March 1, 1932. T. F. BURTON ET AL 1,847,812

SHEET HANDLING APPARATUS

Filed July 10, 1929 2 Sheets-Sheet 1

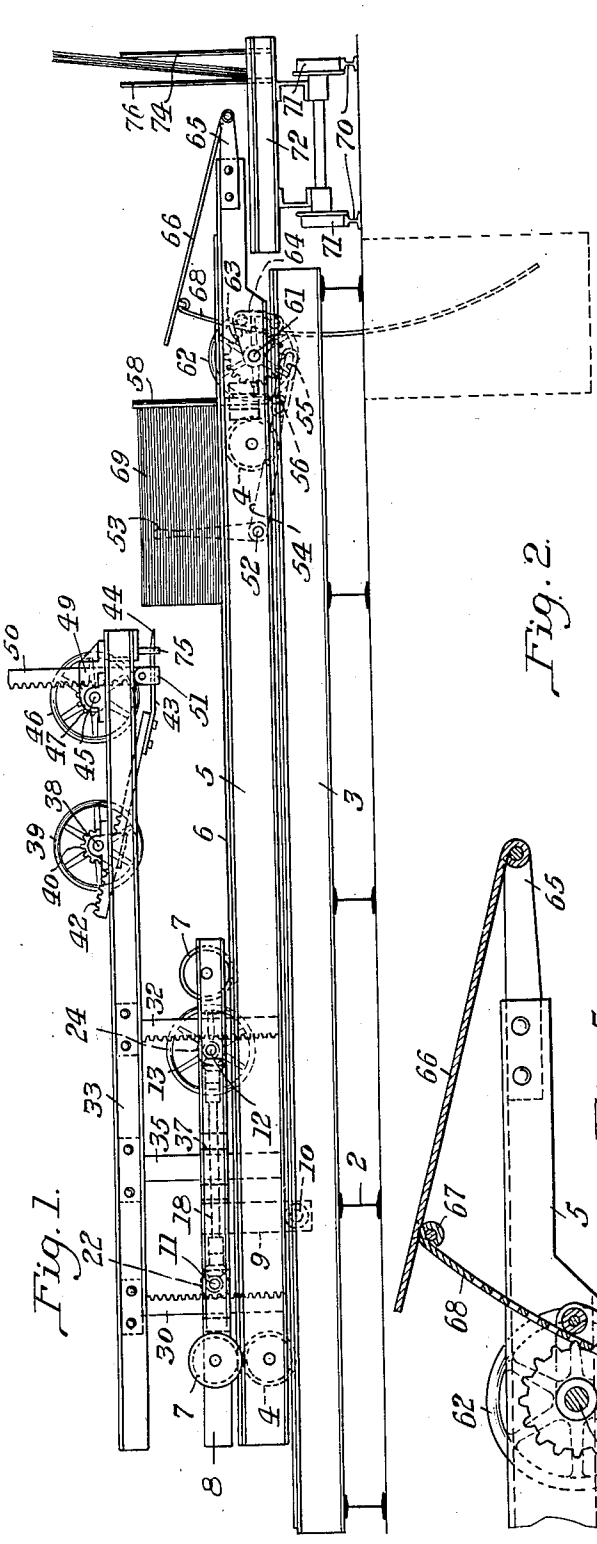


Fig. 1.

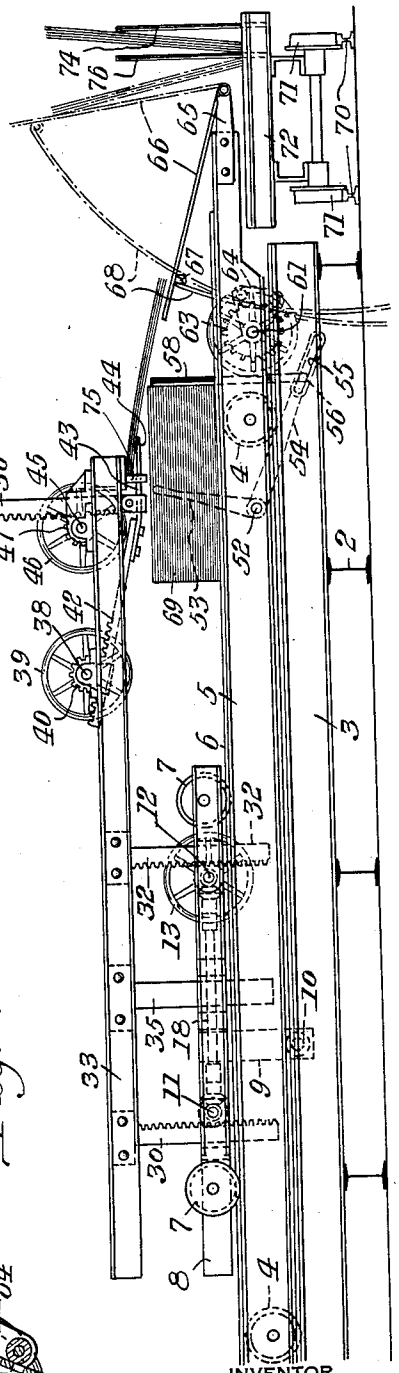


Fig. 2.

Fig. 5.

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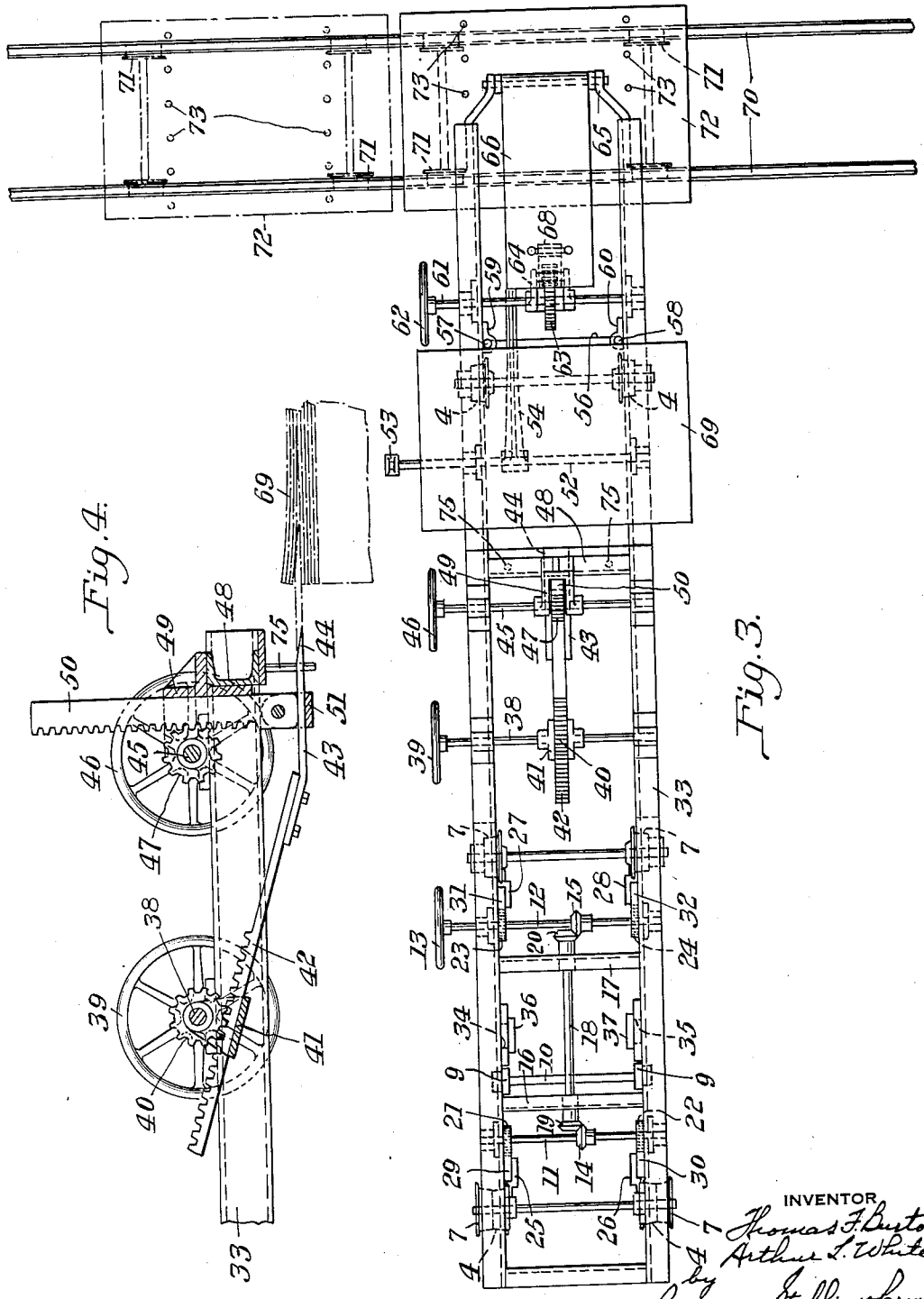


Fig. 3.

Fig. 4.

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UNITED STATES PATENT OFFICE

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SHEET HANDLING APPARATUS

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This invention relates broadly to sheet handling apparatus and more particularly to apparatus for handling metal sheets in a sheet mill. It relates still more particularly to an apparatus for moving sheets which are piled one upon another to a position in which they are disposed on edge.

In the operation of a sheet mill there are certain steps in the handling of the sheets which have heretofore been the source of considerable difficulty and have occasioned undue labor and expense. Among these operations is that in which the sheets are moved from the annealing furnace to the pickling vat. When the sheets are pack-annealed, they are removed from the annealing furnace in a pack or pile. In order to thoroughly and properly pickle the sheets, it is necessary that they be separated before being placed into the pickling vat, so that the pickling liquor will completely surround each individual sheet.

It has been the custom to turn up each sheet from the pack or pile coming from the annealing furnace and position each sheet on edge on a pickling frame or car, whereupon such frame or car is lowered into the pickling vat. This operation has heretofore been performed by hand labor and due to the size, weight, heat and shape of the plates has entailed the labor of a considerable number of men. Not only is the operation difficult and expensive, but it is very slow and decreases the output of the plant and the speed of operation.

We provide a sheet handling apparatus adapted for performing the operations above referred to, which more efficiently and quickly performs the function and which dispenses with the labor of a number of men. It consequently increases the output of the mill and reduces the cost of manufacture of the sheets.

While the apparatus is particularly adapted for moving sheets from a pile and turning them up on edge preparatory to going to the pickling vat, it is adaptable for many other purposes, its utility being by no means limited to the single operation referred to.

We provide sheet handling apparatus, comprising, in combination, means for separating a number of sheets from the top of a pile of sheets, means for moving such sheets from the top of said pile, and means for turning the sheets on edge. We further provide sheet handling apparatus, comprising a carriage carrying substantially vertically adjustable means for engaging a number of sheets at the top of a pile, such carriage being substantially horizontally movable to move the sheets from the pile.

Other objects and advantages of the invention will become apparent as the following description of a present preferred embodiment thereof proceeds.

In the accompanying drawings we have shown a present preferred embodiment of the invention, wherein

Figure 1 is a longitudinal elevational view of a sheet handling apparatus,

Figure 2 is a view similar to Fig. 1, but showing the parts in a different operative position,

Figure 3 is a top plan view of the sheet handling apparatus shown in Figs. 1 and 2,

Figure 4 is a detail view to enlarged scale, and

Figure 5 is a further detail view also to enlarged scale.

Referring more particularly to the drawings, reference numeral 2 designates generally a series of I-beams or supports, upon which are mounted rails 3 forming a track. Mounted upon the rails 3, through wheels 4, is a carriage 5. The top of the carriage 5 is provided with rails 6, upon which is mounted, through wheels 7, a second carriage 8. Connected to the carriage 8 and extending through the carriage 5 is a frame 9, having at its lower extremity a cross-rod 10 which projects laterally beneath the heads of the rails 3, whereby to insure that both of the frames 5 and 8 remain in place with respect thereto.

Journalled in the frame 3 is a pair of cross-shafts 11 and 12, the latter of which is provided with a hand-wheel 13. To each of the shafts 11 and 12 is keyed a bevel gear 14 and 15, respectively. Mounted in the frame 3 are a pair of cross-supports 16 and 17 in which is journalled a longitudinal shaft 18 having keyed thereto at its opposite ex-

tremities bevel gears 19 and 20. The bevel gear 19 meshes with the bevel gear 14 on the cross-shaft 11 and the bevel gear 20 meshes with the bevel gear 15 on the cross-shaft 12. Therefore rotation of the hand-wheel 13 causes rotation of the cross-shaft 12 and, through the gears 15 and 20, the shaft 18 and the gears 19 and 14, also causes rotation of the cross-shaft 11. The shafts 11 and 12, however, rotate in opposite directions.

Keyed to each of the cross-shafts 11 and 12 adjacent the opposite sides of the frame 3 are gear wheels 21, 22, 23, and 24, respectively. Connected with the interior of the frame 3 outside the shafts 11 and 12 and co-operating with the respective gear wheels are guides 25, 26, 27, and 28, respectively. Passing through the respective guides and meshing with the respective gear wheels are four racks 29, 30, 31, and 32, respectively. These racks are connected at their upper extremities to a common frame 33. Also connected with the frame 33 is a pair of downwardly extending guide members 34 and 35, respectively. Connected with the frame 8 are oppositely disposed straps 36 and 37, respectively, in which the guide members 34 and 35 are received.

Rotation of the hand-wheel 13 causes rotation in opposite directions of the gear wheels on the shafts 11 and 12 which gear wheels, meshing with the racks 29, 30, 31, and 32 cause upward or downward movement of the frame 33 with respect to the carriage 8, depending upon the direction of rotation of the hand-wheel 13. The frame 33 is guided with respect to the carriage 8 by the four racks and by the guide members 34 and 35.

Journalled in the frame 33 is a cross-shaft 38 to which is keyed a hand-wheel 39. Also keyed to the shaft 38 is a gear wheel 40. Surrounding the shaft 38 and cooperating with the gear wheel 40 is a guiding strap 41. Passing through the guiding strap 41 and meshing with the gear wheel 40 is a rack 42. Rotation of the hand-wheel 39 causes rotation of the shaft 38 and consequently of the gear wheel 40 which, by reason of its meshing relationship with the rack 42, causes longitudinal movement thereof. The rack 42 has connected to its outer extremity a separating device 43, the function of which will be presently described. Such device is relatively thin and flat and is provided with a substantially pointed extremity 44.

Journalled in the frame 33 is a cross-shaft 45, having keyed thereto a hand-wheel 46. Also keyed to the cross-shaft 45 is a gear wheel 47. Connected with the frame 33 is a cross-brace 48 with which is connected a guiding strap 49, which strap also encircles the shaft 45 and cooperates with the gear wheel 47. Passing through the guiding strap 49 and meshing with the gear wheel 47 is a rack 50, having connected to its lower extremity a guiding-eye 51 which embraces the separating device 43, thus supporting it in the vertical direction but permitting substantially longitudinal movement thereof through the guiding-eye 51. The elevation of the separating device 43 is thus controlled by the hand-wheel 46 through the shaft 45, the gear wheel 47, the rack 50, and the guiding-eye 51.

Journalled in the carriage 5 is a cross-shaft 52, having keyed thereto an operating handle 53. Also rigidly connected to the cross-shaft 52 is a link 54 having at its outer extremity an eye 55. Passing through the eye 55 is a cross-pin 56 to which are connected vertically extending bracing members 57 and 58, respectvely, for a purpose to be presently described. Connected to the frame 5 are guiding straps 59 and 60 for the bracing members 57 and 58, respectively. Operation of the handle 53 causes rotation of the shaft 52 and consequently of the link 54 and, through the eye 55 and the cross-pin 56, up or down movement of the bracing members 57 and 58, depending upon the direction of operation of the handle 53.

Journalled in the carriage 5 is a cross-shaft 61 to which is keyed a hand-wheel 62. Also keyed to the cross-shaft 61 is a gear wheel 63. Connected with the shaft 61 and co-operating with the gear wheel 63 is a guiding strap 64. Connected to the carriage 5 at its extremity is a U shaped pivot member 65 to which is pivoted a platform 66. Pivoted to the platform 66 at 67 is a curved rack 68 passing through the guiding strap 64 and meshing with the gear wheel 63. Rotation of the hand-wheel 62 causes rotation of the shaft 61 and the gear wheel 63, which through the curved rack 68 causes pivotal movement of the platform 66 about its pivot 65.

The carriage 5 is longitudinally movable on the track 3 and the carriage 8 is longitudinally movable on the carriage 5, the frame 33 being vertically adjustable with respect to the carriage 8. On the carriage 5 and next to the bracing members 57 and 58 is a place for the reception of a pack or pile of sheets 69. The sheets 69, as above mentioned, may come from the annealing furnace and they may be placed on the carriage 5 by means of an overhead crane or other suitable conveying mechanism.

A transverse track 70 is provided adjacent the end of the track 3 upon which are mounted, through wheels 71, small flat trucks 72. The trucks 72 are provided with two parallel rows of spaced holes 73 for a purpose to be presently described. The trucks may be such as are adapted to be lowered into a pickling vat when loaded with sheets, as will be presently described, whereby the sheets will be immersed in the pickling liquor. Instead of trucks, pickling frames may be used, the two

being substantial equivalents for the purposes of this description.

As stated above, the sheets 69, if they come from the annealing furnace, are very hot and, due to the various factors mentioned, difficult to handle by manual labor. We shall now describe the manner in which such sheets may be moved from the pile on the carriage 5 to positions on edge on the trucks 72, whereby the sheets are rendered in condition for pickling.

The carriage 5 with the pile of sheets 69 thereon is moved toward the track 70 until the axis of the pivot member 65 is substantially above the second row of holes 73, counting from the remote edge of one of the cars 72 which is directly opposite the track 3. (The axis of the pivot member 65 is shown as being substantially above the third row of holes 73 in Figs. 1, 2, and 3 of the drawings.) Suitable locking means (not shown) may be provided for positively positioning the carriage 5 in any desired position relative to the track 70. Pins 74 are placed in the last row of holes 73 to serve as supports for the sheets to be placed on edge thereagainst.

The handle 53 is pulled to the left, viewing Figs. 1 and 2, so as to raise the bracing members 57 and 58 to a position such as that shown in Fig. 1, wherein the upper extremities of the bracing members are at a higher level than the upper sheet in the pile 69. As above mentioned, the purpose of the separating device 43 is to separate a number of sheets from the top of the pile by reason of the projection of the sharp extremity 44 thereof into the edge of the pile. The number of sheets which will be separated from the top of the pile by projection of the separator 43 thereinto is determined by the height of the separator with respect to the frame 33. When the separator is relatively close to the frame 33,—that is, near its upper position, a relatively small number of sheets will be separated from the pile as compared with the number of sheets which will be separated when the device 43 is in a lower position or farther removed from the frame 33. The reason for this will become apparent as the description proceeds. Assuming now that it is desired to project the separating device 43 into the pack of sheets 69 at such a position that say four or five sheets will be separated from the top of the pile, the height of the separating device with respect to the frame 33 is accordingly adjusted by means of the hand-wheel 46. At such time the separating device is in a retracted position, such as that shown in solid lines in Figs. 1 and 4.

The hand-wheel 13 is next operated to adjust the elevation of the frame 33 with respect to the carriage 8 so that the lower surface of the extremity of the frame adjacent the pile of sheets is in a plane just above that of the top sheet. At such time the edge 44 of the separating device 43 will be substantially in the plane of the fourth or fifth sheet from the top of the pile, due to its previous adjustment as above mentioned. The carriage 8 is then moved toward the pile of sheets until the edge of the separating device 43 almost touches the sheets, the separating device still being in its retracted position. At such time the extremity of the frame 33 will be just above the edge of the pile. The hand-wheel 39 is then operated to advance the separating device into the pile of sheets so as to separate the upper four or five sheets from the pile, as indicated in chain lines in Figure 4. The bracing members 57 and 58 prevent any of the sheets from being pushed away from the frame 33 by the advance of the separator as the opposite edge of the pile is against such bracing members.

Projecting downwardly from the frame 33 is a pair of pins 75 for a purpose now to be described. After the separating device has been advanced to separate the top four or five sheets from the pile, as indicated in Fig. 4, the entire carriage 8 with the frame 33 thereon is advanced toward the pile, the separating device remaining between the sheets, until the pins 75 lie against the edges of the sheets. Then, by operation of the hand-wheel 13, the frame 33 is elevated until the near edges of the separated sheets have been raised some distance above the lower sheets in the pile and until the lower extremities of the pins 75 are higher than all the sheets except those above the separating device. At such time the pivoted platform 66 is in its lower position, such as that shown in solid lines in Figs. 1, 2, and 3. The operating handle 53 is then moved to the right, viewing Figs. 1 and 2, far enough so that the upper extremities of the bracing members 57 and 58 are depressed below the level of the lowermost separated sheet. Thus any opposition to movement of the separated sheets in the general direction of the pivoted platform 66 is removed. The carriage 8 is then moved toward the right, viewing Figs. 1 and 2, and moves the separated sheets off of the top of the pile 69 and above the pivoted platform 66. The separated sheets are positively moved by reason of the bearing of the pins 75 against the edges thereof, the sheets being prevented from sliding upwardly along such pins by the lower surface of the frame 33. This operation is shown in solid lines in Fig. 2.

Movement of the carriage 8 continues until the separated sheets are positioned directly above the pivoted platform 66, whereupon the separator is retracted by operation of the hand-wheel 39, the sheets thereby being allowed to drop down over the platform. The sheets thereby become disengaged from the frame 33 and from the separator 43, and the

carriage 8 is then retracted to its normal position preparatory to repetition of the operation just described.

The hand-wheel 62 is next operated to raise the platform 66 about its pivot 65, whereby the sheets slide to the right, viewing Figs. 1 and 2, until their edges abut against the pins 74 in the truck. Pivotal movement of the platform 66 is continued until the sheets are swung up into a substantially vertical position and resting against the pins 74. Then, while the platform in its upper position is holding the sheets to prevent them from falling down toward the left, pins 76 are placed in the second row of holes 73, whereby to insure positive support of the sheets in their upright position on the truck 72. The outer extremities of the U shaped pivot member 65 are bent back, as shown in Fig. 3, to permit of insertion of the pins 76, while the carriage 5 and the platform 66 are in the position described. After insertion of the pins 76, the platform 66 is returned to its lower position and the carriage 5 is retracted until the axis of the member 65 lies substantially above the third row of holes 73. The carriage 5 is shown in this position in Figs. 1, 2, and 3. The parts are now in position for repetition of the operation just described, whereby a second group of four or five sheets is positioned on edge on the truck on the opposite side of the pins 76, as shown in chain lines in Fig. 2. Each time that a group of sheets is so positioned on the truck, two more pins, similar to the pins 74 and 76, are inserted in the next row of holes so that the truck may be filled with sheets from one side to the other, each group of four or five sheets being separated and supported independently of the others by the upright pins in the truck.

The loaded truck 72 is then removed from its position opposite the sheet handling apparatus and an empty truck replaces it to be loaded with sheets in the same manner. The loaded truck is lowered into the pickling vat to pickle the sheets carried thereby. When only four or five sheets are in each group on the truck, it may be possible to effectively pickle all of the sheets without further separating the sheets in each individual group, but, if desired, wooden spacers may be inserted between the respective sheets of each group so that each sheet will be substantially entirely surrounded by pickling liquor when the sheets are immersed therein.

The longitudinal movement of the carriage 5 on the track 3 and the longitudinal movement of the carriage 8 on the carriage 5 may be effected by any suitable means, such as by electric motors geared to the axles thereof. Likewise the various operating functions which have been above described as being performed by operation of the various hand-wheels may be performed through suitable driving connections as by electric motors geared to the respective shafts and having suitable control means. Some of the operations may be performed by hand, if desired, while other operations are performed mechanically.

The operation of the apparatus may be varied somewhat by the individual operators. For example, instead of first advancing the carriage 8 to its position adjacent the pile of sheets and then advancing the separator into the sheets, the separator may first be advanced and the carriage thereafter moved toward the sheets to force the separator between them. The exact adjustment of the height of the separator with respect to the frame 33 may also be varied according to the ideas of the individual operator, but the general function and operation of the apparatus is substantially as above described.

The apparatus is also useful for moving other shapes, such as plates, frames, and so forth, and is generally useful for handling things which can not be readily or easily handled by hand and which it is desired to change from one position to another.

While we have shown and described a present preferred embodiment of the invention, it is to be distinctly understood that the same is not limited thereto, but may be otherwise variously embodied within the scope of the following claims.

We claim:—

1. Sheet handling apparatus, comprising, in combination, means for separating a plurality of sheets at one time from the top of a pile of sheets, means for predetermining the number of sheets so separated, means for moving such sheets from the top of said pile, and means for turning the sheets on edge.

2. Sheet handling apparatus, comprising, in combination, means for insertion between sheets in a pile to separate a number of sheets from the top of the pile, means for moving such sheets from the top of the pile, and means for turning the sheets on edge.

3. Sheet handling apparatus, comprising, in combination, means for sliding a number of sheets laterally off of a pile of sheets, means for predetermining the number of such sheets, and means for turning such sheets on edge.

4. Sheet handling apparatus, comprising, in combination, means for engaging beneath the edge of a sheet near the top of a pile of sheets, means for raising the engaging means to separate the sheets thereabove from the pile, and means for moving such sheets laterally off of the pile.

5. Sheet handling apparatus, comprising, in combination, means for separating a number of sheets from the top of a pile, pushing means adapted to engage the rear edges of such sheets for pushing them off of the pile, and means for turning the sheets on edge.

6. Sheet handling apparatus, comprising, in combination, means for moving a plurality of sheets at one time from the top of a pile to a position laterally thereof, means for predetermining the number of such sheets, and pivoted means for turning such sheets on edge.

7. Sheet handling apparatus, comprising means for successively moving portions, each comprising a plurality of sheets, of a pile of sheets from the top of such pile to a position laterally thereof and with the sheets disposed on edge, and means for predetermining the number of sheets in each of such portions.

8. Sheet handling apparatus, comprising a substantially horizontally movable sheet pushing carriage having connected therewith means adapted to be inserted between sheets in a pile for separating a number of sheets from the top of such pile, means for vertically adjusting such means to predetermine the number of sheets so separated, and means for engaging such sheets to push them off of such pile.

9. Sheet handling apparatus, comprising a carriage having connected therewith substantially vertically adjustable means adapted to be inserted between sheets in a pile for separating a number of sheets from the top of such pile, the carriage being movable to move said sheets from the pile.

10. Sheet handling apparatus, comprising a fixed support, a frame carried by the support and slidable therein both substantially vertically and substantially horizontally, such frame having connected therewith means for engaging a number of sheets at the top of a pile to move such sheets off of the pile, and means for predetermining the number of sheets so engaged.

11. Sheet handling apparatus, comprising a carriage carrying substantially vertically slidably adjustable means for engaging a number of sheets at the top of a pile, such carriage being substantially horizontally movable to move the sheets from the pile.

12. Sheet handling apparatus, comprising a separator substantially horizontally movable to engage between adjacent sheets of a pile of sheets to separate a number of sheets at the top of the pile from the remainder, the separator being vertically adjustable to enable its use on a desired number of sheets at the top of the pile.

13. Sheet handling apparatus, comprising means for pushing a number of sheets laterally off of a pile and means disposed at the opposite side of the pile from the pushing means to brace the sheets, such means being retractable downwardly to permit the sheets at the top of the pile to be pushed off.

14. Sheet handling apparatus, comprising a carriage having a place for receiving a pile of sheets, and means on the carriage for successively moving portions, each comprising a plurality of sheets, from the top of the pile to a position off of the carriage and with the sheets on edge, the carriage being movable.

15. Sheet handling apparatus, comprising a plurality of superimposed carriages slidable against one another one of which has a place for receiving a pile of sheets, another of said carriages having means for moving such sheets from said pile to a position beside the apparatus.

16. Sheet handling apparatus, comprising a pivoted platform, means for placing sheets above said platform, a curved rack connected with said platform, and a pinion cooperating with the rack for moving the platform about its pivot to stand the sheets on edge.

17. Sheet handling apparatus, comprising a pivoted platform, a pusher for moving sheets off of a pile adjacent the platform to a position above it, and means for pivoting the platform to stand the sheets on edge.

18. Sheet handling apparatus, comprising means for successively moving sheets from a pile to a position adjacent thereto and with the sheets on edge, and means for holding up the sheets in separate groups.

19. Sheet handling apparatus, comprising a carriage having a place for receiving a pile of sheets, a swingable platform connected with the carriage, a second carriage on the first and having means for moving sheets from the pile to a position above the platform, and means for swinging the platform to stand the sheets on edge.

20. Sheet handling apparatus, comprising a substantially vertically adjustable substantially horizontally movable frame having connected therewith an advanceable and retractable separator adapted to be inserted between sheets in a pile for separating sheets from the top of such pile, the frame having means effective upon substantially horizontal movement thereof for moving the separated sheets from the pile.

In testimony whereof we have hereunto set our hands.

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