

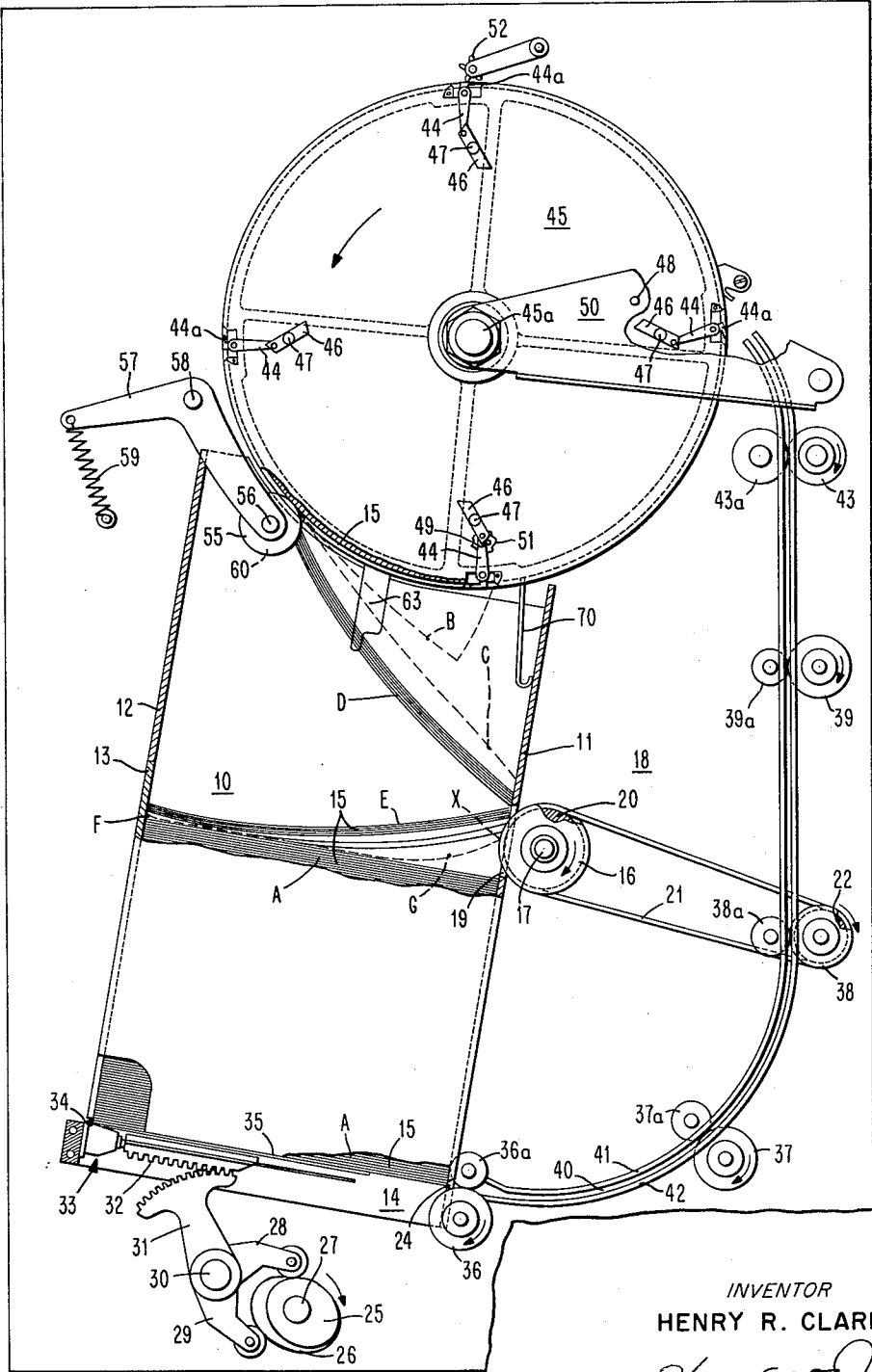
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## FORM HANDLING APPARATUS

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## FORM HANDLING APPARATUS

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This invention relates to apparatus for handling forms, such as record cards or the like, and relates more particularly to apparatus for controlling the feeding of forms into a hopper and/or the joggling of forms in a hopper to align their leading edges before they are fed from the hopper.

It has heretofore been proposed to provide means for feeding cards from a tray into a hopper as necessary to maintain the height of a deck of cards in the hopper substantially constant at an optimum level. This increases the effective capacity of the hopper between loadings and also desirably increases the reliability of a picker knife by maintaining substantially constant the weight of the card deck against which the picker knife must act laterally to feed the bottommost card from the hopper. It is also known to use various types of jogglers to align the cards so that, despite any warpage of the cards, their trailing edges will be prepositioned to be effectively engaged by the picker knife. Jogglers heretofore proposed comprise either oscillating fingers or patterns or reciprocating stepped elements.

Arrangements heretofore proposed are generally not suitable for use, for example, with apparatus comprising a hopper-stacker containing a deck of cards, a picker knife for feeding the bottom card from the deck, and feed rolls for advancing the cards successively onto an endless means which conveys the cards seriatim past a read station and returns them to the hopper-stacker for further recirculation through the apparatus, including the deck. Such an apparatus requires compactly arranged means to control release of the cards from the endless means into the hopper-stacker and then joggle the cards so that, as they settle on the deck, their leading edges will be aligned against the front wall of the hopper-stacker.

Accordingly, the principal object of this invention is to provide a relatively inexpensive form handling apparatus embodying novel means for joggling forms, such as record cards, onto a deck in proper alignment with cards already aligned and deposited on the deck and in such manner to maintain the height of the deck substantially constant.

Another object is to provide novel means for effecting automatic release of forms from an endless means, such as a drum, and so controlling their movement that they will be deposited properly in a hopper or in a hopper-stacker.

Another object is to provide a versatile form handling apparatus embodying a joggling means which can align forms for proper feeding irrespective of whether the forms are automatically recirculatable through a hopper-stacker, or feedable from an auxiliary or supplementary supply source into the hopper to augment the hopper capacity, or are insertable by hand in the hopper above the joggling means.

According to these objects, the improved form handling apparatus comprises at least one preferably high-friction dribble roll having a peripheral portion partially projecting through a cut-out in the front wall of a hopper or hopper-stacker. Each dribble roll segregates a deck of aligned and joggled forms disposed in the hopper below said rolls from a pile of bowed, sagging forms whose trailing parts rest on the deck and leading parts rest on each such peripheral portion. As the deck level tends to drop due to feeding of successive bottommost cards from the

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deck, the leading edges of the bottommost sagging forms will be fanned and drop below the point of maximum penetration of each dribble roll into the hopper. As each bottommost form moves past said point, it will tend to be flexed by a reactive force resultant from rotation of the dribble rolls; and as said form drops below said point, it will move forward into aligning contact with said front wall while the form is temporarily freed of the major part of the weight of the overlying forms which are still held up by the dribble roll.

Also, according to the invention, a high-friction stacking roll is temporarily braked as each form carried by the endless means approaches the hopper, thereby to apply drag to the form to effectively withdraw it from under a clamp on the drum. Then, as the leading part of the form snaps away from the drum, the trailing part is driven by the stacking roll toward the front wall of the hopper and, after being temporarily supported by restraining fingers, such form drops onto the pile which is supported by the dribble rolls and deck. Each form will thereupon work its way down through the pile until it is joggled by the dribble rolls onto the deck.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawing, wherein the single FIGURE is a side view, partially in section and partly in outline, of a form handling apparatus embodying the invention.

*Description*

As illustrated in the drawing, the form handling apparatus embodying the invention comprises a hopper-stacker 10 having front and rear walls 11, 12 which are parallel and preferably inclined downward and rearward at a slight angle. A suitably hinged hopper door 13, when closed, is flush with and forms part of the rear wall 12. The lower end of the hopper-stacker is closed by a bed plate 14 which supports a deck A of record forms, such as conventional record cards 15, the leading edges of which have aligned contact with the front wall 11, due to the joggling action of a joggling means.

This joggling means comprises a pair of dribble rolls 16 (only one of which is shown) mounted on a transversely extending drive shaft 17. Shaft 17 is suitably journaled in side frames 18 (only one of which is shown) and is disposed somewhat forward of front wall 11 with the result that something less than one-half of the peripheral surface of each roll 16 projects through a corresponding cut-out 19 in front wall 11 at a point slightly above the card deck A. The rolls 16 are adapted to be driven clockwise, as viewed in the drawing, by suitable means, such as a pulley 20 which, through a belt 21 and a pulley 22 mounted on shaft 17, drives said shaft and rolls. The rolls 16 are preferably driven according to a cyclic pattern during only a part of each card cycle.

Means are provided for feeding the bottommost card of deck A through a throat 24 provided in front wall 11 at the point where it joins the bed plate 14. As illustrated, this feeding means comprises a pair of complementary cams 25, 26 which are rotated by a shaft 27 and act through respective roller-type followers 28, 29 to oscillate a shaft 30. A gear sector 31, which meshes with a rack 32, is secured to and oscillated by shaft 30 to reciprocate the rack and thereby at least one picker knife 33. Each picker knife 33 is secured to rack 32 and has a picker knife edge 34 that projects upwardly through a corresponding longitudinal slot 35 in the bed plate 14. During each forward stroke (i.e., rightward stroke as viewed in the drawing), the picker knife edge 34 pushes on the trailing edge of the bottommost card of deck A to advance the card through throat 24 and into a series

of driven feed rolls 36, 37, 38, 39 which mate with idler rolls 36a, 37a, 38a, 39a, respectively, to keep successive cards moving up along a chute 40 defined between two fixed guides 41, 42. After leaving rolls 39, 39a, the cards enter between an accelerating roll 43 and a mating idler 43a disposed near the upper end of chute 40.

At an appropriate time in the card feed cycle, roll 43 is driven at a speed higher than the rolls 36 to 39 to accelerate the card so it will leave the chute 40 at high speed and catch up to, and pass under, the then opened clamping jaw 44a of one of a plurality of clamping elements 44 equally spaced somewhat more than a card length apart, and carried by, an endless card-conveying means. As illustrated, this endless means is a drum 43 rotated by suitable means (not shown) and mounted on a shaft or stud 45a.

Opening and closing of the jaw 44a of each clamping element 44 is controlled by an associated toggle-type actuator 46 which is rockably supported on a corresponding pin 47 projecting laterally from the side of the drum 45. Each actuator 46 is pivotally connected at one end to the radially innermost end of the associated clamping element 44 and at its opposite end has a heel which is adapted at different times to graze one or the other of two studs 48, 49. These studs 48, 49 project toward the side of drum 45 and into the path of revolution of the actuators 46 to flip each actuator respectively one way to clamp the jaw 44a against a card and the opposite way to unclamp said jaw from a card. These studs 48, 49 are shown supported by fixed brackets 50, 51 respectively. Thus, when a card is accelerated onto the drum 45 by roll 43 and at substantially the instant the leading edge of the card registers with a fixed registration edge (not shown) extending radially outward from the drum through a slot in the respective clamping jaw 44a of the appropriate element 44, the toggle-type actuator 46 will graze stud 48 to flip the actuator to clamp the card between the element and drum.

In the arrangement illustrated, the drum 45 will now carry the card from the entry station (at the exit end of chute 40) past sensing means (such as a bank of star wheels 52) at a read station and thence to a stacking station which is just above the hopper-stacker 10. When the card reaches the stacking station, the heel of the toggle-type actuator 46 will strike and be flipped by the laterally projecting stud 49 to actuate the clamping element 44 to card-unclamping or open position. However, since the leading edge of the card extends into the "bite" of the clamping jaw 44a of element 44, it will be apparent that mere opening of the clamping jaw will not permit the leading edge of the card to snap down away from the drum and into the hopper-stacker 10.

Hence according to the invention, means is provided which is operative, substantially at the time the jaw of the clamping element 44 is flipped open, to impose a temporary drag on the card to thereby effectively withdraw the leading edge of the card from under the overlying then-opened jaw. As illustrated, this means comprises a high-friction roll 55 normally freely rotatable on a shaft 56 carried by one arm of a bell crank 57 that is rockably fulcrumed at its knee on a fixed pin 58. A suitably anchored spring 59 pulls on the other arm of the bell crank to bias the roll 55 into contact with the outer face of a card carried by drum 45. Mounted over shaft 56 beside roll 55 is a stacking brake coil 60 that is suitably energized substantially at the time clamping jaw 44a is flipped open, thereby to apply an electromagnetic braking force to roll 55 to impede its freedom of rotation. This will cause roll 55 to impose a drag on the trailing portion of the card so that as the drum 45 continues to rotate, it will carry the clamping element 44 away from the card until the leading edge of the card clears the trailing edge of the jaw 44a of said element.

The leading edge of the card will then snap down away from the drum 45, generally to the position indicated at B as the card tends to straighten itself.

The stacking brake coil 60 is then deenergized to permit roll 55 to rotate like an idler roll. As the drum 45 continues to rotate, it and roll 55 will cooperate to drive the card angularly downward and forward successively toward and then down along front wall 11, but depending upon the inherent stiffness of the card and humidity, the now unsupported leading edge of the card may tend to droop somewhat as indicated at C. However, during this period, the unsupported leading edge of the card will be prevented from curving in a generally C-shaped path back toward rear wall 12 by a pair of flexible restraining fingers 63 (only one of which is shown). These fingers 63 depend from the upper inside edges of the respective side walls of the hopper-stacker 10 and curve generally downward and toward each other to laterally support the cards temporarily intermediate their leading and trailing edges.

By the time the trailing edge of the cards is advanced past roll 55, the card will assume generally the position indicated at D. In this position, the trailing edge of the card will be supported on the periphery of roll 55; the leading edge of said card will be supported either directly on the portions of the dribble rolls 16 that project into the hopper-stacker 10 above point X or else indirectly on such portions by resting on the leading part of a pile E of bowed or sagging cards having leading edges which rest on said portions of the dribble rolls; and the card intermediate its ends will be laterally supported by the lowermost part of the restraining fingers 63. It should here be noted that the fingers 63 also serve to prevent the leading edge of each card from contacting, and hence from being dragged over and snagged in, the punched holes in the top card of pile E.

Due to the high coefficient of friction of stacking roll 55 and its clockwise direction of rotation, the card when at position D will become temporarily bowed or buckled as roll 55 tends to drive the trailing edge of the card downward. As cards accumulate at position D, the restraining fingers 63 will spread from time to time as necessary to release the then bottommost cards under the driving action of roll 55. As the card is thus released and its trailing edge driven downward, it will tend to pivot on its leading edge and will come to rest as the new top card on pile E.

The trailing edges of the cards of pile E rest on the top of deck A whereas, as above noted, the leading portions of these cards rest on the hopper-penetrating portions of the dribble rolls 16. Since these rolls 16 are rotated clockwise as viewed in the drawing, they tend to fan out and separate the bowed cards on pile E in much the same manner as during "peeling" of a deck of playing cards with ones thumb. Also rolls 16 support most of the weight of the cards on pile E and thus desirably relieve deck A of a substantial part of the weight of the cards on said pile. This reduces the weight which is imposed on the bottommost card of the deck A and which must be overcome by each picker knife 33 in feeding said card.

As the cards drop onto pile E, their trailing edges may, and generally will, be staggered somewhat. Occasionally the trailing edge of a card will be curled up or warped, such as shown at F. This would cause a misfeed or a jam if such card is not properly joggled to align or register it before it is picked by the picker knife. As the weight of overlying cards increases, it becomes increasingly difficult to correct the position of a misaligned card; and hence the dribble rolls 16 are provided to joggle or align the cards against front wall 11 as they are deposited on the top of deck A, as will now be explained.

As cards are fed from the hopper-stacker 10 by each picker knife 33, the level of deck A will tend to drop and

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permit the dribble rolls 16 to fan and separate the cards on pile E. The leading edge of the bottommost card on pile E will be forced down past point X (the point of maximum penetration of the dribble rolls 16 into the hopper-stacker) and be further bowed, generally as shown at G. As soon as the card drops below point X, the bowing or flexure stress will be relieved and the potential energy thus released will become effective to snap said card forward into flush aligning contact or registry with front wall 11. It is to be noted that this forward snapping occurs while the card is relieved of the major portion of the weight of the overlying cards (which are still supported by the rolls 16) and before its leading part settles to form the new top card on deck A.

In the same manner as just described, the leading edges of succeeding cards will be freed from drum 45 by the drag imposed on such cards by the stacking roll 55 during the period coil 60 is energized. Thereafter, the roll 55 will be permitted to rotate and cooperate with the drum 45 to deposit the form in the hopper-stacker in the controlled manner assured by the restraining fingers 63. Then, after the cards are deposited on pile E, each in turn will be joggled by the dribble rolls 16 so that its leading edge will be in perfect alignment with the front wall 11 of the hopper-stacker 10 as the cards are deposited at the top of deck A. Hence, the leading edges of all cards on deck A will be aligned with each other and assure that each card will be properly picked as it comes to the bottom of the deck.

A card pick-off spring 70 is preferably provided as a safety measure to assure that a card will be picked off the drum 45 if (due to such as excessive static friction or condensation of moisture on the drum) the roll 55 and coil 60 should not withdraw the card from under the proper clamping jaw 44a. However, this spring 70 should not be relied upon to the exclusion of the roll 55 and brake coil 60 because if all cards are removed from the drum by such spring, their useful life will be materially reduced by repeated impact of such spring against the leading edge of each card.

In my copending application, U.S. Ser. No. 79,049, filed December 28, 1960 there is disclosed a programming apparatus which includes, but does not specifically claim, a form handling apparatus embodying the present invention. The drum shaft 45a, the picker knife cam shaft 27, the feed rolls 36, 37, 38, 39, accelerating roll 40 disclosed in the instant application, and also the pulley 20 which is driven from the drive shaft for feed roll 38, may be driven in the manner fully disclosed in said copending application, which also discloses circuitry for controlling the energization and deenergization of the stacking brake coil 60. However, it is to be understood that for purposes of the present invention, these elements may be driven by other suitable means, such as gear drives, because the particular drive means and control circuitry disclosed in said copending application are necessary only to achieve results (such as an optional reread feature) not pertinent to the present invention. Also in my said copending application, mechanism is disclosed for controlling intermittent but cyclic rotation of the feed rolls 36, 37, 38, 39 and hence of pulley 21 and the dribble rolls 21 during a portion of each card cycle that cards are to be advanced up the chute.

Also, it is to be understood that while the present invention has been disclosed associated with a hopper-stacker through which cards are automatically recirculatable, the stacking control feature (involving roll 55, coil 60 and fingers 63) and the joggling feature (involving rolls 16) may be associated with a drum which is used to transport cards from an auxiliary or supplemental hopper to a main hopper to increase the effective capacity of the main hopper between loadings without imposing an excessive weight of cards against the bed plate 14; in other words, cards can be fed from such auxiliary source onto the drum, rather than from

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the bottom of the hopper-stacker 10. Also, if desired, the dribble rolls 16 may be employed with a manually loadable hopper into which the operator would deposit a pile of cards generally in the position shown at E, in which case there would be no need for the stacking control feature.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In a form handling apparatus, a hopper having spaced front and rear walls and containing a deck of forms and also a pile of forms having their rear parts resting on said deck, means for feeding forms successively from the bottom of the deck and past the front wall, rotatable means adjacent the front wall and supporting the leading edges of the forms of said pile, and means for rotating said rotatable means in a direction tending to drive the leading part of the pile away from the deck such that, as forms are fed from the deck and the deck level drops, the bottom form of said pile will, under the weight of the overlying forms, drop substantially singly but in fanned out relation past the rotatable means and, while free of a major part of the weight of such overlying forms, be aligned against said front wall as each such dropped form settles on said deck.

2. The combination according to claim 1, wherein said rotatable means is rotated intermittently in a cyclic pattern.

3. In combination, a hopper containing record forms; at least one rotatable member having a peripheral portion which projects through a cut-out in one wall of the hopper and segregates the forms into two groups, one comprising a deck of flatwise stacked superposed forms below each member and the other comprising sagging superposed forms having trailing parts supported generally on the deck and leading parts supported on said portion; means for rotating each member in a direction tending to drive the leading edges of the forms of said other group upward away from said deck; and means for feeding forms successively from the bottom of the deck and causing the trailing parts of said sagging forms to gradually drop until the bottommost thereof, under the weight of the overlying forms, can pass substantially singly below said portion, each such bottommost form being bowed as it passes below the point of maximum penetration of said portion to store energy which, as said bottommost form drops below said point and settles toward the top of the deck, becomes effective to drive such form into flush aligning contact with said one wall while it is free of a substantial part of the weight of said overlying forms.

4. In combination, a hopper containing record forms; at least one rotatable member having a peripheral portion which projects through a cut-out in one wall of the hopper and segregates the forms into two groups, one comprising a deck of flatwise stacked superposed forms below each member and the other comprising sagging superposed forms having trailing parts supported generally on the deck and leading parts supported on said portion; means for rotating each member; means for feeding forms successively from the bottom of the deck and causing the trailing parts of said sagging forms to gradually drop until the bottommost thereof, under the weight of the overlying forms, can pass substantially singly below said portion, each such bottommost form being bowed as it passes below the point of maximum penetration of said portion to store energy which, as said bottommost form drops below said point and settles toward the top of the deck, becomes effective to drive such form into flush aligning contact with said one wall while it is free of a substantial part of the weight of said

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overlying forms; endless means for conveying forms successively to the hopper; means for clamping each form to the endless means; and other means, operative when each form reaches a point above the hopper, to successively impose a temporary drag on such form to withdraw its leading part from under the corresponding clamping means and then drive its leading edge into contact with said one wall above each rotatable member and drive its trailing part off said endless means for deposit on the top of said other group of forms.

5 5. The combination according to claim 4, including a pair of transversely extending restraining fingers curving generally downward and toward each other from opposite sides of said hopper at points intermediate said one wall and the opposite wall to temporarily laterally support the forms as they are driven off said endless means to prevent them from grazing along said other forms, said fingers being adapted to spread and drop the bottommost of the restrained forms as additional forms accumulate between said fingers, thereby to cause these dropped forms to settle on top of and become part of said other group of forms.

6. The combination according to claim 5, wherein said other means comprises a normally freely rotatable high-friction roll, and means for impeding rotation of said roll to apply such temporary drag on the form, and wherein said high-friction roll rotates in a direction tending to drive the trailing edges of restrained forms downward toward the deck while their leading edges rest generally at the point of junction of said other group of forms with said one wall.

7. In combination, a hopper having one wall against which the leading edges of a deck of record forms are aligned; means for feeding forms successively from the bottom of the deck past said one wall; at least one dribble roll above said deck and having a peripheral portion projecting partially through a cut-out in said one wall and adapted to support the leading parts of other forms disposed in the hopper with their trailing parts generally resting on the deck; and means for rotating each roll such as to tend to drive the leading edges of the bottom-

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most of said other forms upward away from the deck until eventually as the deck level drops each is forced down by the weight of the overlying forms past the point of maximum projection of said portion into the hopper and is bowed to store energy which, as each such form drops below said point and settles toward the deck free of a substantial part of the weight of such overlying forms, becomes effective to joggle such form into aligned contact with said one wall and with the leading edges of the forms already on the deck.

8. In combination, a hopper containing a deck of forms, a pile of forms inclined downwardly toward the rear wall of the hopper and having their rear parts supported on the deck, and a group of forms above the pile and inclined downwardly and forwardly and supported on the leading parts of the forms of the pile; means for feeding forms successively from the bottom of the deck; rotatable means extending inwardly from the front wall of the hopper for supporting the leading edges of the forms of the pile and thereby indirectly supporting the leading edges of the forms of said group; a support member above said rotatable means for supporting the rear edges of the forms of the group; and a pair of flexible fingers extending downwardly and inwardly from the side walls of the hopper to laterally support the forms of said group, whereby as forms accumulate in said group their weight will cause the fingers to spread and drop the forms onto the top of said pile, and as the deck level drops the bottom forms on said pile will drop down below the rotatable means and be aligned against the front wall of the hopper.

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