June 18, 1929. W. M. KELLY 1,717,454

SHEET FEEDING MECHANISM

Filed April 15, 1927 3 Sheets-Sheet 1

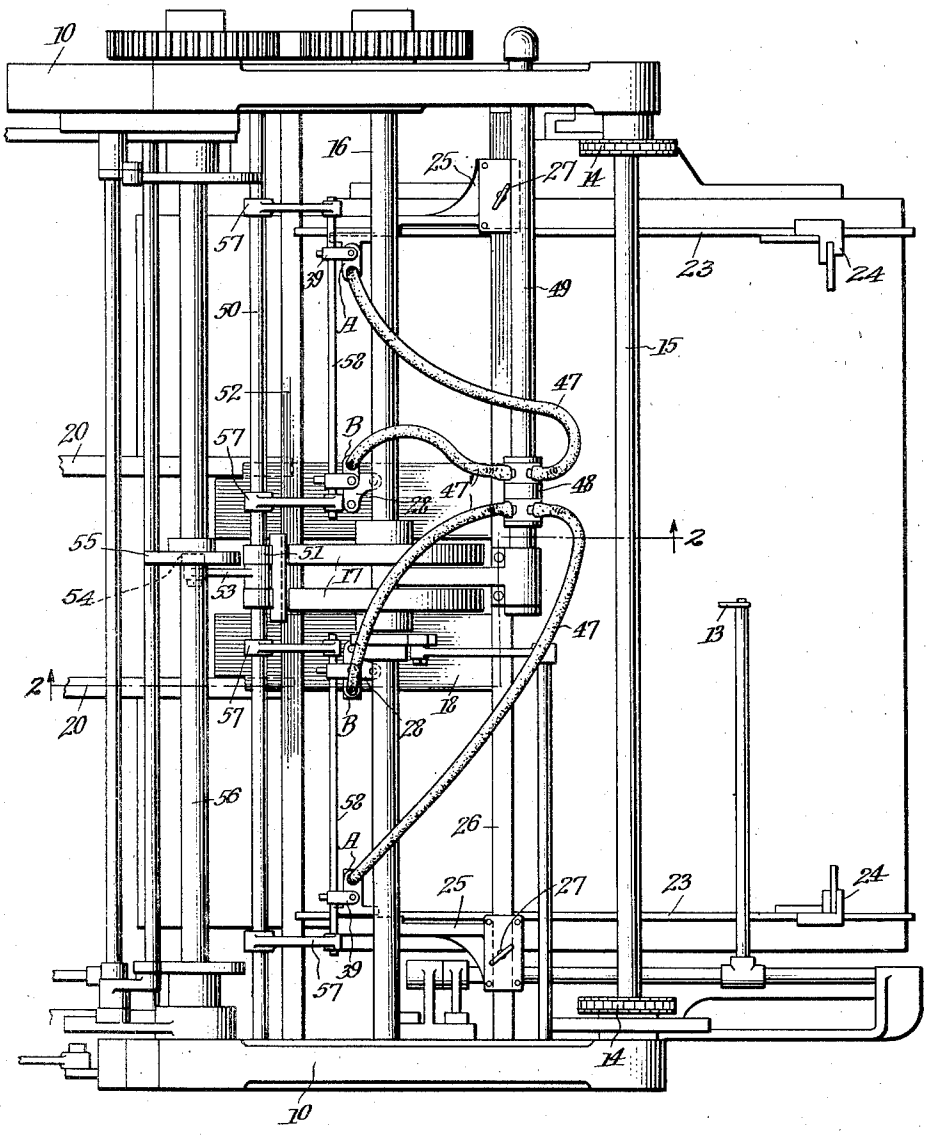


Fig. 1.

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SHEET FEEDING MECHANISM

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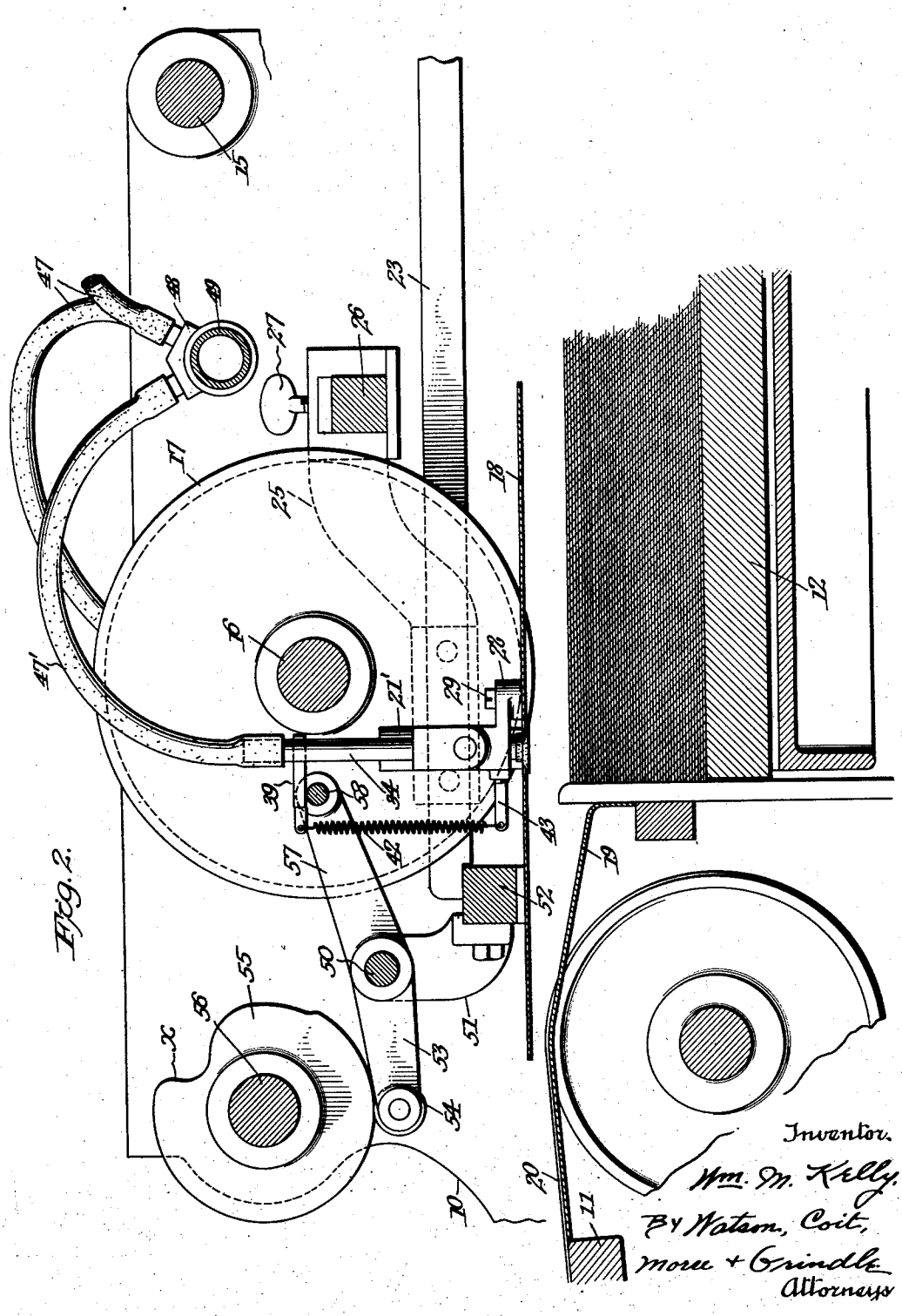


Fig. 2.

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SHEET FEEDING MECHANISM

Filed April 15, 1927 3 Sheets-Sheet 3

Fig. 3.

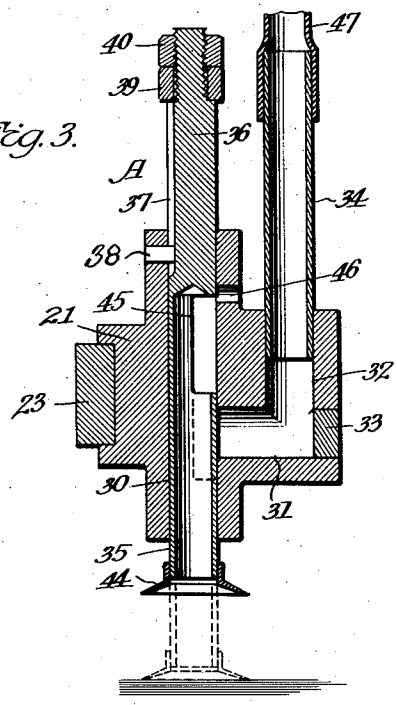


Fig. 4.

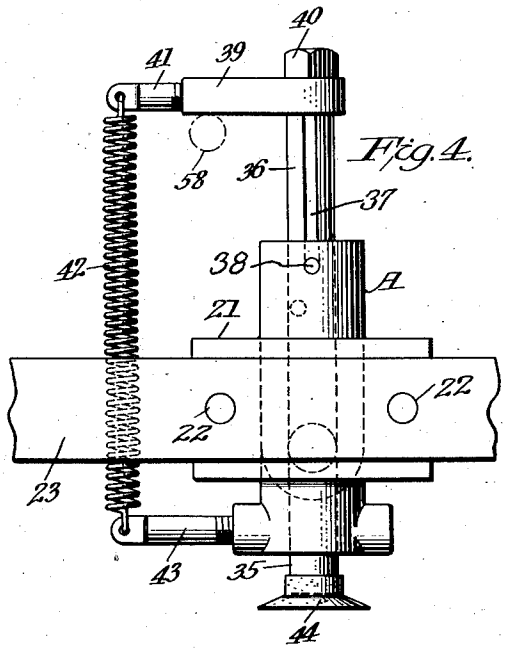
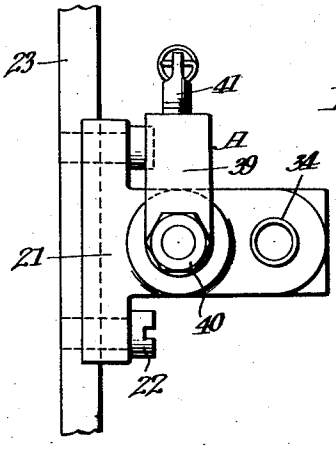


Fig. 5.



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UNITED STATES PATENT OFFICE.

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SHEET-FEEDING MECHANISM.

Application filed April 15, 1927. Serial No. 184,117.

The present invention relates to automatic sheet feeders, and particularly to suction devices for intermittently lifting sheets from a pile.

The sheet lifting mechanism embodying the invention has been particularly designed for use with an automatic feeder of the type shown in the patent to W. M. Kelly, No. 1,401,707, but the invention of course is not limited to use with a feeder of this type. The object sought to be accomplished, in general, is to provide suction devices for lifting sheets singly from a pile, which are certain in operation, simple in construction and flexible as to adjustment. To these ends, the invention provides a pneumatic sheet lifter comprising a plurality of vertically reciprocating suction tubes mounted in lateral alignment over the forward edge of the sheet pile and spaced so as to fully support the entire forward edge of the sheet when the latter is being lifted, whereby the sheet does not sag at any point and is properly positioned for feeding forward to the conveyor. The outer of the suction tubes are mounted so as to be laterally adjustable in conformity with the width of the sheet being operated on.

Other objects and features of novelty will be apparent from the following description taken in connection with the drawings, in which:

Figure 1 is a plan view of a portion of an automatic feeder provided with the present improvements;

Figure 2 is a vertical longitudinal sectional view taken substantially on the line 2—2 of Fig. 1; and

Figures 3, 4 and 5 are, respectively, a vertical section, a rear elevation and a plan view of one of the suction lifters.

Figs. 1 and 2 show only so much of an automatic feeder, of the type shown in the patent referred to above, as is desirable to illustrate the application of the present invention. The frame of the feeder is designated by the numeral 10, the feed board by 11, and the pile table by 12. The elevation of the pile is automatically maintained by mechanism including a feeler 13 which rests on top of the pile and is connected to mechanism for throwing into operation table lifting devices, including sprocket wheels 14 on a cross shaft 15, whenever the elevation of the pile sinks to a certain point. A cross shaft 16 carries a pair of suction wheels 17 which project slightly beneath a stripper plate 18 and are formed with apertured flanges to which suction is applied, whereby the wheels are adapted to feed forward the sheets lifted from the pile into the influence thereof. The sheets are thus fed forward over a bridge plate 19 to the tapes 20 which convey them over the feed table 11. A fuller understanding of the construction and operation of the parts referred to may be had from a study of the above mentioned patent.

The present invention is directed particularly to suction devices for lifting sheets singly from the pile to the sheet forwarding means, which may be the suction wheels 17. As shown in Fig. 1, there are four spaced suction lifters arranged in lateral alignment over the forward edge of the sheet pile, two on each side of the suction wheels 17. The outer of these lifters, designated generally by the reference character A, are laterally adjustable, while the two inner lifters B are fixed in position. The outer lifters (Figs. 3, 4 and 5) include housings 21 attached by screws 22 to rectangular bars 23 which carry adjustable corner guides 24 (Fig. 1) engaging the outer corners of the sheet pile. Bars 23 are secured to brackets 25, which are slidably mounted on a cross bar 26 and are adapted to be secured in adjusted positions thereon by thumb screws 27. Thus when the brackets 25 are adjusted on bar 26, for sheets of different width, the corner guides 24 and the lifters A are correspondingly moved, so that, whatever the width of the sheet, the lifters A will be positioned over the forward corners thereof. The housings 21′ (Fig. 2) of the inner lifters B are formed with foot portions 28 secured by screws 29 to the stripper plate 18, the plate being apertured as shown in Fig. 2, to permit the suction lifters to project therethrough. With the exception of the attaching means of the housings referred to, the housings and the parts associated therewith are all identical, and therefore a description of one of these housings and associated parts will serve for all.

Referring to Figs. 3, 4 and 5, which illustrate one of the outer lifters, the housing 21 is formed with a vertical bore 30 extending entirely therethrough; with a horizontal bore 31 extending from one side of the housing to the vertical bore; and with a short vertical bore 32

open at the top and communicating at the bottom with the horizontal bore 31. The outer end of horizontal bore 31 is closed by a plug 33; a tube 34 is fixed in the vertical bore 32; and a tube 35 is reciprocable in the vertical bore 30. Tube 35 is integral at its upper end with a solid stem 36 which is formed with a keyway 37 engaged by a key 38 fixed in the housing. The upper end of stem 36 is reduced and threaded, and an arm 39 is clamped thereon by a nut 40. A pin 41, threaded in the end of arm 39 is connected by a tension spring 42 to a pin 43 threaded in the housing near its lower end, the spring tending to move the tube downwards. Secured to the lower end of tube 35 is a nozzle 44 formed of soft rubber, flared at a wide angle and having its material tapered in thickness to the rim, which is very thin, this construction adapting the nozzle to conform closely with any irregularity in the surface of the sheet, thereby insuring a full suction effect and firm grasping of the sheet. The wall of tube 35 is slotted to form a port 45 which communicates with an aperture 46 in the housing when the tube is in its upper position, and communicates with the horizontal bore 31 when the tube is lowered to the dotted line position shown in Fig. 3. Tube 34 is connected by a flexible tube or hose 47 to a distributing head 48, which is secured on and communicates with the interior of a suction pipe 49 connected to a suitable pump (not shown). This distributing head is provided with four nipples for connection with pipes 47 leading to the two outer lifters A, and to the pipes 47' leading to the two inner lifters B.

The four tubes 35 are synchronously operated by mechanism including a transverse rock shaft 50. This shaft is journaled at its outer ends in the frame 10 and centrally in a bracket 51 which is bolted to a square cross bar 52. Fixed on shaft 50, between the arms of bracket 51, is an arm 53 carrying a roller 54 which engages a cam 55 on a cross shaft 56, the latter being the cam shaft of the machine and carrying the several operating cams for the various sheet handling and controlling mechanisms of the feeder. At each side of the suction wheels, rock shaft 50 carries two arms, each designated by the numeral 57, the pair of arms at each side carrying at their outer ends a rod 58 which extends under the arms 39 secured to the suction tube stems.

In operation, the tubes 35 are intermittently lowered and raised in synchronism, lifting the sheets at the forward edges at four spaced points, two of which are at the forward corners of the sheet and two at each side of the center, the said points being substantially equi-spaced, so that the sheet is perfectly supported, and its feeding forward by the suction wheels to the conveyor tapes in proper registry is assured. As shown in Figs. 2 and 3, the suction tube is at the limit of its upper movement, having been brought to this position against the tension of spring 42 by the upward movement of rod 58 due to the travel of roller 54 on the high part of cam 55. In this position the port 45 is in communication with the aperture 46 and the tube is cut off from the suction in bore 31. In Fig. 2 the cam is rotating in a clock-wise direction, and it will be observed from the shape of this cam that the tube will first be lowered slightly and will then be quickly lowered to its limit in this direction. In the lowered position of the tube, shown in dotted lines in Fig. 3, the nozzle 44 firmly seats on the top sheet of the pile, the flexible character of the nozzle adapting it to conform with any irregularities in the surface of the sheet or to small differences in elevation of the sheet pile. In this position the port 45 in the tube is opposite the bore 31, so that the interior of the tube is subjected to the full suction effect and the sheet firmly adheres to the nozzle. The tube remains in this lowered position only for a brief instant, as will be apparent from the shape of the cam, being quickly raised to its upper position as the roller 54 rides over the abrupt surface x to the high part of the cam. When the tube nears its upper limit, port 45 comes into communication with aperture 46, so that the suction in the tube is broken and the sheet is released, being fed forward by the suction wheels 47. These wheels of course support the sheet only at points near the center line thereof, and although the suction in the tubes is broken at the instant the sheet is taken by the wheels, the sheet will not drop from the tubes to any substantial extent while being fed forward by the suction wheels, since the feeding velocity is very rapid.

Although an embodiment of the invention has been described in detail, it is to be understood that the invention is not thus limited, but includes modifications and changes which come within the scope of the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. Sheet feeding mechanism comprising, in combination with means to feed sheets forwardly, suction means for lifting sheets singly to said forwarding means comprising rigidly connected suction tubes mounted for vertical reciprocation in a rectilinear path and disposed in lateral alignment over the forward edge of a sheet pile.

2. Sheet feeding mechanism comprising, in combination with pneumatic means to feed sheets forwardly, suction means for lifting sheets singly to said forwarding means comprising rigidly connected suction tubes mounted for vertical reciprocation in a rectilinear path and disposed in lateral alignment over the forward edge of a sheet pile.

3. Sheet feeding mechanism comprising,

in combination with means to feed sheets forwardly, suction means for lifting sheets singly to said forwarding means comprising rigidly connected suction tubes mounted for vertical reciprocation in a rectilinear path and disposed in lateral alignment over the forward edge of a sheet pile, means for reciprocating said tubes vertically, means for subjecting said tubes to suction when in their lower positions, and means for breaking said suction when the tubes are raised.

4. Sheet feeding mechanism comprising in combination with a pair of suction wheels adapted to feed sheets forwardly, suction means for lifting sheets singly into the influence of said suction wheels comprising suction tubes mounted for vertical reciprocation at the sides of said suction wheels and disposed in lateral alignment over the forward edge of a sheet pile.

5. Sheet feeding mechanism comprising in combination with a pair of suction wheels adapted to feed sheets forwardly, suction means for litfing sheets singly into the influence of said wheels comprising a plurality of suction tubes mounted at each side of said pair in lateral alignment over the forward edge of a sheet pile, means for reciprocating said tubes vertically, means for subjecting said tubes to suction when in their lower positions, and means for breaking said suction when the tubes are raised.

6. Sheet feeding mechanism comprising in combination with means for feeding sheets forwardly, a plurality of suction tubes mounted at each side of said means adapted to raise sheets one by one to said means, said tubes being arranged in lateral alignment over the forward edge of a sheet pile, means for laterally adjusting the outer of said tubes, means for subjecting the tubes to suction when in their lowered position, and means for breaking the suction when the tubes are raised.

7. In sheet feeding mechanism, the combination with means to feed forwardly sheets lifted thereto, of suction tubes mounted for vertical reciprocation at each side of said means and disposed in lateral alignment over the forward edge of a sheet pile, a transverse rock shaft mounted in front of said means and tubes, an arm rigid on said shaft, a cam engaging said arm, and connections between said shaft and tubes whereby the latter are synchronously operated when said shaft is rocked.

8. In sheet feeding mechanism, the combination with means to feed forwardly sheets lifted thereto, of suction tubes mounted for vertical reciprocation at each side of said means and disposed in lateral alignment over the forward edge of a sheet pile, a transverse rock shaft mounted in front of said tubes, an arm rigid on said shaft, a cam engaging said arm, rearwardly extending arms on said shaft, transverse rods carried in the free ends of said last mentioned arms engaging said tubes and adapted to lift the same synchronously, and springs tending to move said tubes downwardly.

9. In sheet feeding mechanism, in combination, a feed table adapted to support a pile of sheets, a stripper plate over said table, a sheet forwarding means projecting slightly below said stripper plate, a suction tube housing at each side of said means and having foot portions secured on said stripper plate, suction tubes mounted for vertical reciprocation in said housings projecting through apertures in said plate, and means for reciprocating said suction tubes.

10. In sheet feeding mechanism, in combination, a feed table adapted to support a pile of sheets, a stripper plate over said table, a sheet forwarding means projecting slightly below said stripper plate, a suction tube housing at each side of said means and having foot portions secured on said stripper plate, suction tubes mounted in said housings for vertical reciprocation projecting through apertures in said plate, longitudinal rods supported for lateral adjustment above said table, corner guides for the sheet pile mounted on said rods adjacent the rear ends thereof, a suction tube housing secured to each rod near its forward end, a vertically reciprocable suction tube in each housing, and means for synchronously operating all of said suction tubes.

11. In sheet feeding mechanism, a suction sheet lifter comprising in combination with a housing having a vertical bore and a suction chamber communicating therewith, a tube mounted in said bore provided on its lower end with a nozzle formed of soft rubber, flared at a wide angle, and having the material tapered in thickness to the rim, which is very thin, said tube formed with a port communicating with an aperture in said housing when the tube is raised and communicating with said suction chamber when the tube is lowered, and means for reciprocating said tube.

12. In sheet feeding mechanism, a suction sheet lifter comprising in combination with a housing having a vertical bore and a suction chamber communicating therewith, a tube mounted in said bore provided on its lower end with a nozzle, said tube formed with a port communicating with an aperture in said housing when the tube is raised, and communicating with said suction chamber when the tube is lowered, an arm secured to the upper projecting end of said tube, a tension spring secured to said arm tending to move the tube downward, a member engaging under said arm and means for oscillating said member.

13. In a sheet feeding mechanism, in combination, a suction device for lifting individual sheets for removal thereof, located

near a forward corner of said sheets, a corner guide for the corresponding rear corner of said sheets, said suction device and corner guide being carried by a laterally adjustable support, whereby simultaneous lateral adjustment of the suction devices and corner guide for one side of the sheets may be obtained.

14. In a sheet feeding mechanism, in combination, a feed table adapted to support a pile of sheets, longitudinal rods supported for lateral adjustment above said table, corner guides for the sheet pile mounted on said rods adjacent the rear ends thereof, a suction sheet lifting device secured to each rod near its forward end, and means for permitting lateral adjustment of said rods, whereby said suction devices are disposed in proper position at the forward corners of the sheets when the corner guides are in their adjusted positions with respect to the sheet pile.

In testimony whereof I hereunto affix my signature.

WILLIAM M. KELLY.