Aug. 9, 1932. E. S. LINCOLN 1,870,338

SHEET FEEDING APPARATUS

Filed June 11, 1930 3 Sheets-Sheet 1

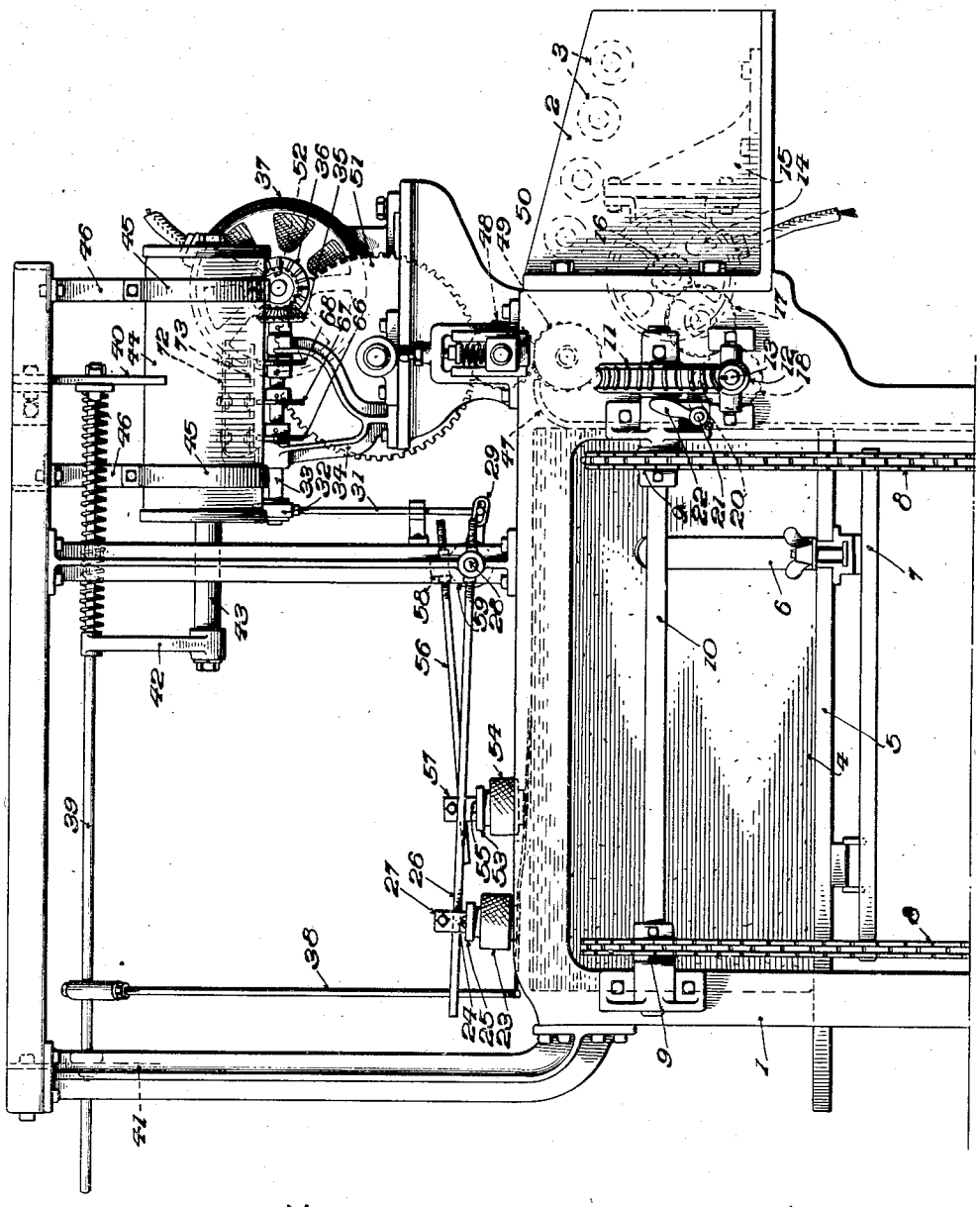


Fig. 1.

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SHEET FEEDING APPARATUS

Filed June 11, 1930 3 Sheets-Sheet 2

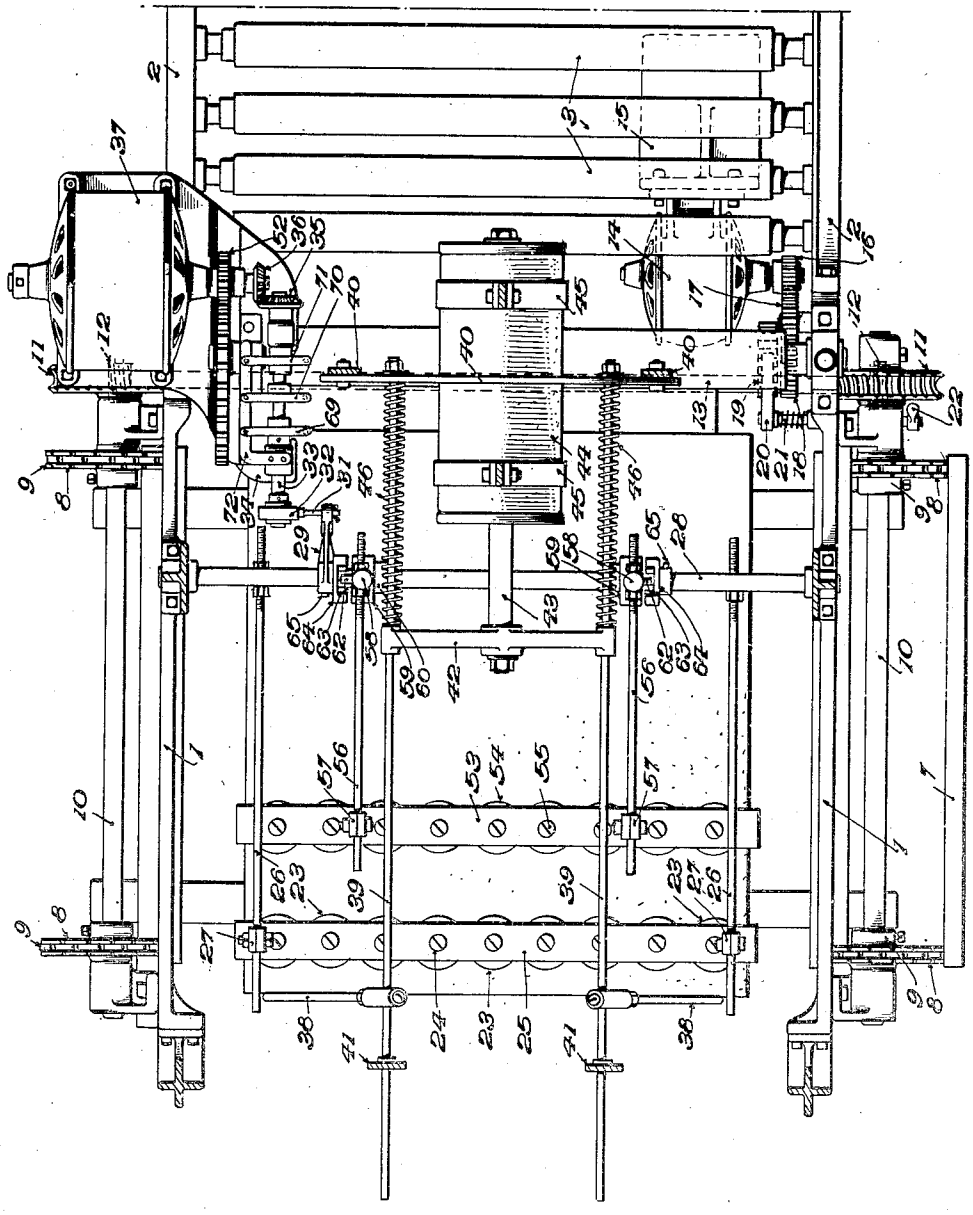


Fig. 2.

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SHEET FEEDING APPARATUS

Filed June 11, 1930 3 Sheets-Sheet 3

Fig. 3.

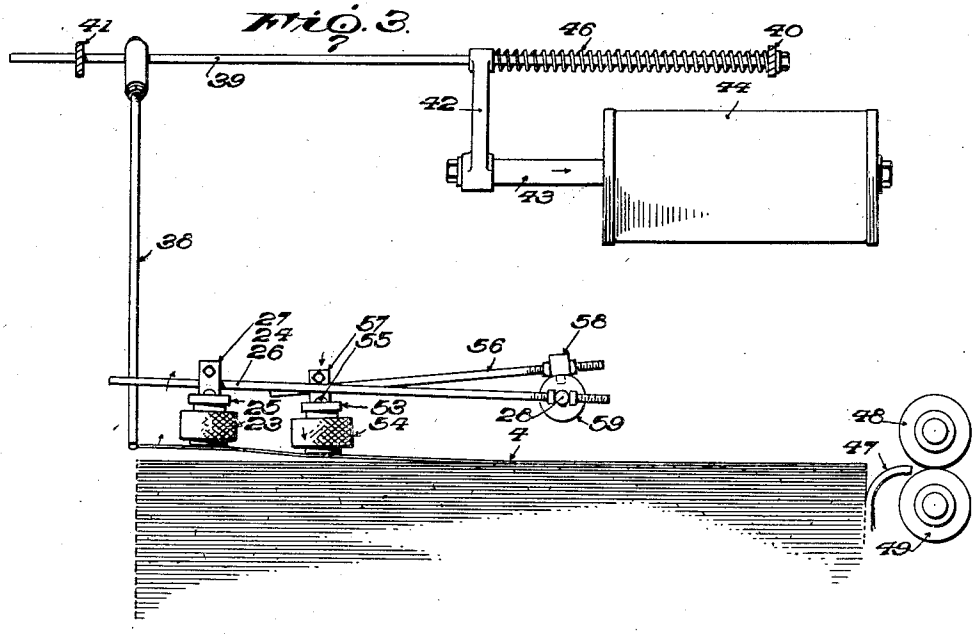


Fig. 4.

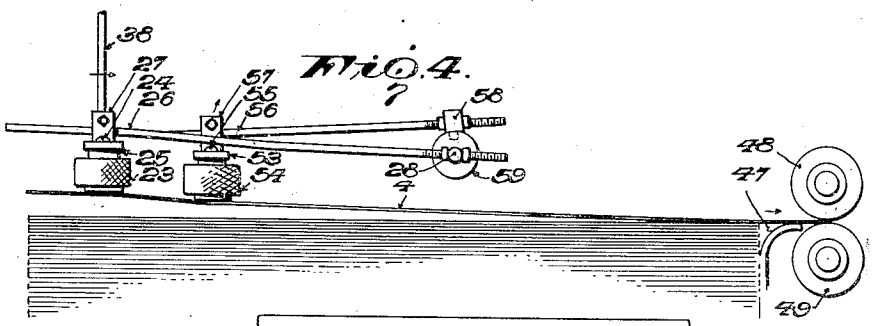
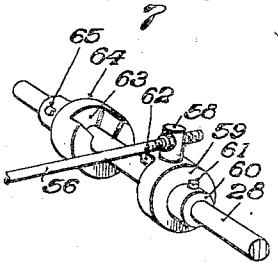


Fig. 6.



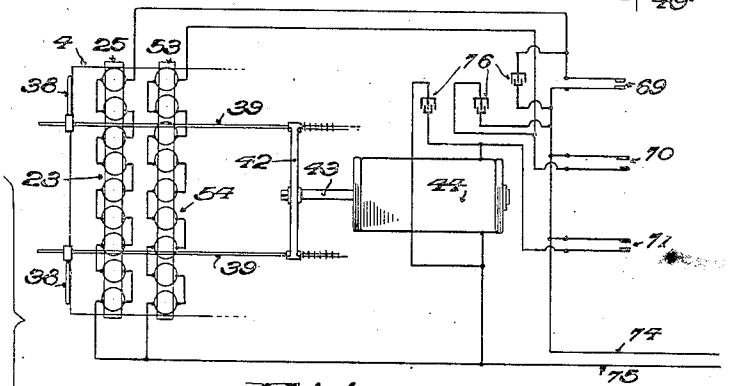


Fig. 5.

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Patented Aug. 9, 1932 1,870,338

UNITED STATES PATENT OFFICE

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SHEET FEEDING APPARATUS

Application filed June 11, 1930. Serial No. 460,529.

This invention relates to means for separating and lifting sheets one by one from a stack, and more particularly to means for feeding sheets of magnetic material.

Heretofore in apparatus of this character considerable difficulty has been experienced in preventing the picking up of more than one sheet at a time. Due to the fact that the metallic sheets, of tin, for example, tend to stick together until air is admitted between them, it often happens that the second sheet is carried up with the top sheet and two sheets are fed at the same time. A greater difficulty, however, resides in the fact that where lifting magnets are employed, the lifting flux tends to penetrate the top sheet and to exert an attractive effort on the second sheet, so that the second sheet is picked up at the same time with the top sheet. Various means of controlling the magnetic flux to prevent this penetration have heretofore been suggested, but it has been found that when the flux of a magnet is cut down to the point where it will not penetrate the sheets, the lifting effort obtained is generally too small to insure reliable operation.

One of the objects of this invention is to provide novel magnetic sheet separating means that will reliably separate sheets one by one from a stack at a rapid rate.

Another object is to provide novel magnetic sheet separating and lifting means whereby the flux is distributed over a large sheet area, so that sufficient lifting effort may be obtained without unduly concentrating the flux at any one point.

Another object is to provide novel magnetic sheet separating and lifting means of the type embodying means for lifting one portion of the sheet while holding down an adjacent portion to bend the sheets and so effect an initial separation of the sheets.

One embodiment of the invention has been illustrated in the accompanying drawings, but it is to be expressly understood that said drawings are for purposes of illustration only and are not to be construed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

In said drawings—

Fig. 1 is a side elevation of an apparatus embodying this invention;

Fig. 2 is a plan view of Fig. 1;

Figs. 3 and 4 illustrate diagrammatically the respective positions of the mechanism in the cycle of operation;

Fig. 5 is a wiring diagram showing the magnetic circuit; and

Fig. 6 is a detail of a part of the apparatus.

While the separating and feeding mechanism constituting the invention is broadly adapted for and may be employed in the separation and feeding of sheets for any purpose, the drawings show the invention embodied in an apparatus for separating and feeding sheets of magnetic material, such as tin, from a stack to a feed or conveying table. Accordingly, a supporting frame 1 of any suitable construction and material, whereby the separating and feeding mechanism is supported, is associated with a feed table 2 of any suitable type that is provided with conveying rollers 3. A stack or pile of sheets 4, in this instance tin, is supported by a suitable table 5 that is preferably provided with suitable side register devices 6. The table 5 is carried by an elevating mechanism of any suitable type and in the form shown, rests on flights 7 secured to elevator chains 8, the latter passing over and being driven by sprocket wheels 9 mounted on a pair of shafts 10, one at each side of the frame.

For the purpose of rotating the sprocket wheels 9 to drive the elevator chain, each of the shafts 10 preferably carries a worm gear 11 meshing with a worm 12, the latter being mounted on a shaft 13 that rotates in suitable bearings formed on the frame 1. Any suitable means may be employed to rotate the shaft 13 to elevate the table 5, and in the form shown, an electric motor 14, which is suitably mounted on a bracket 15 constituting a part of the frame of the feed table 2, carries a pinion 16 on its shaft meshing with an idler 17, which in turn drives a pinion 18 on the shaft 13. The motor 14 may be controlled either manually or automatically in any suitable manner to maintain the top sheet of the stack at the proper elevation. The table 5 is maintained in its elevated position by means

of a ratchet 19 on the shaft 13, with which cooperates a pawl 20 that is carried by a shaft 21 mounted in the frame 1 and provided on its outer end with a handle 22. It is to be expressly understood, however, that the above described pile elevating mechanism is shown for purposes of illustration only and constitutes no part per se of the present invention.

In the embodiment of the invention illustrated, where sheets of magnetic material are to be fed, magnetic means are preferably provided for lifting the rear portion or edge of the sheet from the pile, whereupon the elevated rear portion is engaged by reciprocating feeding means and pushed forwardly off the pile. Preferably a plurality of magnets of small strength are employed, said magnets being mechanically combined so that their total lifting effort is available to raise a portion of the sheet, but at the same time the magnetic flux is not over-concentrated at any one point. As shown, a plurality of electro-magnets 23 are secured in any suitable manner, as by means of screws 24, to a support 25 in the form of a straight bar extending across the rear edge of the sheet, so that as the bar 25 is raised the entire rear edge of the sheet is picked up and separated from the next adjacent sheet. Preferably adjacent magnets 23 have opposite polarities in order to distribute the flux along the sheet. The supporting bar 25 may be raised or lowered in any suitable manner, as by means of rocking arms or rods 26 that pass through clamps or brackets 27 secured to the bar 25 and are rigidly secured to a transverse oscillating shaft 28 rotating in suitable bearings formed in the frame 1. A rock arm 29 that is secured to said shaft 28 has a pin and slot connection 30 with a rod 31, which is reciprocated vertically by suitable means such as an eccentric 32. Shaft 33, to which the eccentric 32 is secured, rotates in suitable bearings formed in a bracket 34 secured to the frame, and carries a bevel gear 35 meshing with a bevel gear 36 on the shaft of an electric motor 37. Rotation of the motor 37, through the eccentric 32 and rock arm 29, oscillates the shaft 28, whereby the supporting bar 25 and magnets 23 are alternately lowered into contact with the top sheet of a stack and then raised to the position shown in the drawings, carrying with them the rear edge of the top sheet.

Suitable means are provided that are movable into engagement with the elevated rear edge of the top sheet to feed the same forwardly off the pile 4. In the form shown, a pair of feeding fingers 38 are secured to reciprocating rods 39 that slide in suitable openings formed in front and rear supporting members 40 and 41 respectively. Preferably, said rods are reciprocated by a V-shaped bracket 42 that has its arms secured to the rods 39, thereby connecting them with the plunger 43 of a solenoid 44 which is hung by means of straps 45 and brackets 46 from the frame 1. When the solenoid 44 is energized, the plunger 43 is pulled inwardly, thereby moving the rods 39 forwardly against the tension of suitable resilient means which, as shown, comprise springs 46 surrounding said rods and interposed between the bracket 42 and the supporting member 40. When the solenoid is deenergized springs 46 push the rods 39 back to the position shown in the drawings. This reciprocating motion of the rods causes the feeding fingers 38 to move forwardly into engagement with the elevated rear edge of the top sheet and to move the same forwardly until the front edge of the sheet passes over a curved guide plate 47 and is engaged by rotating feed rollers 48, 49 as clearly shown in Fig. 4, the feeding fingers then being retracted by the springs 46 until the next sheet has been elevated. The feed rollers 48, 49 are rotated by any suitable means such as intermeshing gears 50 carried thereby, one of the gears 50 meshing with and being driven by an idler 51 that meshes with a pinion 52 on the shaft of the motor 37.

Preferably, means are provided for holding down that portion of the sheet immediately adjacent the rear edge portion that is engaged by the magnets 23, so that as said magnets are lifted the sheet will be bent or flexed to effect the initial separation thereof from the next adjacent sheet. In the form shown, additional magnets are employed to this end, said additional magnets holding down the sheet while the rear edge thereof is being bent up and thereafter being elevated and preferably energized to assist in elevating the rear portion of the sheet. As shown, a second supporting bar 53 carries a plurality of electro-magnets 54 secured thereto in any suitable manner as by screws 55, adjacent magnets preferably having opposite polarities. The support 53 is alternately raised and lowered by means of oscillating arms or rods 56 passing through clamps or brackets 57 secured to the bar 53 and operated by the transverse shaft 28. A suitable lost motion connection is provided between rods 56 and shaft 28 so that as the shaft rotates it first raises the bar 25, leaving the bar 53 and its magnets resting on the pile, and as it continues to rotate, picks up the rods 56 and raises the bar 53 together with the bar 25. In the form shown, rods 56 pass through and are secured to posts 58 that are mounted on collars or sleeves 59 rotating freely on the shaft 28 but held against longitudinal movement thereon by means of a collar 60 and set screw 61. Each of the members 59 is provided with a projection or tooth 62 engaging in a notch or recess 63 in a sleeve or collar 64 that is rigidly secured to the shaft 28 in any suitable manner, as by

means of a set screw 65. When the shaft 28 rotates, rods 26 are rocked to raise bar 25 and magnets 23, and sleeves 64 turn with the shaft, but sleeves 59 turn on the shaft due to the weight of the bar 53 and magnets 54. When the shaft 28 has rotated through an angular distance such that the tooth 62 is engaged by one of the side walls of the notch 63, rods 26 and rods 56 rotate together and bars 25 and 53 are elevated simultaneously.

Suitable means are provided for controlling the circuits of the various magnets in timed relation to the rotation of the shaft 28 in order to obtain the proper cycle of operation. In the form shown, this is accomplished by a plurality of cams 66, 67 and 68 secured to and rotating with the shaft 33 and each adapted to operate a pair of contacts 69, 70 and 71 respectively, in a manner well known in the art. The upper contacts of each pair may be suitably mounted on a bar 72 suitably secured to the frame, while the lower contacts are secured to a similar bar 73 and when engaged by the high points of the cams are bent upwardly to engage the upper contacts.

The operation of this apparatus will be understood from the foregoing description, taken in connection with Fig. 5 showing the wiring connections for the magnetic circuits. Obviously the arrangement and operation of the circuits may be such as to provide any suitable operation of the apparatus. In the arrangement to be described, three circuits are provided, one for the magnets 23 in series, one for the magnets 54 in series, and one for the solenoid 44. Contacts 69 complete a circuit from main 74 through the magnets 23 in series to the main 75. Contacts 70 complete a circuit from main 74 through magnets 54 to main 75. Contacts 71 complete a circuit from main 74 through solenoid 44 to the main 75. Each pair of contacts 69, 70 and 71 is preferably shunted by a condenser 76 in order to prevent arcing when the contacts open.

In operation, assuming the feeding fingers 38 to be retracted, and the supporting bars 25 and 53 lowered until magnets 23 and 54 rest on the top of the stack, cam 66 operates to close the contracts 69 by energizing the magnets 23. Substantially simultaneously the shaft 28 begins to rotate in the proper direction to raise the magnets 23 which attract and carry up with them the rear edge of the top sheet. The bar 53 and the magnets 54, however, due to the lost motion connection between rods 56 and the shaft 28, remain at rest on the stack due to their own weight and cause the top sheet to be bent, as shown in Fig. 1, to effect the initial separation thereof from the next adjacent sheet. Shortly thereafter the tooth 62 is engaged by the wall of the notch 63, whereupon bar 53 is raised together with bar 25, and substantially simultaneously or slightly before the engagement of the tooth 62 with the notch 63, cam 67 closes contacts 70 and energizes magnets 54 so that the latter aid in lifting the sheets as shown in Fig. 3. At this point, cam 68 closes contacts 71 and energizes solenoid 44, whereupon the feeding fingers 38 are pulled forwardly into engagement with the elevated edge of the top sheet and push said sheet forwardly to feed it to the rollers 48, 49 as above described. Preferably, the cams 66 and 67 permit contacts 69 and 70 to open as the sheet is pushed forwardly so that it is released from the magnets. However, the magnets may be caused to keep the rear edge elevated, since the fingers 38 will slide the sheet forwardly off the magnets until it is engaged by the feed rollers, and therefore the magnets 23 and 54 may remain constantly energized if desired. As soon as the sheet has been pushed forward, cam 68 permits contacts 71 to open whereupon solenoid 44 is deenergized and springs 46 push the feeding fingers 38 back clear of the stack. At the same time the rotation of shaft 28 is reversed in direction. and the supporting bars 25 and 53 are lowered into engagement with the stack, whereupon the operation is continued as before.

The apparatus described above is simple, economical to construct and manufacture, and at the same time provides rapid and reliable separation of sheets one by one from the top of a stack of sheets. The extreme simplicity of the device and the elimination of all complicated mechanical movements and the like renders this apparatus particularly free from service difficulties and the like. The distribution of the magnetic lifting effort over a large sheet area renders possible the use of a plurality of magnets of small strength so that a distributed flux of low density is obtained and penetration of the flux through the top sheet is thereby prevented. This arrangement, in combination with the initial bending of the rear edge portion of the sheet to positively separate the same from the next adjacent sheet, practically prevents more than one sheet being picked up at one time.

While only one embodiment of the invention has been described and illustrated in the drawings, it will be understood that the same is capable of a variety of mechanical expressions, and that changes may be made in the form, details of construction, and arrangement of the parts, without departing from the spirit of the invention. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:—

1. In apparatus of the class described, the combination of a plurality of vertically movable supports, lifting means carried by said supports, a common operating shaft for said

supports, and a lost motion connection between one of said supports and said shaft.

2. In apparatus of the class described, the combination of a plurality of vertically movable supports, lifting means carried by said supports, an oscillating shaft, a rock arm connecting each of said supports with said shaft, and a lost motion connection between one of said rock arms and said shaft.

3. In apparatus of the class described, the combination of a pair of movable supports, lifting means carried by said supports, an oscillating shaft, an arm secured to one of said supports and connected with said shaft to rotate therewith and to raise and lower said support, an arm secured to said other support, and means connecting said last named arm with said shaft, said means permitting a limited rotation of said shaft before said arm is moved to raise and lower said other support.

4. In apparatus of the class described, the combination of a plurality of vertically movable supports, lifting means carried by said supports and adapted to lift a portion of the sheet from a pile, a common operating shaft for said supports, a lost motion connection between one of said supports and said shaft, and means movable into engagement with the elevated portion of said sheet to feed it off the pile.

5. In apparatus of the class described, the combination of a plurality of movable supports, lifting magnets carried by said supports and adapted to raise a portion of a sheet from a pile, an oscillating shaft, a rock arm connecting each of said supports with said shafts, a lost motion connection between one of said rock arms and said shaft, and magnetically operable means movable into engagement with the elevated portion of the sheet to feed it off the pile.

6. In apparatus of the class described, the combination of a pair of movable supports, lifting means carried by said supports and adapted to raise a portion of a sheet from a pile, a common operating shaft for said supports, an arm secured to one of said supports and connected with said shaft to rotate therewith and to raise and lower said supports, an arm secured to said other support, means connecting said last named arm to said shaft and permitting a limited rotation of said shaft before said arm is moved to raise and lower said other support, means movable into engagement with the elevated portion of the sheet to feed it off the pile, and a magnet for operating said last named means.

7. In apparatus of the class described, the combination of supports extending along the edge of a sheet to be fed, a plurality of lifting magnets spaced along each of said supports and carried thereby, and means for reciprocating said supports adapted to raise one of the same before the other.

8. In apparatus of the class described, the combination of two supports arranged in spaced parallel relation along the edge of a sheet to be fed, a plurality of magnets carried at spaced points along each of said supports, and means for oscillating said supports adapted to raise one of the same before the other.

9. In apparatus of the class described, the combination of a supporting member extending along the edge of a sheet to be fed, a plurality of lifting magnets spaced along said support and carried thereby, said magnets having adjacent poles of the unlike polarity, and means for raising and lowering said support.

10. In apparatus of the class described, the combination of a pair of spaced parallel supports extending along the edge of a sheet to be fed, a plurality of lifting magnets spaced along each of said supports, means for raising one of said supports, the other support resting on the sheet, and means for thereafter raising said other support.

11. In apparatus of the class described, the combination of a pair of spaced parallel supports extending along the edge of a sheet to be fed, a plurality of lifting magnets spaced uniformly along each of said supports, means for raising one of said supports relative to the other, and means for thereafter raising said other support.

12. In apparatus of the class described, the combination of a pair of spaced parallel supports extending along the edge of a sheet to be fed, a plurality of lifting magnets spaced along each of said supports, said magnets having poles of unlike polarities adjacent one another, means for raising one of said supports relative to the other, and means for thereafter raising said other support.

13. In apparatus of the class described, the combination of a pair of spaced parallel supports extending along the edge of a sheet to be fed, a plurality of electro-magnets spaced substantially uniformly along each of said supports, said electro-magnets being wound to provide adjacent poles of unlike polarity, means for raising one of said supports relative to the other, and means for thereafter raising the other support.

14. In apparatus of the class described, the combination of a pair of spaced parallel supports extending along the edge of a sheet to be fed, a plurality of electro-magnets spaced substantially uniformly along each of said supports and wound to provide adjacent poles of unlike polarity, an oscillating shaft, an arm connecting one of said supports with said shaft to raise and lower said supports, and an arm connecting the other of said supports with said shaft to raise and lower said

other support, said last named arm having a lost motion connection with said shaft.

15. In apparatus of the class described, the combination of a pair of spaced supports extending along the edge of a sheet to be fed, a plurality of lifting means spaced along each of said supports, means for raising one of said supports relative to the other to bend the edge of the sheet, means for thereafter raising both of said supports to raise the edge portion of said sheet, and means movable into engagement with the elevated edge portion to feed the sheet off the pile.

16. In apparatus of the class described, the combination of a pair of spaced supports extending along the edge of a sheet to be fed, a plurality of electro-magnets spaced along each of said supports and wound to provide adjacent poles of unlike polarity, means for raising one of said supports relative to the other to bend the edge of the sheet, means for thereafter raising both of said supports to raise the edge portion of the sheet, means movable into engagement with the elevated edge portion to feed the sheet, and a magnet for operating said last named means.

17. In apparatus of the class described, the combination of a plurality of sheet lifting means each movable into engagement with a sheet while it is wholly supported on top of a pile, means for raising one of said means to bend a portion of the sheet away from the pile, and means for thereafter raising another of said means.

18. In apparatus of the class described, the combination of a plurality of sheet lifting means each movable into engagement with a sheet while it is wholly supported on top of a pile, means for raising one of said means while another of said means remains in lowered position to bend the sheet, and means for thereafter raising said other means.

19. In apparatus of the class described, the combination of a plurality of sheet lifting means each movable into engagement with a sheet while it is wholly supported on top of a pile, a common operator for raising said means, and a lost motion connection between one of said means and said operator enabling said plurality of means to be raised successively.

20. In apparatus of the class described, the combination of a plurality of sheet lifting means each movable into engagement with a sheet while it is wholly supported on top of a pile, a common operator for raising said means, and means permitting movement of one of said means relative to the other to cause flexing of the sheet to be lifted.

In testimony whereof I have signed this specification.

EDWIN S. LINCOLN.