

Jan. 25, 1938.

A. WORMSER

2,106,199

SHEET DELIVERY DEVICE AND METHOD

Filed Aug. 18, 1933

6 Sheets-Sheet 1

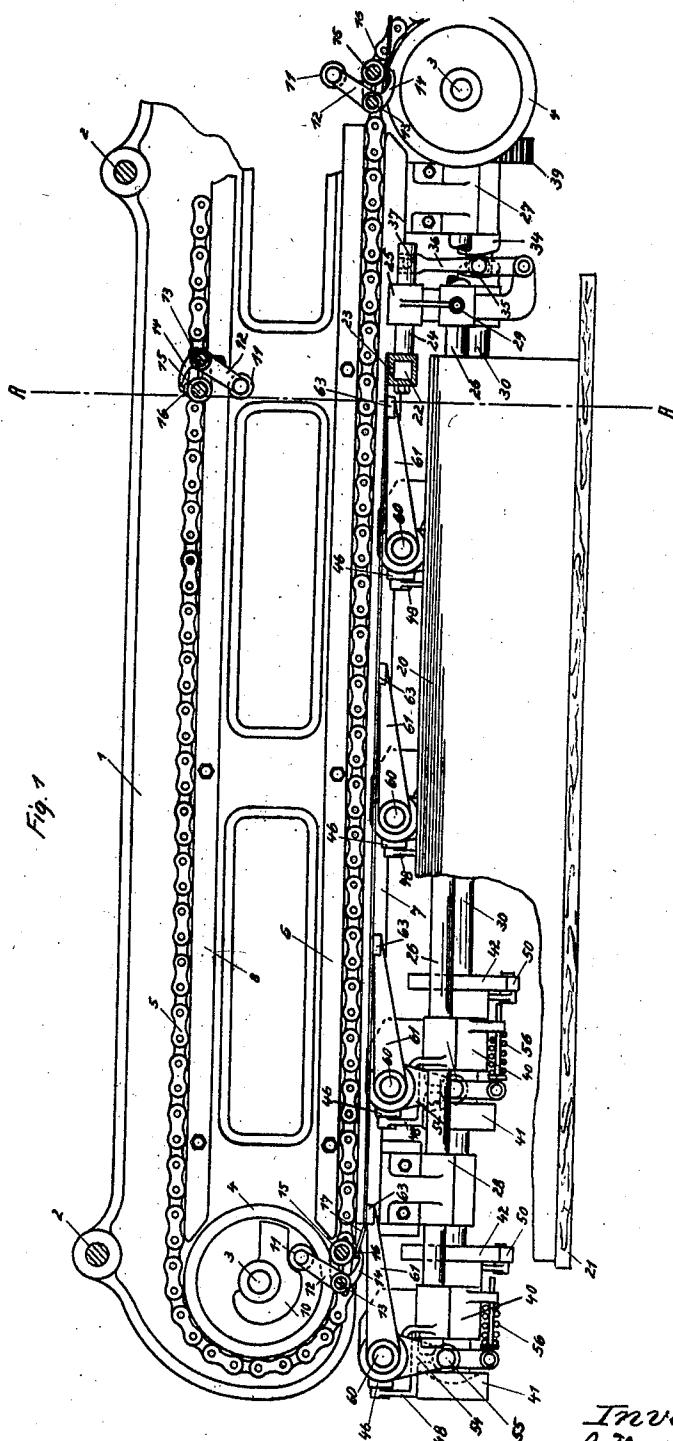


Fig. 1

Inventor:
Arthur Wormser
by Brown & Seward
Attorneys

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6 Sheets-Sheet 2

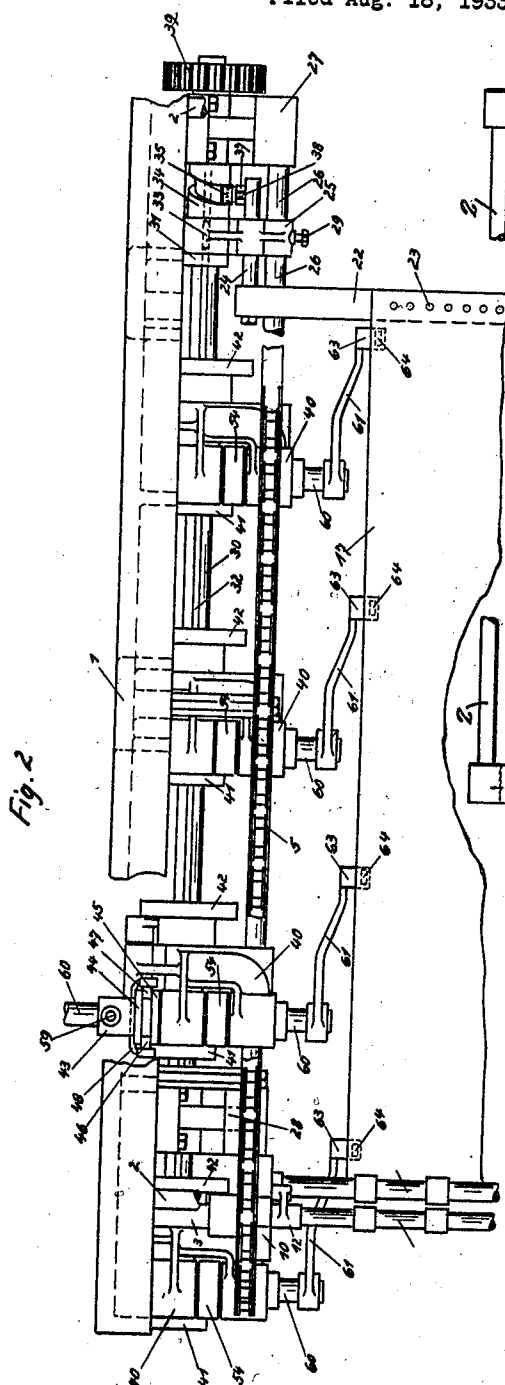


Fig. 2

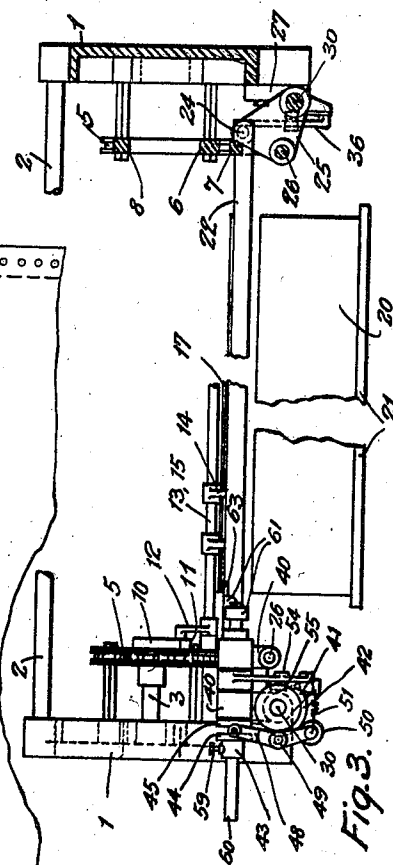


Fig. 3

Inventor:
Arthur Wormser
by Brown & Seward
Attorneys

Jan. 25, 1938.

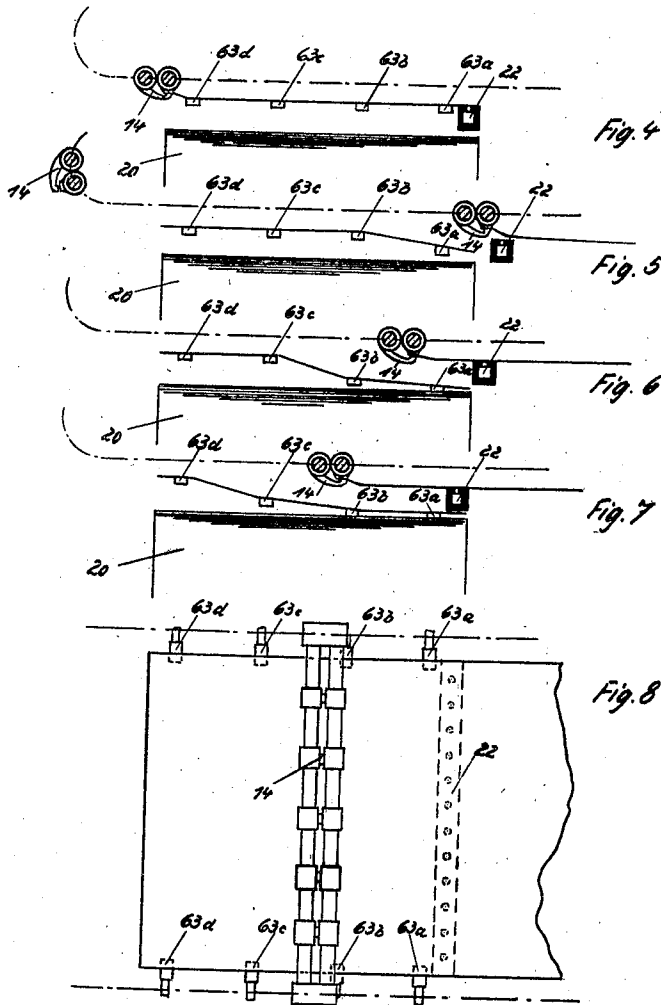
A. WORMSER

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SHEET DELIVERY DEVICE AND METHOD

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6 Sheets-Sheet 3



Inventor:
Arthur Wormser
by Brown & Howard
Attorneys

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SHEET DELIVERY DEVICE AND METHOD

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6 Sheets-Sheet 4

Fig. 9

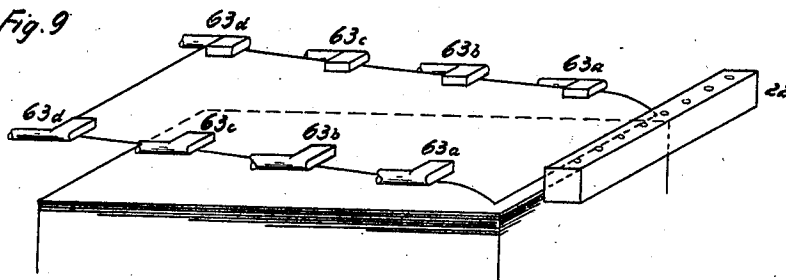


Fig. 10

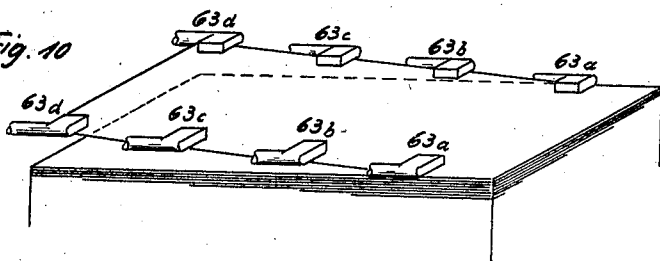


Fig. 11

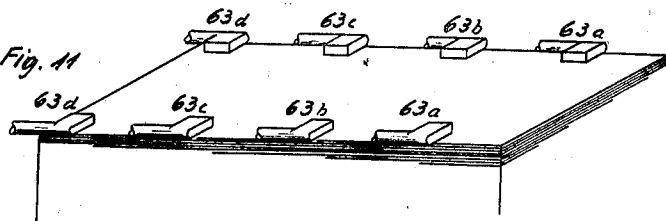


Fig. 12

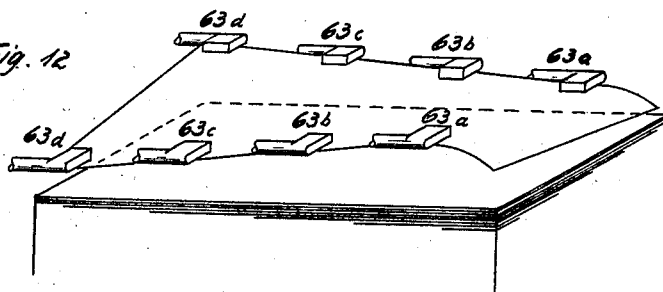
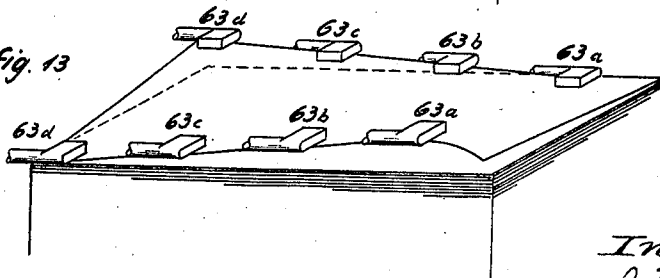


Fig. 13



Inventor:
Arthur Wormser
by Brown & Howard
Attorneys

Jan. 25, 1938.

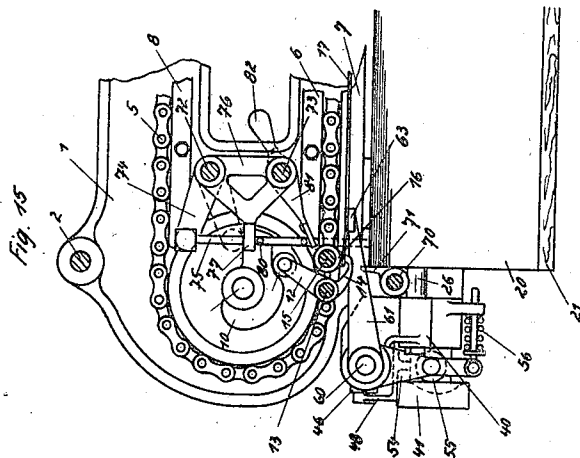
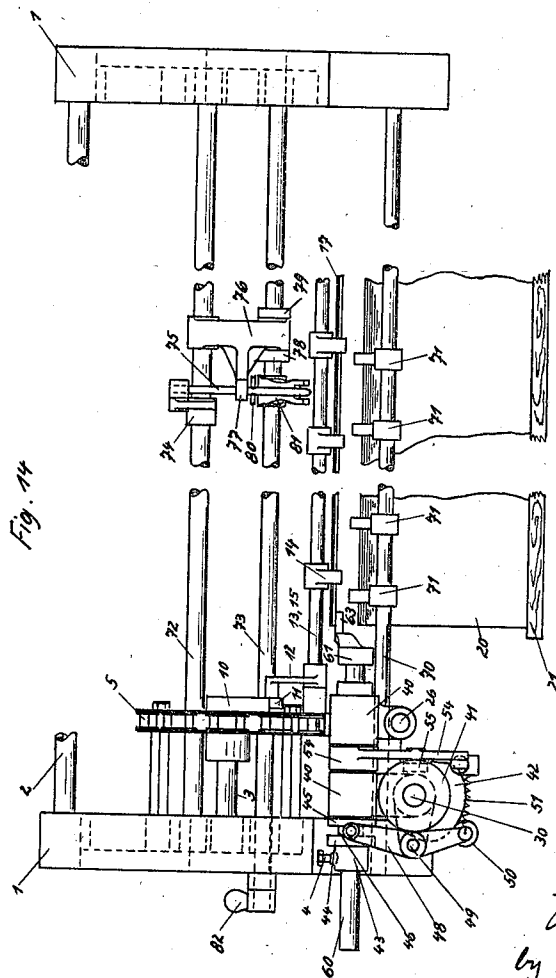
A. WORMSER

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SHEET DELIVERY DEVICE AND METHOD

Filed Aug. 18, 1933

6 Sheets-Sheet 5



Inventor:
Arthur Wormser
by Brown & Howard
Attorneys

Jan. 25, 1938.

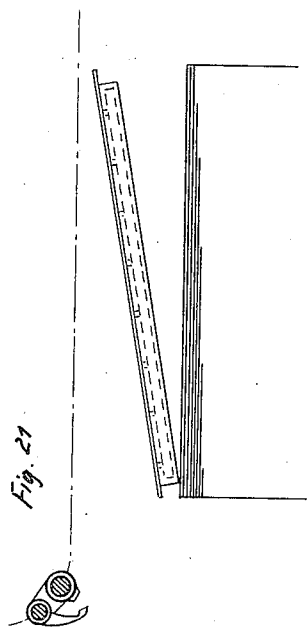
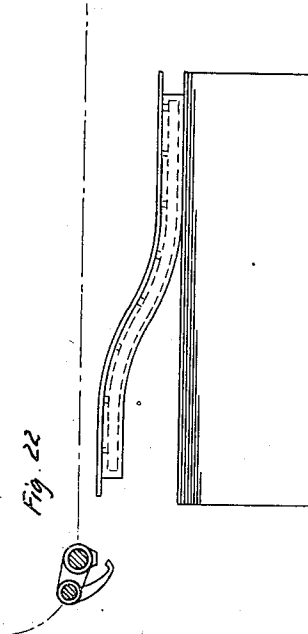
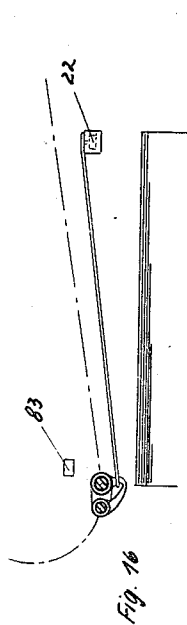
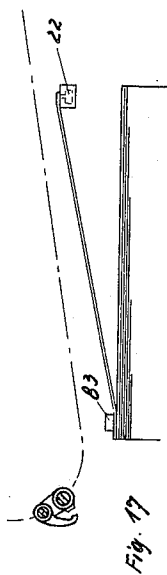
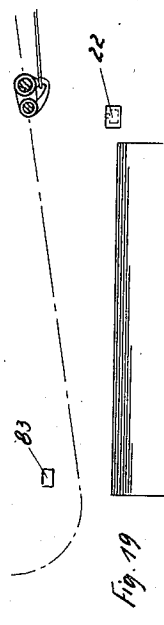
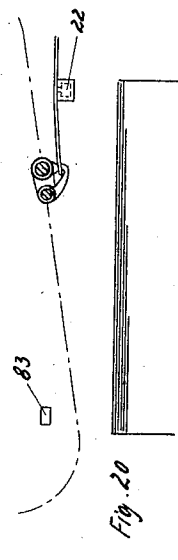
A. WORMSER

2,106,199

SHEET DELIVERY DEVICE AND METHOD

Filed Aug. 18, 1933

6 Sheets-Sheet 6



Inventor:-
Arthur Wormser
by *Kenneth Neward*
Attorneys

UNITED STATES PATENT OFFICE

2,106,199

SHEET DELIVERY DEVICE AND METHOD

Arthur Wormser, Offenbach-on-the-Main, Germany, assignor to Faber & Schleicher, A. G., Offenbach-on-the-Main, Germany, a corporation of Germany

Application August 18, 1933, Serial No. 685,695
In Germany August 31, 1932

46 Claims. (Cl. 271-79)

The present invention is an improvement in sheet delivery devices particularly for use in printing presses, but adapted for use in any machine where sheets are to be delivered after having been processed in that machine; and in methods of sheet delivery.

To prevent blurring of the impression on the sheet deposited on the delivery pile of a printing machine, the following sheet must be advanced at a certain height above the pile. If one allows the newly arriving sheet to drop freely from the height at which it is advanced by grippers, suction nozzles, tapes or the like, the air escapes first at the edges of the sheet and an air cushion is produced in the middle of large sheets. This air cushion, if the machine runs fast, may grow to such an extent that a regular delivery is not possible. Furthermore the sheet after having been jogged up tends to buoy on the air cushion so that it must be jogged up over again.

This situation may be changed if one presses the sheet downwards and forces the air to escape.

The most natural way to do this would be to press down the whole area of the sheet, but the devices that offer themselves for this purpose, e. g. tapes, rolls or the like, must be applied with great care because they blur the fresh impression. An air blast applied from above does not effect the desired result with regularity and does not deposit the sheet on a predetermined place.

Devices have therefore been applied which press down either the forward or the rear edge of the sheet. But the main difficulties are not removed by these devices because they leave the sheet in a flag like condition and most of its area is compelled to press out the air by its own weight. Thus the formation of an air cushion is not prevented.

A principal object of my invention is to provide a delivery device in which means are provided for holding two opposite edges of the sheet at the same time and pressing them down.

If this pressing down happens at the same time all along the two opposite edges, though there remains some air under the middle of the sheet, no air cushion is produced, but the sheet will be bent in shape of a cylinder and the air will easily escape at the two edges not held.

A second object of my invention is to provide a delivery in which the holding devices disposed on two opposite edges of the sheet are movable away from each other so that the sheet when being deposited is tensioned or tightened.

By this means still less air is caught under the sheet, and any so caught is effectively removed.

Another object of my invention is to provide a delivery device in which the means holding two opposite edges of the sheet are moved down-

wards, or at least finish their downward motion, at different times.

By this means it is possible to force the air under the sheet in any direction one deems fit, be it to one of the held edges or to one of the free edges or to the corners.

Another object of my invention is to provide a delivery device in which the order in which the devices holding two opposite edges of the sheet are depressed is such that the holding devices exactly opposite to each other are moved down simultaneously, but the devices disposed on the same edge go down step by step.

By this means one can produce a motion of the sheet that is similar to its being rolled down though it is not touched from the printed side. It is evident that this is a most efficient way entirely to do away with any air captured under the sheet to be deposited.

Other objects of my invention will be apparent from the following description.

In order that my invention may be fully understood, I will first describe the same with reference to the accompanying drawings, and afterwards point out the novelty thereof more particularly in the annexed claims.

Fig. 1 is a vertical section of the delivery pile showing the parts arranged at the side frame of the delivery device, taken along the centre line of the pile.

Fig. 2 is a plan of the parts arranged at one side frame of the delivery device.

Fig. 3 is an elevation, partly in section taken along the line A-A in Fig. 1, showing the parts arranged at the two side frames of the delivery device, as seen from the end of the machine.

Figs. 4-7 are diagrammatical elevations of the whole device showing its operation in successive moments.

Fig. 8 is a diagrammatical plan of Fig. 7. Figs. 9-13 diagrammatically show two other modes of application of the whole device.

Figs. 14-15 are a front and side elevation of the feeler device controlling the level of the pile.

Figs. 16-22 are further diagrammatical drawings showing three different applications of my invention.

In Fig. 1 the side frames of the delivery device are designated by 1. The frame is stiffened by transverse rods 2. On fixed pivots 3 guide rolls 4 of the delivery chains 5 turn loosely. The chains 5 are guided in the direction towards the rolls 4 by guides 6 and 7 and away from the rolls by guides 8. Gripper devices arranged at suitable intervals extend from one chain to the other. These gripper devices of conventional type comprise a gripper shaft 13 with grippers 14 operated by a stationary cam 10 acting on roller 11 which is carried by arm 12. A non-turnable

rod 15 bears the blocks 16 against which the sheet 17 is pressed by the grippers 14.

Above the rear end of the pile 20 formed by the sheets which have been deposited on the delivery table 21, a suction tube 22 is arranged which has suction holes 23 on the upper face. The sheet to be delivered is drawn over the suction tube by the gripper devices and consequently is tensioned or tightened as long as the suction effect is applied by means of a valve and pipes not shown. The suction pipe 22 is supported at each end by bolts 24 sliding in brackets 25. The brackets 25 are supported by rods 26 fixed to the side frames 1 by means of brackets 27 and 28, the place where brackets 25 are fixed on the rods 26 by set screws 29 depending on the length of the sheet to be delivered. Brackets 27, 28 support also a one revolution shaft 30 driven by gear wheel 39 in a suitable manner, the drive of which is not shown as being of no interest. On shaft 30 slides a sleeve 31 which may be turned in bracket 25 by shaft 30 in consequence of a key 33 sliding in a groove 32 but which can not move lengthwise in this bracket.

A cam 34 is fixed to the sleeve 31 and by means of roller 35, lever 36, fork 37 and pivot 38, causes the bolt 24 and the suction tube 22 connected with it to move to and fro independent of the place where the bracket 25 has been fixed.

Several brackets 40 are fixed on rod 26 at suitable intervals by set screws. In these brackets another sleeve (not shown) is turned by means of a key (not shown) and shaft 30 with its groove 32; this sleeve bears two cams 41 and 42 which are fixed on each end of the sleeve so as to prevent it from sliding lengthwise in the bracket 40. Transversely to shaft 30 brackets 40 have another bearing in which a sleeve 43 is supported so that it may rock and slide lengthwise. On one end of this sleeve 43 two set rings 44, 45 are fixed between which sliding pieces 46, 47 are arranged. These sliding pieces are supported by a fork lever 48 which rocks around a pivot 49 borne by bracket 40, this rocking movement being caused by cam 42 and roller 50 which are kept in contact by spring 51. On sleeve 43 slides an arm 54 which is prevented from moving along with the sleeve by two parallel surfaces of bracket 40. This arm bears a roller 55 which is kept in contact with cam 41 by a spring 56, and when given a rocking movement by this cam imparts this movement to the sleeve 43 by means of a key and groove not shown. In the sleeve 43 a rod 60 may be fixed by set screw 59 so that it projects more or less on either end according to the width of the sheet. On the inner end of rod 60 an arm 61 is fixed which bears a suction nozzle 63 the opening 64 of which is on the upper face.

A transverse rod 70 fixed in the side frames 1 (Figs. 14-15) in front of the pile 20 supports front stops 71. Above the pile two shafts 72 and 73 are arranged pivotally supported in the side frames 1. In the middle of shaft 72 a lever 74 is fixed which on its ends is pivotally connected with a feeler 75 controlling the level of the upper surface of the pile. The shafts 72 and 73 support a bracket 76 containing the guide 77 for the feeler 75 in such a way that they may turn in this bracket and nevertheless it is prevented from moving sideways by strings 78 and 79 fixed on shaft 73. In feeler 75 a stud 80 is fixed. Shaft 73 bears a fork 81 between which the feeler 75 may move up and down when the fork is in its lowered position. But if by means of a hand lever 82 arranged on shaft 73 outside the side frames 1 the

fork 81 is raised, it bears against the stud 80 and this keeps high the feeler 75. By turning the hand lever 82 the suction effect in the nozzles 63 and in the suction tube 22 may be stopped at the same time. For this purpose as well as for the lowering and raising of the feeler 75 by means of rocking shaft 72 conventional means may be applied.

The described device operates in the following way.

While shaft 30 makes one revolution, the cams 41, one of which is contained in each of the four nozzle brackets 40 represented in the drawings, impart one rocking movement to arms 54 and since these arms are connected with sleeves 43 by a key and since the arms 61 bearing the nozzles 63 are fixed to rods 60 screwed on to the sleeves 43 by set screws 59, the arms 61 make the same rocking movement so that the nozzles 63 are lowered and raised once per revolution. At the same time cams 42 impart one rocking movement to levers 48 and these transmit it to sleeves 43 by means of the sliding pieces 46, 47 without interfering with the said rocking movement. Thus the nozzles 63 are given an in- and outward motion which may take place simultaneously with the up and down motion if required. At the same time the two cams 34 move the suction tube 22 once to and fro by means of levers 36 and bolts 24 as has been described.

Now the working of the whole device in the manner intended depends on these three movements being executed in proper timed relation. To show this I refer to Figs. 4-7.

It will be readily understood, that in order to produce the herein referred to variations in the sequence of the delivery movement of the nozzles 63 or the like, and some of which variations are indicated diagrammatically in Figs. 4 to 13, the contour of the cams involved in the operation of said nozzles may be varied correspondingly. It might also be desirable to so mount the cams that they could be conveniently substituted by cams having the desired contours.

In Fig. 4 all parts are shown in the same position as in Fig. 1. The front edge of the sheet is held by grippers 14 of one gripper device and the rear edge of the sheet is sucked against the suction tube 22. In consequence of the motion of grippers 14 the sheet is drawn over the suction tube and tensioned or tightened. The four nozzles 63 on each side of the delivery device which are designated by a, b, c, d a moment before being in the position shown in Figs. 1 and 4 had risen so far that they stood a very small distance underneath of the tensioned sheet this distance being sufficient to prevent the grippers from striking against the nozzles. But at the moment shown in the drawings the suction air has been let in the nozzles by pipes and valves not shown, so that the sheet has been seized by the nozzles.

At approximately the same moment the grippers 14 let go of the sheet and the latter being under the sucking effect of the suction tube 22 and the eight nozzles 63 a-d is stopped immediately. Although the grippers move with the full speed of the chains it has proved possible to stop the sheet at a definite point, because the mass of the sheet is so small in comparison with the retarding forces.

As soon as the sheet is taken hold of by all nozzles, the suction effect is terminated in suction tube 22 by pipes and valve not shown and tube 22 is moved backwards by the device 24-38, so that the rear edge of the sheet is free to be low-

ered. As the sheet can easily be bent, it is not necessary that the tube 22 be entirely out of the way when the two opposite nozzles 63a begin their downward stroke.

5 In Fig. 5 the suction tube 22 is shown after having finished its outward motion. The grippers which had forwarded the sheet now seized by nozzles 63, have continued their movement in opened condition and the subsequent gripper device is advancing the next sheet. The suction effect of tube 22 is started by the means mentioned as soon as this new sheet is dragged over it. The two nozzles 63a opposite to each other have begun their downward motion pressing down the rear end of the sheet to be deposited whilst the nozzles 63 b—d keep their initial position.

10 Figs. 6 and 7 show clearly how this mode of operation continues: suction tube 22 advances until it reaches its initial position. Grippers 14 advance the following sheet in a tightened condition. Nozzles 63 b—d are lowered successively so that a flat S-shaped wave moves over the sheet and the air is systematically forced out at the front edge of the sheet.

15 No drawing has been made showing the end of the depositing action because one can easily realize that after the position shown in Fig. 7 the nozzles 63c finish their downward motion and nozzles 63d are lowered so that all nozzles will stand immediately above the last sheet deposited exactly like the nozzles 63a and 63b shown in that position.

20 While the gripper device forwards the next sheet up to the position shown in Fig. 4, the nozzles 63 let go of the deposited sheet and recede so far that they do not touch it anymore. Then they rise and when they are at the height of the gap between the deposited sheet and the next sheet (which is tightened between the gripper and the suction tube 22 and so will not interfere with the nozzles 63), they are moved inwards. After having passed the edge of the sheet, they finish their upward motion until they reach their initial position underneath the next sheet.

25 It has not been said and it is not necessary that any one of the nozzles 63 should finish its downward stroke before the next one or the next ones begin their downward motion; on the contrary these motions may partly overlap. But it is an essential feature that the nozzles finish their downward motion step by step, if one wants to imitate a rolling effect.

30 To cause the sheet to follow the motion of the nozzles 63 still more exactly than it does with the motions described I add the following motion of the nozzles 63 by means of a suitable shape of cams 42, i. e., I cause them to move outwards a small distance after they have seized the sheet. Thus the sheet that is tightened lengthwise by the grippers 14 and the suction tube 22 and is kept in this condition by nozzles 63, is tightened transversely too.

35 When mentioning that the nozzles 63 are lowered successively or step by step, I wanted to say that any nozzle 63 is depressed later than the nozzle adjoining it on one side and earlier than that adjoining its other side and in no case is one nozzle depressed later than both adjacent nozzles. To secure the desired result it is not necessary to begin the successive depressions from the rear end of the sheet. In some cases it may be preferable to begin from the front end or from the middle of the sheet. In the latter case the sheet is "rolled" down towards the two free edges at the same time which means that the air is as

effectively done away with as when beginning from either end, but one half of the time needed is saved.

The number of pairs of nozzles 63 may be more or less than four according to the size of the sheet.

5 When the delivery device has been provided with a certain number of nozzles 63 adapted to handle the largest sheet adequately, the nozzles may be adjusted closer to each other when handling smaller sheets. For this purpose brackets 10 40 can be shifted on rods 26 and shaft 30. If they can not further be narrowed, one may shift one of the outermost nozzles so that it is beyond the rear edge of the sheet and so operates idly.

15 Card board, sheets of metal and the like are not adapted to be seized by the suction tube 22 and can not therefore be tightened by it. Consequently sheets of such heavy material will tend to sag between the grippers and the suction tube, and the nozzles 63 b—c, when entering the gap 20 over the deposited sheet, may knock against the sagging edge of the following sheet. It is advisable therefore to have only the nozzles 63a and 63d work, because they are positioned at parts of the sheet which occupy a predetermined height 25 even with sagging sheets. The nozzles 63 themselves which preferably are of metal when handling paper to allow for the transverse tightening motion, may be provided with rubber mouths 30 when handling card board. If one keeps the same order of motions as though the middle nozzles were working i. e. depresses the nozzles 35 63d later than the nozzles 63a, the air will again be forced towards one end of the sheet because such stiff materials do not form a cushion even 35 when seized only at the corners. Thus the main feature of my invention, i. e., holding two opposite edges of the sheet is made use of in two different ways at a time. For holding at the corners 40 means holding at the two lateral edges and holding at the front and rear edges according as one interprets it.

45 When in this case or the one mentioned before one makes idle some of the nozzles 63 it is desirable to provide an individual hand operated valve for every nozzle so that loss of air suction is avoided. Furthermore the nozzles may be removed by shifting the rod 60 outwards in the sleeves 43 or the nozzles may entirely be done away with if deemed fit together with the arms 50 61 and rods 60.

55 As one sees clearly from Fig. 6 a sheet which has been seized by nozzles 63 in a tightened condition lengthwise would be stretched or dragged over the surface of the nozzles, if both ends of the sheet were compelled to go down vertically. This can be prevented by lowering the nozzles on a circular path the centre of which is near the place where the nozzle is that goes down next. If it is not possible (as for instance in the described construction) to arrange so high the centre of the path, it will be recommendable to lower all nozzles about simultaneously until they have reached the outermost point of the circle, and to begin the stepwise lowering then only. 60 65 Thus the nozzles move on parallel paths, i. e., without stretching of the sheet until this is on the same level as the axis of sleeves 43, but from this moment the mentioned condition of depositing without stretching the sheet in a flat S-wave-like shape is complied with. An approximate application of the foregoing will be sufficient in many cases.

70 Although by the described device the sheet is deposited on the pile with very little deviations, 75

it is recommendable to make use of the conventional joggers, for the operation of which it is a favorable circumstance that the sheet is not pressed to contact with the preceding sheet, but
 5 a layer of air of the thickness of the nozzles 63 remains under it. This layer is not sufficient to form an air cushion which could be prejudicial, but it is sufficient to give the sheet the easiness of motion necessary for the action of the joggers.

10 The lateral joggers which must work between the nozzles 63 will be built in the shape of narrow strips of metal or wood and their interval will be made adjustable according to the distance of the nozzles. The joggers may be fixed to the suction
 15 tube 22 and to the arms 61.

Instead of stopping the sheet suddenly by means of stationary nozzles 63, one may move these nozzles lengthwise in the direction and with the speed of the grippers 14, so that in the moment
 20 of their seizing the sheet there is no relative motion between the nozzles and the sheet. In this case the suction tube 22 may be made stationary (though adjustable according to the length of the sheet as before) because the nozzles 63 preferably
 25 will seize the sheet when it is sucked and tightened by suction tube 22, but will not be lowered before the grippers are opened and the nozzles themselves will have moved forwards with retarding motion so far that the rear edge of the
 30 sheet has passed the suction tube 22.

If one disconnects the nozzles 63 and the suction tube 22 from the source of vacuum by means of hand lever 82, the sheet is thrown out of the machine when the grippers are opened. This is
 35 a very simple way to single out specimen sheets to be inspected, for with the device herein described the grippers are opened just above the front stops 71 of the delivery and these stops may project less above the pile than in ordinary delivery devices
 40 because the sheet never flies but is pressed down to its place. Thus it is superfluous to remove the stops for the purpose mentioned. It will be sufficient to keep high the feeler 75 which is arranged for the purpose of automatically controlling the height of the pile. The device which
 45 I apply for this purpose consisting of the parts 70-81 described above may be controlled by the same hand lever 82 shutting off the vacuum.

From the device thus described those experienced in the art will be able to conceive similar
 50 devices in which two opposite edges of the sheet are held and depressed.

First of all it is not necessary that the two opposite edges which are depressed should be the lateral edges of the sheet, but devices in which the front and rear edges of the sheet are gripped may be arranged to have the same effect.

Very little has to be altered when applying this form of the delivery device (see Figs. 16-20): I
 60 do away with the lateral nozzles 63 and make the gripper chains descend in front so that the grippers at the delivering point are just at the top of the pile. Here I arrange a depressing rule 83 or the like for holding down the front edge of the
 65 sheet when the grippers are opened. I make the suction tube 22 about as thin as the nozzles 63 are shown in the drawings and I provide suitable mechanism to cause it to move up and down in addition to its motion to and fro. The mode of
 70 operation will then be the following: The front edge of the sheet is lowered by the grippers 14 when these arrive at the front edge of the pile (Fig. 16). The rear edge of the sheet is kept high and tensioned by the suction tube 22. When the grippers are opened (Fig. 17) the suction tube 22

stops the sheet and its front edge is pressed down by the rule mentioned before. Now the suction tube 22 is depressed (Fig. 18) so that the air is forced to escape at the rear end and lateral edges of the pile. If a little air is captured it will
 5 easily be pressed out at the free lateral edges because the sheet held at the front and rear edges allows the depressing effect to be spread over the whole area. When the suction tube is lowered so far that it nearly touches the pile, it is removed beyond the rear end of the pile (Fig. 19)
 10 whereby suction may remain in action so that the sheet is tensioned and the effect of pressing out the air is augmented. After the suction tube has let go of the sheet, suction is stopped and the suction tube rises and moves forward (Fig. 20) until it reaches its initial position. The depressing device in front rises too to allow the following sheet to enter under it.

If one end of the suction tube is lowered before the other end, the formation of an air cushion is still more surely prevented because finally it is one corner only that has to be depressed.

Any other devices which hold the front and rear edges of the sheet at the same time and
 25 depress them in any desirable manner simultaneously or not, whereby the word "simultaneously" may be taken for both edges or for the different parts of one edge, form a part of my invention.

If, on the other hand, one holds and depresses
 30 the lateral edges one may depress the nozzles 63 simultaneously on each edge, but lowering one whole edge before the other, or lowering both edges simultaneously. Or one may depress the nozzles 63 so that at every moment they are situated in a straight line instead of the S-shaped curve mentioned above. When doing this one may arrange the movements so that the straight line is inclined for some time and this inclination may be the same on both edges all the time or
 40 not. If, for instance, one depresses two diagonally disposed corners first, one diagonal of the sheet is lowered first and the air under the sheet is divided into two triangular wedge like spaces. At the end of the operation it will then easily be
 45 forced out at the two remaining corners.

The two last mentioned forms of application of the invention are shown in Figs. 9-11 and in Figs. 12-13. Fig. 9 shows the first step of the lowering of the sheet in such a way that the two
 50 parallel edges of the sheet are depressed alike. The nozzles 63a may be lowered by three eighths of an inch, the nozzles 63b by a quarter of an inch and the nozzles 63a by one eighth of an inch, whilst the nozzles 63d are in their initial position.
 55 During the second step of the lowering, the result of which is shown in Fig. 10, all nozzles are depressed by half an inch. At last in Fig. 11 the nozzles 63b are shown lowered by further one eighth of an inch, nozzles 63c by a quarter of
 60 an inch and nozzles 63d by three eighths of an inch. Fig. 12 shows the first step of the second method. In this case on one edge nozzle 63a is lowered by three eighths of an inch, 63b by a quarter of an inch, 63c by one eighth of an inch
 65 and 63d is not lowered, whilst on the other edge the nozzle 63d is lowered by three eighths of an inch, 63c by a quarter of an inch, 63b by one eighth of an inch and nozzle 63a stands still. A moment later all nozzles have been lowered by
 70 half an inch as shown in Fig. 13 and finally the two corners which are still lifted in Fig. 13 are depressed so that the same position of the sheet and the nozzles results as shown in Fig. 11. In Figs. 9-13 the nozzles 63 are shown gripping the 75

sheet from above which in some cases may be advisable.

When applying these forms of the device the separated nozzles 63 may be replaced by a straight suction tube (Fig. 21). If however the nozzles are not in a straight line all the time over, the nozzles 63 may be substituted by a flexible tube containing suction holes (Fig. 22). Instead of the nozzles one may apply grippers or other holding means.

The definite position the sheet must occupy when the holding means get hold of it, does not necessarily require tensioning. Thus one may grip the sheet by adequate seizing devices while it is held in a straight line by a suction tube similar to that designated by 22, and depress it by means of said seizing devices other than the suction tube. The straight line is not essential but the definiteness of the position is.

The sheet may be seized on the two opposite edges before it reaches the delivery. It may, for instance, be seized by a suction tube fastened to the gripper chains at such a distance from the front grippers that the rear edge of the sheet is held during the passage of the sheet through the machine, or the lateral holding means may seize the sheet when it is leaving the impression cylinder or a delivery drum so that the sheet is held at two opposite edges when it arrives above the delivery pile.

It is evident that various changes may be resorted to in the form, construction and arrangement of the several parts without departing from the spirit and scope of my invention and hence I do not intend to be limited to the details herein shown and described except as they may be included in the claims.

What I claim is:

1. In a sheet delivery device, holding means adapted to seize the sheet at opposite edges thereof, and operating means for depressing said edges at different times.

2. A method of sheet delivery comprising, seizing the sheet at opposite edges thereof, depressing simultaneously corresponding points of said edges, and depressing different points along each edge at different times.

3. A method of sheet delivery comprising, seizing the sheet at opposite edges thereof, depressing simultaneously corresponding points of said edges, and depressing different points of the same edge step by step.

4. A method of sheet delivery comprising, seizing the sheet at opposite edges thereof, depressing simultaneously corresponding points of said edges, and depressing different points of the same edge step by step beginning at points substantially in the middle of said edges.

5. A sheet delivery device comprising, holding means adapted to seize the sheet at opposite edges thereof, operating means for depressing said holding means, and means for moving said holding means apart in order to tension the sheet.

6. A sheet delivery device comprising, holding means adapted to seize the sheet at opposite edges thereof, operating means for depressing said edges at different times, and means for moving said holding means along a substantially arcuate path.

7. A sheet delivery device comprising, holding means adapted to seize the sheet at opposite edges thereof, operating means for depressing said edges at different times, and means for moving said holding means along a substantially arcuate path, the axis of said arcuate path being approximately

at the point where the holding device next to be depressed is situated.

8. A sheet delivery device comprising grippers adapted to grip the front edge of the sheet, a suction tube adapted to engage by suction the rear portion of the sheet, and holding means adapted to seize the sheet at opposite edges thereof while said sheet is tensioned between the grippers and the suction tube, and operating means for depressing said holding means.

9. A sheet delivery device comprising means for advancing the sheet substantially in its own plane, holding means adapted to take over the advancing sheet from said first means and engage it adjacent each corner of opposite edges thereof, to thereby stop its motion, and operating means for depressing said holding means.

10. A sheet delivery device comprising holding means adapted to seize the lower surface only of the sheet at opposite edges thereof, operating means for depressing said holding means, and means for moving said holding means from their depressed position around said edges of the sheet.

11. A sheet delivery device comprising holding means adapted to seize the sheet at opposite edges thereof, operating means for depressing said holding means, and means for holding down one of said edges after it has been depressed and released by said holding means.

12. A sheet delivery device comprising, holding means adapted to seize the sheet adjacent its corners, operating means for depressing said holding means, in predetermined order, and means acting on said holding means to tension a sheet.

13. In a sheet delivery device, holding means adapted to seize one surface only of the sheet at opposite edges thereof, and operating means for depressing said holding means in order to deposit a sheet bodily by maintaining the sheet in a position substantially parallel to its path of travel and to prevent a sheet from fluttering while it is being delivered.

14. In a sheet delivery device, holding means adapted to seize the lower surface only of the sheet at opposite edges thereof, and operating means for depressing said holding means in order to deposit a sheet bodily by maintaining the sheet in a position substantially parallel to its path of travel and to prevent a sheet from fluttering while it is being delivered.

15. A sheet delivery device comprising, holding means adapted to seize the sheet adjacent all of its corners, and operating means for depressing said holding means in succession to move a sheet down bodily under positive control of said holding means to thereby prevent fluttering of said sheet.

16. A sheet delivery device comprising, holding means adapted to seize the sheet adjacent all of its corners, operating means for depressing said holding means, and means for depressing said holding means in predetermined order relative to each other to move a sheet down bodily for the purpose of preventing fluttering of said sheet.

17. A sheet delivery device comprising, holding means adapted to seize the sheet along a plurality of its edges, and operating means for depressing said holding means to move a sheet down bodily by maintaining the sheet in a position substantially parallel to its path of travel and under positive control of said holding means to thereby prevent fluttering of said sheet.

18. A sheet delivery device comprising, holding means adapted to seize the sheet at opposite edges thereof, operating means associated with said

holding means for depressing opposite points of said edges at different times, and means for moving said holding means along a substantially arcuate path.

19. A sheet delivery device comprising, holding means adapted to seize the sheet at opposite edges thereof, operating means associated with said holding means for depressing said edges at different times, and means for moving said holding means along a substantially arcuate path, the axis of said arcuate path being approximately in the plane where the holding device next to be depressed is situated.

20. A sheet delivery device, comprising, holding means adapted to seize the sheet adjacent all of its corners only, operating means for depressing said holding means, and means for depressing said holding means in predetermined order relative to each other to move a sheet down bodily for the purpose of preventing fluttering of said sheet.

21. A sheet delivery device comprising, holding means adapted to seize the sheet adjacent its corners only, operating means for depressing said holding means in predetermined order, and means acting on said holding means to tension a sheet.

22. A sheet delivery device comprising, a movable member to engage a sheet and maintain it taut, holding means adapted to seize the sheet along a plurality of its edges, and operating means for depressing said holding means.

23. A sheet delivery device comprising, a movable member to engage a sheet and maintain it taut, holding means adapted to seize the sheet along a plurality of its edges, and operating means for depressing said holding means to move a sheet down bodily under positive control of said holding means and to thereby prevent fluttering of said sheet.

24. A sheet delivery device, comprising holding means adapted to seize a sheet along more than two of its edges, operating means for depressing some of said holding means to move a sheet down bodily by maintaining the sheet in a position substantially parallel to its path of travel and under positive control of said holding means to thereby prevent fluttering of said sheet, and means for simultaneously moving another of said holding means longitudinally of and out of engagement with said sheet.

25. In a sheet delivery device, holding means adapted to seize a sheet at opposite edges thereof and operating means for depressing said edges at substantially different times.

26. In a sheet delivery device, holding means adapted to seize a sheet at opposite edges thereof, means for simultaneously depressing corresponding points of said edges, and means for depressing different points along each edge at different times.

27. In a sheet delivery device, a continuously traveling sheet carrier, holding means for engaging a moving sheet conveyed by said carrier and seize the sheet along opposite edges, and operating means for depressing said holding means to move a sheet down bodily by maintaining the sheet in a position substantially parallel to its path of travel and under positive control of said holding means to thereby prevent fluttering of said sheet.

28. A sheet delivery device, comprising an endless sheet carrier, holding means adapted to engage a sheet conveyed by said carrier and seize the sheet at opposite edges, operating means for depressing opposite points of said edges at different times and means for moving said holding means along a substantially arcuate path.

29. In a sheet-delivery device, the combination of means to convey the sheets in succession over the delivery-pile, sheet-holding means, means to cause said holding-means to engage and hold different portions of each sheet undergoing delivery, and means to lower said holding-means and said sheet portions at different times, and to deliver the sheet to the pile, thus facilitating the expulsion of the air beneath the sheet being delivered, and to return said holding-means to engage the next successive sheet.

30. In a sheet-delivery device, the combination of means to convey the sheets in succession over the delivery-pile, sheet-holding means, means to cause said holding-means to engage and hold opposite edges of each sheet undergoing delivery, and means to lower said holding-means and said edges at different times, and to deliver the sheet to the pile, thus facilitating the expulsion of the air beneath the sheet being delivered, and to return said holding-means to engage the next successive sheet.

31. In a sheet-delivery device, the combination of means to convey the sheets in succession over the delivery-pile, sheet-holding means, means to cause said holding-means to engage and hold different portions of each sheet undergoing delivery, and means to lower said holding-means and said portions progressively, and to deliver the sheet to the pile, thus facilitating the expulsion of the air beneath the sheet being delivered, and to return said holding-means to engage the next successive sheet.

32. In a sheet-delivery device, the combination of means to convey the sheets in succession over the delivery-pile, sheet-holding means, means to cause said holding-means to engage and hold opposite edges of each sheet undergoing delivery, and means to lower each of said holding-means and each of said edges progressively, and to deliver the sheet to the pile, thus facilitating the expulsion of the air beneath the sheet being delivered, and to return said holding-means to engage the next successive sheet.

33. In a sheet-delivery device, the combination of means to convey sheets in succession over the delivery-pile, sheet-holding means, means to cause said holding-means to engage and hold opposite edges of each sheet undergoing delivery, and means to lower corresponding portions of said holding-means and corresponding portions of said edges substantially simultaneously and the remaining portions of said holding-means and said edges progressively, and to deliver the sheet to the pile, thus facilitating the expulsion of the air beneath the sheet being delivered, and to return said holding means to engage the next successive sheet.

34. In a sheet-delivery device, the combination of means to convey the sheets in succession over the delivery-pile, sheet-holding means, means to cause said holding-means to engage and hold opposite edges of each sheet undergoing delivery, and means to lower uncorresponding portions of said holding-means and the answering uncorresponding portions of said edges simultaneously and other portions of said holding-means and said edges progressively, and to deliver the sheet to the pile, thus facilitating the expulsion of the air beneath the sheet being delivered, and to return said holding means to engage the next successive sheet.

35. In a sheet-delivery device, an endless sheet conveyor, means for receiving the sheet from said conveyor comprising holding-means adapted

to seize the sheet along two opposite edges to thereby maintain the sheet in a position substantially parallel to its path of travel, and operating means for depressing said holding-means to move said sheet down bodily for deposit on a pile.

36. In a sheet-delivery device, a continuously moving sheet carrier, means for receiving the sheet from said carrier, comprising holding-means for seizing the sheet along one edge thereof, and separately and independently operable holding-means for seizing the sheet along the opposite edge, and operating means for each holding-means for depressing the same to thereby move the sheet seized by the holding-means downwardly under positive control.

37. In a sheet-delivery device, a continuously moving sheet carrier, means for receiving the sheet from said sheet carrier, comprising holding means for seizing the sheet along one edge thereof, and separately and independently operable holding-means for seizing the sheet along the opposite edge, and operating means for each holding-means for actuating the same in a downward direction to deposit the sheet on a pile, each operating means being independent whereby said holding-means may have movement downwardly simultaneously or at different sequences to deposit the edges of the sheet in predetermined order.

38. In a sheet-delivery device, a continuously moving sheet carrier, means for receiving the sheet from said carrier comprising holding-means adapted to seize the sheet at opposite edges thereof, operating means for depressing said holding-means, means supporting said holding-means, and means causing movement of said supporting means in a direction apart as downward movement progresses to thereby maintain the sheet in tension during said downward movement.

39. In a sheet-delivery device, a continuously moving sheet carrier, means for receiving the sheet from said sheet carrier, comprising holding means for seizing the sheet along one edge thereof, and separately and independently operable holding-means for seizing the sheet along the opposite edge, operating means for each holding-means for depressing the same downwardly, means supporting each holding-means, and means causing movement of said holding-means to permit movement of the same in a direction away from the other as downward movement progresses to thereby maintain the sheet in tension during said downward movement.

40. In a sheet-delivery device, a continuously moving sheet carrier, means for receiving the sheet from said carrier, comprising holding-means for seizing the sheet along one edge thereof, and separately and independently operable holding-means for seizing the sheet along the opposite edge, operating means for each holding-means for depressing the same, means supporting each holding-means, and means causing movement of said supporting-means in an arcuate path, whereby action of the operating means will produce downward movement of the holding-means and movement outwardly away from each other.

41. In a sheet-delivery device, a continuously moving sheet carrier for advancing a sheet substantially in its own plane, means for receiving the sheet from said carrier, comprising holding-means for seizing the sheet along one edge there-

of, and separately and independently operable holding-means for seizing the sheet along the opposite edge, whereby advancing movement of the sheet is stopped and the same is maintained in a plane substantially parallel to that assumed during said movement, and independently operating means for each holding-means for depressing the same downwardly to move the sheet seized by said holding-means in a downward direction under positive control for deposit on a pile.

42. In a sheet-delivery mechanism, the combination of endless chain-means equipped with sheet grippers and operable to advance a sheet, suction means operating at a speed less than that of said grippers and acting on the rear portion of the sheet undergoing advance by said grippers to tauten the sheet in its direction of travel, means to operate said suction means, a support to receive delivered sheets, second suction means to receive an edge portion of the sheet carried by said grippers and to lower the sheet toward said support, and means to operate said second suction means.

43. In a sheet-delivery mechanism, the combination of endless chain means equipped with sheet grippers and operable to advance a sheet, suction means operating at a speed less than that of said grippers and acting on the rear portion of the sheet undergoing advance by said grippers to tauten the sheet in its direction of travel, means to operate said suction means, a support to receive delivered sheets, second suction means to engage said advancing sheet adjacent its front edge portion and, upon release of the sheet by said grippers, lower it toward said support, and means to operate said second suction means.

44. In a sheet-delivery mechanism, the combination of endless chain means equipped with sheet grippers and operable to advance a sheet, suction means operating at a speed less than that of said grippers and acting on the rear portion of the sheet undergoing advance by said grippers to tauten the sheet in its direction of travel, means to operate said suction means, a support to receive delivered sheets, second suction means to receive an edge portion of the sheet from said grippers and to lower the sheet toward said support, and means to operate said second suction means to deposit a sheet onto said support and thereupon move beyond the edge of said sheet and into position to engage the next oncoming sheet.

45. In a sheet-delivery device, a traveling sheet conveyor having sheet grasping means, sheet seizing means to engage an oncoming sheet at a plurality of points and hold it against further forward movement upon its release by said grasping means, a sheet support, mechanism for operating said seizing means to deposit the sheet onto said support and to move beyond the edge of said sheet and into position to engage another sheet.

46. In a sheet-delivery device, a traveling sheet conveyor having sheet grasping means, suction means to engage an oncoming sheet at a plurality of points and hold it against further forward movement upon its release by said grasping means, a sheet support, mechanism for operating said suction means to deposit the sheet onto said support and to move beyond the edge of said sheet and into position to engage another sheet.