Aug. 26, 1930. G. W. SWIFT, JR 1,774,113

SHEET FEEDING MACHINE

Filed April 16, 1929 3 Sheets-Sheet 1

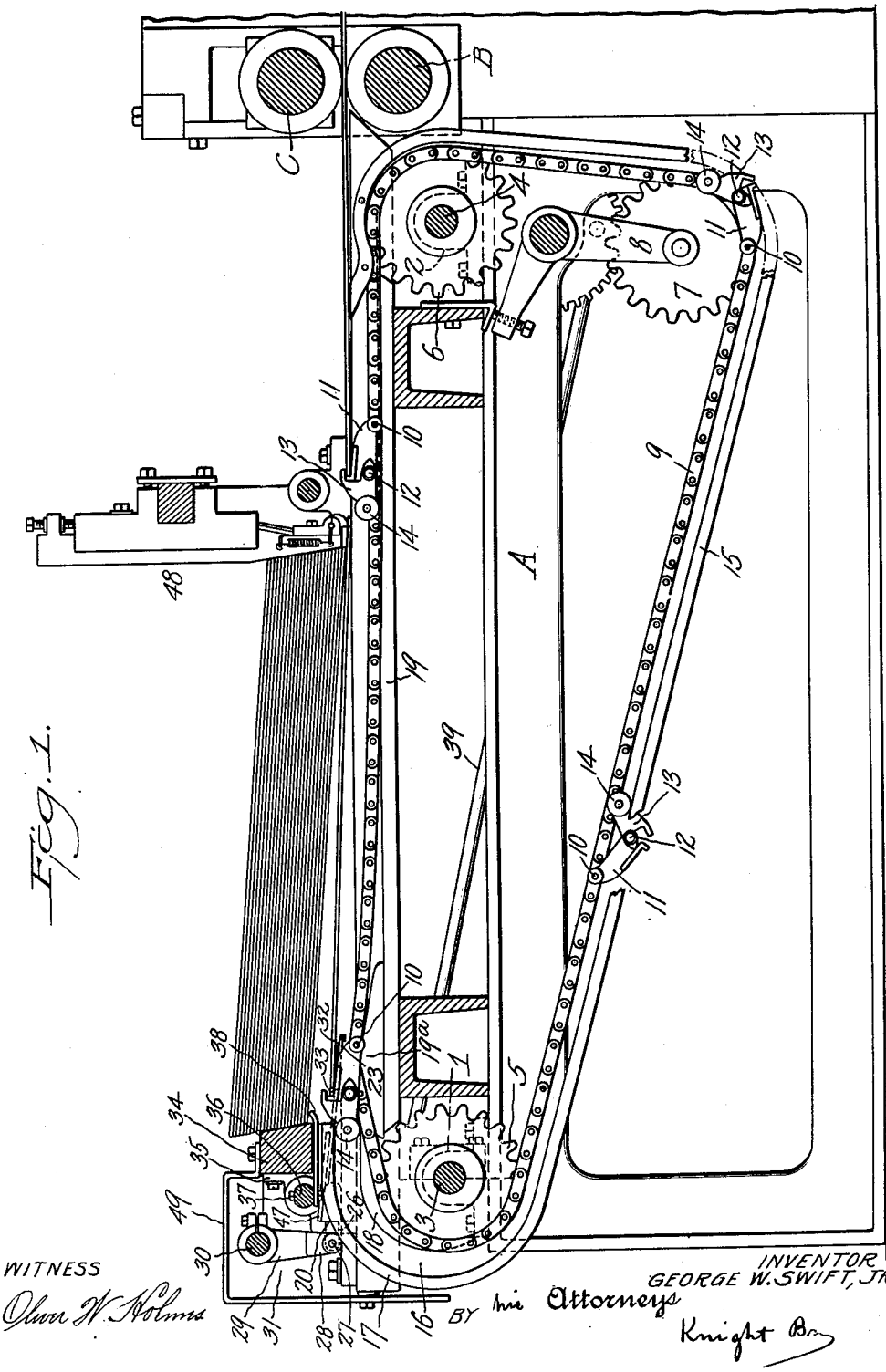

Fig. 1.

WITNESS

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SHEET FEEDING MACHINE

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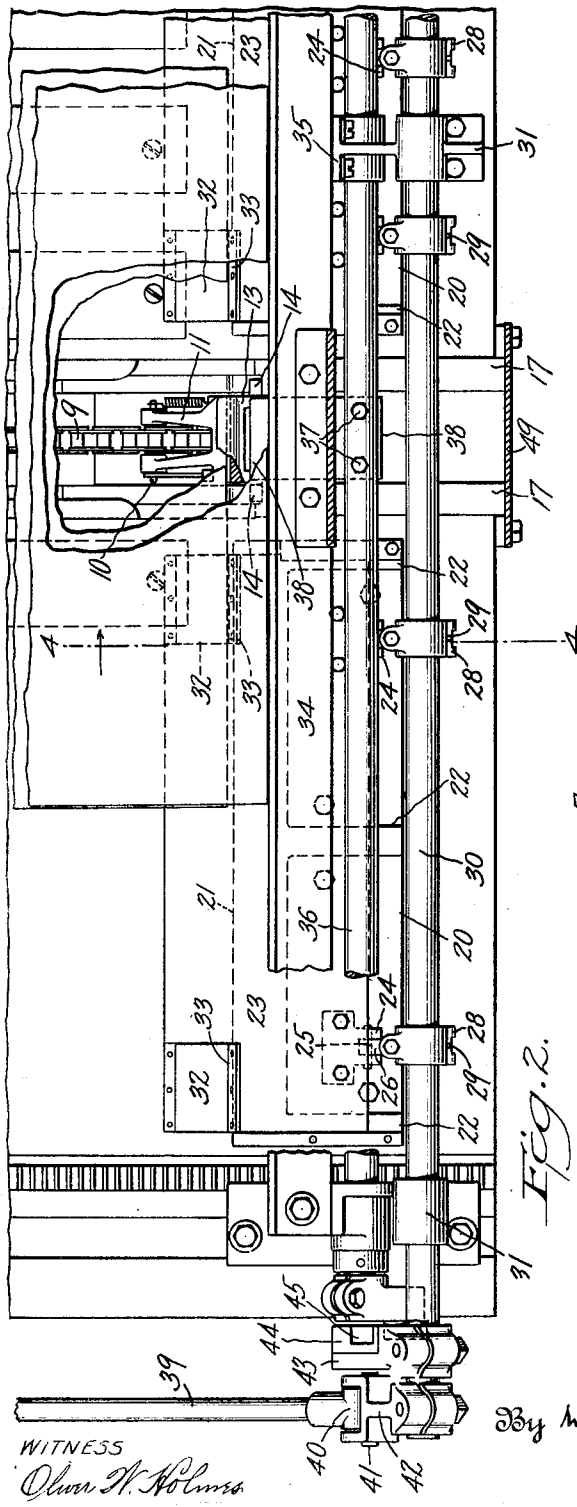

Fig. 2.

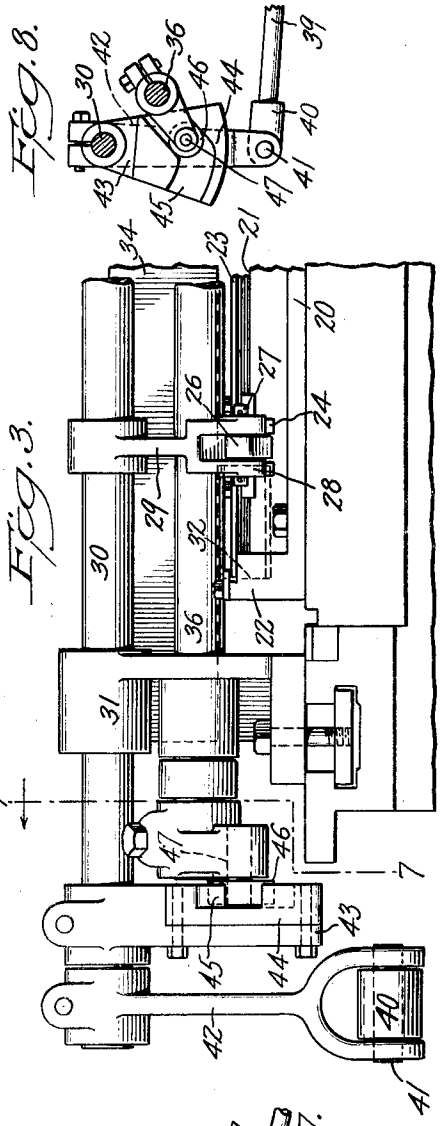

Fig. 3.

Fig. 8.

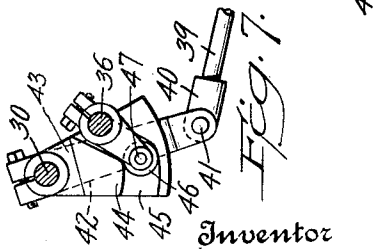

Fig. 7.

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SHEET FEEDING MACHINE

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Fig. 4.

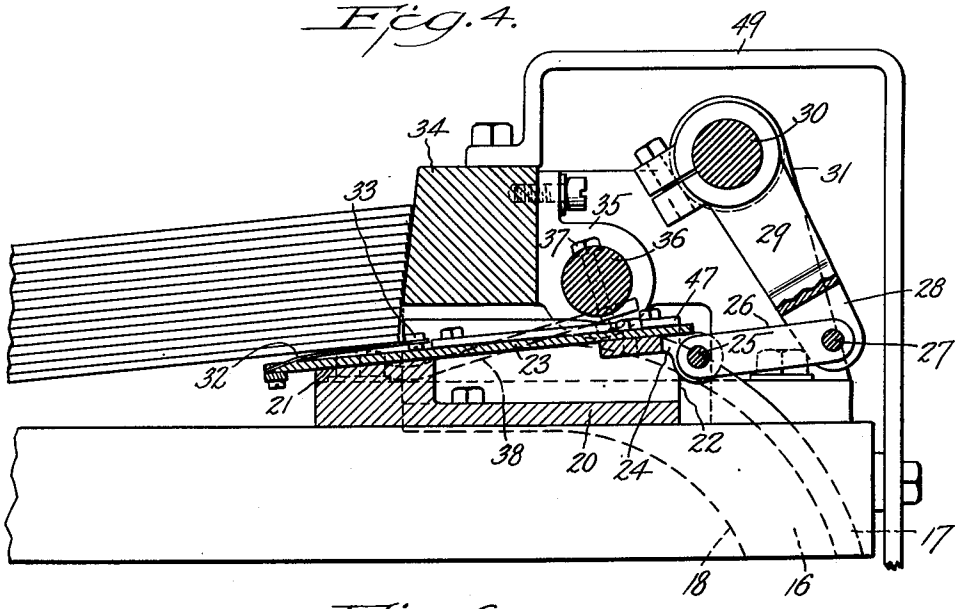

Fig. 6.

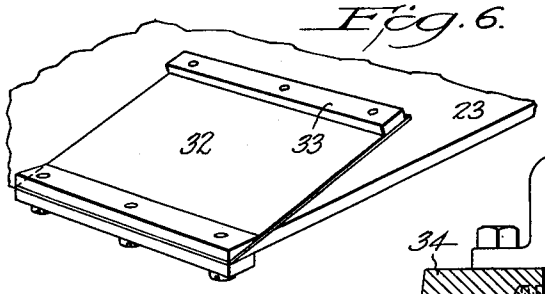

Fig. 5.

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UNITED STATES PATENT OFFICE

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SHEET-FEEDING MACHINE

Application filed April 16, 1929. Serial No. 355,530.

This invention relates to that type of sheet-feeding machines, in which sheets of stiff material such as cardboard, faced corrugated board, and the like, are arranged in a pile above suitable sheet-feeding mechanism, which operates upon the rear edges of successive bottom sheets for feeding them off one at a time from the pile. More especially, my invention relates to machines of this character in which, after a preliminary forward displacement of the bottom sheet of a pile, suitable means are set in operation for lifting the rear end of the pile remainder to permit the entrance of rear-edge sheet-engaging devices below the elevated rear edge of the pile remainder, and the unrestricted movement of said sheet-engaging devices into engagement with the disencumbered rear edges of successive bottom sheets.

The primary object of my invention is to provide means of improved construction for imparting the preliminary forward displacements to successive bottom sheets of the pile, and an improved arrangement of said means with respect to the mechanism for elevating the rear edge of the pile remainder and the rear-edge sheet-engaging devices.

Other and more particular objects of invention will be understood from the following description, reference being had to the accompanying drawings, which show a preferred embodiment of my invention.

In the drawings,

Figure 1 is a vertical longitudinal section of a sheet-feeding machine provided with my improved sheet-feeding mechanism, parts being broken away and parts shown in side elevation.

Figure 2 is an enlarged top plan view of an upper rear corner of the machine, parts being being broken away and parts shown in section.

Figure 3 is an enlarged rear elevation of the left hand portion of Figure 2.

Figure 4 is an enlarged vertical longitudinal section on the line 4—4 of Figure 2.

Figure 5 is a section similar to Figure 4, showing parts in changed positions.

Figure 6 is a fragmentary perspective view of one of the reciprocatory slides with yieldably-mounted rear-edge sheet-engaging device.

Figure 7 is a vertical, detail section corresponding to the line 7—7 of Figure 3; and

Figure 8 is a detail section similar to figure 7 with the parts shown in changed positions.

According to the embodiment of my invention shown on the drawings, a main frame A is provided with suitable bearings 1 and 2 in which are journalled transverse shafts 3 and 4. Keyed to these transverse shafts 3 and 4 are sprocket wheels 5 and 6, a third sprocket wheel 7 being journalled in the outer end of an angularly adjustable arm 8. Running over the sprocket wheels 5, 6 and 7 is an endless conveyor chain 9. The endless conveyor assembly, comprising the sprocket wheels 5, 6 and 7 and endless chain 9, is one of a plurality of laterally-spaced conveyor units. Connected to each of the conveyor chains 9 are sheet-propelling devices adapted to loosely engage the rear edges of successive sheets which are removed one by one from the bottom of the pile. For this purpose, each of the conveyor chains 9 is provided at regularly spaced intervals with a number of laterally projecting pins 10 upon the oppositely-presented ends of which are pivotally mounted the sheet-engaging members 11 of a plurality of said sheet-propelling devices, each of said sheet-engaging members 11 being pivotally connected by pins 12 to other sheet-engaging members 13 which trail behind the members 11 under the constraint of cam-rollers 14 operating between suitable cam-tracks 15 as shown, described, and claimed in U. S. Patent, No. 1,647,819, which was granted in my name under date of November 1, 1927.

By an inspection of Figure 1 of the drawings, it will be understood that during the upwardly-inclined approach of each of the sheet-gripping devices toward the sprocket wheels 5, the sheet-engaging members are flexed with respect to each other until the cam-rollers 14 enter the laterally-spaced arcuate slots 16 which are formed between cam-tracks 17 and 18. Said cam-tracks 17 and 18 extend upwardly around the axis of shaft 3

and gradually diverge from the outer peripheries of the sprocket wheels 5 mounted on said shaft. Reaching their greatest height at or near a vertical plane through the axis of shaft 3, said cam-tracks are inclined downwardly toward the right of Figure 1 and are brought into parallelism with the track-bars 19 which support the forwardly-moving portions of the upper runs of chains 9. Arranged above and toward the right of shaft 3, is a substantially triangular guide-block 19^a which is arranged to deflect each of the conveyor chains 9 upwardly as it leaves the sprocket wheel 5. The effect of this construction and arrangement of parts is to straighten out the sheet-engaging members and to bring them together about the rear edge of a sheet which is delivered thereto in the manner to be hereinafter pointed out.

Arranged in alignment but spaced laterally from each other across the feed table are a plurality of slide-supports 20, said slide-supports being provided with elevated shelves or ledges 21 which are inclined forwardly and downwardly and in alignment with the upper edges of laterally-spaced ribs 22 with which said slide-supports are provided. A plurality of laterally-spaced slides 23 which slide on said shelves or ledges and the upper edges of said ribs 22, are thereby adapted to support the rear end of a pile of cardboard or other relatively heavy material at a higher elevation than the forward end of said pile resting upon the feed-table. As shown in Figures 2, 4 and 5, each of said slides is provided with rearwardly-presented bifurcated arms 24 which carry pins 25, a connecting link 26 being connected at one end to each pin 25, and at its other end to a pin 27 in the bifurcated lower end 28 of a rock-arm 29. The split hub portions of the rock-arms 29 are mounted on a rock-shaft 30, said rock-shaft being oscillatably mounted in bearings 31. As shown in Figures 4 and 5, the slides 23 more or less overhang the forward edges of the shelves or ledges according to the angular position of the rock-arms 29. Secured to the forward edge of each of the slides 23 are rearwardly-presented spring blades 32, and upon the rear edges of these spring blades are mounted cleats or pusher bars 33. Said cleats or pusher bars are adapted to engage the rear edges of successive bottom sheets of the pile for imparting the preliminary sheet-separating movements to successive bottom sheets of the pile. As shown in Figures 3, 4 and 5, suitable guide strips 47 are secured to the upper edges of ribs 22 and arranged to overhang the lateral edges of the slides 23 for constraining them to a reciprocatory movement in a plane immediately below the bottom sheet of the pile. Secured to the rear vertical wall of a squared transverse bar 34 are a plurality of coaxially arranged bearing brackets 35 which carry a rock-shaft 36. Secured to this rock-shaft by means of bolts 37 are a plurality of laterally-spaced lifting blades or arms 38 which are preferably arranged in the same vertical planes with the endless conveyors 9. It will be understood from the above description and by a reference to Figure 2 of the drawings, that the lifting arms or blades are interposed between adjacent pusher plates or slides, the former being actuated upwardly shortly after the latter have started the bottom sheet of the pile on its forward movement. As the lifting arms 38 move upwardly to elevate the rear end of the pile remainder from the forwardly-displaced bottom sheet, said bottom sheet is left free along its rear edge for the unobstructed forward movement of the sheet-propelling grippers as indicated in Figure 5. During the interval of time that the bottom sheet is being separated from the pile by the combined action of the slides 23 and lifting arms 38, the rear-edge sheet-engaging devices overtake the slides 23 while the latter are moving forwardly, the separated bottom sheet being thus fed off under a flying start. Suitable means for oscillating the rock-shafts 30 and 36 in properly timed relations to each other and for properly correlating the movements of these rock-shafts with the preliminary sheet-separating movements of the rear-edge sheet-engaging devices, may be provided as follows.

Referring now to Figures 1, 3 and 7, the inclined power-driven connecting rod 39 has its upper end 40 (see Figure 3) pivotally connected by a pin 41 to the lower end of a rock-arm 42 which is secured to the outer end of the rock-shaft 30. Secured to the rock-shaft 30 next to the rock-arm 42 is a sector-shaped cam-block 43 which carries an inset cam-plate 44. As shown best in Figure 7, the cam-plate 44 is provided with an inwardly-presented cam-groove 45 comprising an outer portion concentric with the rock-shaft 30 and with an upwardly extending portion which is deflected towards said rock-shaft. Operating in this cam-groove is a cam-roller 46 journalled on a pin 47 which projects laterally from the outer end of a cam-arm 47, said cam-arm being keyed to the rock-shaft 36. The arcuate concentric portion of the cam-groove 45 permits the pile-lifting arms to fall below the slides as shown in dotted lines in Figure 4, and the inwardly-deflected portion of said cam-groove operates to elevate said lifting arms as shown in Figures 1 and 5.

A front-guide assembly, which is represented in Figure 1 of the drawings by the reference character 48, includes two yieldably mounted sheet-engaging and controlling devices of substantially similar construction to those shown and described in my U. S. Patent No. 1,643,646, which was granted under date of September 27, 1927. These devices are

supported directly above the feed table or platform and form therewith controlling delivery throats. According to the embodiment of my invention, shown on the drawings, as a completely separated sheet is delivered from the pile by the movement of the rear-edge sheet-engaging devices, the forward edge of said sheet is presented to feed rolls C and B which move the sheet forwardly from the machine.

As shown in Figures 1 and 2, laterally-spaced guards or bands 49, which comprise vertical and horizontal portions extending in the rear and above the rock-shafts 30 and 36, may be secured at their forward ends to the transverse bar, their downwardly-presented ends being secured to the feed table.

Operation

Briefly described, the operation of my improved sheet-feeding machine is as follows:—

A pile of sheets having been stacked between the inclined guide surfaces of the front and rear guides, as shown in Figure 1, a preliminary separating movement is imparted to the bottom sheet of the pile by the forward movement of the slides 23 which operate through the resiliently-mounted pusher-bars 33. During the early portion of this movement, the spring-blades 32 are depressed under the weight of the pile. After a short travel of said slides, however, the lifting arms 38 on their upward swing, lift the rear edge of the pile remainder and thus permit the unencumbered movement of the rear-edge sheet-engaging devices to overtake and engage the rear edge of the forwardly-moving sheet. As the superimposed load is lifted from the rear edge of the forwardly displaced bottom sheet, there may be a tendency for said sheet to curl or warp, or there may be mutilated portions in the rear edge of the sheet which tend to raise said rear edge out of the path of travel of a fixed slide. According to my present invention, this tendency or condition is compensated for by the upward spring of the pusher bars 33 due to the resilience of spring-blades 32 which operate to elevate the pusher-bars 33 to the required degree to maintain them in engagement with the rear edge of the sheet. According to the present embodiment of my invention, the rear-edge sheet-engaging devices carried by the conveyors overtake the rear edge of the separated bottom sheet before the resiliently-mounted pushers have reached the limit of their forward movement and preferably accelerate said movement above the maximum velocity imparted by the slides 23.

I claim:—

1. In a sheet feeding machine, the combination with a supporting shelf extending along and under the rear edge of a pile of sheets, a yieldably supported sheet-pusher reciprocably mounted on said shelf for imparting preliminary separating movements to successive bottom sheets of said pile, and means movable transversely to and across the reciprocatory path of said sheet pusher into and out of elevating engagement with the rear end of the remainder of said pile.

2. In a sheet feeding machine, the combination of means for supporting a pile of sheets, a rock-shaft, a rock-arm mounted on said rock-shaft, a slide movably connected to said rock-arm, a sheet-pusher resiliently mounted on said slide for imparting preliminary sheet-separating movements to successive bottom sheets of the pile, and a pivotally-mounted lever operatably connected to said rock-shaft and movable thereby into elevating engagement with the rear end of the remainder of said pile.

3. In a sheet feeding machine, the combination of pile supporting means including an elevated shelf arranged below the rear edge of a pile of sheets, a slide reciprocable on said shelf, pushers operated by said slide for imparting relative forward displacements to successive bottom sheets of the pile, spring blades connecting said pushers to said slide, said spring blades tending to elevate said pushers relatively to said slide, and means for elevating the rear end of the pile remainder.

4. In a sheet feeding machine, the combination of means for supporting a pile of sheets including a reciprocatory slide arranged below the rear edge of a pile of sheets, spring arms secured at their forward ends to said slide and presented rearwardly thereon, a pusher mounted on the rear ends of said spring arms, said spring arms imparting an upward tendency to said pusher, a lever mounted on a fixed axis for momentarily elevating the rear end of the remainder of said pile, and means for reciprocating said slide and oscillating said lever for imparting relative forward movements to successive bottom sheets of said pile.

5. In a sheet feeding machine, the combination of means for supporting the rear edge of a pile of sheets, said supporting means including a yieldably-mounted pusher movable into and out of engagement with the rear edges of successive bottom sheets of the pile for imparting relative forward movements thereto, means for periodically elevating the rear end of the remainder of said pile, and mechanism for feeding-off successive forwardly-displaced bottom sheets.

6. In a sheet feeding machine, the combination with a shelf extending under the rear end of a pile of sheets, of a yieldably-mounted sheet pusher movable above said shelf at the rear of said pile for imparting relative forward movements to successive bottom sheets of said pile, means for ele-

vating the rear end of the undisplaced remainder of said pile, said means including a pivotally-mounted lever movable into and out of engagement with the pile remainder, and fed-off mechanism for the forwardly displaced bottom sheets.

7. In a sheet feeding machine, the combination of front and rear edge guides for a pile of sheets, a shelf extending below the rear edge guide, a slide reciprocably mounted on said shelf, means yieldably mounted on said slide for engaging successive bottom sheets of the pile, means for momentarily elevating the rear end of the pile remainder, and means movable below the elevated end of said pile remainder and forwardly along the bottom of said pile and into engagement with a forwardly-dislpaced bottom sheet for feeding-off said bottom sheet from the pile.

8. In a sheet feeding machine, the combination of a feed table, means for supporting a pile of sheets above said feed table, a rock-shaft, a rock-arm mounted on said rock-shaft, a slide pivotally connected to said rock-arm, a sheet-pusher resiliently mounted on said slide and movable thereby into displacing engagement with successive bottom sheets of the pile, a pivotally-mounted lever operatively connected to said rock-shaft and movable thereby into elevating engagement with the rear end of the remainder of said pile, and feed-off mechanism movable over said feed table for removing the displaced bottom sheets.

9. In a sheet feeding machine, the combination of a feed table, pile supporting means including a shelf spaced above said feed table and a slide reciprocable on said shelf, pushers operating above said slide for imparting relative forward displacements to successive bottom sheets of the pile, spring blades connecting said pushers to said slide and tending to elevate said pushers relatively to said slide, a pivotally-mounted lever for elevating the rear end of the pile remainder, and a feed-off carrier operating above said feed table and below the elevated rear end of the pile remainder for removing the successive bottom sheets from said pile.

10. In a sheet feeding machine, the combination with a table over which successive bottom sheets are fed-off from said pile, of means for supporting the rear end of said pile of sheets, at an elevation with respect to said table, said supporting means being provided with a yieldably-mounted pusher movable into and out of engagement with the rear edges of successive bottom sheets in said pile for imparting relative forward movements thereto, and means for momentarily elevating the rear end of the remainder of said pile of sheets.

11. In a sheet feeding machine, the combination with a table over which successive bottom sheets are fed-off from a pile of sheets resting along its forward edge on said table, of a shelf raised above said feed tables and extending under the rear edge of said pile of sheets, a yieldably-mounted sheet pusher movable above said shelf at the rear of said pile for imparting relative forward movements to successive bottom sheets of said pile, and means for momentarily elevating the rear end of the undisplaced remainder of said pile.

12. In a sheet feeding machine, the combination with a feed table, of front and rear guide assemblies for a pile of sheets, said rear guide assembly including a shelf extending above and transversely with respect to said feed table, means yieldably mounted on said shelf and reciprocable thereon for displacing successive individual sheets, means for momentarily elevating the rear end of the pile remainder, and means for feeding-off the bottom sheet from the pile.

13. In a sheet feeding machine, the combination with a feed-table, of front and rear edge guide assemblies for a pile of sheets, said feed-table being adapted to support the forward end of said pile, a raised shelf for supporting the rear edge of the pile above said feed-table, a sheet pusher resiliently and reciprocably mounted on said shelf for imparting preliminary separating movements to successive bottom sheets of said pile, means for momentarily elevating the rear end of the remainder of said pile, and feed-off mechanism for moving successive bottom sheets over said feed-table after their preliminary separation from the pile.

14. In a sheet feeding machine, the combination of a feed table, a raised shelf for supporting the rear end of a pile of sheets above said feed table, a rock-shaft, a rock-arm mounted on said rock-shaft, a slide reciprocable on said shelf and connected to said rock-arm, rearwardly-presented springs mounted on said slide, a sheet-pusher mounted on the rear ends of said springs and movable into displacing engagement with successive bottom sheets of the pile, means operated by said rock-shaft for momentarily elevating the rear end of the remainder of said pile, and feed-off mechanism for removing the displaced bottom sheets.

15. In a sheet feeding machine, the combination of a feed table, a shelf spaced above said feed table for supporting the rear end of a pile of sheets, a slide reciprocable on said shelf, pushers operating above said slide for imparting relative forward displacements to successive bottom sheets of the pile, spring blades connecting said pushers to said slide and tending to elevate said pushers relatively to said slide, said spring blades being depressed under tension due to the weight of the rear end of said pile, a pivotally-mounted lever for elevating the rear end of the pile remainder, and a feed-off carrier

operating above said feed table and below the elevated rear end of the pile remainder for removing the successive bottom sheets from said pile.

16. In a sheet feeding machine, the combination with means for feeding-off successive sheets separated from the bottom of a pile of sheets, of means arranged above the path of movement of said sheet feeding-off means and reciprocable in a plane inclined to said path for supporting the rear edge of said pile of sheets, said rear edge pile-supporting means being provided with a yieldably-mounted rear-edge pusher adapted to impart a preliminary sheet-forwarding movement to the bottom sheet of a pile, and means for momentarily elevating the rear edge of the pile-remainder.

17. In a sheet feeding machine, the combination with rear-edge sheet-engaging means movable across and below a pile of sheets for feeding-off partially separated sheets from the bottom of a pile, of a slide reciprocable relatively to said rear-edge sheet-engaging means, and a yieldably-mounted pusher movable by said slide into and out of the path of said rear-edge sheet-engaging means.

18. In a sheet feeding machine, the combination of rear-edge sheet-engaging means for feeding-off sheets from the bottom of a pile, of a slide reciprocable relatively to said rear-edge sheet-engaging means, a pusher yieldably-mounted on and movable by said slide into and out of the path of said rear-edge sheet-engaging means, and means movable relatively to said pusher for periodically elevating the rear end of the remainder of said pile.

19. In a sheet feeding machine, the combination with means for feeding-off sheets from the bottom of a pile of sheets, a reciprocatory slide, a sheet pusher resiliently mounted on said slide for moving the rear edges of successive bottom sheets of said pile into the path of said feeding-off means, means for elevating the rear end of the undisplaced remainder of said pile, and coordinated rock-shafts operably connected to said slide and rear-end elevating means respectively.

20. In a sheet feeding machine, the combination of an endless conveyor provided with rear-edge sheet-engaging means, a slide reciprocable below the bottom of a pile of sheets, a sheet-feeding hook yieldably mounted on said slide for moving the rear edges of successive bottom sheets into the path of the rear-edge sheet-engaging means on the endless conveyor, and a lever for momentarily elevating the pile remainder during the transfer of each successive bottom sheet from said sheet-feeding hook on the slide to the sheet-engaging means carried by the endless conveyor.

21. In a sheet-separating machine, the combination with a pile-supporting table provided with a forwardly-inclined shelf elevated above the plane of said pile-supporting table and arranged to support the rear edge of said pile at higher elevation than the forward edge thereof, of a slide reciprocable on said shelf below the bottom of said pile, a pusher resiliently mounted on said slide and adapted by the reciprocatory movements of the latter to be moved forwardly into engagement with the rear edge of each successive bottom sheet of the pile for imparting a preliminary sheet-separating movement thereto, rear-edge elevating means for the pile-remainder, and coordinately operated rock-shafts for respectively reciprocating said slide and operating said rear-edge elevating means.

22. In a sheet-separating machine, the combination with a pile-supporting table provided with a forwardly-inclined shelf elevated above the plane of said pile-supporting table and arranged to support the rear edge of said pile at higher elevation than the forward edge thereof, of a slide reciprocable on said shelf below the bottom of said pile, a pusher resiliently mounted on said slide and adapted by the reciprocatory movements of the latter to be moved forwardly into engagement with the rear edge of each successive bottom sheet of the pile for imparting a preliminary sheet-separating movement thereto, rear-edge elevating means for the pile-remainder, and means movable past said resiliently-mounted pusher in its advanced position and across said pile-supporting table for feeding-off the successively separated sheets.

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