

July 18, 1961

Filed May 6, 1959

G. FORRESTER
APPARATUS FOR STACKING SHEETS IN PRECISE
EDGE ALIGNMENT WITH EACH OTHER

2,992,823

2 Sheets-Sheet 1

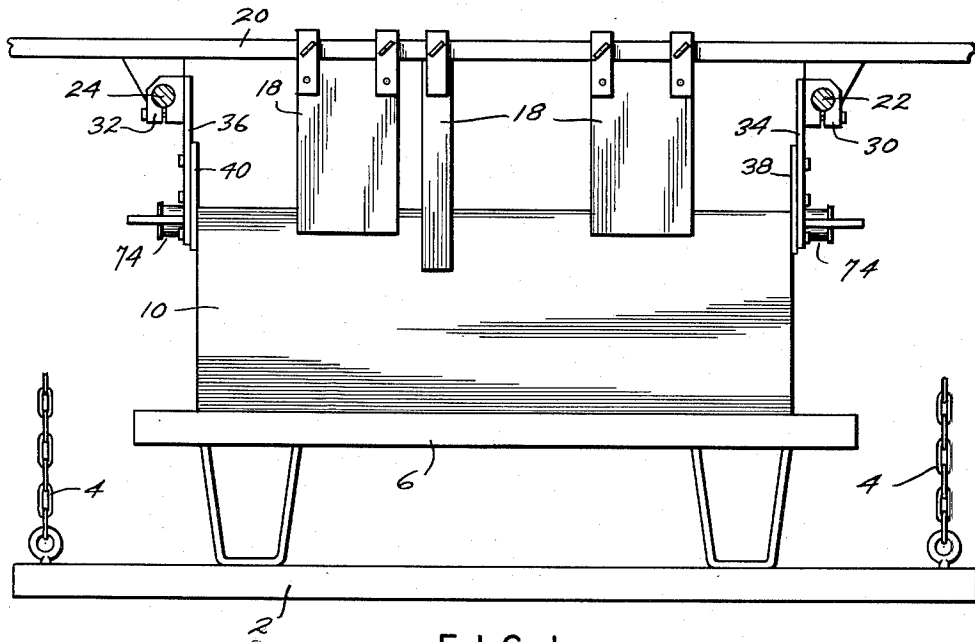


FIG. 1

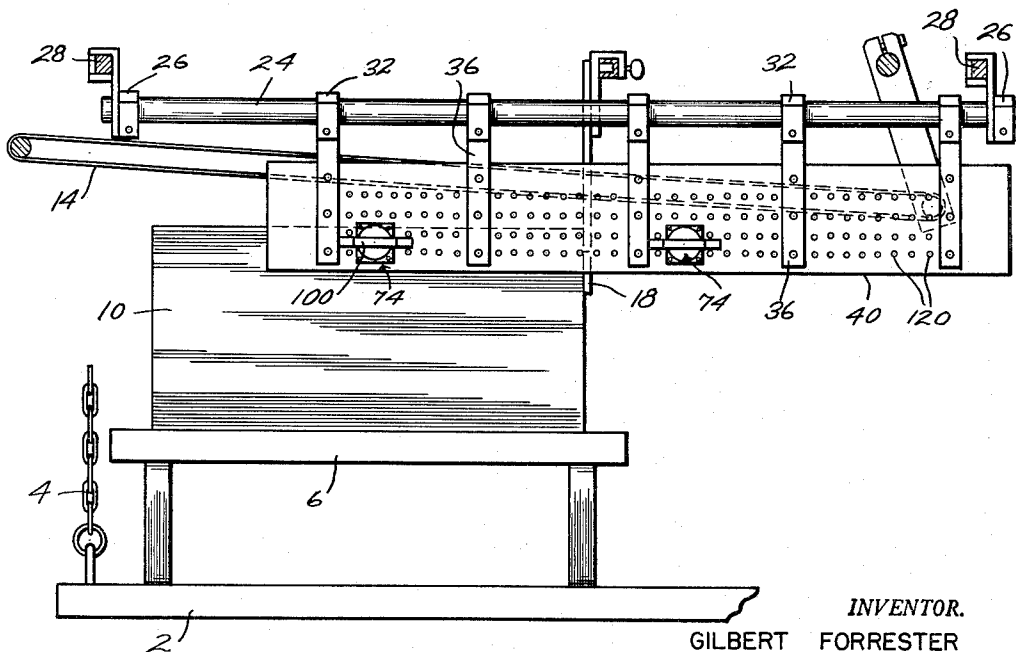


FIG. 2

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2 Sheets-Sheet 2

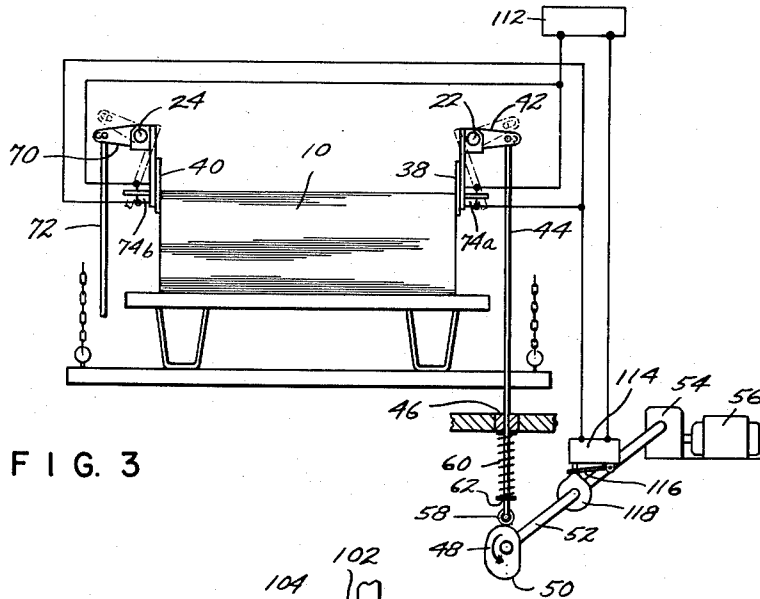


FIG. 3

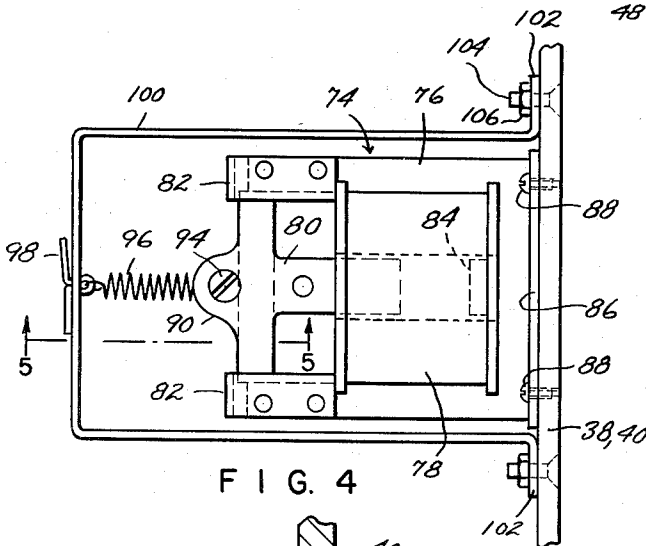


FIG. 4

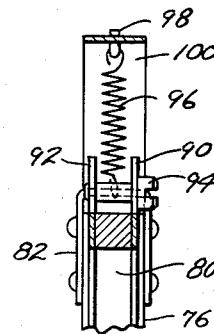


FIG. 5

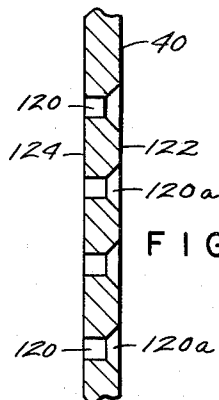


FIG. 6

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APPARATUS FOR STACKING SHEETS IN PRECISE EDGE ALIGNMENT WITH EACH OTHER

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9 Claims. (Cl. 271-89)

This invention relates to apparatus for stacking sheets of paper in neat piles and more particularly to improved means for aligning the edges of successive sheets as they are stacked in a pile.

Many machines designed to convey and process materials in web, sheet, or slab form, as, for example, paper, plastics, sheet metal, wall board, and the like, contain a stage where the product is cut or trimmed into individual sheets of predetermined sizes and piled in a stack. Usually, it is necessary that these sheets be stacked uniformly in preparation for some subsequent operation such as printing, scoring, stamping, molding, binding, etc. To achieve uniform piling, devices known as "layboys" have been developed. Layboys generally comprise an end stop which is engaged by and automatically aligns the forward edges of successive sheets, and a pair of movable side walls commonly called "joggers" which are located at opposite sides of the pile and which move inwardly and outwardly at a frequency ranging from one to several strokes per sheet delivered to the pile.

Unfortunately, these joggers have not proven very efficient; and in many cases, difficulty is encountered in piling successive sheets in precise edge alignment with each other. This difficulty may be due to the inherent flexibility of the product or to friction between the sheets due to surface roughness, tackiness, or weight. Occurrence of this difficulty is costly since it means that additional work must be done on the pile in order to get the uniformity required for later operations. This additional work may be a repiling operation—by hand or mechanical device—or an edge trimming operation.

In an attempt to render the joggers more efficient it has been thought to use a vibrating motor to produce rapid oscillations (i.e., 30 cycles per second and higher) in the surfaces confining the piled stack. However, this idea has proven unsatisfactory. In the first place, the oscillations set up in the pile-confining surfaces may be insufficient in amplitude to have any effect on the pile. In the second place, if the oscillations are increased to a significant amplitude, they tend to produce an adverse rather than a beneficial effect on pile straightness. This adverse effect is due to the fact that the resulting energy impulses to the pile are delivered at random without regard to the positions of the joggers relative to the pile. The nature of this adverse effect is a slow creeping out of position of portions of the pile which may not be confined tightly, and it becomes more pronounced when the material has a slippery surface or when air is trapped between successive sheets or when for some reason the sheets do not all lie horizontal.

I have discovered that the action of jogging devices may be augmented in such a manner as to enable them to stack in neat aligned piles materials which heretofore have been difficult to handle.

Accordingly, the general object of this invention is to provide means and a method of augmenting the action of joggers whereby to enable them to readily and precisely stack sheet materials which heretofore were difficult to handle.

More particularly, I have discovered that the pile straightening action of reciprocating jogger boards can be markedly improved by delivering a sharp sudden rap to each board at the end of its inward stroke. The sharp

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rap applied to the joggers is transmitted to the pile; and because of the sharpness of the rap and its timing, a sheet held out of position by friction is broken loose and moved into precise edge alignment with sheets previously deposited and aligned. The rapper action is distinguishable from the normal jogger action. The rapper action creates a sudden shock which is applied along the edge of the sheet, whereas the jogger action takes the form of a relatively slow push which tends merely to bend the flexible sheet.

Accordingly, a specific object of this invention is to provide means for automatically delivering a sudden sharp rap to a jogger board each time it closes in against a pile of sheets.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the invention becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. 1 is an end view in elevation of a portion of a layboy having a jogger mechanism embodying the present invention;

FIG. 2 is a fragmentary side elevation of the apparatus of FIG. 1;

FIG. 3 is an end elevation on a reduced scale showing a suitable electromechanical system used in and forming part of the present invention;

FIG. 4 is a plan view showing one of the rapper devices mounted on one of the jogger boards;

FIG. 5 is a sectional view taken along line 5-5 of FIG. 4; and

FIG. 6 is a cross section of one of the jogger boards.

Essentially, my invention consists of an automatically operated device which may be mounted on a reciprocating jogger board and which is adapted to deliver a sudden sharp rap to the board at the instant when the board has closed in to the desired resting place for the edge of a sheet which is delivered to or deposited in the layboy.

Referring now to FIGS. 1 and 2, there is shown a rectangular elevator platform 2 supported at its four corners by chains 4. These chains are connected to conventional drive mechanisms (not shown) which act through the chains to raise and lower platform 2. Resting on and carried by elevator platform 2 is a conventional skid platform 6 on which sheets of paper are to be stacked in a neat pile 10.

To assist in guiding sheets to pile 10, it is customary to provide a series of parallel conveyor belts which extend longitudinally of the path of movement of sheets delivered to the layboy. For convenience of illustration, a single belt 14 is shown, and then only in FIG. 2. These conveyor belts decline in the direction of movement of the sheets so that their lower runs tend to direct sheets downward as well as forward. Forward movement of delivered sheets is terminated by a plurality of end stops which take the form of flat vertical bars 18 which are suspended from a suitable beam 20 that extends transversely of the path of movement of the sheets. Stop bars 18 also function to align the forward edges of sheets delivered to pile 10.

Located above the elevator platform 2 are two horizontal shafts 22 and 24 which extend parallel to the path followed by sheets as they are delivered to the pile. Shafts 22 and 24 are journaled in suitable bearings 26 which are supported by a plurality of fixed horizontal beams 28 which extend transversely of the path followed by sheets as they are delivered to the pile. Secured to shafts 22 and 24 are several split collars 30 and 32 to which are secured depending arms 34 and 36 respectively. The bottom ends of arms 34 and 36 are secured to and support elongated flat jogger boards 38 and 40 respectively.

Shafts 22 and 24 are rotated back and forth through a predetermined angle so as to move jogger boards 38 and 40 between a first truly vertical position (FIG. 1) wherein they engage the side edges of the sheets in pile 10 and a second inclined or canted position (represented by broken lines in FIG. 3) wherein they are spaced from the pile.

Reciprocating movement can be imparted to shafts 22 and 24 by any stable mechanism, as, for example, the mechanism shown schematically in FIG. 3. Here, shaft 22 is provided with a bell crank 42 which is operated by a lever 44 that is slidably supported for reciprocal axial movement by a suitable fixed bearing 46. Lever 44 is actuated by a cam 48 having a suitable shaped lobe 50 mounted on a shaft 52 which is driven by a gear reduction unit 54 powered by a motor 56. Lever 44 is provided with a roller-type cam follower 58 that rides on cam 48. A compression spring 60, acting between a collar 62 on lever 44 and bearing 46, functions to urge the lever toward cam 48. Assuming that shaft 52 is rotating and jogger board 38 is in engagement with the side of pile 10, lever 44 will remain stationary until the lobe 50 of cam 48 reaches cam follower 58. Thereafter, lobe 50 will act on follower 58 to move lever 44 in a direction to move jogger board 38 away from pile 10. Spring 60 opposes movement of lever 44; and, as the lobe passes by cam follower 58, spring 60 causes lever 44 to move in the opposite direction to restore jogger board 38 back to its original vertical position.

Jogger board 40 is made to reciprocate in unison with jogger board 38. Shaft 24 is provided with a bell crank 70 and a lever 72 corresponding to crank 42 and lever 44. Although not shown, it is to be understood that lever 72 is actuated by a cam corresponding to cam 48 and mounted on a shaft driven at the same speed as shaft 52.

To the extent already described, the apparatus illustrated in the drawings is old and well known, and no claim is made thereto apart from the improvement provided by the present invention.

In practicing the present invention, it is possible to use an electrically, pneumatically, hydraulically, or mechanically operated device for imparting a sudden rap to the jogger boards. The preferred form of rapper device and the one which I have chosen to illustrate is an electrically energized solenoid 74. The solenoid is of such design that the iron core or plunger acts as a hammer on the armature frame, transmitting its energy through the frame to the jogger board which in turn contacts the sheet material being jogged.

Although one solenoid on each jogger board is sufficient, I prefer to use at least two solenoids on each board, as shown in FIG. 2.

Solenoids 74 are of conventional construction and comprise a laminated U-shaped armature frame 76, a solenoid coil 78, a T-shaped plunger or armature 80, and U-shaped retainer plates 82 which retain plunger 80 in the armature frame and limit outward movement of the plunger. The base of frame 76 has a projection 84 which extends upwardly inside of coil 78 and acts as a stop for the plunger when it is drawn inward by the magnetic force generated upon energization of the coil. Frame 76 is attached to a rectangular mounting plate 86 which is secured to the jogger board by means of screws 88.

Plunger 80 has two parallel-spaced ears 90 and 92 at its outer end. Ears 90 and 92 have aligned holes to accommodate a cross pin 94. One end of a tension spring 96 is secured to pin 94. The opposite end of spring 96 is secured to a cotter pin 98 which is attached as shown to the base of a U-shaped bracket 100. The latter straddles solenoid 74 and is provided with perforated feet 102 which are secured to the outer surface of the jogger board by screws 104 and nuts 106. Spring 96 keeps the

plunger in extended position. When the coil is energized, plunger 80 is drawn inwardly and strikes projection 84 with sufficient force to produce a sharp rap on the jogger board. When the coil is deenergized, the plunger is moved outward again by spring 96.

FIG. 3 illustrates how the solenoids on both jogger boards are energized simultaneously at the instant the jogger boards are in engagement with the pile of sheets. For convenience of illustration, only two solenoids, one for each jogger board, are shown in FIG. 3. However, it is to be understood that where more than one solenoid is provided for each board, all of the solenoids are connected in parallel.

In FIG. 3, solenoids 74a and 74b are connected in parallel with each other and in series with an electric current supply source 112 and a normally open switch 114. Switch 114 has an actuating member 116 which is operated by a cam 118 mounted on shaft 52. Cam 118 is shaped to operate actuating member 116 at the instant that the jogger boards engage pile 10. The solenoids are energized substantially instantaneously with the closing of switch 114. Cam 118 closes switch 114 only momentarily and only once for each cycle of operation of the jogger boards.

In a typical installation, I have used solenoids each having a 2-ounce armature and a coil which exerted a starting pull of 3½ to 5 pounds. The pull increased rapidly to a maximum of 13 to 18 pounds at the point where the plunger was stopped by contact with the armature frame. The time distance of travel was so short as to be almost instantaneous, and the energy delivered by the armature was approximately 6 foot-pounds. Of course, suitable selections of armature weights and solenoid power may be made to suit each application.

Depending on the specific design illustrated, the solenoid armature may move inwardly or outwardly to deliver its blow and may be returned to its starting position not only by springs but by gravity or other means as well.

It is to be noted that in a conventional layboy, the jogger boards normally reciprocate once for each sheet and are timed to move inward just after a sheet has been deposited on the pile. However, the jogger boards may be operated at a slower speed (for example, once for each second sheet delivered to the pile) without departing from the principles of the present invention, since the rapper device is synchronized with the jogger boards and not with the sheet delivery mechanism. Although not shown, it is contemplated also that the rapper devices may be operated at a fraction of the jogger reciprocation rate, as, for example, every third inward stroke of the jogger boards. In addition, other means such as a reciprocating arm may be used in place of cam 118.

Of course, solenoids 74 may be replaced by other mechanisms capable of producing a suitable rapping action. For example, it is possible to use (1) hammers driven by air pressure released by a valve which is opened at the desired instant by mechanical or electrical means, or (2) hammers tripped at the correct instant by linkages, latches, or escapements.

FIGS. 2 and 6 illustrate an additional modification for further improving the action of a jogger mechanism. This modification takes the form of a plurality of holes 120 drilled in each of the jogger boards. FIG. 6 is an enlarged fragmentary sectional view of jogger board 40. The inner and outer surfaces of the board are identified by numerals 122 and 124 respectively. As used herein, "inner surface" denotes the surface which engages the pile, and "outer surface" denotes the surface on which the solenoids are mounted. As illustrated clearly in FIG. 6, each hole 120 is flared on the inner surface 122 so as to provide a tapered mouth 120a. Holes 120 act as air passages. When the jogger boards are moved inwardly toward the pile, they displace air. If the boards are not perforated, they will pump air into the pile and thereby produce a lifting action on the topmost sheets of the pile

which will impair the desired jogging action. Holes 120 provide an escape path for air trapped and compressed between the jogger boards and the pile during the inward stroke of the boards.

I have found that these disturbing effects are reduced by flaring holes 120 as described. The rounded or enlarged mouths 120a promote outward flow of air during inward movement of the jogger boards, while the smaller sharp-edged openings on the outer face of the board inhibit inflow of air during the outward jogger board movement. To enhance the inducement of air to move away from the space between the pile and the jogger boards, the reciprocation of the jogger boards is modified by suitable shaping of cam 48 in FIG. 3 to cause the jogger boards to move inward with a gradual closing motion and to move outward with a relatively rapid stroke. The combined effect of this non-uniform jogger reciprocation and the air flowing more readily outward through the jogger perforations than inwardly is to promote a definite pumping away of air from the upper sides of the pile with each outward stroke of the jogger, and a minimum fanning of air back into this space during inward motion of the jogger boards.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. Therefore, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts specifically described or illustrated, and that within the scope of the appended claims, it may be practiced otherwise than as specifically described or illustrated.

I claim:

1. Apparatus for aligning rectangular sheets successively deposited in a pile on a base, said apparatus comprising a pair of flat elongated boards, means for positioning said boards at opposite sides of said base and associated pile and parallel thereto, means for repeatedly moving said boards inwardly against and outwardly away from said opposite sides of said pile, and means on each board for striking said each board a sharp sudden blow each time said each board engages said pile at one of said opposite sides.

2. Apparatus as defined by claim 1 wherein said last-mentioned means are electrically operated.

3. Apparatus as defined by claim 1 wherein said last-mentioned means are solenoids each comprising an armature frame mounted on one of said boards, an electric coil operative when energized to generate a magnetic field, and an armature positioned to be driven in a first direction by the force of said magnetic field into contact with a portion of said frame, whereby to produce a sharp blow on said one board.

4. Apparatus as defined by claim 3 further including means for moving said armatures in the opposite direc-

tion away from said portion of said frame when said coils are deenergized.

5. In combination with mechanism for stacking successively delivered sheets of paper in a neat vertically extending pile on a base, the improvement comprising a pair of elongated flat boards positioned at opposite sides of said pile and parallel thereto, means for repeatedly moving said boards inwardly against and outwardly away from the sides of said pile, and means for striking said boards a sharp blow each time they engage said pile.

6. In combination with a jogger mechanism for a lay-boy, said jogger mechanism comprising a pair of flat elongated boards, means mounting said boards for pivotal movement about parallel horizontal axes, means for supporting said boards on said parallel horizontal axes parallel to opposite sides of a base for receiving sheets, means for simultaneously and repeatedly pivoting both boards between first positions wherein the plane of each board extends downwardly and outwardly away from the pivotal axis of the other board and second positions wherein the plane of said each board is vertical, and means for simultaneously striking a sharp blow to each board when and only when said boards are in said second positions.

7. The combination of claim 6 wherein said last-mentioned means comprises a solenoid mounted on each board, an energizing circuit for said solenoid, a normally open switch in said circuit, and means for momentarily closing said switch to actuate said solenoids when said boards are in said second positions.

8. The combination of claim 6 further including a plurality of holes in each board, said holes having tapered mouths on the inner sides of said boards.

9. Apparatus for stacking sheets in precise edge alignment comprising: a base defining a stacking area, means for depositing sheets in said stacking area, jogging means positioned parallel to opposite sides of said base and adjacent to said sheets in said stacking area for moving said sheets into a stacked position when said sheets reach said stacking area by periodically contacting said sheets at their lateral edges and pushing them toward said stacked position, and shock means operatively associated with said jogging means for subjecting said sheets to a shock wave when said jogging means is in contact with the lateral edges of said sheets; whereby said shock means disrupts frictional forces between the uppermost sheets and thereby permits said jogger to position said sheets with extreme accuracy.

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