Dec. 12, 1939. E. R. KAST 2,183,077

SHEET FEEDING APPARATUS

Filed Nov. 30, 1938 2 Sheets-Sheet 1

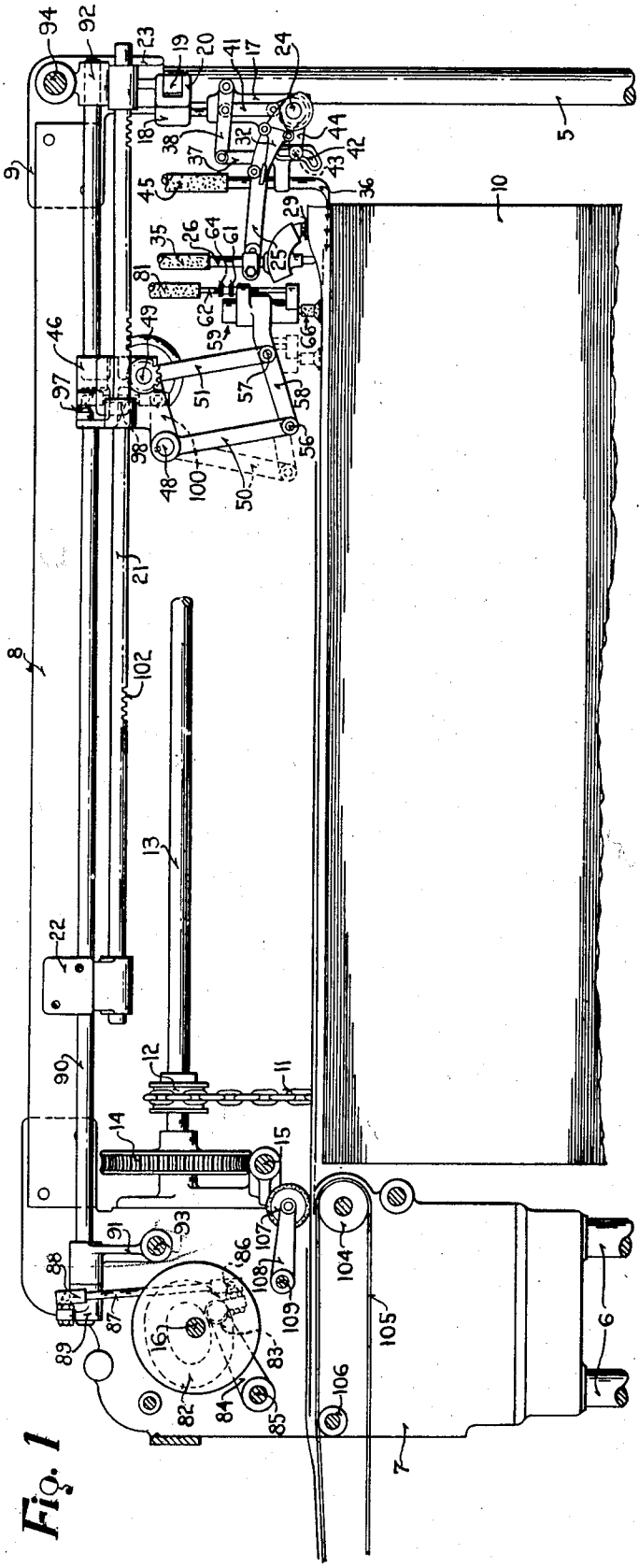


Fig. 1

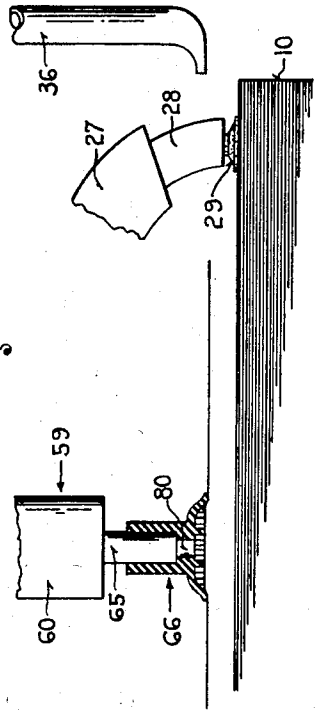


Fig. 3

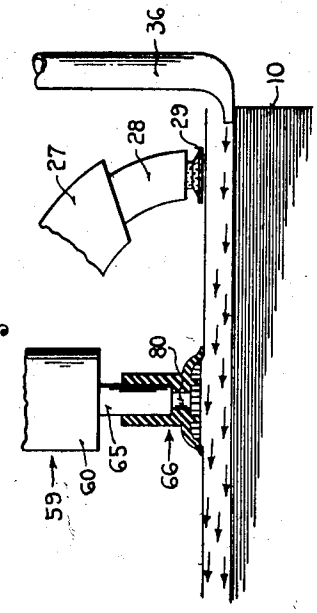


Fig. 2

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Fig. 4

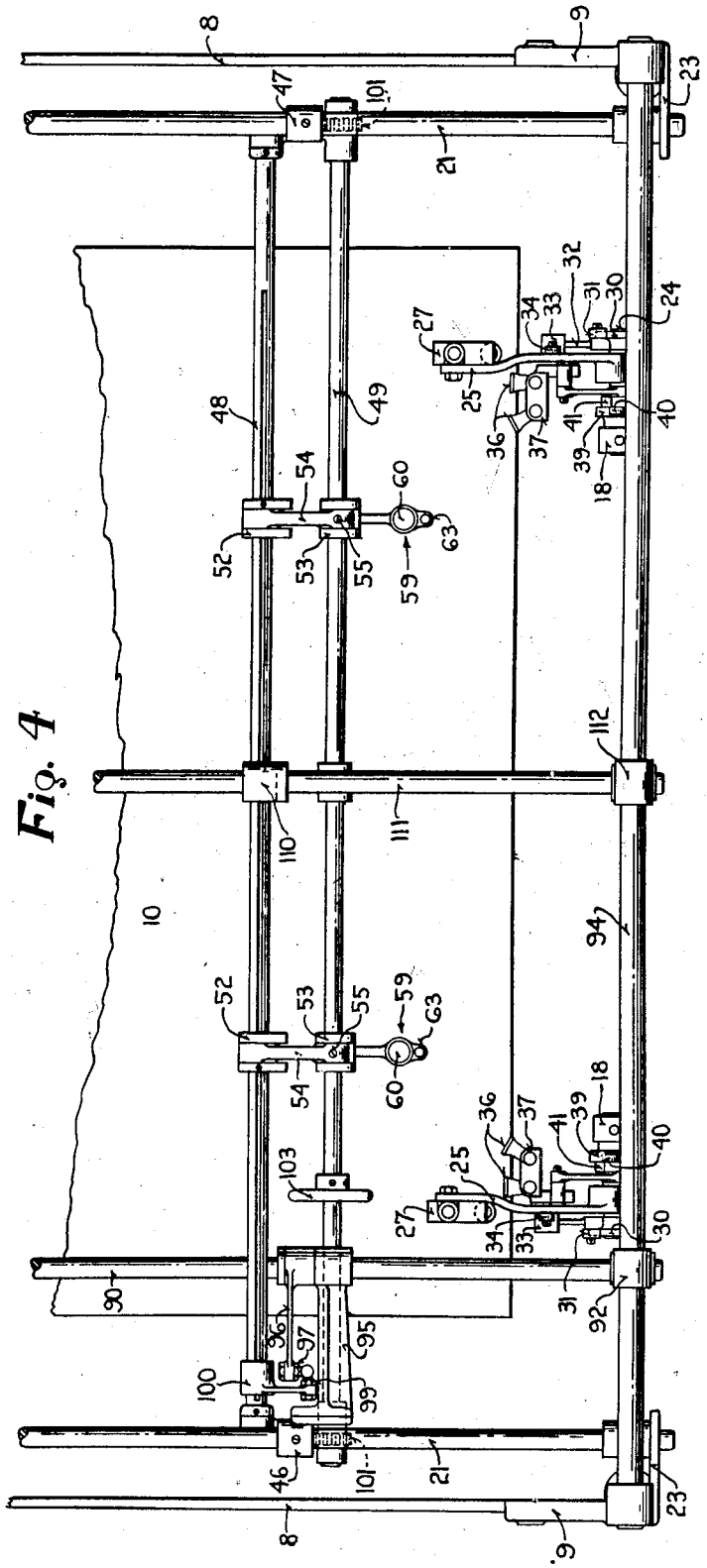


Fig. 7

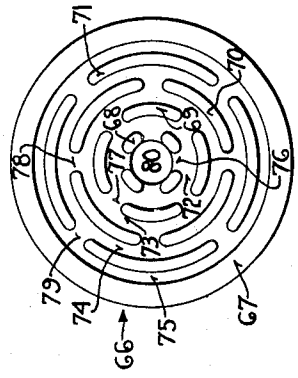


Fig. 6

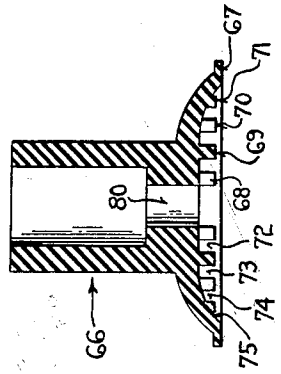
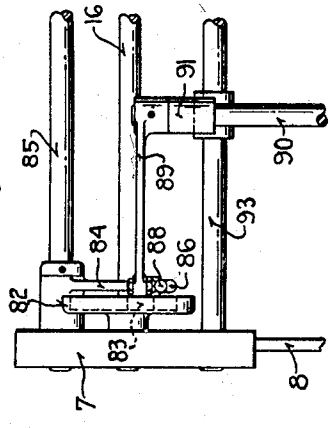


Fig. 5



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SHEET FEEDING APPARATUS

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Application November 30, 1938, Serial No. 243,070

7 Claims. (Cl. 271—31)

This invention relates to sheet feeders and more particularly to suction type sheet engaging or forwarding devices thereof.

In the feeding of sheets from a supply to a printing press or other machine, the sheet areas actually subject to the suction and gripping action of the suction sheet engaging devices are often insufficient to prevent slippage of the sheets on said devices that results from various causes such as the air supplied under pressure to assist in separating the sheets or from air currents otherwise present in proximity to the sheet supply and the line of travel of the sheets therefrom. This is true both with respect to sheet by sheet feeders and stream feeders and while both of these types have heretofore been equipped with sheet engaging elements comprised by rubber suction cups, the aforesaid slippage or displacement of the sheets has been of frequent occurrence with resulting inaccurate feeding and registration of the sheets.

It is therefore one object of the present invention to provide a sheet feeder having improved suction type rubber sheet engaging elements adapted for separating sheets from a supply as well as for forwarding them therefrom and which will prevent slippage of the sheets on said devices either when they are employed for sheet by sheet feeding or stream feeding.

In the stream feeding of sheets from a supply to a printing press or other machine, a preferred method is to separate them one after another from the supply, engage rear portions of the sheets with suction forwarding devices, direct blasts of air under the separated sheets, and forward each separated sheet in lapped relation with a preceding advanced sheet while the air blasts are being supplied. In this case, and prior to the present invention, not only has the aforesaid slippage of the sheets due to air currents persisted, but also the sheets frequently buckle for lack of sufficient gripping effect of the sheet engaging elements thereon to counteract resistance in forwarding each sheet in lapped relation with a preceding advanced sheet.

It is therefore another object of the present invention to provide a stream feeder having suction type rubber sheet forwarding means operable on rear portions of the sheets to advance them in lapped relation, and which forwarding means are so constructed that the aforesaid buckling of the sheets, as well as displacement or slippage thereon due to air currents, will be prevented.

Another object of the present invention is to provide a sheet feeder having suction type rubber sheet engaging elements so constructed that the suction applied thereby on a sheet is distributed over a considerably increased area thereof, with resulting considerably increased gripping effect of said elements on the sheets.

A further object of the present invention is to provide a sheet feeder having suction type rubber sheet engaging elements which are so constructed that distribution of suction on an increased area of a sheet, with resulting increased gripping effect thereon by said elements, is obtained without marking or otherwise damaging the sheet.

These and other objects of the invention will appear from the present disclosure thereof and in order to more clearly understand said invention one embodiment of the same is illustrated in the accompanying drawings to which reference may be had as the following description proceeds.

In said drawings:

Fig. 1 is a fragmentary side elevation, partly in section, of the sheet feeder constituting said embodiment of the invention;

Fig. 2 is an enlarged diagrammatic side elevation, partly in section, of sheet separating means and sheet forwarding means illustrated in Fig. 1 and shown in the positions they occupy when a sheet separated from a supply is being winded and about to be forwarded relative to said supply;

Fig. 3 is a view similar to Fig. 2 but showing the sheet separating means and the sheet forwarding means in the positions they occupy when said sheet has been forwarded relative to the supply and the next sheet is about to be separated therefrom;

Fig. 4 is a fragmentary plan view of the feeder shown in Fig. 1 looking from the top and right thereof;

Fig. 5 is a fragmentary plan view of sheet forwarder operating mechanism shown in Fig. 1 looking from the top and left thereof;

Fig. 6 is an enlarged vertical sectional view of one of the sheet engaging elements shown in Figs. 1, 2 and 3; and

Fig. 7 is a bottom plan view of said sheet engaging element.

Referring to the drawings, wherein like reference characters designate like parts throughout the several views, 5 indicates the rear standards and 6 the front standards of the frame of the feeder that also includes heads 7 secured to the upper ends of standards 6 and side members

8 secured to the heads 7 and brackets 9 which, in turn, are secured to the standards 5.

A pile of sheets 10 is supported in the feeder on a suitable elevator including chains 11 the links of which pass over teeth of sheaves 12 that are fixed on shafts 13 journalled in suitable bearings at the top and opposite sides of the elevator. The shafts 13 have fixed thereon worm wheels 14 which mesh with worms (not shown) on a shaft 15 extending transversely of the feeder and journalled in suitable bearings on the heads 7.

This shaft 15 is intermittently driven by suitable means (not shown) from a cam shaft 16 that extends transversely of the feeder and is journalled in suitable bearings in the heads 7. The cam shaft 16, in turn, is driven in any suitable manner from any suitable source of power, as for example, the printing press or other machine with which the feeder is associated.

The pile elevator that carries the pile of sheets 10 is of well known construction and operation and needs no further description except to say that as the sheets are fed off the top of the pile, as hereinafter described, the elevator is automatically operated through the described means for this purpose to maintain the top of the pile at a predetermined level and thus insure continued and accurate separation and feeding of the sheets from the top of said pile.

As herein shown, the sheets are separated from and winded at the top and rear of the pile, by sheet separating and winding devices of substantially the same construction and operation as those disclosed in Patent No. 1,475,621 granted November 27, 1923 to C. E. Christophel.

The sheet separating and winding devices are each arranged at opposite sides of the feeder and carried in separator frames 17 supported for vertical adjustment by brackets 18 which are clamped in any suitable manner to and adjustable along a bar 19. The bar 19 extends transversely of the feeder and is supported at opposite ends thereof in brackets 20 which are clamped in any suitable manner to and adjustable along side bars 21. These bars 21 are fixed at their forward ends in brackets 22 which are bolted or otherwise suitably secured on the side members 8 and supported at their rear ends in arms 23 secured to or formed integrally with the brackets 9.

Journalled in suitable bearings in the frames 17 are short cam shafts 24 which are driven from any suitable source of power (not shown) and utilized to operate the suction sheet separating devices and winding devices hereinafter described. Loosely mounted on the short cam shafts 24 are arms 25 to which are adjustably secured suction sheet separating devices each comprised by a conduit 26, an arcuate housing 27 connected therewith, and a tubular arcuate member 28 slidable in the housing 27 and provided on the lower outer end thereof with a rubber suction cup 29.

Motion is imparted to the arms 25 to raise and lower the suction sheet separating devices at proper predetermined intervals, by cams 30 fixed on the cam shafts 24 and which engage rollers 31 journalled on arms 32 that are pivoted on the frames 17 and provided with flat extensions 33 which engage rollers 34 journalled on the arms 25. Vacuum is created in the arcuate housings 27 at predetermined intervals through flexible conduits 35 which are connected with the conduits 26 and with a suitable valve mechanism (not shown) that, in turn, is connected with a vacuum pump (not shown) or other suitable source of vacuum. Through creation of vacuum in housings 27 as aforesaid and the action of springs (not shown) members 28 have telescoping action with respect to housings 27 and cups 29 separate and lift the sheets successively from the top and rear of the pile in proper sequence as motion is imparted to housings 27 by the cam operated arms 25.

After each sheet is separated and lifted at the rear thereof as aforesaid, said sheet is winded to completely separate the same from the next underlying sheet. This is accomplished by hollow foot clamps 36 which are moved downwardly and forwardly beneath the lifted sheet and into engagement with the top of the pile. These hollow foot clamps 36 are adjustably mounted in arms 37 which are pivotally connected at the forward ends of arms 38 pivoted on the frames 17. Raising and lowering movement of the hollow foot clamps 36 at proper predetermined intervals is effected by cams 39 fixed on the cam shafts 24 and which engage rollers 40 journalled on cam straps 41 that are pivotally connected with the arms 38. The arms 37 are provided in the lower ends thereof with cam slots 42 cooperating with rollers 43 carried on fixed arms 44 which cause forward and backward movement to be imparted to the hollow foot clamps 36 as the same are lowered and raised, respectively.

Air under pressure is delivered to the hollow foot clamps 36 at the required predetermined intervals through flexible conduits 45 which are connected with said foot clamps and with a suitable valve mechanism (not shown) that is, in turn, connected with a suitable source of compressed air. The forwardly directed currents of air discharged from the hollow foot clamps 36 not only aid to completely separate the lifted sheet from the next underlying sheet as previously described, but also act, in conjunction with suction devices that engage rear portions of the sheets, to feed the sheets in lapped relation to conveying means as hereinafter described.

These suction sheet forwarding devices are preferably mounted, constructed and operated as follows. Mounted on, and slidable along the side bars 21 are brackets 46 and 47 having journalled in suitable bearings therein two transversely extending shafts 48 and 49. Keyed to the shaft 48 and loosely mounted on the shaft 49 at opposite sides of the feeder are parallel arms 50 and 51 having bifurcated hub portions 52 and 53 adapted to receive corresponding ends of tie links 54. The arms 50 and 51 at each side of the feeder, and parts carried thereby, are therefore adjustable as a unit along the shafts 48 and 49 to various positions and may be secured in any desired position of adjustment thereon by screws 55 or the like threaded in the ends of the links 54 engaged over the shaft 49. Pivotally connected at the lower ends of arms 50 and 51, as at 56 and 57, are rearwardly extending arms 58.

Loosely mounted in suitable openings formed in the rear ends of arms 58 are suction devices indicated broadly at 59 the construction and operation of which is substantially the same, except as hereinafter described, as the construction and operation of the suction devices disclosed in the application Serial No. 116,692 of Leonard Baker, George A. Martin and Leo C. Williams filed December 19, 1936. These suction devices 59 include cylinders 60 which are verti-

cally adjustable and held against lowering movement by adjusting nuts 61 threaded on conduits 62 that are connected with said cylinders at the lower ends thereof and project through suitable openings in lugs 63 formed on the arms 58. Turning movement of the adjusting nuts 61 is prevented by lock nuts 64.

Slidably mounted in the cylinders 60 are vacuum operated pistons (not shown) formed with hollow piston stems 65 which project through the lower ends of said cylinders. Suitably connected with the piston stems 65 at the lower ends thereof are flexible rubber sheet engaging suction cups indicated broadly at 66 which, in accordance with the present invention, are so constructed that increased application of vacuum on the sheets by the cups is obtained to counteract the displacement effect of the air on the sheets.

As shown in Figs. 6 and 7, the suction cups 66 are formed on the lower sides thereof with unbroken circular outer rims 67, and series of spaced arcuate shaped ribs 68, 69, 70 and 71 concentric with said outer rims 67 and progressively increasing in size from the center of said cups outwardly toward the rims 67. The arcuate shaped ribs 68, 69, 70 and 71 of each series are staggered with respect to each other and form therebetween a series of concentric channels 72, 73, 74 and 75. The channels 72, 73, 74 and 75 are interconnected by spaces 76, 77, 78 and 79 formed between each of the arcuate shaped ribs 68, 69, 70 and 71 and said spaces also connect said channels with central ports 80 formed in the cups 66 and communicating with the hollow piston stems 65 of the suction devices 59. The lower surfaces of the ribs 68, 69, 70 and 71 are slightly undercut with respect to the lower surfaces of the outer rims 67 to insure a perfect seal of the cups 66 on the sheet. It will thus appear that when vacuum is created in the cups 66 through the ports 80 to cause said cups to grip the sheet, the ribs 68, 69, 70 and 71 therein prevent the portions of the sheet engaged by the cups from being drawn into said cups by vacuum. In this manner the sheet gripping areas of the suction cups 66 are increased enabling increased application of vacuum on the sheet by said cups which will prevent slippage of the sheet on the cups when said sheet is forwarded from the pile in lapped relation with a preceding sheet by the suction devices 59. Further, through the concentric and staggered arrangement of the ribs 68, 69, 70 and 71 increased application of vacuum on the sheets may be obtained without disfiguring or marking said sheets.

Cylinders 60 are connected by conduits 62 and 81 with a suitable source of vacuum, and through the provision of suitable valve mechanism (not shown), vacuum is created at proper predetermined intervals in cylinders 60, piston stems 65 and cups 66 so that the latter grip each sheet lifted by the separator cups 29 just before the cups 29 are released from the sheet and while the same is being winded by the hollow foot clamps 36.

The sheets gripped successively by the cups 66 are forwarded one under the other in lapped relation and for this purpose oscillating motion is imparted to the parallel arms 50 and 51 to move the suction devices 59 forwardly and rearwardly in a plane substantially horizontal with the upper surface of the pile. This is accomplished by a box cam 82 that is fixed on the cam shaft 16 and driven thereby. Cam 82 engages a roller 83 journalled on an arm 84 which is loosely mounted on a shaft 85 that extends transversely of the feeder and is fixed in the heads 7. Connected with the arm 84, as by a ball and socket connection 86, is one end of a link 87 the opposite end of which is connected, as by a similar ball and socket connection 88, with an arm 89 that is fixed on a shaft 90. Shaft 90 extends longitudinally of the feeder and is journalled in suitable bearings in brackets 91 and 92 which are fixed on stay shafts 93 and 94, respectively. Shafts 93 and 94 extend transversely of the feder and are fixed in the heads 7 and brackets 9 respectively. An additional bearing and support for the shaft 90 is provided by a bracket 95 which is bolted or otherwise suitably secured to the bracket 46.

Keyed to the shaft 90 adjacent the bracket 95 and slidable along said shaft is an arm 96 which is connected, as by a ball and socket connection 97, with one end of a link 98 the opposite end of which is connected, as by a similar ball and socket connection 99, with an arm 100 that is keyed or otherwise suitably secured to the shaft 48. It will thus appear that as shaft 16 is rotated cam 82, through the described connections therefor with the shaft 48, will oscillate the parallel arms 50 and 51 and thus impart straight line forward and backward movements to the suction devices 59. Movement of the brackets 46 and 47 and parts carried thereby along the side bars 21 to adjust the suction devices 59 longitudinally of the feeder in accordance with the length of sheet acted upon is accomplished by spur pinions 101 fixed on the shaft 49 at opposite ends thereof. These pinions 101 mesh with rack teeth 102 formed on the lower sides of the bars 21. A hand wheel 103 fixed on the shaft 49 is employed to rotate shaft 49 and pinions 101.

The separated and winded sheets are forwarded one after another from the pile by the suction devices 59 which deliver said sheets in lapped relation one under another to conveying means comprised by a transversely extending feed roller 104. The feed roller 104 is journalled in suitable bearings in the heads 7. Passing around and driven by the roller 104 is a series of endless tapes 105 which carry a stream of the lapped sheets to the printing press or other machine to be fed. The front portions of the tapes 105 pass around other rollers (not shown) and over a roller 106 that extends transversely of the feeder and is journalled in suitable bearings in the heads 7. Cooperating with the feed roller 104 are pressure rollers 107 journalled on arms 108 which are adjustably secured to a shaft 109 that extends transversely of the feeder and is fixed in the heads 7. At or about the time the front edge of each sheet reaches the rollers 104 and 107 the air blasts from hollow foot clamps 36 are cut off. Thereupon the sheet is gripped by rollers 104 and 107 and suction is broken in the devices 59 which then return rearwardly to engage the next sheet.

An additional bearing and support for the shafts 48 and 49 is provided by a bracket 110 which is carried by and slidable along a shaft 111 that is fixed at one end thereof in a bracket 112 secured to the stay shaft 94, and at the opposite end in a bracket (not shown) similar to the bracket 91 secured to the stay shaft 93.

The present description and accompanying drawings set forth with more or less particularity the preferred embodiment of the invention, but it is to be expressly understood that

said invention is not limited to said embodiment or otherwise than by the terms of the appended claims.

What I claim is:

1. In a sheet feeder having means for separating sheets successively from the top and rear of a supply thereof and means for directing air under pressure from the rear of each separated sheet forwardly thereunder, means for forwarding the separated sheets in lapped relation and comprising flexible rubber vacuum applying cups operable on rear portions of the separated sheets and having unbroken outer rims engageable therewith, and concentric series of arcuate shaped spaced staggered ribs and interconnecting channels therebetween formed in said cups for preventing said portions of the sheets from being drawn in the cups by vacuum sufficiently to reduce the sheet gripping effect of the cups and thereby enabling increased application of vacuum on the sheets by the cups through said channels to counteract resistance to forwarding of the sheets in lapped relation from the rear thereof and to counteract the displacement effect of said air on the sheets when they are engaged by said cups.

2. In a sheet feeder having means for separating sheets successively from the top and rear of a supply thereof and means for directing air under pressure from the rear of each separated sheet forwardly thereunder, means for forwarding the separated sheets in lapped relation and comprising flexible rubber vacuum applying cups operable on rear portions of the separated sheets and having unbroken outer rims engageable therewith, and spaced concentric series of arcuate shaped ribs formed in the flexible rubber cups and progressively increasing in size from the centers of the cups toward the outer unbroken rims thereof, the ribs of each series being spaced apart and staggered with respect to the ribs of the adjacent series and said ribs serving to prevent said portions of the sheets from being drawn into the cups by vacuum sufficiently to reduce the sheet gripping effect of the cups and enabling increased application of vacuum on the sheets by the cups through the spaces between the ribs to thereby counteract resistance to forwarding of the sheets in lapped relation from the rear thereof and to counteract the displacement effect of said air on the sheets when they are engaged by said cups.

3. In a sheet feeder having means for separating sheets successively from the top and rear of a supply thereof and means for directing air under pressure from the rear of each separated sheet forwardly thereunder, means for forwarding the separated sheets in lapped relation and comprising flexible rubber sheet engaging and vacuum applying cups operable on rear portions of the separated sheets and having unbroken outer rims engageable therewith, and means for preventing slippage of the sheets relative to the cups due to said air and for counteracting resistance to forwarding of the sheets in lapped relation from the rear thereof, said last named means comprising spaced pluralities of ribs formed in the cups, the ribs of each plurality being spaced apart and staggered with respect to the ribs of the adjacent plurality and said ribs serving to prevent the portions of the sheets engaged by the cups from being drawn therein by vacuum sufficiently to reduce the sheet gripping effect of the cups and enabling the cups to apply vacuum on correspondingly increased areas of the sheets to increase the gripping action of the cups thereon and thereby prevent the slippage and counteract the resistance aforesaid.

4. In a sheet feeder having means for separating sheets one after another from the top and rear of a supply thereof and means for directing air under pressure from the rear of each separated sheet forwardly thereunder, flexible rubber vacuum applying sheet forwarding cups having unbroken outer sheet engaging rims and operable on rear portions of the separated sheets for feeding them in lapped relation relative to said supply, and spaced concentric series of staggered arcuate shaped ribs formed in the flexible rubber cups for preventing the sheets from being drawn therein by vacuum sufficiently to reduce the sheet gripping effect of the cups and thereby enabling increased application of vacuum on the sheets by the cups through the spaces between said ribs to counteract resistance to forwarding of the sheets in lapped relation from the rear thereof and to counteract the displacement effect of said air on said sheets relative to said cups.

5. In a sheet feeder having mechanism for feeding sheets successively from a supply thereof, a flexible rubber sheet engaging and vacuum applying cup forming part of said mechanism and having an unbroken outer sheet engaging rim, means for connecting the cup with a vacuum pump or the like to produce vacuum in the cup when it engages a sheet, and means for obtaining maximum vacuum gripping effect of the cup on the sheet comprising concentric series of arcuate shaped spaced staggered ribs and intercommunicating channels therebetween formed in the cup, said ribs preventing the portion of the sheet engaged by the cup from being drawn therein by vacuum sufficiently to reduce the sheet gripping effect of the cup and said channels enabling the cup to apply vacuum on an increased area of the sheet to produce the aforesaid maximum vacuum gripping effect of said cup thereon.

6. In a sheet feeder, a sheet engaging and vacuum applying flexible rubber cup having an unbroken outer sheet engaging rim, means for connecting the cup with a vacuum pump or the like to produce vacuum in the cup when it engages a sheet, and means for obtaining maximum vacuum gripping effect of the cup on the sheet comprising spaced concentric series of arcuate shaped ribs formed in the cup and progressively increasing in size from the center of the cup toward the unbroken outer sheet engaging rim thereof, the ribs of each series being spaced apart and staggered with respect to the ribs of the adjacent series and said ribs preventing the portion of the sheet engaged by the cup from being drawn therein by vacuum sufficiently to reduce the sheet gripping effect of the cup and enabling the cup to apply vacuum on an increased area of the sheet through the spaces between the ribs to thereby obtain the aforesaid maximum vacuum gripping effect of said cup on said sheet.

7. In a sheet feeder, a sheet engaging and vacuum applying flexible rubber cup having an unbroken outer sheet engaging rim, means for connecting the cup with a vacuum pump or the like to produce vacuum in the cup when it engages a sheet, and means for obtaining maximum vacuum gripping effect of the cup on the sheet comprising spaced pluralities of ribs or projections in the cup, the ribs or projections of each plurality being spaced apart and staggered with respect to the ribs or projections of the adjacent plurality

and said ribs or projections preventing the engaged portion of the sheet from being drawn into the cup by vacuum sufficiently to reduce its gripping effect, whereby the cup may apply vacuum on an increased area of the sheet through the spaces between the ribs or projections so that the aforesaid maximum gripping effect of said cup on said sheet is obtained and objectionable marking of the sheet is prevented by staggering of said ribs.

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