second conveyor means in said second zone downstream of said first conveyor means for receiving said signatures therefrom;
 second power means connected to drive said second conveyor means;
 signature-handling means to guide each signature and discharge it from said second zone;
 collection means for receiving a predetermined number of signatures from said handling means and forming a stack thereof and capable of moving said stack, said collection means comprises a bottom support, a pair of joggers on either side thereof and a front wall extending transversely in the direction of signature discharge, said wall positioned to intercept each discharged signature to assist in aligning the leading edges of the forming stack;
 signature conveyor means to receive said stack of signatures from said collection means; the improvement comprising said first and second power means selectively halting and moving said first and second conveyor means at various speeds in response to predetermined signals;
 said first conveyor means includes a separate driven conveyor means;
 a stripper assembly is mounted in position relative to said separate conveyor means to spread the signatures apart in

the direction of conveyance a distance greater than they are in the oncoming direction of said first conveyor means;
 switch means connected to said collection means capable of sensing
 1. the formation of a stack comprising a predetermined number of signatures, and
 2. the removal of said stack on said signatures conveyor means,
 and signaling said first and second power means to
 a. stop said second conveyor means and simultaneously slow said first conveyor means when said stack of signatures has been completed,
 b. stop said first conveyor means when said stack is being removed on said signature conveyor means;
 c. starting both said first and second conveyor means after said stack has been removed.
 9. The apparatus as set forth in claim 8, wherein:
 said signature-handling means comprises an upper and lower pair of guide wheels, corresponding ones of which are aligned to nip the signatures therebetween;
 further including a pair of forming wheels having a larger diameter than, and adapted to rotate coaxially with, one pair of said guide wheels;
 at least one pair of said guide wheels being powered.
 10. The apparatus as set forth in claim 9, wherein:
 said forming wheels are mounted outwardly of said guide wheels comprising said guide surfaces to curve said signatures concave upwardly.
 11. The apparatus as set forth in claim 8, further including:
 at least two driven brush means, each mounted on a separate side of said collection means and positioned to intercept and depress corresponding edges of the top few signatures on said stack as it is being formed.

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