M. J. MILMOE.

SHEET FEEDING MECHANISM.

APPLICATION FILED OCT. 25, 1916.

1,315,739.

Patented Sept. 9, 1919.

2 SHEETS—SHEET 1.

Fig. 1.

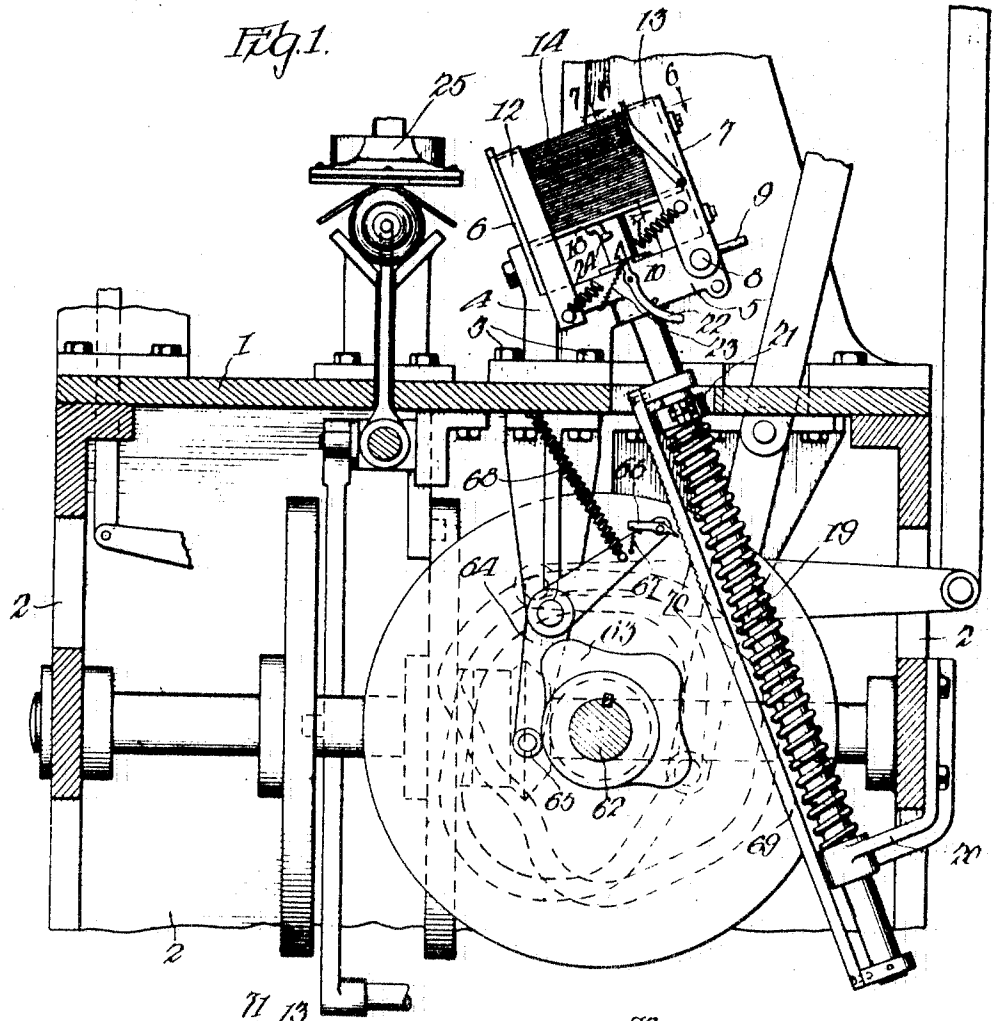


Fig. 6.

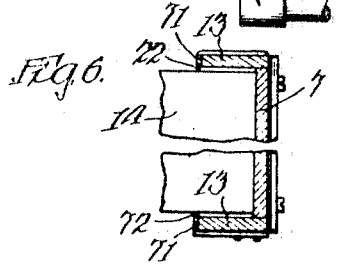
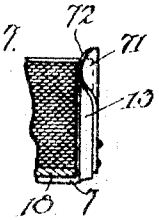


Fig. 7.



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2 SHEETS—SHEET 2.

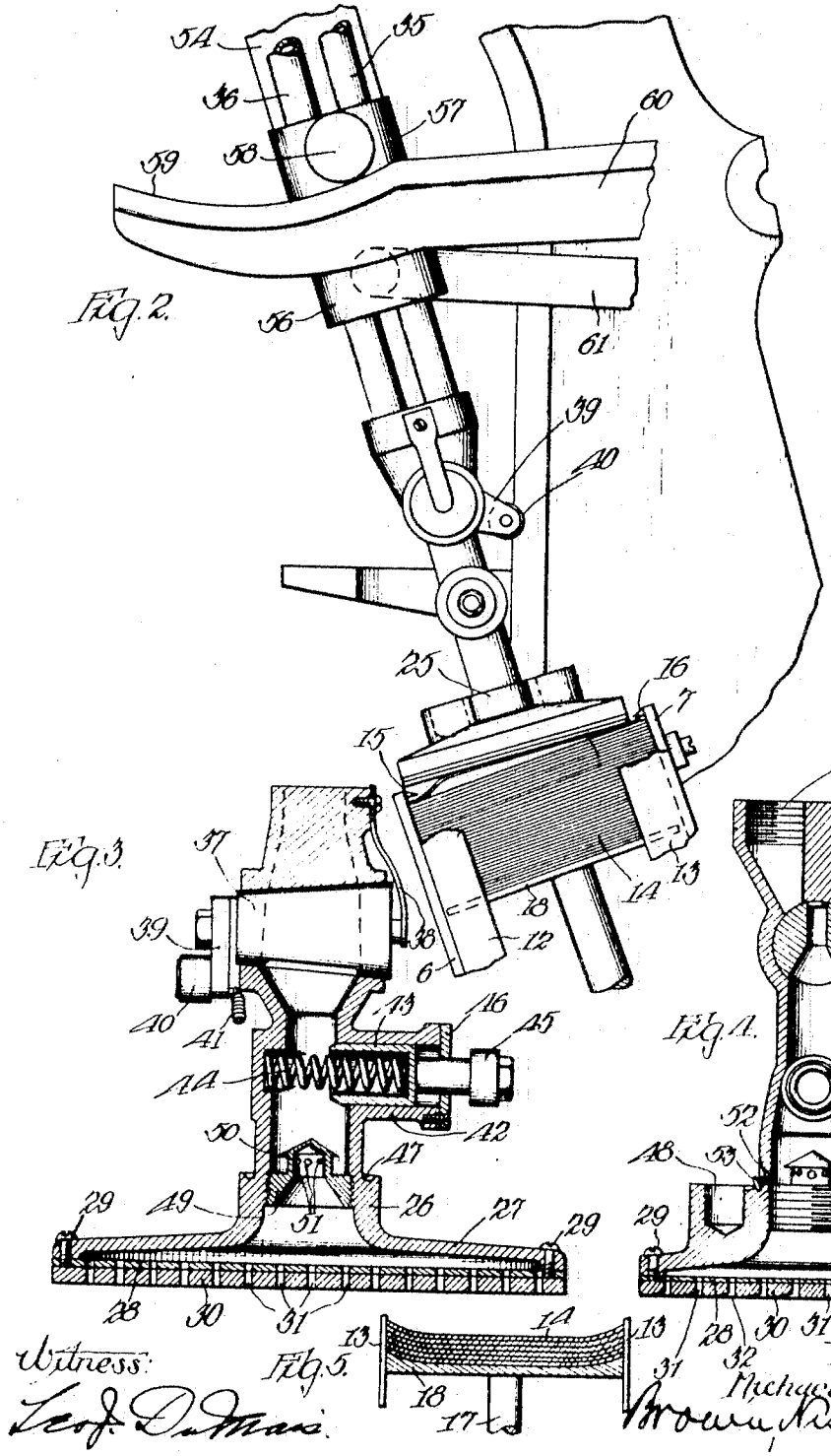

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE.

MICHAEL J. MILMOE, OF CHICAGO, ILLINOIS, ASSIGNOR TO F. B. REDINGTON COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

SHEET-FEEDING MECHANISM.

1,315,739. Specification of Letters Patent. Patented Sept. 9, 1919.

Original application filed January 18, 1915, Serial No. 2,887. Divided and this application filed October 25, 1916. Serial No. 127,616.

To all whom it may concern:

Be it known that I, MICHAEL J. MILMOE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Sheet-Feeding Mechanism, of which the following is a specification.

This application is a division of my copending application for patent on automatic labeling machines, Serial No. 2,887, filed January 18, 1915.

This invention relates to mechanism for feeding thin sheets of material, such as paper, and is illustrated in connection with the labeling machine described and claimed in the application referred to above. The object of the invention is to provide a device of the character named, which shall be of improved construction and operation. The invention is exemplified in the combination and arrangement of parts shown in the accompanying drawings, and described in the following specification, and it is more particularly pointed out in the appended claims. In the drawings—

Figure 1 is a fragmentary sectional view of a portion of an automatic labeling machine showing a part of a feeding mechanism embodying the present invention.

Fig. 2 is a fragmentary elevational view of a portion of the feeding mechanism showing the sheet-carrier in the act of removing a sheet from the magazine.

Figs. 3 and 4 are vertical sectional views taken on planes at right angles to one another of the suction-head comprising a part of the invention; and,

Figs. 5, 6 and 7 are details of the construction of the sheet-holding magazine.

In the drawings, the numeral 1 designates the top of a table-like frame-work carried by supporting members 2. Secured to the upper surface of the table top, by lag screws, is a magazine bracket 4, which has integrally fastened thereto, the bottom member 5 of the sheet-holding magazine. Extending upwardly from the front edge of the bottom member 5, is a wall 6, which constitutes the front wall of the magazine. The rear wall 7 of the magazine is pivotally connected to the base member 5 to swing outwardly about a pivotal center 8. The pivotal movement of the wall 7 is limited by a stop 9, and the wall is resiliently held inwardly by a spring 10. Secured to the upright edges of the walls 6 and 7, are side plates 12 and 13 respectively, which form guards for preventing lateral movement of the sheets of paper 14, or other material, held within the magazine. Projecting inwardly at the upper edges of the walls 6 and 7, are ledges 15 and 16 respectively. The ledge 16 preferably extends across the entire width of the wall 7, while the ledge 15 is preferably merely a comparatively narrow finger extending inwardly from the upper edge of the wall 6 at the central portion thereof.

The bottom member 5 is provided with a central opening, through which an upright rod or bar 17 extends, the bar 17 carrying a plate 18 at its upper end, which forms the supporting plate for the sheets 14 within the magazine. The bar 17 is free to move up and down through the opening in the plate 5, and is normally pressed upwardly by a coil spring 19 which surrounds the bar, and which is supported at its lower end on a bracket member 20 secured to the machine-frame. The upper end of the spring 19 bears against a collar 21, adjustably fastened on the bar 17. A catch 22 is pivoted to the member 5, and is resiliently held in place by a spring 23. The pivoted catch 22 is arranged to coöperate with a fixed catch 24 on the plate 18, to hold the plate and bar 17 in their lowermost position, when desired. It will be seen that the spring 19 normally presses the stack of sheets 14 upwardly, so that the edges of the uppermost sheets in the stack are held against the overhanging ledge 16. The projection 15 is spaced slightly above the upper surface of the sheets.

For the purpose of lifting the sheets 14 one at a time from the magazine, and for transferring these sheets to any mechanism to which they are to be fed, a suction-head or carrier designated generally by the numeral 25 is provided. The construction of this suction-head will best be understood by reference to Figs. 2, 3 and 4. A hollow casting 26 is provided at its lower end with a flaring portion 27, to the lower surface of which a plate 28 is secured by screws 29. The outer surface of the plate 28 is covered by a layer of yielding frictional ma-

terial 30. The covering 30 is preferably of rubber, or similar material, while the plate 28 is preferably made of metal. A series of perforations 31 extend through the plate 28 and the contact covering 30. The outer ends of the perforations 31 located at the front side of the suction-head, as shown in Fig. 4, are provided with connecting grooves 32 cut in the surface of the contact member 30.

The upper end of the suction-head, as shown in Fig. 4, has a pair of threaded openings 33 and 34 arranged to be connected with pipes 35 and 36 respectively, (Fig. 2). The pipes 35 and 36 are connected respectively with pneumatic suction and compression devices by any suitable means, not shown in the drawings, and the interior of the suction-head 25 may be selectively connected with either of these devices by means of a cone-shaped valve 37, held in its seat by a spring 38. The valve 37 is provided with a rocker arm 39, which carries a cam roller 40, and which is normally held in position to connect the suction-head with the suction-pipe 35 by means of a spring 41. Below the valve 37, and extending laterally from the suction-head 25, is a hollow cylindrical projection 42 which connects with the interior of the suction-head, and in which a piston 43 is mounted to slide. The piston 43 is normally pressed outwardly by a spring 44, and it carries a cam roller 45 at its outer end. The end of the projection 42 is covered by a plate 46, which does not make air-tight connection with the sliding extension which carries the roller 45. The piston 43 does however make air-tight connection with the interior of the cylindrical projection 42.

Extending around the suction-head, near the lower portion thereof, is a ditch or groove 47 for the purpose of intercepting oil, or other liquid, which may run downwardly over the surface of the suction-head, thus preventing the oil from coming into contact with the sheets that are lifted by the head. The groove 47 communicates with collection receptacles 48 which receive the oil intercepted by the groove. The receptacles 48 may be provided with waste, or similar material, for absorbing the oil. In order that oil may not drain downwardly on the inside of the suction-head, a threaded plug 49 is secured within the head, which carries a hollow housing 50, provided with openings 51, through which air may pass, but which are so located that oil running down from above will not enter them. Passages 52, provided with ball valves 53 are arranged to permit the oil to drain from the interior of the suction-head into the receptacles 48.

The suction-head is moved by an arm 54, which is pivotally supported in any suitable manner, not shown in the drawings, and which carries a guide 56 secured thereto, through which the pipes 35 and 36 are free to move longitudinally. A collar 57 is secured to the pipes 35 and 36 to move therewith, and carries a projecting stud 58 arranged to rest on a cam surface 59, secured to a pivoted arm 60. A link 61 is pivotally secured to the guide 56, and together with the arm 60, it imparts the necessary movements to the suction-head 25. Any suitable mechanism, not shown, may be provided for moving the arm 60 and the link 61, the arm 60 being arranged to impart up and down motion to the suction-head, while the link 61 swings the suction-head laterally. By combination of these two movements, any desired motion may be imparted to the suction-head.

The mechanism as described is all driven by a main drive shaft 62, which is provided with the requisite cams and connections for imparting the movements to the suction-head. In addition to the cams which operate the head, the shaft 62 is provided with a cam 63, which operates a bell crank lever 64, having a cam roller 65 at one end, which bears against the cam 63, and having a pawl 66 at the opposite end thereof. The point of the pawl 66 is normally held outwardly by a coil spring 67, and a second coil spring 68 holds the cam roller 65 in contact with the surface of the cam 63. A bar 69 is secured to the rod 17, and extends parallel therewith. The bar 69 is provided with a series of ratchet teeth 70 in position to be engaged by the pawl 66, when the bell crank lever 64 is oscillated by the cam 63. It will be seen that when the cam roller 65 is swung outwardly by the cam 63, the pawl 66 will engage one of the notches in the bar 69, and force the rod 17 downwardly against the action of the spring 19. The shape of the cam 63 is such that for each revolution of the shaft 62, the bar 17 will be moved downwardly, and then vibrated up and down a number of times before it is returned to its uppermost position.

As shown in Fig. 5, the plate 18 is curved upwardly at its lateral edges, giving the upper surface of the plate a somewhat concave form. The object of this is to assist the suction-head 25 to lift but a single sheet at a time from the top of the stack. When the suction-head is brought into contact with the upper sheet of the stack, this upper sheet will touch the suction-head only at its edges, and hence to be lifted from the stack, it must be drawn upwardly in the central portion. Since the sheet is held in a curved formation, it will resist to a certain extent this action of the suction-head, and only the sheets subjected directly to the action of the head will be thus lifted, the curve in the other sheets forming a kind of an arch to resist upward movement, and thus be separated from the top sheet. This separation

of the top sheet from those beneath it is further assisted by a pair of spring pressed blades 71, which have knife edges 72 arranged to bear against the edges of the sheets 14, as shown in Figs. 1, 6 and 7. Obviously the surface of the plate 18 may be curved either laterally or longitudinally, the effect being the same in either case. If the curvature extends longitudinally, the ledge 16 will bear against the uppermost sheet entirely across the end thereof, but if the curvature is in the other direction, it will bear only at the outer edges.

The operation of the device is as follows:—

The sheets to be fed, are placed in the magazine by forcing the plate 18 downwardly against the tension of the spring 19, and inserting a stack of sheets 14 on top of the plate 18, with the edges of the uppermost sheet beneath the shoulders 15 and 16. The spring 19 will hold the stack with the uppermost sheet against the shoulder 16, and as the sheets are removed, the stack will be raised upwardly by the spring 19 to keep the top level of the stack always in the same position in the magazine. As the shaft 62 is rotated, the suction-head 25 will be swung backwardly to a position over the magazine, and then be lowered until it rests upon the upper sheet in the magazine. It will be seen from Fig. 2, that the lower surface of the lifter does not rest squarely upon the upper sheet, but touches it only at its rear edge. When the lifter is in this position, a portion of the top sheet will be drawn by suction into contact with the frictional surface forming the lower portion of the suction-head, and the weight of the head will force the stack downwardly a sufficient amount to release the pressure between the uppermost sheet and the ledge 16. The suction-head is then given a slight movement forwardly, and will carry with it, the rear edge of the uppermost sheet, drawing the edge from beneath the ledge 16. The fact that the contact surface is covered with frictional material, such as rubber, assists in this sliding movement of the sheet, and prevents the suction-head from sliding over the surface of the sheet itself. During this forward movement, the sheet buckles slightly, as shown in Fig. 2, the front edge of the sheet remaining beneath the ledge 15. As the suction-head is slid forwardly on the surface of the stack and carries the upper sheet with it, there is a tendency for the lower sheets to move with the upper one. They are held in place however by the knife edges 72 which cut slightly into the edges of the sheets, and prevent forward movement of all of the sheets, except the uppermost one, which because of its close connection with the suction-head, and because of the frictional contact surface, is carried forwardly in spite of the knife edges 72, the edges of the sheet being slightly mutilated. When the rear edge of the uppermost sheet is moved from beneath the overhanging ledge 16, the suction-head is carried upwardly by the arm 60, pulling the forward edge of the sheet from beneath the shoulder 15. This turns the edge of the sheet and separates it from those below in a manner similar to that in which a single card may be flipped from a pack by one's thumb. During this upward movement, there is a tendency to strip the sheet from the suction-head, this tendency being greatest of course, at the front portion of the head. To overcome this tendency, the grooves 32, leading to the openings 31, are provided as previously explained. These grooves increase the effective area of the suction device, and thus cause the sheet to adhere more firmly at its front portion. The grooves also form a suction surface, which is substantially continuous in the direction to which the grooves extend. If this were not true, as soon as the sheet 14 was disconnected from one row of holes, it would have no support between that row and the next succeeding row, and would tend to fall away from the surface between the two rows, thus making it easier to strip the sheet from the entire surface. When the sheet has been lifted clear of the magazine, the head is moved to carry the sheet upwardly and forwardly to perform any operation that may be desired.

In the device shown in the co-pending application referred to, the sheet is covered with mucilage and deposited upon an article to be labeled, the valve 37 being operated to admit compressed air into the suction-head to discharge the sheet when desired, and the piston 43 acting under the influence of the pressure in the suction-head to position the cam roller 45 to control the suction-head relative to the glue roller. These features are described more fully in the application referred to.

While the suction-head is being moved to carry the sheet to the position where it is to be discharged, the bell crank lever 64 is oscillated by the cam 63, and the pawl 66 is thus forced into engagement with one of the notches 70, and the bar 17 thus forced downwardly against the tension of the spring 19. This moves the stack of sheets 14 so that the uppermost sheet is moved out of engagement with the ledges 15 and 16, and any sheets which may have been deranged by the suction-head during the last operation, are permitted to drop back into their proper position in the magazine. To assist in the positioning of the deranged sheets, the cam 63 is shaped so that the plate 18, with the stack of sheets thereon, is oscillated up and down a slight amount, while the stack is held in its depressed position, thus causing

the sheets to be adjusted properly between the walls and the magazine. Before the suction-head is returned to pick up the next sheet, the rod 17 and the plate 18 are freed from the action of the pawl 66, so that the stack of sheets are returned to their proper position for the next operation of the suction-head.

I claim:

1. In sheet feeding mechanism, a carrier having an extended substantially continuous surface composed of frictional material with spaced perforations therethrough, the mouths of said perforations being distributed over said continuous surface and opening at the level of said surface so that substantially the entire surface of said frictional material intermediate said mouths will engage a sheet held against said surface, mechanism for drawing a sheet against said surface, and means for moving said frictional surface in the direction of the plane of a sheet to be fed and in contact therewith.

2. In sheet feeding mechanism, a suction head having an extended substantially continuous lifting surface composed of frictional material with spaced perforations therethrough, the mouth of said perforations being distributed over said surface and opening therethrough in the plane thereof so that substantially the entire surface of said frictional material intermediate said mouths will engage a sheet held against said surface, and means for moving said lifting surface in the direction of the plane of a sheet to be fed and in contact therewith.

3. In sheet feeding mechanism, means for holding a stack of sheets to be fed, a carrier for removing sheets from said stack, said carrier having an extended substantially continuous lifting surface composed of frictional material with spaced perforations therethrough, the mouths of said perforations opening in alinement with the said continuous surface of said frictional material so that said surface intermediate said mouths will engage a sheet held against said surface, and means for moving said lifting surface parallel with the sheets in said stack.

4. In sheet feeding mechanism, means for holding a plurality of sheets to be fed in stack formation, a suction head having an extended substantially continuous lifting surface composed of frictional material with spaced perforations therethrough, the mouths of said perforations being distributed over said continuous surface and opening in alinement therewith so that substantially the entire surface of said frictional material intermediate said mouths will engage a sheet held against said surface, and means for moving said lifting surface into contact with the uppermost sheet in said stack and for moving said surface parallel with said sheet while in contact therewith.

5. In sheet-feeding mechanism, a magazine for holding sheets to be fed, means for removing sheets from the top of a pile in said magazine and means for lowering the sheets within said magazine and relative thereto after a removing operation to adjust said sheets in said magazine.

6. In sheet-feeding mechanism, a holding device, means for removing sheets from the top of a pile in said holding device, and means for lowering and raising the sheets remaining in said holding device a plurality of times after a removing operation and prior to a subsequent removing operation to adjust the position of said sheets in said holding device.

7. In sheet-feeding mechanism, a magazine having side members for holding a plurality of sheets in stack formation, means for removing the uppermost sheets from said stack, one at a time, and means for lowering the sheets remaining in said magazine relative to said side members after a removing operation to readjust the sheets in said magazine.

8. In sheet-feeding mechanism means for holding a plurality of sheets in stack formation including a support for said sheets, means for removing said sheets, one at a time, from the top of said stack, means for vibrating the support for said stack after each removing operation, and means for disconnecting said lowering means from said support to permit return of said stack to its uppermost position.

9. A sheet-holding device comprising a stationary bottom member, stationary side members, and a pivoted side member resiliently held in closed position and arranged to bear against the edges of the sheets in said holder at one side of the stack to hold said sheets in proper alinement in said stack.

10. A sheet-holding magazine comprising a stationary bottom member, a stationary side member, a movable side member pivoted to said stationary bottom member and arranged to bear against the edges of the stack of sheets in said magazine, resilient means for holding said movable side member in closed position against the edges of said sheets, a movable bottom member, resilient means for pressing said bottom member upwardly, and means for contacting the sheets held in said magazine for limiting the upward movement of said bottom member.

11. In sheet feeding mechanism, means for holding a supply of sheets, means for removing the sheets one at a time from said supply, means for feeding the sheets forwardly, and means for retracting and advancing said feeding means a plurality of times after the removal of a sheet from said supply and prior to the removal of a subsequent sheet therefrom to re-adjust said remaining sheets in said sheet holding means.

12. In sheet-feeding mechanism, a holding device, means for removing sheets from said holding device, one at a time, means for retracting the sheets remaining in said holding device after each operation of the removing means and for vibrating said sheets while in retracted position to re-adjust any sheets displaced by the removing operation.

13. In sheet-feeding mechanism, means comprising stationary side walls for holding a plurality of sheets in stack formation, means for removing the sheets, one at a time, from the top of the stack, and means for retracting and advancing the stack within said side walls after the removal of a sheet from said stack and prior to the removal of a subsequent sheet therefrom.

14. In a device of the character described, means for holding a plurality of sheets in stack formation, means for contacting with the upper sheet of the stack near two of the edges thereof, a paper lifting device for sliding one edge of said upper sheet from under its contacting means and then raising said sheet from said stack to remove the other edge of said sheet from its contacting means.

15. In sheet-feeding mechanism, means for holding a plurality of sheets in stack formation, means for contacting with the uppermost sheet of said stack near one edge thereof, and a paper lifter arranged to slide said sheet from beneath said contacting means and then lift said sheet bodily from said stack.

16. In a machine of the character described, a sheet-holding magazine, a paper lifter for removing sheets, one at a time, from said magazine and means for operating said lifter to cause it to first slide one edge of the sheet to be removed while the other edge is held stationary and then lifting the sheet bodily.

17. In sheet-feeding mechanism, a magazine for holding a plurality of sheets in stack formation, a movable bottom for said magazine, means for resiliently pressing said bottom upwardly to lift said sheets, means for limiting the upward movement of said bottom, a suction-head for removing the top sheets, one at a time, from said magazine, said head being arranged to engage the uppermost sheet in said magazine with its lifting face at an angle to said sheet, and means for moving said head to impart a preliminary sliding movement to the sheet to be removed before it is lifted from said magazine.

18. In sheet feeding mechanism, means for holding a plurality of sheets in stack formation including an abutment member for engaging said sheets at one edge thereof, a suction head for removing the sheets, one at a time, from said holding means, said suction head being arranged to contact with said stack of sheets near the edge thereof opposite said abutment member while the remaining portion of the suction head is raised slightly from said sheets, there being suction openings in said head adjacent said contacting portion and other openings in said raised portion, and means for moving said suction head toward said abutment member while so positioned to cause a sheet to buckle toward said last-mentioned openings.

19. In sheet-feeding mechanism, means for holding a stack of sheets, a suction-head for removing the sheets, one at a time, from said holding means, means for moving one edge of said suction-head into contact with said stack of sheets, while the remaining portion of said suction-head is raised from said stack, means for sliding said suction-head laterally along the surface of said stack while in this position, and means for lifting said suction-head bodily away from said stack.

20. In sheet-feeding mechanism, means for holding a stack of sheets, means arranged to over-lie said sheets at two of the edges thereof, and a lifting device arranged to contact with a sheet near one of said over-lying means and move in the direction of the plane of said sheet to slide said sheet from under said over-lying means and then lift it bodily, drawing it from under the other over-lying means.

21. In a machine of the class described, a device for holding a plurality of flattened articles in stack formation, means for separating the articles from others in said stack, one at a time, by sliding motion, and spring pressed knife edges contacting with the edges of said articles to prevent more than one article to be slid by said removing means.

22. A device for feeding flattened articles, one at a time, from a stack comprising means for separating the articles from others in said stack, a sharpened spring pressed blade arranged to contact with the edges of said articles and mechanism for moving said separating means transversely of said blade during a separating operation.

23. A device for feeding flattened articles, one at a time, from a stack comprising means for removing said articles from the stack by sliding the upper article, and a spring pressed knife edge adjacent one side of said stack and arranged to bear against the edge of the other articles of the stack to prevent sliding motion of the latter mentioned articles.

24. A device for feeding flattened articles comprising means for holding a stack of articles, a suction-head adapted to contact with the upper articles of the stack near one edge thereof and slide said edge of said articles forwardly on said stack, and a knife

edge extending transversely of the direction of said sliding movement and arranged to contact with the side of said stack to prevent sliding of the other articles on the stack.

25. In sheet-feeding mechanism, a suction-head having a surface arranged to contact with articles to be lifted, one portion of said surface being provided with a greater effective suction area than the other portion thereof.

26. In combination, means for holding flattened articles to be lifted, a suction-head for lifting said articles, means for moving said suction-head into contact with said articles at one side of said suction-head, said suction-head being provided with a greater effective suction area at the side of said head away from the contacting portion than on the side near the contacting portion.

27. In sheet-feeding mechanism, a suction-head comprising a member provided with a lifting surface and a plurality of openings therethrough, and means for producing a greater effective suction area at one side of said lifting surface than at the other.

28. In sheet-feeding mechanism, a suction-head comprising a member having a lifting surface, and means for producing a greater effective suction area at one side of said surface than at the other.

29. In sheet-feeding mechanism, a suction-head comprising a member having a lifting surface, and a plurality of openings therethrough, the openings at one side of said member being enlarged at the lifting surface while the openings at the other side of said member present a smaller suction area than said enlarged openings.

30. In sheet-feeding mechanism, a lifting head, a groove surrounding said head for the purpose of catching liquid, and a reservoir in said head connected with said groove for retaining said liquid.

31. In sheet-feeding mechanism, a hollow lifting head, a plug secured within said head having an opening therethrough, and an upstanding flange surrounding said opening, in position to intercept liquid flowing downwardly in said head to exclude said liquid from said opening.

32. In sheet-feeding mechanism, a hollow lifting head, a member for closing the opening in said head, said member having a passage therethrough, an upstanding flange surrounding said passage, a cover resting on the top of said upstanding flange, and openings through said upstanding flange.

33. In sheet-feeding mechanism, a hollow lifting head, means for preventing the flow of liquid from the upper to the lower portion of the interior of said head, an opening through the wall of said head to conduct liquid from the interior to the exterior of said head, and means for preventing the flow of air to the interior of said head.

34. In sheet-feeding mechanism, a lifting head, means for stopping the flow of liquid downwardly on the exterior surface of said head, means for stopping the flow of liquid downwardly on the interior surface of said head, and means for accommodating the liquid intercepted by said stopping means.

35. A sheet-feeding mechanism, a magazine having stationary side members for holding a supply of sheets, means for removing the sheets one at a time from the top of the supply in said magazine, and means for readjusting the sheets in said supply after each removing operation while lowering the supply between said walls and relative thereto.

36. In sheet-feeding mechanism, means for holding a supply of sheets, a bottom plate for said holding means having its supporting surface concave for bending said sheets upwardly at opposite edges, abutments for the upwardly bent edges, and a suction head arranged to act directly on the low portion of the uppermost sheet of said supply above the low portion of said concave surface to lift said sheet from said supply.

37. In sheet-feeding mechanism, a plate for supporting sheets having the supporting surface thereof concave to bend opposite edges of said sheets upwardly, abutment members for the upwardly bent edges of said sheets, and a suction head arranged to operate on the uppermost sheet of a stack held by said plate at the central downwardly bent portion of said sheet and while said sheet is held in bent position by said plate and abutment members.

38. In sheet-feeding mechanism, means for supporting a supply of sheets, means for holding said sheets in bowed condition, and a suction lift for removing said sheets, one at a time, from said supporting means, said suction lift being arranged to operate along substantially the entire length of a curve formed by a sheet to be lifted.

39. In sheet-feeding mechanism, means for supporting a supply of sheets with the surface thereof bowed, and suction means for removing the sheets from said supply, said means being arranged to exert lifting force over substantially the entire area of a sheet to be lifted.

40. In sheet-feeding mechanism, means for supporting a supply of sheets with the central portions thereof bowed downwardly, and a suction device arranged to exert a lifting force on said downwardly bent portion for lifting said sheets, one at a time, from the top of said supply.

41. In sheet-feeding mechanism, means for holding a stack of sheets, a suction-head

for removing said sheets, one at a time, from said holding means, means for moving one edge of said suction-head into contact with said stack of sheets, while the remaining portion of said suction-head is raised from said stack, means for sliding said suction-head laterally along the surface of said stack, and means for separating said suction-head and stack.

42. In sheet-feeding mechanism, means for holding a stack of sheets, a suction-head for removing sheets, one at a time, from said holding means, means for moving said suction-head to bring one edge thereof into contact with said sheets while the other edge is spaced therefrom, means for sliding said suction-head parallel with the surface of said sheets while in contact therewith, to cause said sheet to buckle upwardly into engagement with other portions of the lifting surface of said head, and means for separating said suction-head and stack.

43. A device for feeding flattened articles, one at a time, from a stack comprising means for removing the articles from the stack by sliding them along the surface thereof, and a sharpened blade for contacting during such sliding movement with the edges of the articles parallel with the direction of sliding movement and for cutting into said articles at the edges thereof to resist said sliding movement.

44. A device for feeding flattened articles, one at a time, from a stack comprising a suction-head, means for moving said suction-head parallel with the surface of the stack and in contact therewith, and sharpened blades for contacting with said flattened articles at the edges thereof parallel with the direction of movement of said suction-head while said articles remain in stack formation.

45. A device for feeding flattened articles comprising means for holding a stack of articles, a suction-head arranged to contact with the upper article of the stack near one edge thereof and slide said edge forwardly upon said stack, and sharpened blades extending transversely of the lateral edges of said articles and arranged to contact with a lateral face of said stack to prevent the sliding of other articles upon the stack.

46. In sheet-feeding mechanism, a suction-head comprising a member having a flat lifting surface, a plurality of openings through said surface, and grooves in said surface communicating with said openings, the ends of said grooves being terminated by walls to form a pocket beneath the level of the lifting surface of said suction head.

47. A device for feeding flattened articles, one at a time, from a stack comprising a suction-head, having a flat lifting surface arranged to contact along one edge thereof with said stack and having openings through said surface, and pockets in said surface communicating with said openings and surrounded by walls the outer edges of which are flush with said surface.

48. In sheet-feeding mechanism, a suction-head for lifting flattened articles from a stack, means for moving one edge of said suction head into contact with said stack while the other edge is out of contact therewith, said suction-head having a plurality of openings through the contacting surface thereof and having grooves in said surface extending through said openings in a direction substantially at right angles to said contacting edge.

49. In sheet-feeding mechanism, means for holding a plurality of sheets in stack formation, a retainer arranged to engage one edge of the outermost sheet of said stack, resilient means for pressing said stack toward said retainer to hold said outermost sheet in engagement therewith, a lifter for said sheets, and means for moving said lifter into contact with said outermost sheet to cause said lifter to exert pressure thereon to relieve the pressure between said sheet and said retainer and for subsequently shifting said lifter to move said sheet away from said retainer.

50. In sheet-feeding mechanism, means for holding a plurality of sheets in stack formation, a suction head having an extended sheet engaging surface with a plurality of suction openings extending therethrough and distributed over said surface for removing the sheets one at a time from said holding means, and mechanism for causing said suction head to contact with the uppermost sheet of said stack near one edge of said sheet-engaging surface while the remaining portion of said sheet engaging surface is raised slightly from said sheet and for moving said head in a direction parallel with the plane of said sheet while thus positioned.

51. In sheet feeding mechanism, means for holding a plurality of sheets in stack formation, retaining devices extending inwardly a slight distance over opposite edges of the uppermost sheet of said stack, a suction head for lifting the uppermost sheet from said stack, and mechanism for causing said suction head to contact with said sheet adjacent one of said retaining devices and for moving said suction head in the direction of the plane of said sheet to slide the edge of said sheet from beneath said retaining device, said mechanism being arranged to move said suction head upwardly and to lift said sheet bodily after said sliding movement to draw the opposite edge of said

sheet from beneath the other retaining device.

52. In sheet feeding mechanism, means for holding a plurality of sheets in stack formation, a suction head for lifting sheets from said stack, mechanism for moving said suction head into and out of engagement with said stack, said suction head having a groove extending around the periphery thereof for intercepting oil or other liquid flowing downwardly on the outer portion of said suction head, and a partition within said suction head for intercepting oil or other liquid flowing downwardly on the interior of said suction head.

53. In sheet feeding mechanism, means for holding a plurality of sheets in stack formation, a suction head for lifting sheets from said stack, mechanism for moving said suction head into and out of engagement with said stack, moving parts within said suction head for controlling the passage of air therethrough, said suction head being provided with a channel on the outer periphery thereof for intercepting oil or other liquid flowing downwardly on the outer surface of said suction head from said operating mechanism, and a partition within said suction head for intercepting oil flowing downwardly from said moving parts on the interior of said head, said partition having openings therethrough to permit passage of air through said suction head.

54. In sheet feeding mechanism, a suction head for lifting sheets to be fed, said suction head having an extended flat sheet engaging member with a plurality of openings therethough, a portion of said openings being enlarged at their outer ends to form pockets at the mouth of said openings to increase the effective suction area of said openings.

55. In sheet feeding mechanism, a suction head for lifting sheets to be fed, said suction head having a rubber covered plate forming a flat lifting surface for engaging the sheets, said plate being provided with a plurality of openings extending therethrough, the outer ends of some of said openings being enlarged to increase the effective suction area of the portion of said plate in which said openings with enlarged mouths are located.

In testimony whereof I have signed my name to this specification on this 20th day of October, A. D., 1916.

MICHAEL J. MILMOE.

Witnesses:
FRED G. BROOKS,
G. J. BECKER.