Aug. 15, 1939. N. G. A. STRÖMBERG ET AL 2,169,400

ARRANGEMENT FOR FEEDING PAPER SHEETS

Filed May 26, 1936 4 Sheets-Sheet 1

Fig. 1

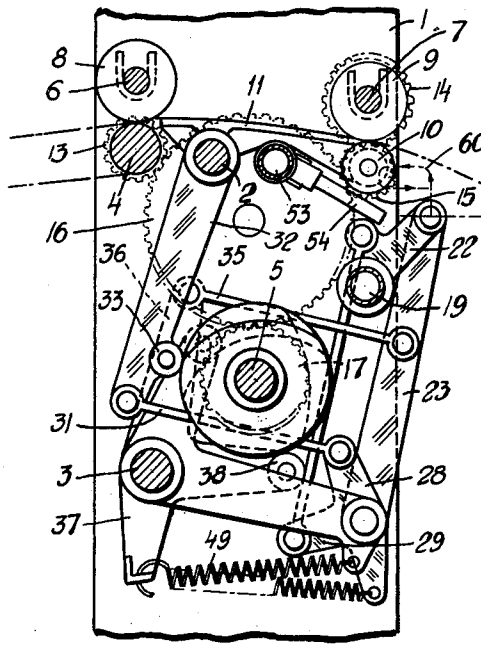


Fig. 7

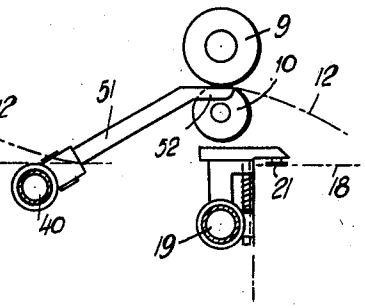


Fig. 8

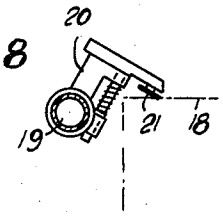


Fig. 9

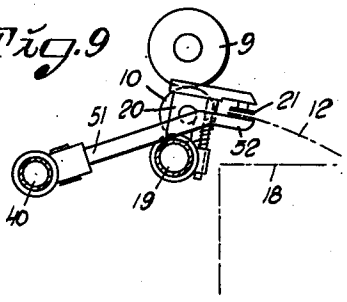
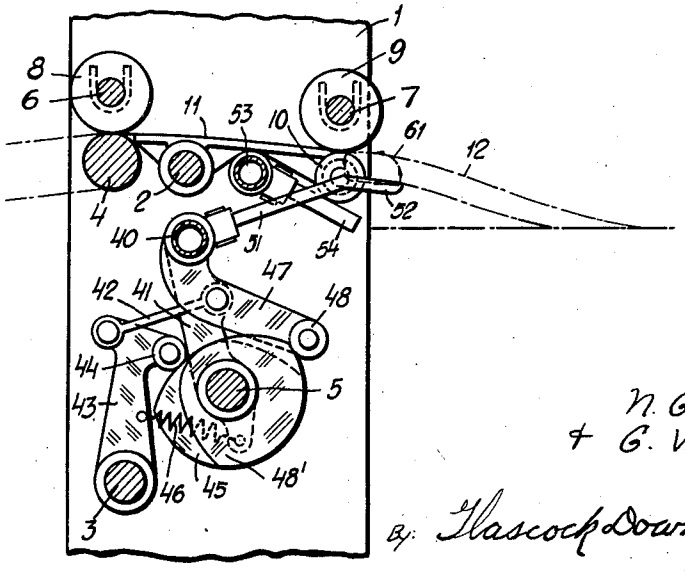


Fig. 2



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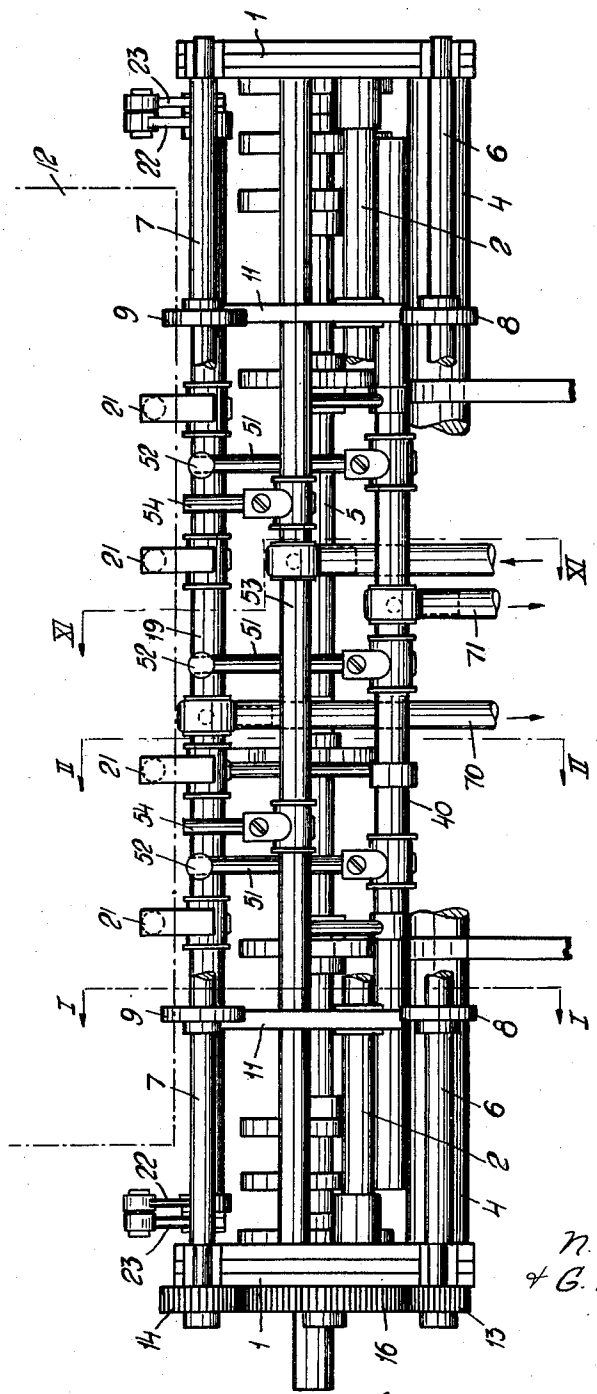
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Attys.

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ARRANGEMENT FOR FEEDING PAPER SHEETS

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Fig. 3



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Fig. 4

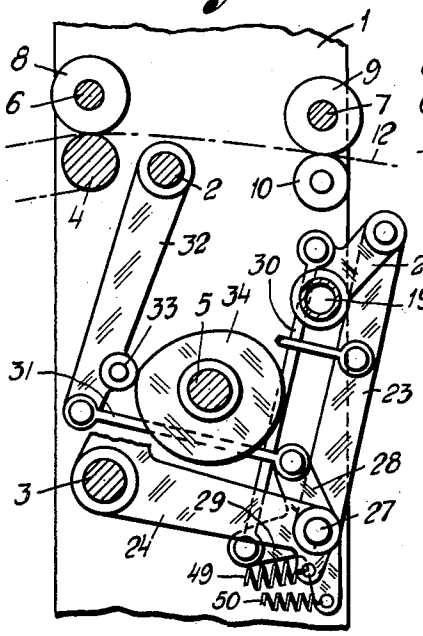


Fig. 5

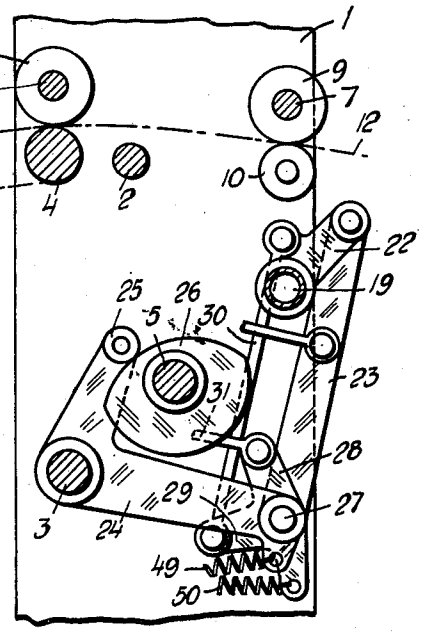


Fig. 6

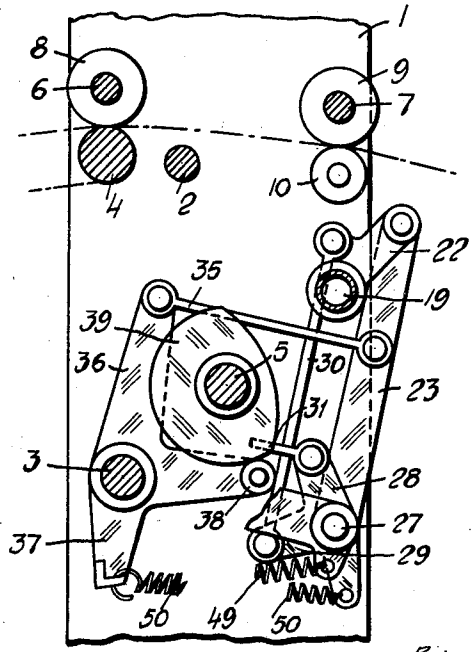
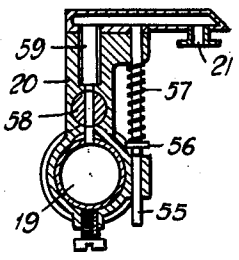


Fig. 10



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Fig. 11

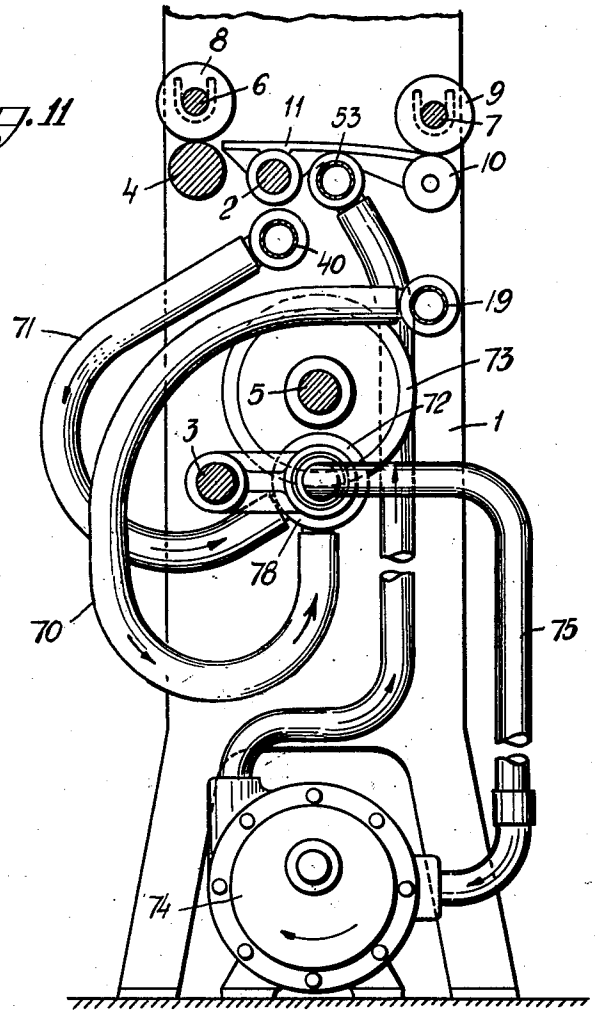
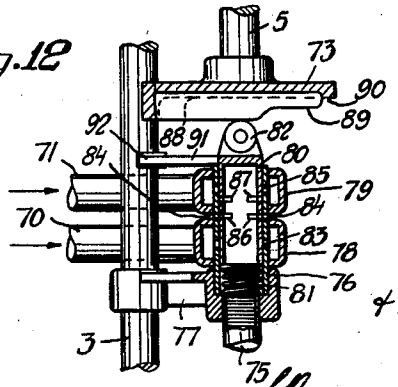


Fig. 12



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ARRANGEMENT FOR FEEDING PAPER SHEETS

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Application May 26, 1936, Serial No. 81,946
In Sweden April 25, 1936

17 Claims. (Cl. 271—26)

The present invention relates to an arrangement for feeding paper sheets. Previously, a method of feeding paper sheets to printing presses and machines of such type has been used in which the sheets are fed successively from a stack of sheets so that the sheets form a continuous path in which the sheets overlap each other partly in the longitudinal direction of the path. The front edge of each sheet becomes thus free to be gripped as it is to be fed to the printing press. The gripping members used for the purpose and operating constantly underneath the sheet path have hitherto been constructed so as to initially grip the sheet and while maintaining the grip then pull it forward to be introduced between feeding rollers taking the sheet to the printing press. In other words, the gripping members have carried out the gripping operation proper as well as the pulling operation. Having said double function the apparatus has suffered from certain drawbacks as for instance that when the paper sheet is to be introduced between the feeding rollers it has lost, for a moment, its contact with the gripping members whereby the introduction of the sheet between the feeding rollers has been uncertain, so much the more as air is blown to the lower side of the sheet in a manner known per se in a direction opposite to the feeding direction.

The present invention which has for its object to remove the drawbacks is substantially characterized by one gripping member or a group of such members for initially elevating the sheet and another gripping member or group of gripping members for afterwards pulling the sheet forward.

By this arrangement of gripping members it is possible to feed the sheet without causing it to lose, at any moment, the contact with the gripping members or the feeding rollers whereby the introduction of the sheet between said rollers is fully assured.

According to one important feature of the invention the arrangement comprises sheet elevating member or members to engage the sheet on the upper side thereof and then sheet pulling member or members to engage, afterwards, the lower side thereof.

Initially, the edge portion of the sheet is turned up by the upper side gripping members which are adapted to elevate the sheet. After elevating the sheet the lower side gripping members are carried underneath the elevated sheet to grip and pull it forward.

In the accompanying drawings a suitable arrangement for carrying out the method according to the invention is shown by way of example.

Fig. 1 is a side elevation, partly in vertical section on line I—I, Fig. 3, and showing a part of the arrangement.

Fig. 2 is a similar side elevation, partly in vertical section, taken on line II—II, Fig. 3, and showing a fraction of the arrangement.

Fig. 3 is a plan view of the arrangement.

Figs. 4, 5 and 6 are side elevations of various details of the mechanism, transmitting the movements to the gripping members.

Figs. 7, 8 and 9 are elevations, partly in section, showing the upper and lower side gripping members for the sheet in different positions.

Fig. 10 is a vertical section showing, on an enlarged scale, one of the members engaging the sheet on the upper side thereof.

Fig. 11 is an elevation, partly in vertical section on line XI—XI of Fig. 3 and showing the suction generating means, and

Fig. 12 is a top view, partly in section, showing a suction control device in detail.

Referring to the drawings, the substantial elements of the arrangement are carried by two side frames 1. It is to be noted that the detailed construction of those frames is of no importance for the invention and, therefore, the frames are shown diagrammatically and have their top and bottom broken away. For the sake of clearness, in Figures 4, 5, 6, and 11, parts or elements positioned behind those parts or elements actually described with reference to the respective figures are omitted in said figures.

The two side frames 1 are connected by stay-shafts 2 and 3, extending therebetween and passed therethrough. Journalled in the side frames 1 are a band roller 4 and a cam shaft 5 and further shafts 6 and 7 to which are secured feeding rollers 8 and 9; the rollers 8 engage the band roller 4 and the rollers 9 engage the rollers 10. Secured longitudinally to the stay-shaft 2 are guide pieces 11, forming a support for the paper sheet 12 in its passage between the rollers 9 and 8. The rollers 10 are journalled at the rear ends of the guide pieces 11. The roller 4 and the shaft 7 are driven by means of gear wheels 13, 14, 15, 16, and 17 from the shaft 5 (Figs. 1 and 3). 18 is the upper front edge of a stack of paper sheets. Extending parallelly with said edge is a suction pipe 19, and mounted along said pipe are nozzle holders 20, in which the suction nozzles 21 are mounted to slide up and down. The suction pipe 19 is fixed at its ends to tilting levers 22, which are displaceably con-

nected by draw-links 23 to angular cam levers 24 (Fig. 5) rotatably mounted on the fixed shaft 3 and having rollers 25 engaging cam disks 26, secured to the shaft 5. Pivoted on bolts 27 connecting the links 23 and the levers 24 are angular arms or levers 28, 29, the latter arms 29 being connected to the tilting levers 22 by draw-links 30, and the former arms 28 being connected by draw-rods 31 to cam levers 32 (Fig. 4), rotatably mounted on the rear shaft 2 and having rollers 33 engaging cam disks 34 secured to the shaft 5. Furthermore, the links 23 are connected by means of draw-rods 35 (Fig. 6) to cam levers 36, 37 pivoted to the shaft 3 and having rollers 34 engaging cam disks 39, secured to the shaft 5. Between the arms 37 of the cam levers 36, 37 and the cam levers 24 are springs 49, and between said arms 37 and the angular levers 28, 29 are springs 50 clamped so as to force all the cam levers to engage their rollers on the corresponding cam disks.

Parallel to the front edge of the sheet stack is a further suction pipe 40 (Fig. 2), carried by levers 41, pivoted to a shaft 5 and connected by draw-links 42 to cam levers 43 which have rollers 44 engaging cam disks 45 secured to the shaft 5. Furthermore a draw-spring 46 is mounted between the levers 41 and the cam levers 43.

Secured to the suction pipe 40 which is able to rotate within the levers 41 are cam levers 47 having rollers 48 engaging cam disks 48^1, fixed to the shaft 5.

Secured to the suction pipe 40 at a plurality of points thereon are pipes 51 extending laterally and having their outer ends formed as or forming a holder for the suction nozzles 52.

53 is a blast pipe having blowing nozzles 54 secured thereto and adapted to blow air in a known manner to the lower side of the sheet to be fed.

Each of the suction nozzles engaging the sheet on the upper side comprises the holder 20 and the mouth piece 21 proper, the latter being yieldingly connected with the holder. The part forming the nozzle is secured to a pin 55 adapted to slide up and down in the holder 20 and surrounded by a spring 57 mounted between the holder 20 and a shoulder 56 on the pin. 58 is a cock, by which the suction conduit 59 leading to the nozzle 51 may be opened or closed.

The nozzles 21 and 52, the former of which engages the upper side of the sheet, the latter engaging the lower side thereof, are disposed along the suction pipe so as to engage in the space between each other (Fig. 1) whereby the nozzles 21 do not affect the movements of the nozzles 52 in the vertical plane or vice versa.

The suction pipes 19 and 40 are connected by flexible conduits 70, 71 respectively to a regulating valve 72 guided by a cam disk 73 secured to the shaft 5, the valve in turn being connected to a suction pump 74 by a pipe 75 as clearly shown in Figure 11. The pressure side of the pump is connected to the blast tube 53 by a flexible pipe 76.

The valve comprises an inner tubular member 76 fitted at one end in and secured to a bracket 77 fixed to the stay-shaft 3. The tubular member 76 is surrounded by two valve casings 78 and 79 communicating with the conduits 70 and 71 respectively, and slidably mounted within the member 76 is a sleeve 80. A spring 81 engaging the inner end of said sleeve is adapted to force a roller 82 mounted at the outer end of the sleeve against the circumferential flange or rim of the cam disk 73. The tubular member 76 has three slots 83, 84 and 85, one of which is positioned between the two casings 78, 79 and opens to the atmosphere. The remaining slots 83 and 85 are situated within said casings 78 and 79 respectively. Two corresponding slots 86,87 are arranged in the wall of the sleeve 80. The cam disk 73 has three axial surfaces 88, 89 and 90 adapted to be engaged successively by the roller 82 when the cam disk is rotated. When the roller 82 engages the surface 88 as shown in Fig. 12 slots 86 and 84 are in register, and the inner of the valve thus communicates with the atmosphere. On rotation of the disk 73 the roller 82 will engage the lower surface 89 allowing the sleeve to move axially by the action of the spring 76 so as to bring slot 87 in alignment with slot 85 and thus opening a communication between the suction side of the pump and the suction pipe 40. At the same time the connection to the atmosphere is shut off, because slot 86 moves out of alignment with slot 84. Further rotation of the disk 73 causes the roller 82 to engage the lowest surface 90 so that the inner end of the sleeve 80 will pass the slot 83 which consequently opens a communication between the suction side of the pump and the suction pipe 19. The outer end of the sleeve 80 has secured thereto a radial arm 91 having a fork-shaped end 92 engaging the shaft 3 and adapted to slide therealong when the sleeve moves axially.

Supposing that the suction members 21 and 52 respectively engaging the upper and the lower side of the sheet have the positions shown in Fig. 7, the operation of the arrangement during a revolution of the cam shaft 5 is the following, the nozzles 21 moving along the closed path 60 shown in dotted lines in Fig. 1, and the nozzles 52 moving along the closed path 61 similarly shown in Fig. 2 in dotted lines. The nozzles 21 engaging the uppermost sheet in the stack suck the sheet so that it adheres thereagainst, and then said nozzles are tilted, turning up the edge of the sheet, under the influence of the levers 22 and 28, which are actuated by the cam levers 32 and the cam disk 34 (Fig. 4) by way of the draw-links 31. The nozzles 21 move straight upwards and carry along the sheet such movement being caused by the links 23 and the cam levers 24, which are actuated by the cam disks 26. At the same time the nozzles 21 are rocked back. When the nozzles 21 have reached their uppermost position, the nozzles 52 move underneath the elevated sheet under the influence of the shaft 47 (Fig. 2) obtaining its movement by the draw-links 42 from the cam levers 43, which are actuated by the cam disks 45. At the same time the suction is shifted in the pipes 19 and 40 by means of the valve 72 and the cam disk 73 to cause the former pipe to operate and to set the latter pipe out of operation, the sheet being released by the nozzles 21 and immediately gripped by the nozzles 52. The free nozzles 21 will then rapidly move forward (to the left in Fig. 1) and downwards past the front edge of the paper sheets, such operation being caused initially by the rods 35 and the cam levers 36, actuated by the cam disks 39 (Fig. 6), and then by the links 23 and the cam levers 24 actuated by the cam disks 26 (Fig. 5). The nozzles 21 will then pass back (to the right in Fig. 1) and downward under the influence of the links 23 which are actuated by the cam levers 36 and the draw-rods 35. The nozzles 21 have now returned to

their initial position as shown in Fig. 7 to take another paper sheet.

In the meantime the nozzles 52 carrying the paper sheet 12 have moved upwards under the influence of the cam levers 47 secured to the suction pipe 40 (Fig. 2) and actuated by the cam disks 48, and then move backwards pulling the paper sheet forwards, the latter operation being caused by the levers 41. The front edge of the sheet pulled forwards in this manner is fed between the feeding rollers 9 and 10. This instant is shown in Fig. 7, the suction in the pipe 40 being broken at the same time by the valve 72. The feeding rollers 9 and 10 carry the sheet over the bridges 11 into the space between the rollers 8 and 4 the latter being a band roller, associated with a band conveyor carrying the sheet to the printing press. The nozzles 52 then move downwards and backwards (to the right in Fig. 2) and are introduced below a sheet again elevated by the nozzles 21.

The paper sheet is not able to become free at any moment of the feeding operation described above, to such an extent that it could be fed between the feeding rollers 9 and 10, before it is positively delivered thereto by the nozzles 52. The only moment in which the paper is released is during the shifting from the nozzles 21 to the nozzles 52, but at this moment the nozzles are in close proximity to each other so as to prevent the sheet from moving in horizontal direction.

What we claim is—

1. In a sheet feeder, a group of gripping members for initially engaging and lifting a sheet from a supply of sheets and a group of suction gripping members for moving between the supply and the lifted sheet and pulling the latter forward.

2. In a sheet feeder, a group of gripping members arranged in spaced relation for initially engaging an edge portion of a sheet and separating it from a supply of sheets and a group of suction gripping members operating in the spaces between the first named members for moving between the supply and the lifted edge portion of the separated sheet, engaging said edge portion of the separated sheet and pulling said sheet forward.

3. In a sheet feeder, a group of spaced gripping members for initially engaging and lifting a sheet from a supply of sheets and a group of spaced suction gripping members each operating in a space between a pair of said first named members for moving between the supply and the lifted sheet, engaging said lifted sheet and pulling it forward.

4. In a sheet feeder, a group of sheet separating members acting on one side of a sheet to separate it from a supply of sheets and a group of suction sheet forwarding members acting on the opposite side of the separated sheet and movable between the supply and the separated sheet to engage the latter.

5. In a sheet feeder, sheet lifting members for gripping an edge portion of a sheet on the upper side thereof and lifting it from a supply of sheets, suction sheet pulling members for gripping said edge portion of the sheet on the underside thereof and pulling it forward, operating means for the sheet lifting members moving them so that they turn up said edge portion of the sheet before it is lifted, and operating means for said suction sheet pulling members moving them between the supply and the lifted sheet to grip the latter.

6. In a sheet feeder, the combination with means to which sheets are fed from a supply thereof and suction means for engaging the front edge portion of the top sheet of the supply on its upper side and lifting it from said supply without advancing the sheet thereover, of suction means for moving inwardly between the supply and the lifted sheet, gripping said edge portion on the underside thereof, and moving outwardly from said supply to advance said sheet therefrom to said first named means.

7. In a sheet feeder, a group of sheet lifting members for engaging the upper side of a sheet and lifting it from a supply of sheets, a group of suction sheet pulling members for moving between said supply and the lifted sheet and gripping and pulling the latter forward, and cooperating rollers for receiving the sheet from said suction sheet pulling members and feeding said sheet forward therefrom.

8. In a sheet feeder, the combination with a group of suction nozzles for initially lifting a sheet without advancing it, of another group of suction nozzles for moving under and gripping the lifted sheet and pulling it forward.

9. In a sheet feeder, the combination with a group of suction nozzles for initially gripping the upper side of a sheet and lifting said sheet without advancing it, of another group of suction nozzles for moving under the lifted sheet, gripping it on its under side, and pulling said lifted sheet forward.

10. In a sheet feeder, the combination with a group of suction nozzles for initially gripping the upper side of a sheet and lifting said sheet without advancing it, of another group of suction nozzles for moving under the lifted sheet, gripping it on its under side, and pulling said lifted sheet forward, means for creating suction in the sheet lifting and pulling nozzles, and means for breaking the suction in the sheet lifting nozzles when they have lifted the sheet and the sheet pulling nozzles have moved thereunder, whereby the lifted sheet is released from said sheet lifting nozzles and immediately gripped by said sheet pulling nozzles.

11. In a sheet feeder, the combination with a group of suction nozzles for initially gripping the upper side of a sheet and lifting said sheet without advancing it, of another group of suction nozzles for moving under the lifted sheet, gripping it on its under side, and pulling said lifted sheet forward, and cooperating levers, draw-links and driven cams for moving the sheet lifting and pulling nozzles upward, forward, downward and rearward in closed paths relative to the principal direction in which the sheet is fed.

12. In a sheet feeder, the combination with a group of suction nozzles for initially gripping the upper side of a sheet and lifting said sheet without advancing it, of another group of suction nozzles for moving under the lifted sheet, gripping it on its under side, and pulling said lifted sheet forward, a suction pump, conduits connecting the sheet lifting and pulling nozzles with said pump, cooperating levers, draw-links and driven cams for moving said sheet lifting and pulling nozzles upward, forward, downward and rearward in closed paths relative to the principal direction in which the sheet is fed, and means for breaking the suction in the sheet lifting nozzles before they move forwardly and when the sheet pulling nozzles have moved rearwardly and upwardly under the lifted sheet.

13. In a sheet feeder, the combination with a

group of suction nozzles for initially gripping the upper side of a sheet and lifting said sheet without advancing it, of another group of suction nozzles for moving under the lifted sheet, gripping it on its under side, and pulling said lifted sheet forward, a suction pump, conduits connecting the sheet lifting and pulling nozzles with said pump, cooperating levers, draw-links and driven cams for moving said sheet lifting and pulling nozzles upward, forward, downward and rearward in closed paths relative to the principal direction in which the sheet is fed, and valve means in said conduits for breaking the suction in the sheet lifting nozzles before they move forward and for creating suction in the sheet pulling nozzles when they move rearward and upward under the lifted sheet and suction is broken in said sheet lifting nozzles.

14. In a sheet feeder, the combination with a group of suction nozzles for initially gripping the upper side of a sheet and lifting said sheet without advancing it, of another group of suction nozzles for moving under the lifted sheet, gripping it on its under side, and pulling said lifted sheet forward, holders for the sheet lifting nozzles, operating means for the sheet lifting nozzles and carrying said holders, and spring means connecting the holders and the sheet lifting nozzles, said spring means yieldably pressing said sheet lifting nozzles against the upper side of the sheet and being movable with the sheet lifting nozzles and holders during movement of the same imparted thereto by said operating means.

15. In a sheet feeder, the combination with a group of suction nozzles for initially gripping the upper side of a sheet and lifting said sheet without advancing it, of another group of suction nozzles for moving under the lifted sheet, gripping it on its under side, and pulling said lifted sheet forward, holders for the sheet lifting nozzles, operating means for the sheet lifting nozzles and carrying the holders, pins carrying the sheet lifting nozzles provided with spaced shoulders and slidably mounted in the holders, and springs mounted on the pins between said shoulders for counteracting upward movement of said pins and sheet lifting nozzles relative to the holders.

16. In a sheet feeder, a group of spaced sheet separating members for lifting a sheet from a supply of sheets, a group of spaced suction sheet forwarding members movable between the supply and the lifted sheet and adapted to engage and forward the same, said separating and forwarding members acting on the sheet substantially throughout the length of the front edge portion thereof and each member of one group operating in the space between a pair of members of the other group, and means for operating said groups in proper timed relation.

17. In a sheet feeder, a group of spaced sheet separating members for lifting a sheet from a supply of sheets, a group of spaced suction sheet forwarding members, said separating and forwarding members acting on the front edge portion of the sheet and each member of one group operating in the space between a pair of members of the other group, sheet winding means arranged between some of said members, and means for operating said groups in proper timed relation and for moving the sheet forwarding members between the supply and the lifted sheet to engage the latter.

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