METHOD AND MEANS FOR STACKING ARTICLES

Inventor: Raymond L. Wiseman, 1550 S., Macon St., Aurora, Colo. 80012

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Primary Examiner—Evon C. Blunk
Assistant Examiner—Bruce H. Stoner, Jr.
Attorney, Agent, or Firm—Grover A. Frater

ABSTRACT
A stacker of newspapers of similar articles including an input conveyor, the discharge end of which is movable up and down over a paper stacking platform. Sensor controlled systems maintain the end of the conveyor adjacent the top of the stack as the stack height is increased. The stack is removed from the stacking platform after a selected number of papers have been piled up to form the stack. While the stack is being removed, a catcher mounted at the end of the conveyor is moved into position to catch papers in a starter pile and to hold them in a position that causes the starter pile to remain clear of the stack being removed. Thereafter, the conveyor is lowered as the catcher is removed so that the pile of papers is deposited on the stacking platform. Then the conveyor end moves up as the stack height is increased and the cycle is repeated.

16 Claims, 16 Drawing Figures
FIG. 12B

FIG. 14
METHOD AND MEANS FOR STACKING ARTICLES

This application is a continuation-in-part of Application Ser. No. 197,744, filed Nov. 11, 1971 and now abandoned. It relates to improvements in article stackers, particularly stackers of magazines, books, newspapers and other publications.

It is an object of the invention to provide an improved article stacker generally and to provide an improved book, magazine, newspaper and publication stacker in particular. It is an object to provide a stacker which can operate more reliably at higher speeds, over a wider range of stack heights, over a wider range of paper thicknesses, and over a wider range of spacing between papers at delivery. A further object is to achieve those advantages at minimum cost.

The stacking of newspapers is particularly difficult. The papers are conventionally delivered to a stacking station on a conveyor in overlapping fashion such that each paper overlies the preceding one in part. They are usually conveyed with the folded edge leading and, while the invention is not limited to that arrangement, folded edge first delivery to the stacker is preferred. In one example, the invention is embodied in a stacker that will accept newspapers comprising any number of pages up to one hundred and twenty pages at a rate to eighty-two thousand papers per hour. The cycle time for forming and discharging paper stacks is as short as 0.85 seconds. Thus, for example, the device is capable of forming and discharging stacks twenty papers high of one hundred and twenty page papers at the rate of seventy stacks per minute.

A number of factors operate to preclude tying the stacks into bundles at the stacking position. That means that it is stacks of loose papers that are being delivered from the machine at the rate of seventy per minute. The task is complicated by the fact that the standard newspaper is folded along two edges and not along the other two, so that the height of the stack is not uniform over its upper surface. Thus, the center of gravity of the stack shifts from issue to issue as the number of pages in the paper is changed from day to day. The invention employs both a novel method and novel apparatus to attain its objects and more successful stacking.

The method utilizes a novel series of substeps to accomplish stacking. It has the advantage that it is capable of being practiced by a number of different machines. It is best practiced by machines of the kind herein described. While machines of that kind may be variously embodied, the particular embodiment selected for illustration in the drawing is now preferred.

In the method, a number of articles, such for example as newspapers, are caught on a pile where they lie one on top of the next on their broad surfaces. Advantageously, the papers are held so that those broad surfaces lie in a plane that is tilted toward the folded edge of the papers. Thereafter, the pile of papers is dropped vertically downward to a lower plane that is similarly tilted in the sense that it is tilted in the same direction although not necessarily at the same angle. Thereafter, an additional quantity of papers is permitted to be added to that pile to form a stack of some given or selected size. After the stack has reached that size, subsequently arriving papers are caught at the upper plane where the first pile was formed and a second pile is formed while the stack below is moved laterally to clear the space below.

The preferred apparatus includes a stacking platform above which is located a structure which serves both as the terminus of the paper delivery conveyor and as the carrier for a catcher on which the initial pile of papers is formed. The structure is movable toward and away from the platform so that the conveyor and catcher can be moved toward and away from the platform. After an initial pile is caught on the catcher, the catcher, and so the pile is moved downwardly toward the platform. Thereupon, the pile is dropped on the platform to continue the stack as the catcher moves away. As additional papers are delivered to the stack, the structure carrying the terminus of the conveyor system moves upwardly so that the papers are delivered to the stack at a point immediately above the top paper of the stack.

In preferred form, the platform is tilted downwardly toward a stop. That arrangement insures that the papers of the stack are maintained by gravitational force in proper position relative to one another. When the stack has been completely formed, the platform moves to a horizontal position in an action that tends to push the stack toward the stop in a way that forces the stack to be squared up at its front and rear edges except for a planned stagger to be described below.

In the preferred form of the invention, the catcher drops its pile to the platform such that the papers do not free fall. Instead, they engage the platform prior to being released from the catcher; that action provides an extra measure of stability. Also, the preferred embodiment includes a provision for relative motion between the discharge end of the conveyor and the catcher to the end that there is no free fall of any paper in being transferred from the conveyor to the catcher.

In the embodiment illustrated, this relative movement is arranged so that the angle at which papers are delivered to the pile and at which they come to rest on the pile is substantially unchanged as the pile is formed.

The preferred embodiment employs a novel means for discharging the stack of papers from the stacking position. That discharging means permits successive stacks to be discharged either in like direction or in opposite directions. The discharge element is a push rod that engages one edge of the stack or the other and removes it by pushing against the stack. The push rod is variable in length. It is longer when stacks are tall and shorter when the stacks are short. In the preferred embodiment the length of the push rod is determined by the position of the discharge end of the conveyor at the time that the stack is to be removed because the position of the discharge end of the conveyor at stack removal is a function of stack height.

In accordance with another feature of the invention the speed at which the discharge end of the conveyor is moved up is adjustable with the rate at which stack height increases. Separation between the discharge end of the conveyor and the top of the stack is sensed and the conveyor is moved upwardly at different speeds according to the degree of separation.

The invention includes other features and advantages which will be apparent in the description that follows. Not all of these features need be incorporated in every embodiment to achieve the objects of the invention; but the objects are achieved in greater degree as the number of those features is increased.

In the drawings:
FIG. 1 is a cross-sectional view taken on line 1—1 of FIG. 2 of the side of a newspaper stacker embodying the invention;

FIG. 2 is a view in elevation of the input end or front end of the stacker;

FIG. 3 is a view in rear elevation of the stacker of FIGS. 1 and 2 except that one structural member has been broken partly away and the control cabinet has been removed;

FIG. 4 is a view partially in cross-section and partly in elevation of a fragment of the input conveyor mechanism;

FIG. 5 is a pictorial view of a fragment of the apparatus by which catcher movement is controlled;

FIG. 6 is a cross-sectional view of one end of the catcher mechanism;

FIG. 7 is a view partially in section and partially in elevation of a fragment of the apparatus by which the conveyor is raised and lowered;

FIG. 8 is a sectional view looking down on the structure that drives the stack discharge push rod;

FIG. 9 is a view in side elevation of the input conveyor arm and mechanism that drives the catcher;

FIGS. 10, 11, 12A, 12B and 13 are schematic diagrams of the controller by which operation of the stacker is controlled;

FIG. 14 is a graph that describes stacker operation with time; and

FIG. 15 is a schematic diagram of the mechanical and electrical system that comprises the stacker.

In FIG. 1 the stacker is shown in the condition in which a stack has just been completed. The catcher is in position to start a new stack and has caught one paper 10. The newspapers to be stacked are delivered in a stream by a stream diverter, not shown, at the upper left corner of the stacker. They are transferred to a short section of conveyor 11 that may be seen at the upper portion of FIG. 1 toward the left. That conveyor conducts papers to the central region of the unit. The initial papers of a stack are caught in a pile or starter stack on a starter or catcher apparatus visible at the upper portion of the drawing toward the right. The initial pile is formed at the upper center region and then is dropped to, or deposited at, a stacking position immediately below in the mid-region of the apparatus. It is stacked on a platform, part 14 of which is movable between a horizontal and a tilted position. That part of the platform is shown tilted in FIG. 1. The stack is formed on that part. Thereafter, the movable portion of the platform moves down level with the remainder whereupon a push rod 20, operated by mechanism in the lower part of the unit, pushes the stack toward the viewer or away from him in FIG. 1 to make room for the succeeding stack. The space in which the stack is formed, either on the catcher or the platform, is called the stacking location.

The stack of papers is shown just prior to being lowered with the platform. While the stack is forming, the papers are held with their upper broad surfaces tilted. By that means, gravity can be utilized to maintain the papers in an orderly arrangement. They gravitate toward a stop 12 which extends from the level of the platform to the upper regions of the unit. When the stack has been completed, the movable platform section 14 will be made to swing counterclockwise about pivot axis 16 until its upper surface is flush with the upper surface 17 of the stationary platform portion.

Movement of the movable platform section is controlled by a cam and toggle actuator 18. As the movable platform 14 swings to the right, less of its upper face will extend to the left of the stop 12. Friction between the platform and the papers of the stack insures that the right edge of the stack continues to bear against the stop 12 as the platform swings and the stack is lowered to the horizontal position. The proportions of the movable and stationary portions of the platform, the radius of the arc of platform movement, and the position of stop 12 are adjusted so that the juncture of the movable and stationary parts of the platform occur midway along the width of the stack. A gap is provided between the movable and stationary portions through which a pusher rod can be moved. The lower portion of pusher rod 20 is mounted upon a pair of chains 22. The chains are mounted on sprockets carried by a shaft 24 which is coupled to a stack discharge drive motor 26 through a gear box 28 and one of two clutches 30 and 31. A chain 27 is revolved over the sprockets in a figure 8 arrangement so that the pusher rod 20 may be driven in opposite directions by selective engagement of clutches 30 and 31.

To prevent free fall of the papers to the stack, a means is provided for maintaining the discharge end 13 of conveyor 11 in a position immediately above the top paper of the stack while the stack is being formed. This is done in the invention by moving the conveyor end relative to the platform, or by moving the platform relative to the conveyor end, or both. In this embodiment, the preferred embodiment, it is the conveyor end that is made movable toward the stacking platform. The conveyor 11 comprises a series of rollers that extend transversely to the path of paper movement. These rollers are connected by endless belts. One set of rollers and belts is disposed below the stream and another set of rollers and belts is disposed above the stream. The papers are compressed between them and forced to move along as the rollers are made to turn. The rollers of the upper set are numbered 32, 33 and 34. Belt 35 extends around rollers 32 and 33 and belt 36 extends around rollers 33 and 34. The rollers of the lower set are numbered 37 and 38 and the belt that interconnects them is numbered 39. The rollers are driven by a drive motor 40. A chain connects the motor output shaft to a gear 42. That gear is fixed to a shaft 44. The shaft extends through the plate 46 to other gears and chains, not shown, which are connected to the rollers of the conveyor. The conveyor rollers are turned at constant speed whereby the papers to be stacked arrive at the end of the conveyor at uniform velocity. The number of them that arrive within a given time depends upon spacing between the papers. Examination of the drawings will show that the belts are really a number of belts in parallel and the rollers are sectioned and the sections are slightly tilted but the description will neglect that in the interest of clarity.

The plate 46 is part of the means by which the conveyor is moved up and down relative to the stacking platform. The plate is part of an L-shaped arm which is identified by the reference numeral 48. There are two such arms. The other 49 is visible in FIG. 9. They have substantially the same shape and they straddle the conveyor and catcher mechanisms. The shafts of rollers 32, 33 and 37 are journaled in the two arms. The shafts of rollers 34 and 38 are free to move relatively to the arm. The shaft of roller 38 is carried by a pair of sup-
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port arms, one of which is visible in FIG. 1 where it is designated 50. The other is visible in FIG. 4 and is numbered 50a. They carry a structure at their right ends in which the shaft of roller 38 is journaled. At its left end the support arm 50 is fixed to a shaft 51 which is journaled in the arm 48. Thus, roller 38 may swing up and down relative to arm 48 about the pivot axis formed by shaft 51. The roller 34 is free to move up and down relative to arm 48 and relative to roller 38. The shafts of rollers 33 and 34 are journaled in the ends of a structure 373 which holds the two rollers. The shaft of roller 38 is not journaled in arm 48. A tension spring in FIG. 4, is connected between arm 48 and the shaft of roller 38 such that the roller is urged upwardly against the belt, omitted from FIG. 4, which encompasses rollers 32 and 33.

A structure 54 serves to supply a bias which tends to urge rollers 34 downwardly relative to roller 33 and arms 48 and 49. It also measures and provides a signal indicative of the position of the roller 34 relative to arms 48 and 49. Thus, the structure 54 is a detector whose function is to sense the degree in which the sensing roller 34 is pushed upwardly relative to arms 48 and 49 along the discharge end of the conveyor. It includes a signal which actuates a servo control by which an arm lifting motor 58 is employed to lift and lower the right end of arms 48 and 49. The motor acts through a toothed pulley 61 and a connecting link 62 to lift the end of the arms 48 and 49. When the motor 58 is reversed and the chain is extended, gravity pulls the arms down.

The structure 54 includes one part that is fixed to arms 48 and 49. Specifically it is fixed to the cross member 48b in FIG. 4. It has a lower part that is movable relative to the upper part and is connected by a link 339 to the arms or bracket 337 on which the axes of rollers 33 and 34 are mounted. Thus the upper part of structure 54 is fixed to arms 48 and 49 and the lower part of structure 54 is fixed to the arms 337. A bias spring inside the structure 54 biases the lower part of the structure to extended position. The effect of that is to bias the member 337 to clockwise rotation relative to the arms 48 and 49 when viewed in FIG. 1. There is a limit to the degree in which the two parts of structure 54 can separate and that serves to limit the degree of counterclockwise rotation of support member 337 and roller 34. In FIG. 1 the member 337, sometimes called the sensing arm, is rotated almost to its clockwise limit.

Structure 54 houses a series of switches whose fixed contacts are carried with the fixed part of the structure and whose movable parts are actuated by the movable, lower part of structure 54. As the sensing arm 337 is moved counterclockwise against the bias of structure 54 and four switches in the structure are closed in sequence. Since the sensing arm is pushed to counterclockwise displacement by contact with the upper surface of a stack, whether the stack be formed on the sensing platform 14 or on the catcher, the degree of counterclockwise rotation and of the sensing arm and switch closure is an indicator of the degree of separation of the upper surface of the stack and the discharge end of the conveyor. In this particular embodiment the discharge end of the conveyor is the point at which the articles emerge from between the rollers 33 and 38. The switches within the structure 54 are shown schematically as a rotary switch 343 at lines 2-29, 2-30, and 2-31, of FIG. 13.

Returning to FIG. 1, the sensing roller 34 rotates counterclockwise, (in FIG. 1.) It may comprise a spiked wheel as shown. In this case it is provided with L-shaped projections that extend radially outward and are bent clockwise. When the apparatus is operating and a stack is formed, the arm 48 is lowered sufficiently to bring those projections into contact with the upper paper of the stack. As they rotate, they wipe across the upper face of the top surface of the upper paper of the stack and aid in maintaining it in abutting contact with the stop 12. They serve also to catch the leading edge of papers as they arrive and to hold that leading edge slightly above the top paper of the stack in a degree sufficient to reduce friction between the arriving paper and the one below it as the arriving paper moves to the top position. The use of the spiked wheel provides a secondary effect that is advantageous in some applications. It results in the slight staggering of the folded edges of successive papers in the stack. That stagger aids greatly in reducing the difference in height between the forward folded edge and the rearward cut edge of the stack.

As the stack height increases, the roller 34 must rise. When it does, it moves upward relative to arms 48 and 49. That upward movement is sensed in the structure 54 whereupon the motor 58 is operated to raise the end of the arms. As the arms are raised, the bias developed in structure 54 maintains the roller 34 in contact with the upper paper so that the arms 48 and 49 move up relative to the roller. That condition is sensed in structure 54 by switch 343 which again affects the controller. Together, these elements serve as a means for positioning the arm so that the discharge end of the conveyor is immediately adjacent the upper surface of the stack whereby papers are added to the stack with minimum free fall and without any free fall in the preferred embodiment. The bias developed in structure 54 exerts downward pressure on the stack by way of the roller 34 whereby the roller force is utilized to compress the stack.

The description of the apparatus to this point has neglected the fact that papers will continue to arrive at the stacker while the completed stack is being moved from stacking position. A means is incorporated in the invention to catch the first papers to arrive after completion of a stack and to hold them at a point above the stack. After the stack has been removed, those papers are deposited in the stacking position and the stack is completed as previously described. In this embodiment, that means comprises a structure that is carried by the end of the arms 48 and 49. It includes catcher tines that straddle the roller 34 and belt 36. Those tines can be moved to a position just below roller 34 and to the end of the conveyor 11 where they will catch papers as they arrive. When the stack below has been moved to one side and the movable portion of the platform has been returned to the tilted position in which it is shown in FIG. 1, then the catcher is moved out of the way and the papers on the catcher are dropped or deposited onto the platform. In this embodiment, that "dropping" is accomplished without free fall. Some part of the upper and lower papers remains in contact with the elements of the stacker as they are deposited on the stack. More particularly the cut edge of the papers fall into contact with platform section 14 before the catcher tines release the folded upper edge. Thereafter the tines move away and the upper part of the papers
fall the short distance to the platform section. That method promotes gravitational action to urge the folded edges against the stop.

To facilitate description, the collection of papers is called a "stack" when resting on the platform in the "stacking position" either tilted or flat. The collection of papers on the catcher is called a "starter stack" or "pile." The pile is formed in the catching position and immediately below the end of the conveyor whatever the position of arms 48 and 49 may be. In FIG. 1, the catching mechanism is generally designated 66. This mechanism includes two sets of catching tines 68 and 70. The tines are carried on bars or plates that extend between, and are pivotally connected to, a pair of yokes. The yokes are fixed to a shaft which extends between arm 48 and its counterpart 49 on the other side of the mechanism. Thus, the catcher drive shaft extends generally parallel to the shafts of the conveyor rollers and indeed it is rotated by the motor 40 through a drive mechanism best shown in FIG. 9.

The tines are connected to the drive shaft but they have a pivotal mounting at a pivot axis removed from the axis of that shaft and they are caused to pivot, as the shaft rotates, by a cam 72 which is fixed to arm 48. That structure is more clearly shown in FIG. 5 and in FIG. 6. First, however, attention is invited to FIGS. 2 and 3, both of which show both of arms 48 and 49 straddling the conveyor and catcher mechanism. Catcher 70 is shown to comprise three tines 70a, 70b and 70c. The catcher 68 also comprises three tines 68a, 68b, and 68c. Referring to FIG. 3, the roller 34 is seen to comprise two roller sections 34a and 34b, both of which are provided with the L-shaped projections. The two arms 48 and 49 straddle the stop 12. That stop is comprised of four parallel sections 12a, 12b, 12c and 12d. The catcher tines and the roller 34 sections rotate in planes between the sections of the stop. The platform 14 is formed by the upper edge of four parallel plates 14a, 14b, 14c and 14d. Two of which, 14b and 14c, serve as the platform and two of which serve as supplements to stop 12.

Returning to FIGS. 5 and 6, the catcher tines are mounted upon two traverse plates. The plate associated with the tines 70 is designated 80 whereas the plate associated with tines 68 is numbered 82. The ends of these plates are pivotally connected to the pair of yokes, one at each end of the plate. The yoke at the end toward arm 48 is designated 84, the other is designated 83. At their centers the yokes are mounted upon the drive shaft 85. The yoke is fixed to the shaft and turns with it. The shaft is journaled in the arms 48 and 49 and it is rotated by a chain driven gear 86. That gear is driven through a power train, shown in FIG. 9. The power is derived from motor 40 and the speed of rotation is constant if not interrupted. The power train includes a clutch 87 which is visible in FIGS. 2 and 9. It is a stacked starter clutch and its electrical symbol appears in FIG. 12B at line 1-61.

The two plates 80 and 82 have pivotal connection to the two yokes 84 and 83. That pivotal connection occurs at one edge of the plate. This may be seen in FIG. 6 where the plate 80 is pivotally connected to yoke 84 by the pin 90. The plate 82 is shown to be connected to yoke 84 by the pivot pin 91. The other edge of the two plates are urged to rotation toward the shaft 85 by a set of bias springs visible only in FIG. 6 where they are numbered 92. They provide a bias which maintains followers carried by the plates in engagement with cam 72. A follower is carried by each of the plates 80 and 82. In FIG. 5 the follower carried by plate 80 is visible and is designated 94. The plate itself is not shown. Both followers are shown in FIG. 6 in dotted lines. The follower associated with plate 82 and the tine set 68 is designated 98.

The cam 72 comprises two parts; one of them is movable and is designated 72a. That part can be retracted by a solenoid 100 to vary the time during a cycle when the tines are lowered from a position above the height sensor roller 34 to the catching position immediately below that roller.

In FIG. 1 the catcher tines 68 are positioned just below the roller 34. While the follower 94 is hidden in FIG. 1 comparison with FIGS. 5 and 6 will make it apparent that the follower 94 has just passed that portion of the cam where the lower end of the plate 82 was permitted to swing inwardly in a counterclockwise direction whereby the tines 68 were lowered rapidly as an incident to that motion. In FIG. 6 the follower 98 has moved up onto cam parts 72a almost to the time dropping point. The cam 72 is stationary and the shaft 85 and yoke 84 are rotating counterclockwise. The follower 98 is being driven over the surface of cam 72. If part 72a is retracted upwardly in FIG. 6, the follower will drop suddenly to the edge surface of cam part 72 and tines 68 drop from a position above roller 34 to the position shown in FIG. 1. Thereafter as the catcher drive shaft 85 turns, the follower moves over the part of the cam surface which projects downwardly and toward the left. Because of that shape, the catcher tines will move downwardly away from the roller 34 for some distance at substantially the same tilt angle that they are shown to have in FIG. 6. This characteristic is incorporated so that the paper pile on the catcher will lie at substantially the same angle at which successive papers are arriving so that there is neither interference by the papers of the pile with the arrival of successive papers nor free fall of the arriving paper to reach the pile.

While the pile is forming on the catcher, the stack below is pushed out of the way by pusher 20. Before the pile of papers on the catcher is released to the platform below, the movable portion 14 of the platform tilts upwardly and the arms with the conveyor and catcher mechanisms are permitted to descend toward that platform. That action is completed prior to the time that the follower 98 reaches the lower part of the surface of cam 72. When the follower reaches that lower portion, tines 68 rotate rapidly in a counterclockwise direction to release the pile of papers which "drop" to the movable part of the platform 14. In the preferred embodiment shown, the catcher tines have dimensions in proportion to the axis of rotation of the catcher structure and the length of the upper surface of the movable platform so that the lower surface of the pile of papers engages the left edge of the platform section 14 prior to their being entirely freed from the catcher, so that in this embodiment "dropping" means placing or depositing the pile on the platform 14 with little or no free fall.

This action is graphed in FIG. 14. The left half of the graph depicts small stack action; large stack action is shown at the right. The graph shows the distance above the horizontal platform section 17, with time of: the left edge of platform section 14, the sensing roller 34 at the end of arms 48 and 49, and the end of the tines of
catchers 68 and 70. In the graph, zero time has been selected to correspond to a time after a stack has been formed and beginning at the time that it is to be removed from the platform. At zero time the movable section 72c of the cam is retracted permitting the inward swing of the mechanism to which tines 68 are attached. The tines rapidly fall below sensing roller 34 and catch the next paper to arrive. Thereafter, the tines descend slowly to greater distance below the roller as the pile is accumulated on the catching tines 68. Immediately after the catcher tines fall below the roller 34, the platform 14 swings down level with the discharge platform. The pusher 20 operates beginning at time zero to remove the previous stack from the stacking position. At time 1 the edge of platform 14 begins to swing upwardly as the platform is moved to its tilted position. At the same time the follower 94 enters the lower curve of the cam and the tines move down more rapidly. The pile of papers on the tines 68 extend further beyond the edge of the tines and are brought into engagement with the upper edge of platform 14 about the time that the arm is moved down to move the sensing roller to its lowest position. The catcher tines are now being moved counterclockwise rapidly, out of the way and the pile is transferred from the catcher tines to the platform. The sensing roller remains in engagement with the upper paper during that lowering operation. In fact, additional papers arrive during that period and are added to the pile. After the pile has been transferred to the platform the sensing roller begins its upward movement. That begins at time 2. The separation between the sensing roller and the platform 14 at that time represents the height of the pile. That pile has become the bottom of the stack and as the stack increases in height the roller 34 and the arm on which it is moved up upwardly.

There are two sets of tines and, while the stack is approaching completeness, the other set of tines 70 is approaching the position where it will be controlled by the movable part of the cam. When the paper counter indicates that the requisite number of papers have been added to the stack and that a new stack is to be started, the solenoid 100 is actuated to remove the variable part of the cam and to drop the catcher tine 70 below the sensing roller 34. The tines then begin catching successive papers and the platform 14 moves downward rapidly under the stop 12 pushing the stack of papers to vertical orientation. The stack is then pushed to the side.

The push rod and its actuating mechanism are shown from the side in FIG. 1 and are shown from the front and rear in FIGS. 2 and 3. If one of the clutches is engaged, shafts 24 will rotate to carry the chains 22 around and the pusher 20 with them. Additional idler gears are included in the system and are mounted on a shaft 126. The path of movement of the catcher extends completely around the stationary platform 17 of the platform. While the top is not shown in the drawings, that stationary portion is trapezoidally shaped in top plan view. The catcher moves through the space 132 at the right of section 17 (see FIG. 1). It cannot move through space 132 until platform section 14 has been lowered. The two clutches permit a change in rotational direction so that the catcher 20 may be rotated completely around section 17 in the clockwise direction or rotated completely around that section in the counterclockwise direction or oscillated from the position shown to a corresponding position on the opposite side of the stationary platform section 17. Thus, it can be moved transversely across the stacking position so that it moves in the same direction as it traverses the stacking position on successive occasions, or it can be made to move in opposite direction on successive occasions. FIG. 8 is a view looking down on one of the chain and gear sets.

The upper part 20a of the pusher telescopes into the lower part 20b. It is made to telescope in and out as the conveyor 11 is moved up and down with arms 48 and 49. A connecting rod 341 is hinged at its lower end to the top of section 20a. The upper end of rod 341 has a sliding connection on a transverse rod 343 which extends between arms 48 and 49 below roller 38 as best shown in FIG. 2.

One of the features of the scheme employed in the invention is that a wide range of anomalies can be accommodated. The speed of rotation of the catcher mechanism shaft is fixed. Nonetheless, cycle time can be varied somewhat because the time at which the catcher tines are lowered to catching position is controlled by actuation of clutch 87 and of the solenoid 100. Up movement of the discharge end of the conveyor is determined as a function of stack height and down movement as a function of stack height, push bar position, platform position and time position. The formation of a stack continues until the count sensor 150 mounted on the arms 48 and 49 has reached a preselected count. The sensor 150 appears in FIG. 1. It is mounted on the arms 48 and 49 and moves up and down with them. It counts individual papers and, at a selected count number, furnishes a signal to the control system. Then the pusher operates a cam linkage to move the platform down and to allow the platform to return to its up position by spring force. As the pusher moves it strikes limit switches which control the synchronization of the catcher and input conveyor motion. When the push rod is rotated by claims 22, a cam roller 347 engages one of the cam paddles 349. The paddle is fixed to the end of a lever which is fixed to a shaft 351 to which an actuator bar 353 is also fixed. The upper end of bar 353 has pivotal connection to platform 14. When the roller 347 pushes the paddle, the bar and platform move to the position shown in dotted lines in FIG. 1. A second roller cam 357 bears against a cam bar 359 which extends between the paddles whereby the platform 14 is held in the dotted line position as the pusher bar moves through the space 132. A bias spring connected to the paddles returns the platform to tilted position after the pusher has moved through space 132.

To this point the explanation of the movement of the arm catcher, platform, and the pusher has all but neglected the fact that means are incorporated in this embodiment for stopping rotation of the catcher tines without stopping movement of the other elements. FIG. 9 shows the outer side of arm 49 together with the catcher drive. The catcher structure is mounted on a shaft 85 and that shaft extends through the arm 49. The drive gear 86 is fixed to the shaft at a point adjacent to the outer side of the arm. That gear is driven through a chain 158 by a small gear mounted on a shaft 160. A larger gear 161 fixed to shaft 160 is driven by means of a chain 162 from the shaft 164 of roller 32. The shaft 164 is ultimately driven by the motor 40 in the manner previously described. The shaft 164 is connected to
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chain 162 only when the clutch 87 is energized. In this embodiment, the clutch 87 is energized and de-energized by a logic system that includes switches that are carried by the frame of the unit and are actuated by cams that are fixed to shaft 172. That shaft is driven by gear 61 and its rotational position is an indicator of conveyor height.

There are four cams on shaft 172 and each of them cooperates with a follower that actuates a respectively associated one of four switches. The arrangement is best shown in FIG. 7. Cam 173 actsuates switch M1S1. Cam 174 actsuates switch TPLS. Cam 175 and cam 176 actuates switches TLS and BLS, respectively. BLS stands for “bottom limit switch.” The symbol TLS stands for “top limit switch.” TPLS stands for “transfer position limit switch.” Finally, M1SLS stand for “maximum stack limit switch.” In this embodiment the arms 48 and 49 are lowered by gravity when rotation of motor 58 permits the shaft 172 to turn. Downward movement is opposed by the action of a spring 361. The shaft 172 is rotated by the motor through a belt 363 and a drive gear 365. That gear is fixed to shaft 72 as are the gears 61 and 367. Chain 62 extends from the gear 61 to arm 48 and the chain 369 extends from gear 367 to arm 49. Spring 361 is fixed at one end to gear 367 and it is fixed at another end to a structure 371 which is tied to the frame of the unit.

The system includes additional limit switches. One of them designated 75LS, is mounted with solenoid 100 so that it is actuated when the stack starter mechanism has a given degree of rotation. Other limit switches are not shown in the structural drawings. While they form part of the system they are located ahead of the structure shown in the drawing. One of these switches is called SBLSS which stands for “bad stream” and is actuated when the papers are arranged askew on the delivery conveyor. Another limit switch designated SPLS indicates that there is a stream of papers ready for delivery. Limit switch CILS, senses any paper jam, is actuated by the paddle 373 and is housed in the unit 375 which can be seen at the top of FIG. 1. A limit switch structure CSLS can be seen in FIG. 1 where it is mounted on the arm 48 with solenoid 100. The symbol CSLS stands for “cock sure limit switch.” It is operated when the stack starter is cocked and ready to intercept. Other limit switches are mounted in the lower part of the structure but are not visible. They include the platform limit switch, PLS, which senses position of the platform, a discharge left limit switch, DLLS, which is operated by the discharge mechanism to control interlocked positions and the stop position and the direction of discharge. A corresponding discharge right limit switch RLLS performs the same functions when the stream is discharged to the opposite side.

The structural relationship between these several limit switches and the remainder of the structure and their electrical relationship to the logic controller and counter, and the electrical control in general, is depicted in FIG. 15.

A schematic diagram of the control system is shown in FIG. 15. That diagram shows the primary elements of the mechanical system in schematic form. It shows the conveyor arm 48, mounted on the frame at pivot 44 and it shows the separately pivotally mounted sensing arm 337. It shows the platform 14 and the pivot 16 by which that arm is pivotally mounted on the frame. A stack of papers is shown mounted on the platform. The pusher mechanism and pusher rod 20 shown and so is a stream diverter 392 and a section of conveyor 90 which are mounted ahead of the stacker unit but which are included here because the stream diverter is controlled by some of the sensing devices in the stacker and some sensing devices that are associated with the conveyor section 390. The motor 40 operates the stacker conveyor system and also serves to rotate the catcher mechanism 66 when the clutch 87 is engaged.

The conveyor arm 48 and the sensing arm 337 pivot during operation so that the end of the sensing arm rests on the top of the newspaper stack being formed. The conveyor arm 48 is held down by gravitational force and it is lifted by the motor 58. It is controlled by a servo control unit 512 which controls the speed and the direction of the motor. The servo control also includes a means by which to dynamically brake the motor 58 to a stop.

The platform 14 pivots during stacking operation and that pivotal movement is powered by a platform moving system previously described and shown as boxes labeled “Pusher Motor,” “Clutch Left,” “Clutch Right” and “Pusher Mechanism.”

Paper stacks are moved from the platform by the pusher mechanism and pusher 20. Power is supplied to the pusher mechanism by the pusher motor 26. The pusher motor rotates continuously and the pusher mechanism movement is controlled through a pair of clutches. One clutch 31 is effective to move the pusher mechanism in one direction and the other clutch 30 is effective to push it in the opposite direction.

The catcher mechanism 66 is powered by motor 40 through the clutch 78 but it does not rotate unless the latch solenoid 100 is operated.

The motors 26, 40 and 58, the stream diverter 392, clutches 87, 30 and 31, and solenoid 100 and platform mover 312, are all energized from a logic controller and counter unit 520. Power can be applied to and be removed from the system by manual operation of the logic control. Ordinarily, however, the power is applied manually and removed automatically from the system by operation of the logic controller and counter. That unit controls the sequence and timing of the operation of the various elements in the stacker unit. A basic element in that automatic control is the counter switch 150. That switch is activated by the individual papers of a stream of paper as they pass along the input conveyor to be added to the stack. The counter switch simply provides a signal indicating how many papers have passed through the conveyor. The output of that counter switch is applied by line 600 to the input of the logic controller and counter. For convenience at this point input signal lines to the logic controller are represented as being connected at an input terminal 600. The output of the counter switch 150 is applied to that terminal 660. The counter (or logic controller) counts those signals and arranges to start a new stack and to discharge the previously formed stack when a predesignated count is reached.

Since the apparatus is to be capable of creating stacks of papers over a wide range of paper thicknesses and delivery rates and a range of other variables, means are provided in the system for controlling the timing of the events in the stacking process on the basis of actual stack formation and movement. Control is effected primarily by the TOSS switch, in structure 54, and the limit switches.
The time duration of the various events in the sequence of stacker operation is quite variable whereby there is no single circumstance that is a reliable indicator that the system is malfunctioning. In view of that, a number of sensors are provided (the limit switches) which measure whether or not system operation does or does not fall within previously defined tolerance limits. Some of those switches are position sensors that cooperate with the logic controller and counter unit to prevent the institution or termination of events until various pieces of apparatus have obtained a given position. Others of those switches serve to shut down the stacker or divert the stream of papers from the stacker if the condition they sense persists for some pre-established interval of time. The limit switches were identified above and are shown in FIG. 15. The following is a list of the control components and their functions in the terminology of the art. The motor 58 is referred to as a servo motor.

<table>
<thead>
<tr>
<th>CONTROL COMPONENTS - STACK-PAK</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DB Discharge Brake</td>
<td>Energizes to stop discharge mechanism in &quot;rest&quot; positions.</td>
</tr>
<tr>
<td>CRD Clutch Right</td>
<td>Energizes to discharge stacks to &quot;right&quot;.</td>
</tr>
<tr>
<td>Discharge</td>
<td>Energizes to discharge to &quot;left&quot;.</td>
</tr>
<tr>
<td>UPR Up Relay</td>
<td>Energizes to control raising of Input Conveyor (direction and speed).</td>
</tr>
<tr>
<td>DNR Down Relay</td>
<td>Energizes to control lowering of Input Conveyor (direction and speed).</td>
</tr>
<tr>
<td>CO Counter Output</td>
<td>In electronic counter to energize latch relay.</td>
</tr>
<tr>
<td>ULR Up Limit Relay</td>
<td>De-energizes to stop UP travel of conveyor.</td>
</tr>
<tr>
<td>SDOR Stream Diverter Operating Relay</td>
<td>Energizes to divert stream by de-energizing SDV.</td>
</tr>
<tr>
<td>SDV Stream Diverter Valve</td>
<td>Solenoid air valve energizes to divert stream.</td>
</tr>
<tr>
<td>DRC Discharge Right Control</td>
<td>De-energizes to stop discharge &quot;right&quot;; or to stop &quot;left&quot; motion if selection is &quot;alternating&quot;.</td>
</tr>
<tr>
<td>XR1 Interlock Relay No. 1</td>
<td>Energizes to interlock UP motion of conveyor with travel of discharge mechanism (via RDCR, USR, ULR).</td>
</tr>
<tr>
<td>XR2 Interlock Relay No. 2</td>
<td>Energizes to interlock DOWN motion of conveyor with travel of discharge mechanism.</td>
</tr>
<tr>
<td>PR Platform Relay</td>
<td>Energizes when PLATFORM is down to prevent discharge mechanism from stopping; and de-energizes to allow STACK STARTER to resume rotation and discharge to stop.</td>
</tr>
<tr>
<td>DR Discharge Right Relay</td>
<td>to control clutch CRD, brake DB.</td>
</tr>
<tr>
<td>DRX (Auxiliary)</td>
<td>XRX, XRX and Cycle Monitor (CM) when discharging &quot;right&quot;.</td>
</tr>
<tr>
<td>DRXX (Auxiliary)</td>
<td>to control clutch CL, brake DL, XRX, XRX and CM when discharging &quot;left&quot;.</td>
</tr>
<tr>
<td>DL Discharge Left Relay</td>
<td>Energized to start conveyor DOWN after transfer of new stack to PLATFORM.</td>
</tr>
<tr>
<td>DLX (Auxiliary)</td>
<td>Relay energizes to stop &quot;down&quot; direction of conveyor and set &quot;up&quot; direction.</td>
</tr>
<tr>
<td>DLXX (Auxiliary)</td>
<td>Energizes to energize DSSU and set slowest &quot;up&quot; speed.</td>
</tr>
<tr>
<td>FDR Final Down Relay</td>
<td>Energized to set &quot;up&quot; direction for armature current.</td>
</tr>
<tr>
<td>DSSU Down Stop/Start Up</td>
<td>Energized to set &quot;down&quot; direction for armature current.</td>
</tr>
<tr>
<td>TOSR Top of Stack Relay</td>
<td>Energizes to start the stacker.</td>
</tr>
<tr>
<td>UPC Up Contactor</td>
<td>Energizes to energize DSSU and set slowest &quot;up&quot; speed.</td>
</tr>
<tr>
<td>DNC Down Contactor</td>
<td>Energizes to set &quot;down&quot; direction for armature current.</td>
</tr>
<tr>
<td>ASR Automatic Start Relay</td>
<td>Energizes to start the stacker.</td>
</tr>
</tbody>
</table>
AOR Automatic Off Relay — de-energizes to signal "off" monitor AOD.

AOM Automatic Off Monitor — energizes when stream is not present to indicate machine is not in use.

CM Cycle Monitor — energizes if entire cycle of discharging and starting a new stack takes longer than preset time, turning off machine.

CJM Conveyor Jam Monitor — energizes if count sensor raises for a longer time than the portion preset, to turn off machine.

SDM Stream Diverter Monitor — energizes to establish that stream diverter fully cycles anytime SDOR is energized.

PCR Press Control Relay — energizes to stop press and activate "stop" signal or may be used to suit other customer interlocks.

USSD Up Stop - Start Down — energized to stop UP conveyor direction and start DOWN direction.

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<table>
<thead>
<tr>
<th>ITEM</th>
<th>LOCATION</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>1-13</td>
<td>Starts stacker and energizes controls.</td>
</tr>
<tr>
<td>M</td>
<td>1-1-2-3</td>
<td>Starts and stops motors (conveyor and discharge).</td>
</tr>
<tr>
<td>CR</td>
<td>2-14</td>
<td>External reset - resets counter.</td>
</tr>
<tr>
<td>CR</td>
<td>1-43</td>
<td>Closes to energize CSLR and CSLR-1.</td>
</tr>
<tr>
<td>MCR</td>
<td>1-11</td>
<td>Opens to prevent press stop on start-up of stacker. Closes to stop press if stacker is turned off.</td>
</tr>
<tr>
<td>AOR</td>
<td>1-11</td>
<td>Closes when stacker starts if stream is present and stays closed as long as stream is present. If stacker is turned off, PCR energizes to stop press.</td>
</tr>
<tr>
<td>AOR</td>
<td>2-1</td>
<td>Allows ASR to energize if stream approaches stacker.</td>
</tr>
<tr>
<td>AOR-1</td>
<td>2-3</td>
<td>Closes to lock-in AOR and AORX as long as stream remains present.</td>
</tr>
<tr>
<td>ASR</td>
<td>1-14</td>
<td>Closes to energize controls and start stacker as stream approaches. Opens after start.</td>
</tr>
<tr>
<td>PCR</td>
<td>1-7</td>
<td>Closes to stop press.</td>
</tr>
<tr>
<td>PCR</td>
<td>1-8</td>
<td>Opens to signal press stop.</td>
</tr>
<tr>
<td>CSLR</td>
<td>1-14</td>
<td>Closes to energize solenoid and intercept stream.</td>
</tr>
<tr>
<td>CSLR-1</td>
<td>1-71</td>
<td>Closes to energize solenoid and intercept stream.</td>
</tr>
<tr>
<td>SSR</td>
<td>1-61</td>
<td>Closes to rotate stacker starter.</td>
</tr>
<tr>
<td>PR</td>
<td>1-62</td>
<td>Closes to allow stacker starter to resume rotation.</td>
</tr>
<tr>
<td>TPR</td>
<td>1-62</td>
<td>Closes to allow stacker starter to resume rotation.</td>
</tr>
<tr>
<td>DL-1</td>
<td>1-63</td>
<td>Opens to release brake when discharging left. Closes to energize brake when discharging left.</td>
</tr>
<tr>
<td>DR-1</td>
<td>1-63</td>
<td>Opens to release brake when discharging right. Closes to energize brake when discharging right.</td>
</tr>
<tr>
<td>DR-1</td>
<td>1-65</td>
<td>Closes to discharge right. Opens to stop drive.</td>
</tr>
<tr>
<td>DL-1</td>
<td>1-67</td>
<td>Closes to discharge left. Opens to stop drive.</td>
</tr>
<tr>
<td>ULR</td>
<td>1-74</td>
<td>Opens to prevent SERVO up direction.</td>
</tr>
<tr>
<td>ULR</td>
<td>1-75</td>
<td>Opens to stop SERVO up direction.</td>
</tr>
<tr>
<td>USSD</td>
<td>1-75</td>
<td>Opens to stop SERVO up direction.</td>
</tr>
<tr>
<td>USSD</td>
<td>1-78</td>
<td>Opens to start SERVO down direction.</td>
</tr>
<tr>
<td>DSSU</td>
<td>1-74</td>
<td>Opens to start SERVO up direction.</td>
</tr>
<tr>
<td>DSSU</td>
<td>1-76</td>
<td>Opens to start SERVO down direction.</td>
</tr>
<tr>
<td>FDR</td>
<td>1-77</td>
<td>Opens to start SERVO down after transfer.</td>
</tr>
<tr>
<td>DSR</td>
<td>1-76</td>
<td>Opens to stop SERVO down before transfer.</td>
</tr>
<tr>
<td>ZS</td>
<td>2-7</td>
<td>Closes when SERVO motor is stopped. (Zero speed.)</td>
</tr>
<tr>
<td>RDR</td>
<td>1-73</td>
<td>Closes to set post drive speed of SERVO.</td>
</tr>
<tr>
<td>RDR</td>
<td>1-74</td>
<td>Opens to de-activate top-of-stack sensor.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>ITEM</th>
<th>LOCATION</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOSS1</td>
<td>1-78</td>
<td>Closes to set lowest (No. 1) speed of SERVO.</td>
</tr>
<tr>
<td>TOSS1</td>
<td>1-79</td>
<td>Opens to set lowest (No. 1) speed of SERVO.</td>
</tr>
<tr>
<td>RDCR</td>
<td>1-56</td>
<td>Opens to re-activate TOSS when discharge bar reaches first interlock (XR1); and to allow second interlock (XR2) to function; to allow discharge bar to be stopped; all via RDR and RDRX.</td>
</tr>
<tr>
<td>XR1</td>
<td>1-54</td>
<td>Closes to lock in RDCR until stack starter is cocked.</td>
</tr>
<tr>
<td>TPR</td>
<td>1-52</td>
<td>Closes to lock in TPR until locked.</td>
</tr>
<tr>
<td>DSR</td>
<td>1-53</td>
<td>Closes to mark transfer position when I.C. is moving down and to prevent DSR from stopping final drive down of SERVO. Restarts S.S.</td>
</tr>
<tr>
<td>TRP</td>
<td>1-50</td>
<td>Opens to prevent DSR from stopping final drive down of SERVO.</td>
</tr>
<tr>
<td>SD2R</td>
<td>1-47</td>
<td>Closes to lock in SD2R until S.S. is cocked.</td>
</tr>
<tr>
<td>TLS</td>
<td>1-36</td>
<td>Opens to stop SERVO up travel and to prevent SERVO start up direction: and to prevent SERVO down stop. (Prevents DSS from energizing.)</td>
</tr>
<tr>
<td>SBLS</td>
<td>1-34</td>
<td>De-operated to indicate bad-stream.</td>
</tr>
<tr>
<td>SDOR</td>
<td>1-35</td>
<td>Opens to drop SDV and divert stream.</td>
</tr>
<tr>
<td>SDOR</td>
<td>2-12</td>
<td>Opens to start SDM. Tipped open to prevent flutter of stream diverter.</td>
</tr>
<tr>
<td>SDM</td>
<td>1-35</td>
<td>Opens to hold off SDV to complete stream divert in case of momentary bad stream.</td>
</tr>
<tr>
<td>ZSM</td>
<td>1-12</td>
<td>Closes to prevent stopping of</td>
</tr>
</tbody>
</table>
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Continued

Location Function

DR1 1-23-25 Selects DRLS or DLLS to act as interlocks when platform is down and discharge stops when platform is up.

DL1 1-24-26 Worxs Locat TEM FUNCTION discharge while platform is down.

DR 1-23 Prevents interlock No. 1 and PR from energizing if platform lowers before intercept of stream. (If PR is energized before DR or DL is energized, direction is unpredictable.)

DL 1-24

CLSR 1-25 Prevents intercept No. 2 from premature operation if platform lowers before intercept.

RDR 1-23

XR2 1-32 Closes to "up" stop and starts "down" of SERVO when previous stack is discharged.

DRC 1-27 Opens to stop discharge when discharged right and right is selected.

DLC 1-31 Opens to stop discharge when discharged left and left is selected.

DLC 1-27 Opens to stop discharge when discharged right when alternate is selected.

DRC 1-31 Opens to discharge when discharged left when alternate is selected.

DR 1-27 Lock-in when discharged right.

DL 1-31 Lock-in when discharged left.

SD2R 1-37 If SERVO is stopped and not travelling DRLS or DLLS is selected.

SS 1-38 up, and stack has trans-

FDR 1-38 ferred (SSDR and SSR contacts

TOS 1-39 closed), final down drive will start and lock-in FDR, TOS (1 closes to "down start, start up") if C.I. comes down on started stack. DDSU locks in until up direction is made up.

If BLS is operated (bottom limit) or intercept takes place RDR-1 closes. DDSU will energize until up direction is made.

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catcher tines to move down into catching position. The CR relay is operated by MSL, the maximum stack height limit switch or by pushing the manual "clear" button at line 1-46.

When the times move to intercept position, the other part of CSLS at line 1-43 closes as shown to energize CMR at line 1-57, RDR and RDR-1 at lines 1-55 and 1-56 start raising of the input conveyor and operation of the ejector bar. (See contacts at lines 1-25, 1-29, 1-73, 1-74, 1-41 and note that SSR is energized when intercept occurs because 75LS is closed.) SSR is energized through RDR-1 at line 1-49 until 75LS opens after the catcher tines have moved down to permit a starter pile to form. When 75LS opens at line 1-49 contact SSR at line 1-61 opens to open the catcher drive clutch SSC. That stops the catcher but the push rod continues. When the push rod clears the platform a limit switch energizes PR at line 1-19 to reclose contact PR at 1-62 to energize SSC the stack starter clutch through TPR contacts which are closed if the conveyor height is not improper. That results in continuation of catcher movement through the point at which papers are transferred from the catcher tines to platform A. The other section of 75 LS at line 1-48 reenergizes SSR so that catcher clutch SSC energization through SSR contacts at line 1-61 is reestablished. Now FDR is energized. Its hold-in contacts are on line 1-38. It has a contact at line 1-82 which closes to initiate energization of DNR and DNC to energize conveyor drive motor 58 in a direction to lower the conveyor.

The motor 58 and its controller are shown at line 1-84. It is a conventional D.C. motor connected in a conventional speed control servo. The servo depicted in the drawings is produced by SECO, Inc. as its model No. 8500.

Motor speed is controlled as a function of the voltage applied to the input terminals of a trigger unit. The voltage level is adjusted by changing taps on a voltage divider 505 at lines 1-87 through 1-94. The settings of switches are actuated to accomplish the tap changes. The RDR relay closes to connect the trigger to another tap during up drive of the conveyor to increase the up speed just after intercept to remove the conveyor from the completed stack. That acceleration is referred to as "post drive."

Whether stack discharge is left or right is determined by operation of the manual switch at line 1-29 which disconnects one set of controls or the other.

When the platform 14 is lowered by motion of push rod 20, PLS is operated to energize PR at lines 1-18 and 1-19. While PR is energized neither DRC or DLC can operate to halt push rod motion. The remaining DRLS and DLLS switches are actuated to accomplish the tap changes. The RDR relay closes to connect the trigger to another tap during up drive of the conveyor to increase the up speed just after intercept to remove the conveyor from the completed stack. That acceleration is referred to as "post drive."

Some troubles can be detected directly by a sensor. A paper jam is an example. Other troubles cannot be detected directly. In that case the assumption is made that a trouble has occurred if the interval between certain related events exceeds some selected time. In that event the stacker is shut down or the cycle restarted or some other corrective action is taken. To that end the LOGIC CONTROLLER 520 includes timers, contacts or switches to control ignition and termination and resetting of the timers and solenoids whose energization and de-energization is controlled by the timers. These elements are shown in lines 2-6 through 2-23 of FIG. 13. They are not essential to the invention and are not described in detail.

Electrical power is supplied to the system by the lines at the upper left in FIG. 10. The conveyor motor 40 and the discharge motor 26 are energized when the contacts M at lines 1-1, 1-2 and 1-3 are closed. Power is applied to the remainder of the system through the transformer at lines 1-9 and 1-10.

Depressing start switch 501 at line 1-12 energizes relay M at that line closing the M contacts to apply power to motors 40 and 26. That makes the input conveyor run. Other M contacts at lines 1-13 and 1-17 initiate the diverter system to bring the paper stream to the stacker, the counter will be reset and active and the machine will complete a partially completed cycle of operation to a condition in which the pusher bar has the position shown in FIG. 1 and the catcher tines are in position just above the paper.

The latch solenoid CLS 100 is energized by relay CLSR, line 1-42, which is energized through the counter relay contacts CO or the Clear Relay contact CR and limit switch CSLS at that line. That causes the
clutch 78, may be energized after the conveyor is lowered to the transfer position at which TPLS line 1-50 closes.

Although I have shown and described certain specific embodiments of my invention, I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art.

I claim:

1. In a stacker of the kind that receives articles in a stream and forms them into a series of stacks, in combination:
   a frame;
   a stacking platform carried by said frame at a stacking location;
   an article conveyor pivotally mounted on said frame with its discharge end positioned at said stacking location at a height variable with pivotal movement of said discharge end;
   conveyor pivoting control means for maintaining said discharge end in close proximity to the top of forming stacks of articles during formation of the stack except at the time of initiation of a new stack;
   said conveyor pivoting control means comprising a member carried by said discharge end and extending toward said platform and means sensitive to the pressure applied to said member from the direction of said platform for raising the platform in response to pressures greater than some given pressure and for lowering the platform in response to pressures less than a given pressure.

2. The invention defined in claim 1 in which said conveyor pivot control means comprises holding means for holding the first article of a stack at a height above said stacking platform for an interval of time whereby said conveyor end will be positioned at an upward position permitting removal of a previously formed stack from said stacking platform.

3. In a stacker of the kind that receives articles in a stream and forms them into a series of stacks, in combination:
   a frame;
   a stacking platform carried by said frame at a stacking location;
   an article conveyor pivotally mounted on said frame with its discharge end positioned at said stacking location at a height variable with pivotal movement of said discharge end;
   conveyor pivoting control means for maintaining said discharge end in close proximity to the top of forming stacks of articles during formation of the stack except at the time of initiation of a new stack;
   said conveyor pivoting control means comprising holding means for holding the first article of a stack at a height above said stacking platform for an interval of time whereby said conveyor end will be positioned at an upward position permitting removal of a previously formed stack from said stacking platform.

4. The invention defined in claim 3 in which said conveyor is carried by said conveyor for movement with said conveyor end as it pivots.

5. In a stacker of the kind that receives articles in a stream and forms them into a series of stacks, in combination:
   a frame;
   a stacking platform carried by said frame at a stacking location;
   an article conveyor pivotally mounted on said frame with its discharge end positioned at said stacking location at a height variable with pivotal movement of said discharge end;
   conveyor pivoting control means for maintaining said discharge end in close proximity to the top of forming stacks of articles during formation of the stack except at the time of initiation of a new stack;
   said conveyor pivoting control means comprising holding means for holding the first article of a stack at a height above said stacking platform for an interval of time whereby said conveyor end will be positioned at an upward position permitting removal of a previously formed stack from said stacking platform;

6. The invention defined in claim 5 which further comprises means for removing stacks of articles from said stacking platform during said interval of time.

7. The invention defined in claim 6 in which said stacking platform is mounted for pivotal movement about an axis transverse to the direction of movement to articles being discharged from said conveyor from a first position in which the first arriving part of an article to be stacked is positioned below its last arriving part to a second, substantially horizontal position; and means for maintaining said stacking platform in said first position except during operation of said means for removing stacks.

8. The invention defined in claim 7 which further comprises means in the form of a stop for limiting motion of articles being discharged from said conveyor such that they remain within said stacking location; said stacking platform being pivotal about an axis extending on a line above the level of said stacking platform when horizontal whereby stacks of articles are forced against said stop as the platform is pivoted to horizontal position.

9. In a stacker of the kind that receives articles in a stream and forms them into a series of stacks, in combination:
   a frame;
   a stacking platform carried by said frame at a stacking location;
an article conveyor pivotally mounted on said frame with its discharge end positioned at said stacking location at a height variable with pivotal movement of said discharge end;

conveyor pivoting control means for maintaining said discharge end in close proximity to the top of forming stacks of articles during formation of the stack except at the time of initiation of a new stack;

said conveyor pivoting control means comprising holding means for holding the first article of a stack at a height above said stacking platform for an interval of time whereby said conveyor end will be positioned at an upward position permitting removal of a previously formed stack from said stacking platform;

means for removing stacks of articles from said stacking platform during said interval of time;

said stacking platform being mounted for pivotal movement about an axis transverse to the direction of movement of articles being discharged from said conveyor from a first position in which the first arriving part of an article to be stacked is positioned below its last arriving part to a second, substantially horizontal position;

means for maintaining said stacking platform in said first position except during operation of said means for removing stacks;

means in the form of a stop for limiting motion of articles being discharged from said conveyor such that they remain within said stacking location;

said stacking platform being pivotal about an axis extending on a line above the level of said stacking platform when horizontal whereby stacks of articles are forced against said stop as the platform is pivoted to horizontal position;

said means for removing articles comprising a push rod and means for driving the push rod against a stack of articles;

said push rod having adjustable height and means for adjusting its height to increase when said conveyor end is up and to decrease when said conveyor end is down;

10. A stacker of publications and like articles, comprising in combination:

means in the form of a stacking platform disposed below a stacking location for holding stack;

means in the form of a catcher for holding a starting stack moveable from a first position over said stacking platform in said stacking location to a second position removed therefrom;

means in the form of a conveyor having a discharge end disposed at said stacking location over said stacking platform and over said catcher, when said catcher is in said first position, for discharging articles into said stacking location onto said conveyor when said catcher is in said first position and onto said platform after the catcher is in second position;

conveyor moving means for moving said discharge end of said conveyor downwardly when said discharge end is not located proximately to an article on either of said catcher and said stacking platform and for moving said discharge end of said conveyor up when it is located proximately to an article on either of said catcher and said stacking platform; and

means for moving said catcher from said second position to said first position at a speed sufficient to catch the first article of a starting stack prior to its coming to rest on the top of a preceding stack.

11. The invention defined in claim 10 in which said conveyor moving means is effective to move the catcher with said conveyor end and comprises sensing means for sensing the separation between the discharge end of the conveyor and the top of a stack and for moving the conveyor end and the catcher upwardly when the separation is less than a given degree.

12. In a stacker;

a platform at a stacking position;

conveying means for conveying articles to a catching position above the platform;

catching means comprising a catcher for catching a pile of articles and holding them in the catching position and subsequently depositing the pile upon said platform;

means for selectively removing and replacing said catcher at said catching position;

a frame upon which said platform, said conveying means and said catcher and said means for selectively removing and replacing said catcher are all installed;

describing means and said catching means being mounted on said frame for movement together vertically above said platform; and

means for lowering the catcher to successively lower planes remote to the conveying means prior to dropping said pile on said platform.

13. The invention defined in claim 12 in which said means for lowering the catcher comprises:

a first catcher drive element mounted on said means for lowering the catcher for rotation about an axis normal to the plane of catcher movement, the catcher being mounted on said first catcher drive element for pivotal movement about an axis parallel to and spaced from said first mentioned axis; and

means comprising a cam and cam follower connected one to the first catcher drive element and the other to said catcher for pivoting the catcher about the second mentioned axis as an incident to rotation of said first catcher drive element.

14. The invention defined in claim 12 in which said platform is movable relative to the frame between a substantially horizontal position and a position in which it is tilted downwardly in the direction towards which the discharge end of the conveyor is directed;

said invention further comprising a stop fixed to the frame and extending upwardly from a point adjacent the downward side of said platform; and

said invention further comprising means for moving the platform under the stack to substantially horizontal position whereby the stack is made to lie horizontally with the side arranged vertically.

15. The invention defined in claim 14 which further comprises:

discharging means for moving articles stacked on the platform in stacking position from said position; and

means for maintaining said catching means at catching position while the discharge means is moving articles from below the catching position.

16. The method of stacking folded papers arriving at a stacking position in a stream which includes the step
of catching a number of papers on a pile such that they lie one atop the next on their broad surfaces in an upper plane which is tilted toward the folded edge; depositing the pile of papers vertically downward to a similarly tilted lower plane; permitting an additional quantity of papers to be added to the pile to form a stack of given size; after the stack has reached said given size, catching subsequently arriving papers at said upper plane in a second pile while moving the stack laterally to clear the space below the pile; the stack being lowered from the tilted plane to a substantially horizontal plane prior to being moved laterally; and the stack being formed such that the upper papers of the stack are arranged such that the upper papers of the stack are arranged such that successively higher papers have their folded edge extending partly over the folded edge of the paper below and such that the folded edges of lower papers lie one above the other whereby the folded edge of the stack is concave when the stack is lowered from the tilted plane. * * * * *