

[54] METHOD AND APPARATUS FOR FORMING A VERTICAL STACK OF SIGNATURES

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[58] Field of Search..... **214/1 Q, 1 QA, 6 C, 6 S, 214/7, 152; 271/207, 213, 216, 220, 221; 93/93 DP**

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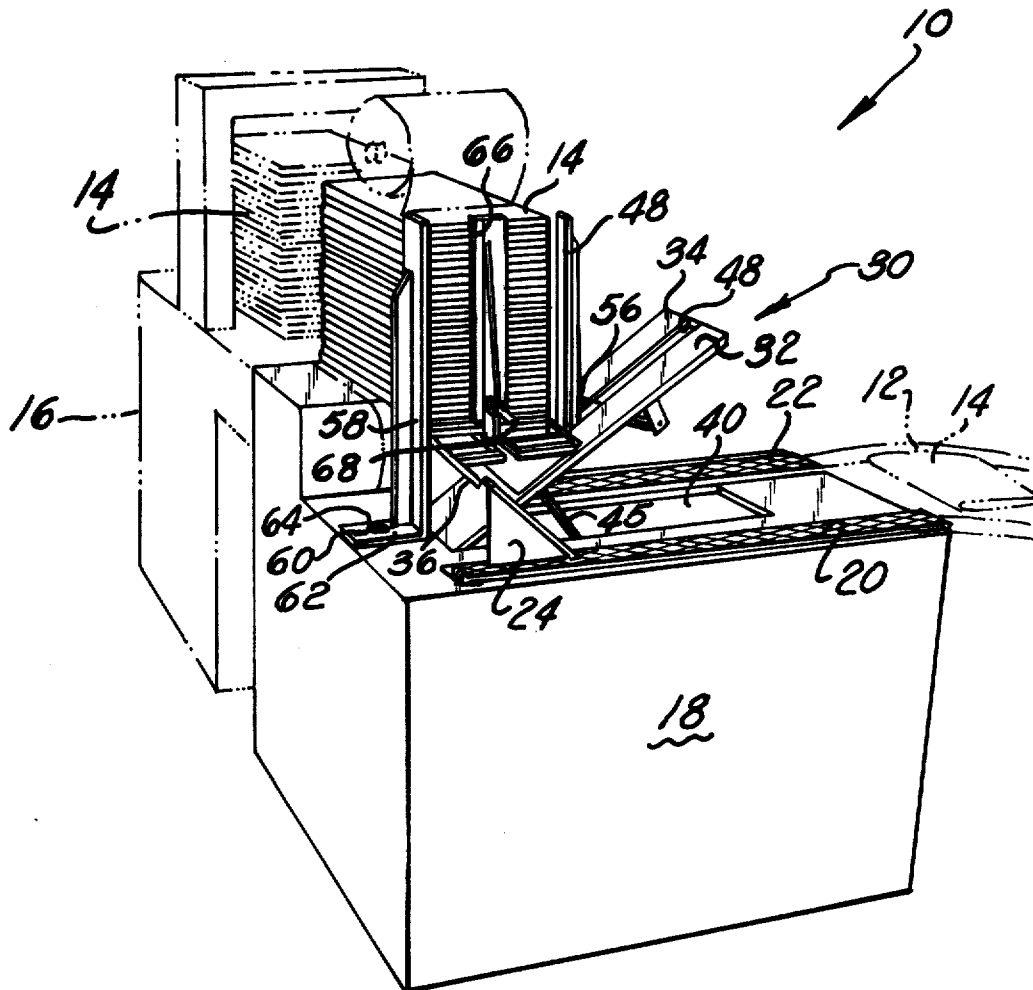
Primary Examiner—Robert J. Spar

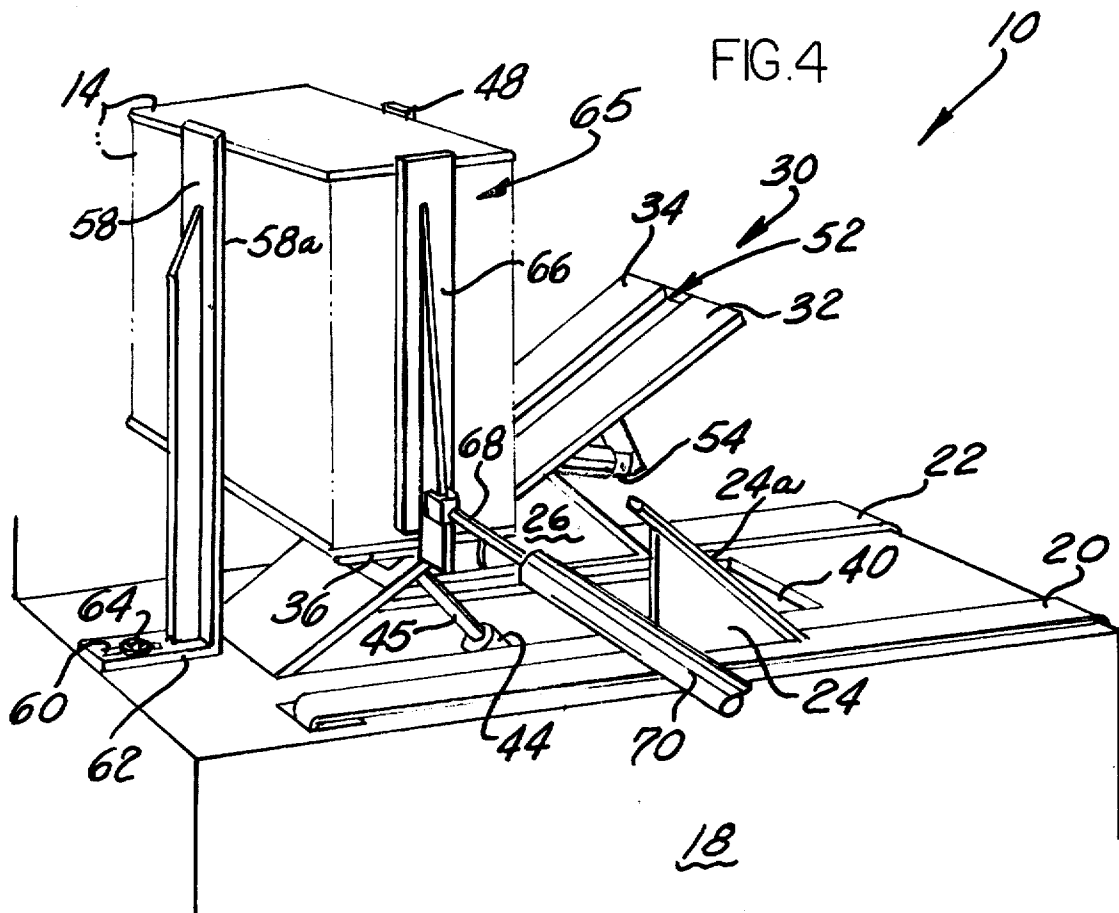
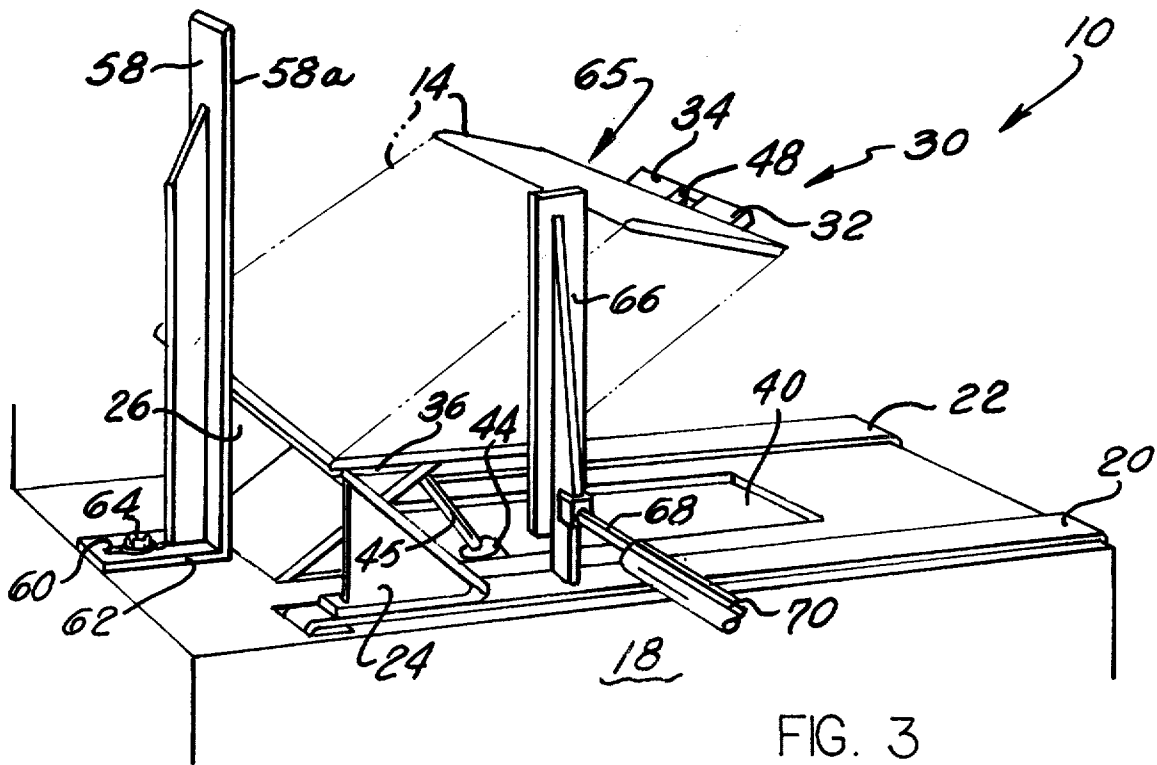
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[57] ABSTRACT

A vertical stack of signatures is formed by first forming a dense, shingled array of signatures on a support means including first and second support surfaces oriented to define an included, obtuse angle. With the support means in a first position and the first surface extending generally horizontal, the signatures are positioned thereon in seriatim order leaning against the second surface and having one of their peripheral edges resting on the first surface. After the dense, shingled array is formed, the support means are shifted to move the dense, shingled array to a position wherein the second support means extends generally horizontally. Subsequently, a force is applied to the signatures' peripheral edges in engagement with the first surface to shift the edges in vertical alignment relative to the second surface. Additionally, guide and stop means are provided to engage the peripheral edges opposite the edges against which the force is applied to assure the desired vertical alignment. In the particular embodiment disclosed, the dense, shingled array is formed by a pair of spaced conveyor belts from a loose, shingled stream of signatures. The belts include inclined members which deflect the leading edge of the signatures in an upward direction and moves them into position on the aforementioned support means.

20 Claims, 5 Drawing Figures





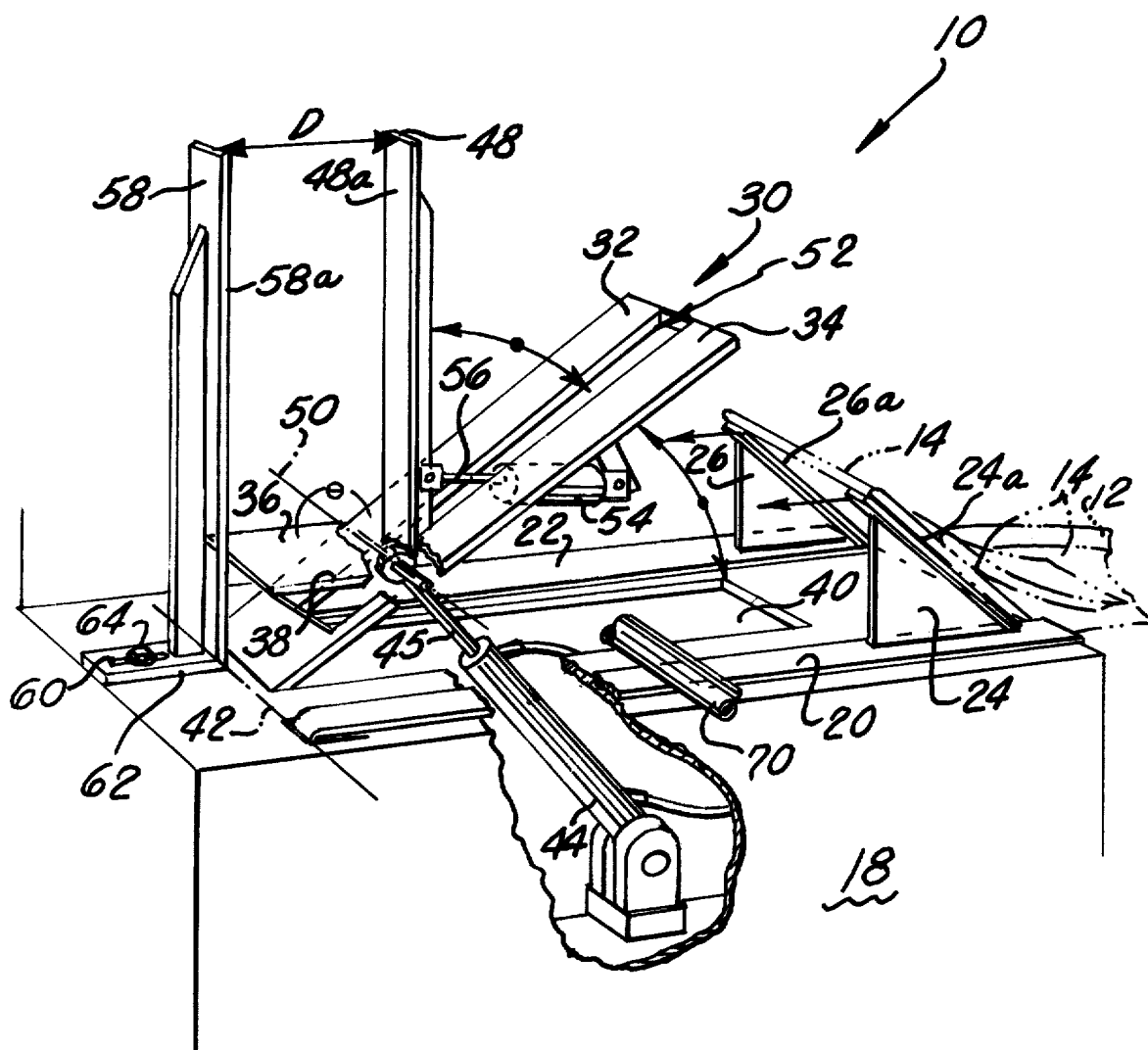


FIG. 5

METHOD AND APPARATUS FOR FORMING A VERTICAL STACK OF SIGNATURES

BACKGROUND OF THE INVENTION

Currently, there is a substantial amount of interest and activity in the area of automating the handling of newspapers in a newspaper plant. Among the many steps carried out in the handling process are forming the printed newspapers into stacks, and wrapping and tying the stacks.

Machines presently in use for forming the stacks drop the stacked product a substantial distance. As a consequence, the stacks tend to move out of alignment. This requires considerable manual realignment of the stacks by "stackermen" at every delivery point. Additionally, because the stacks are not totally under control, difficulties are encountered in attempting to automate the wrapping and tying operations.

SUMMARY OF THE PRESENT INVENTION

The present invention is directed to a method and apparatus which allows newspapers or sections thereof to be rapidly formed into vertical stacks. The method and apparatus are such that the stacks can be maintained under control and transferred directly to associated apparatus such as wrapping and tying machines. As will become apparent, the method and apparatus is applicable to the stacking of all types of signatures, not only newspapers and newspaper sections or inserts.

In accordance with one aspect of the invention, the method generally comprises the steps of providing first and second support surfaces which are oriented relative to one another to form an obtuse, included angle. The support surfaces are positioned in a first position for receiving a dense shingle of signatures. Preferably, but not necessarily, in the first position the first surface extends horizontally and the second surface extends generally upwardly therefrom. With the surfaces in the first position, signatures are placed on the surfaces to form a dense shingle in which each signature has a peripheral edge engaged with and supported by the first surface. A first of the signatures leans against and is laterally supported by the second surface and the remaining signatures are positioned in seriatim order to lean against and be laterally supported by each preceding signature.

After formation of the dense shingle, the support surfaces with the dense shingle carried thereon are moved to a second position in which the second surface preferably extends generally horizontally. Thereafter, a force is applied to the peripheral edges which engage the first surface to move the signatures into a stack wherein the peripheral edges extend generally vertically relative to the second surface.

Although, in certain circumstances, the stack could be wrapped and/or tied while in position on the second surface, it is contemplated that the stack will normally be moved laterally onto a conveyor or directly into a wrapping and tying machine.

Apparatus having somewhat different structural characteristics could be used for carrying out the above method. However, in accordance with a second aspect of the invention, the preferred form of the apparatus generally includes a support means on which a dense shingle can be formed. The support means includes an inclined support surface against which a side surface of

the signatures rest and a lower support for engaging the lower edges of the signatures. Actuating means are provided for moving the support means from the first or shingle-receiving position to a second position wherein the inclined surface is substantially horizontal. Additionally, pusher means are provided which are operable at least when the support means is in the second position for applying a force against the signature edges which engage the lower support to move the edges into vertical alignment.

A more limited aspect of the invention contemplates that the support means can be mounted for pivotal movement about an axis generally parallel to the first and second surfaces. The actuating means can simply be a fluid cylinder mounted to move the support means between the first and second positions.

It should be appreciated that various types of guide or stop surfaces can be associated with the apparatus to control the final positioning of the stack on the inclined surface. Moreover, the apparatus can also be provided with suitable mechanism to transfer the finished stack off the inclined surface directly to an associated conveyor, wrapping or tying machine.

FIG. 1 is a schematic, perspective view of an apparatus embodying the present invention (typical equipment which can be associated with the apparatus is shown in phantom lines);

FIG. 2 is a somewhat enlarged view of the apparatus of FIG. 1 showing the apparatus in a first position of its operating sequence;

FIG. 3 is a further view illustrating the apparatus in a subsequent position of its operation sequence;

FIG. 4 is a further view illustrating the apparatus of FIG. 1 in its final position during formation of a stack of signatures; and,

FIG. 5 is a view similar to FIGS. 2-4 but showing certain portions broken away to more clearly illustrate the overall construction of the preferred embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As noted above, the present invention provides a method and apparatus for forming signatures into vertically aligned stacks. The signatures may be in the form of pre-printed newspapers, newspaper sections, inserts therefor, or the like. Generally, the invention is preferably utilized in an overall system in which the signatures coming directly from a printing press are moved into their vertical, stacked relationship, and these stacked signatures are then transferred to a wrapping and/or tying apparatus. It should be appreciated, however, that the invention may be used in any system to form signatures into a vertical stack irrespective of whether the signatures are delivered from a printing press or other apparatus. The present invention to be described hereinbelow incorporates many detailed structural features, but it should be apparent from the description that the invention can be embodied in a variety of constructions and modifications can be made therein.

As representative of a preferred embodiment of the invention, FIG. 1 of the drawings illustrates a mechanism 10 which embodies the invention and is arranged to receive signatures 14 being conveyed thereto in a loose, shingled relationship by a conveyor 12. The term loose, shingled relationship is used to indicate that the leading peripheral edge of each signature slightly over-

laps the trailing edge of the next preceding signature. FIG. 1 illustrates the apparatus 10 in its final position of operation with the signatures 14 in a vertically stacked relationship suitable for transfer from apparatus 10 to an associated apparatus such as a wrapping and tying machine 16. The machines 12 and 16 are illustrated merely for the purpose of showing one manner in which the apparatus 10 can be utilized. It should be appreciated that many different types of apparatus could be used for supplying the signatures to the stacking apparatus 10 and, also, the apparatus 10 could be arranged to supply the stacked signatures to other types of conveyors and/or apparatus.

The overall construction and functioning sequence of the apparatus 10 can best be understood by particular reference to FIGS. 2 and 5. In general, the apparatus 10 includes a base or support frame 18 which carries a conveyor including a pair of belts 20 and 22. The belts 20 and 22 are laterally spaced apart and trained about suitable pulleys carried on the support frame 18. Power means (not shown) are provided for selectively driving the belts simultaneously in either direction about the pulleys. Carried on the belts 20 and 22 are guide and support members 24 and 26, respectively.

At the start of a stack-forming operation, the belts 20, 22 are in a position such that the guide and supporting members 24, 26 are in the right-hand phantom line position shown in FIG. 2. As the loosely-shingled signatures are delivered to the apparatus 10 by the conveyor 12, the leading signature engages the inclined forward surfaces 24a and 26a of the guide and support members. This causes the leading signature to be deflected upwardly such that the first signature comes to rest lying on the surfaces 24a and 26a and being inclined relative to the belts 20, 22. The belts 20, 22 are controlled so that they move to the left (as viewed in FIG. 2) such that each successive signature supplied by conveyor 12 is deflected upwardly by the preceding signature until a densely-shingled array of signatures is achieved as shown by solid lines in FIG. 2. It should be understood that the belts continue moving to the left until they come to the left-hand position of FIG. 2. Subsequently, in the operation the belts are reversed and the members 24, 26 are returned to the right-hand position.

Broadly, the apparatus thus far described is shown and described in substantial detail in the commonly-assigned, copending application Ser. No. 358,124 filed May 7, 1973, now Pat. No. 3,842,719, and entitled "Method and Apparatus for Forming a Dense, Shingled Array of Signatures", and the specific description thereof in the aforementioned application is incorporated herein by reference.

Of particular importance to the subject invention is the method and apparatus by which the densely-shingled array of signatures such as that shown in FIG. 2 is formed into a vertically-aligned stack. In particular, the subject apparatus includes shingle support means 30 which is located between the belts 20 and 22 for receiving the densely-shingled signatures. As best illustrated in FIG. 5, the support means 30 comprises a first or lower support member 32 which defines a first support surface 34. Support surface 34 engages and supports the lower peripheral edge of the signatures when they are in their dense, shingled relationship shown in FIG. 2. Associated with the first support member 32 is a second support member 36 which is preferably

mounted on member 32 and defines a second support surface 38 which is oriented relative to surface 34 so as to define an obtuse, included angle θ . In the subject embodiment, the surface 38 is inclined at an angle generally corresponding to the angle of the previously-mentioned surfaces 26a and 24a. (Although this angle could vary substantially, it is desirably in the range of approximately 45° from the vertical.)

The support means 30 is mounted for movement between first and second positions. In the first position, member 32 is received within the opening 40 and the surface 34 extends generally horizontally. This is the position of the support means 30 illustrated in FIG. 2. In this position, the densely-shingled array of signatures is formed by the mechanism previously described and moved to a position wherein the first signature of the array of signatures has its side face resting against and supported on the surface 38. Although support means 30 could be mounted in many different ways, in the subject embodiment it is carried by a suitable pivot mounting (not shown) for oscillatory movement generally about an axis 42. This allows support means 30 to move from the first position wherein surface 34 is horizontal to the second position shown in solid lines in FIGS. 3 and 5. The second position is preferably selected so that surface 38 is generally horizontal. At this time, the dense, shingled array is, of course, in the position illustrated in FIG. 3. That is, the left-hand or lower surface of the first shingle of the array is extending generally horizontally with the remaining shingles supported thereon by the surface 34.

Although many different types of power or actuating means could be utilized for moving the support means 30 between the first and second positions, the subject embodiment utilizes a fluid cylinder 44 which is carried within the support base 18 and has its piston rod 45 suitably attached through a pivot connection to the member 32.

The apparatus further includes means operable after the densely-shingled array of signatures have been moved to the position shown in FIG. 3 for applying a force to the peripheral edges which rest on surface 34. The force applied is sufficient to cause the signatures 14 to slide relative to one another until their peripheral edges are in vertical alignment relative to the surface 38. In the subject embodiment, the means used for applying the required force comprises an arm member 48 which is carried within member 32 and mounted for pivotal movement about an axis 50 which is generally at or slightly below the juncture of surfaces 38 and 34. The arm 48 is arranged so that it can move from a first position wherein it is within the opening 52 of member 32 to a second position wherein its pushing surface 48a extends so as to form substantially a 90° angle with the surface 38. The second position is shown in solid lines in FIG. 5. In the embodiment shown, the arm 48 is actuated by a fluid cylinder 54 which is carried subjacent the member 32 and has its piston rod 56 pivotally connected to the arm 48.

Although not shown, it should be appreciated that the cylinders 44 and 54 can be controlled either manually or through any of a variety of types of conventional control means. The specific means used for controlling the operation of the apparatus thus far described forms no particular part of the invention.

FIG. 4 illustrates the position of the apparatus after the arm 48 has been moved to its second position. At

this point, the signatures 14 are in a vertical stack. It should be noted that associated with the support means 30 is a vertically-extending guide or stop member 58. Member 58 is mounted from the upper surface of the support frame 18 and preferably arranged so that it can have some adjustment longitudinally of the apparatus. For this purpose, an elongated slot 60 is provided in the base 62 so that the bolt 64 can be loosened to permit adjustment of the stop. The stop member 58 includes a stop surface 58a which is located such that when the support means 30 is in its second position, the stop surface 58a forms a 90° angle with the second support surface 38. Additionally, member 58 is positioned such that the surface 58a extends generally parallel to the surface 48a of the arm 48 in its second position. This general relationship can best be seen in FIG. 5. The spacing D between surfaces 48a and 58a in the FIG. 5 illustration is preferably substantially equal to the spacing between the opposed peripheral edges of the signatures 14. Thus, as illustrated in FIG. 4, the member 58 together with the arm 48a assures that the lateral edges of the signature 14 are in direct, vertical alignment relative to the support surface 38.

After the stack has been formed to the position shown in FIG. 4, it could be manually transferred from the surface 38 or, alternately, wrapping, tying, or other operations could be carried out thereon. Preferably, however, the subject device further includes a transfer means 65 which acts to move the formed stack laterally off the surface 38 onto a conveyor or into a wrapping and tying machine such as illustrated in FIG. 1. In the particular embodiment under discussion, the transfer means comprises a vertically-extending member 66 adapted to engage an end of the stack and apply sufficient force to slide the stack laterally. Specifically, the member 66 is illustrated as carried at the outer end of the piston rod 68 of a fluid cylinder 70. The fluid cylinder 70 is, of course, suitably mounted from an associated structure not shown.

After the stack of signatures has been removed from its position on surface 38, the support means 30 is retracted to its position within opening 40. Additionally, the arm 48 is retracted into member 32. At this time, the components are in the position illustrated in FIG. 2.

With respect to the belts 20 and the guide and supporting members 24, 26, they are returned to the phantom line, right-hand position shown in FIG. 2, and the above-discussed sequence of operations can be repeated for forming of another stack. It should be noted that the guide and support members 24, 26 are capable of being returned to their right-hand position at any time following movement of the support means 30 to its second position (i.e., the position illustrated in FIGS. 3-5). Note that when the support means 30 is in the second position, the lowermost of the signatures 14 is at an elevation above the tops of the guide and support members 24, 26.

A variety of different control means could be used for controlling the supply of the loosely-shingled signatures to the apparatus. Additionally, many types of conventional sensing and control elements could be used for controlling the remaining functions of the apparatus. The previously-mentioned, commonly-assigned copending application Ser. No. 358,124 describes and illustrates typical controls which could be incorporated if desired.

The invention has been described in great detail sufficient to enable one of ordinary skill in the art to make and use the same. Obviously, modifications and alterations of the preferred embodiment will occur to others upon a reading and understanding of the specification and it is our intention to include all such modifications and alterations as part of our invention insofar as they come within the scope of the appended claims.

Having thus described our invention, we claim:

1. Apparatus for forming a dense, shingled array of signatures into a vertical stack comprising:

support means mounted in a first position for supporting signatures in a dense, shingled relationship including an inclined support surface against which a side surface of the signatures rest and a lower support for engaging the lower edges of the signatures;

actuating means for moving said support means from said first position to a second position wherein said inclined support surface extends generally horizontally; and,

pusher means operable at least when said support means is in said second position for applying a force against the edges engaging said lower support to bring the lower edges into generally vertical alignment relative to said inclined support surface.

2. Apparatus as defined in claim 1 wherein the support means is carried on mounting means which require said actuating means to move said support means in a generally arcuate path between said first position and said second position.

3. Apparatus as defined in claim 1 wherein said inclined surface and said lower surface are positively interconnected for simultaneous movement between said first and second positions.

4. Apparatus as defined in claim 1 wherein said pusher means is mounted on and movable with said support means.

5. Apparatus as defined in claim 4 wherein said lower support includes a pair of spaced support surfaces and wherein said pusher means is mounted between said spaced support surfaces.

6. Apparatus as defined in claim 4 wherein said pusher means is arcuately movable about an axis which is generally parallel to said inclined surface.

7. Apparatus as defined in claim 1 including a generally, vertically-extending locating surface to engage the upper edges of said signatures when said pusher means is operated to bring said lower edges into vertical alignment relative to said inclined support surface.

8. Apparatus as defined in claim 1 including transfer means operable to transfer the signatures off the inclined support surface after said pusher means has brought the lower edges into generally vertical alignment.

9. Apparatus as defined in claim 1 wherein said pusher means includes an elongated bar member carried by said support means and power means for moving said bar member.

10. Apparatus as defined in claim 1 including means for forming a dense shingle on said support means.

11. Apparatus for forming a dense, shingled array of signatures into a generally aligned stack comprising:

support means including first and second support surfaces positioned to define an obtuse angle therebetween, said first surface adapted to engage and support edges of the signatures of a dense, shingled

array of signatures, and the second surface adapted to support the side surface of a first of said signatures with the remaining signatures positioned in seriatim order and leaning against and laterally supported by each preceding signature;

actuating means for moving the support means from a first position for receiving the dense shingle to a second position wherein said signatures are supported primarily on said second surface; and,

pusher means operable when said support means are in said second position for applying a force against the edges of said signatures engaging said first support surface to bring said edges into generally vertical alignment relative to said second surface.

12. Apparatus as defined in claim 11 wherein said pusher means includes a member movable from a first position outside the obtuse included angle between said first and second support surfaces to a second position which generally perpendicular to the second support surface and within said included surface.

13. Apparatus as defined in claim 11 including conveying means for supplying signatures to said support means while said support means is in said first position.

14. Apparatus as defined in claim 13 wherein said conveying means comprise a pair of conveying belts extending in parallel along opposite sides of said support means.

15. Apparatus as defined in claim 14 including means on said conveying belts for deflecting upwardly the leading edge of signatures supplied thereto and supporting said signatures until they are in position on said support means.

16. Apparatus as defined in claim 15 wherein said means for deflecting the leading edge of said signatures include guide members inclined at an angle corresponding to the angle of inclination of said second support surface.

17. A method of forming a plurality of signatures into an aligned stack comprising the steps of:

a. providing first and second support surfaces and orienting them relative to one another to form an included, obtuse angle;

b. positioning said support surfaces in a first position for receiving a dense shingle and placing a plurality of signatures on said support surfaces to form a dense shingle in which said signatures each have a peripheral edge engaged with and resting on said first surface with a first of said signatures leaning against and laterally supported by said second surface and the remaining signatures positioned in seriatim order and leaning against and laterally supported by each preceding signature;

c. moving said support surfaces with the dense shingle supported thereon to a second position and applying a force to the peripheral edges engaged with said first surface to bring said peripheral edges into generally vertical alignment relative to said second surface.

18. The method as defined in claim 17 including the steps of selecting the first position so that said first surface extends generally horizontally and said second surface extends upwardly therefrom, and selecting the second position so that said second surface extends generally horizontally.

19. The method as defined in claim 18 including the step of maintaining the relative orientation of said first and second support surfaces constant during movement from said first position to said second position.

20. The method as defined in claim 18 including the step of providing a generally, vertically-extending locating surface to engage and locate a peripheral edge of said signatures when said signatures are in vertical alignment relative to said second surface.

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