United States Patent [19]

Shields

[11] **3,719,357**

[45] **March 6, 1973**

[54] **AUTOMATIC POWER FEEDER**

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[52] **U.S. Cl.** **271/12,** 271/5, 271/74, 271/75

[51] **Int. Cl.**.....**B65h 5/08,** B65h 5/22

[58] **Field of Search**.....271/27, 28, 10, 11, 12, 46, 271/62, 74, 75

[56] **References Cited**

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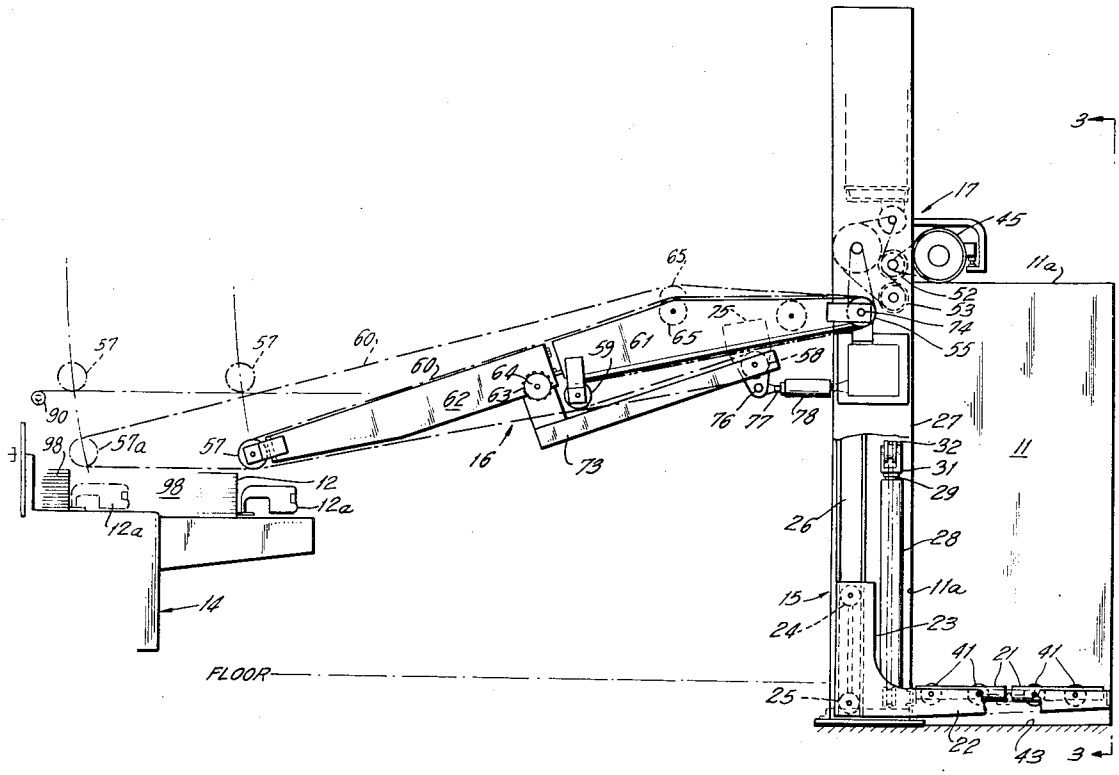
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[57] **ABSTRACT**

An automatic sheet feeder is provided with a relatively slow speed suction wheel that engages the top of a stack of sheets supported by a rising elevator. Sheets removed horizontally from the stack by the wheel are delivered to high speed conveyor rolls which deposit the sheets in a shingled arrangement on a relatively narrow slow speed suction conveyor of adjustable length. Power means acting from below is used to adjust the suction conveyor to a height compatible with the height of the stack in the hopper receiving sheets from the feeder, and is also used to raise the conveyor which permits the hopper to be retracted for servicing the converting apparatus associated with the hopper.

8 Claims, 5 Drawing Figures



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SHEET 1 OF 4

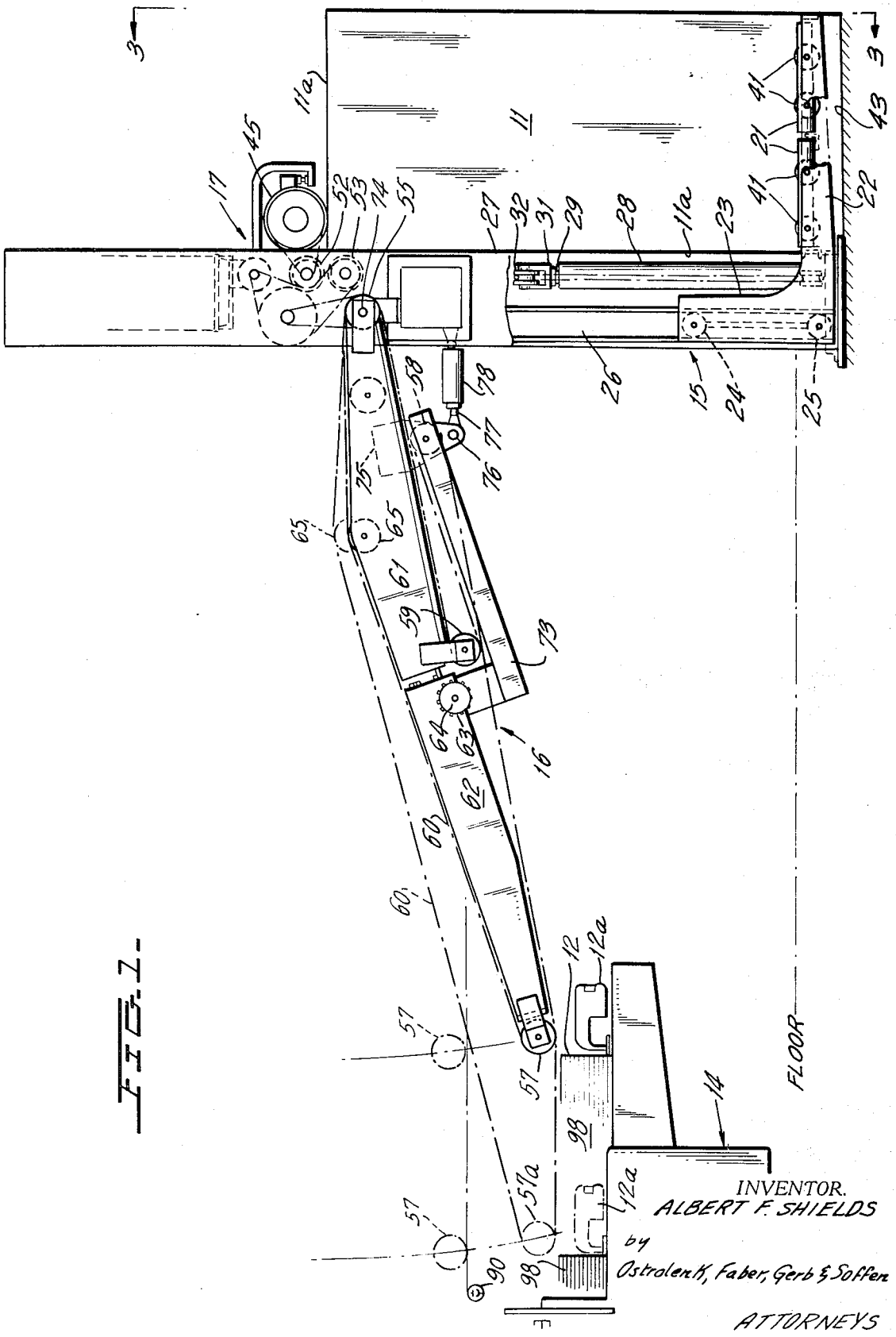


FIG. 1.

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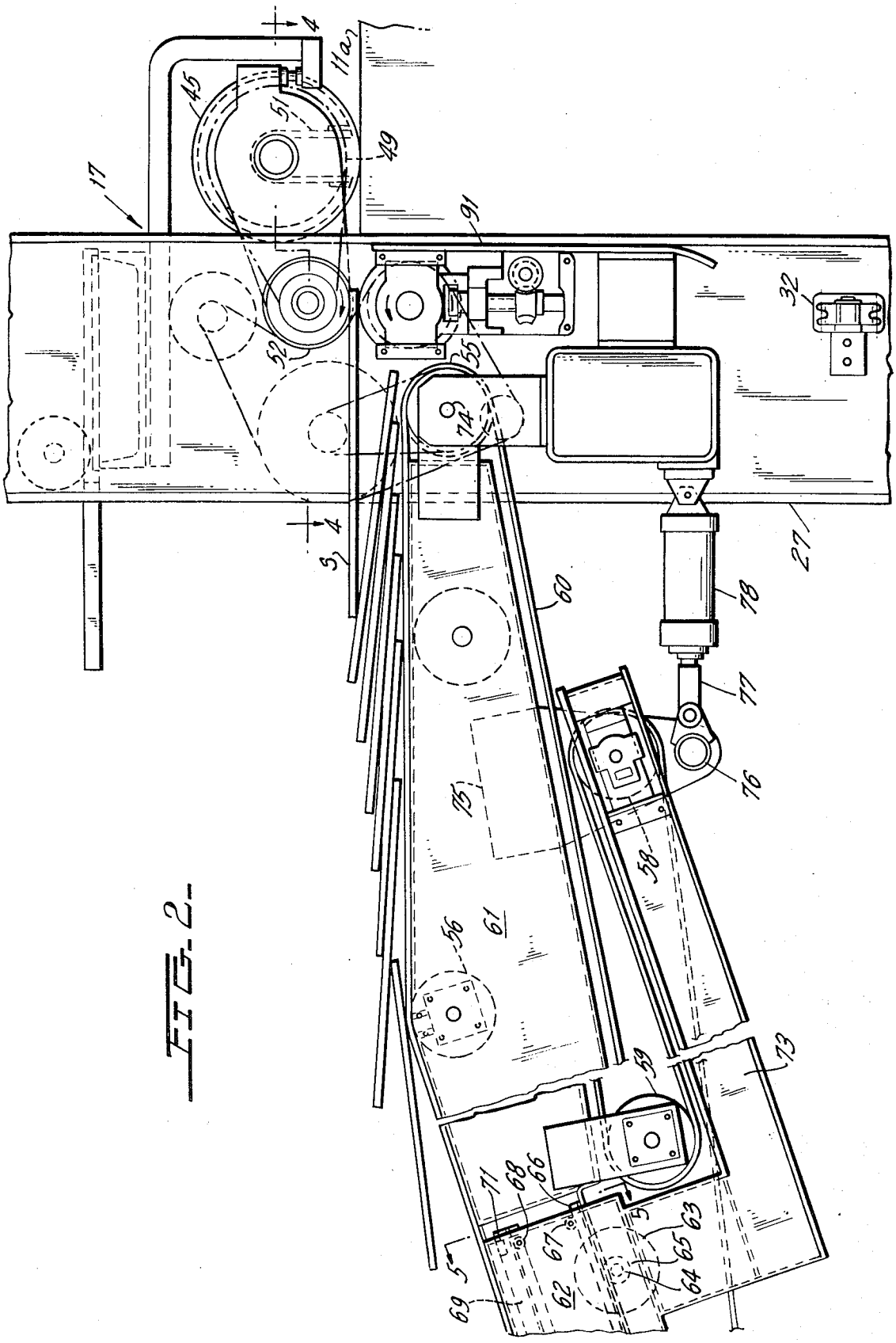

4
11a
45
51
49
17
91
32
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55
74
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FIG. 2

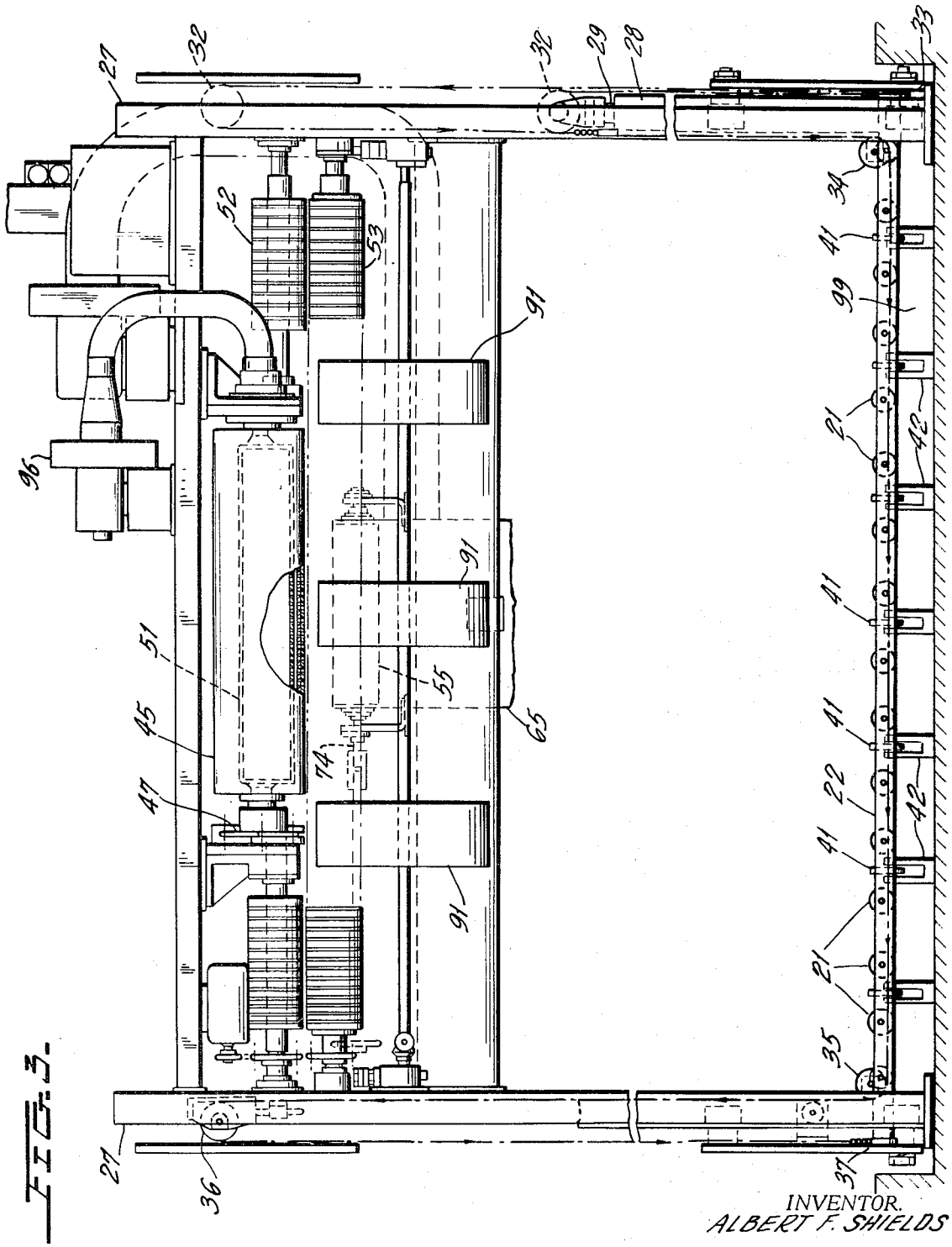


FIG. 3.

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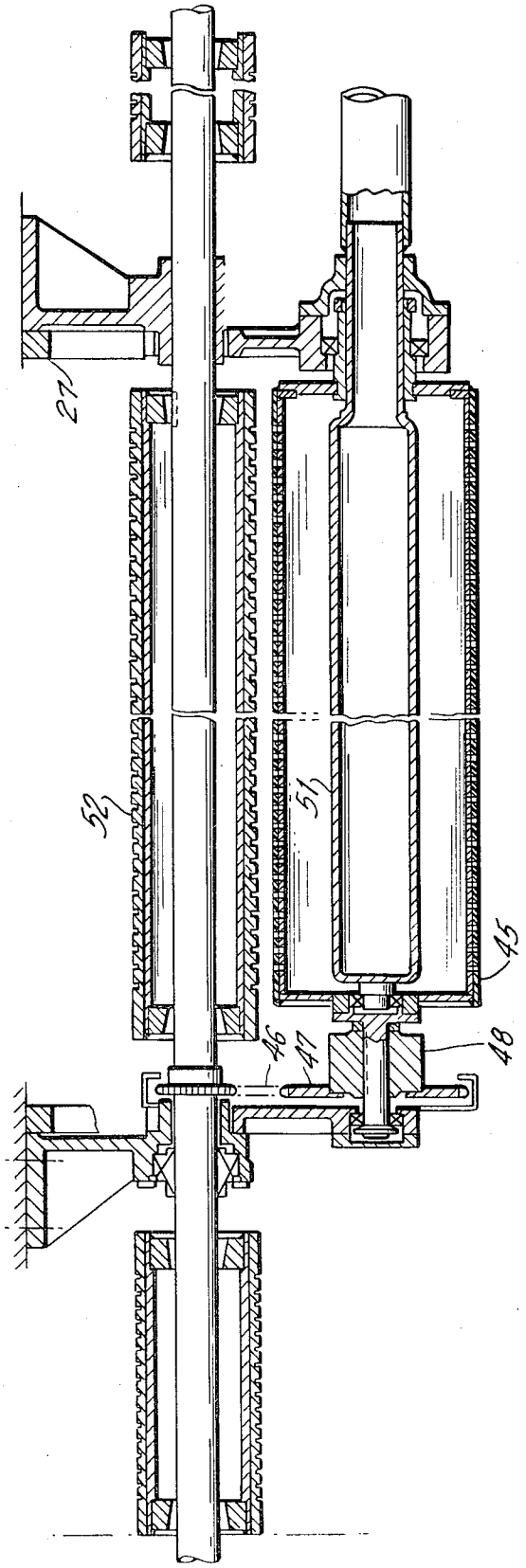


FIG. 4.

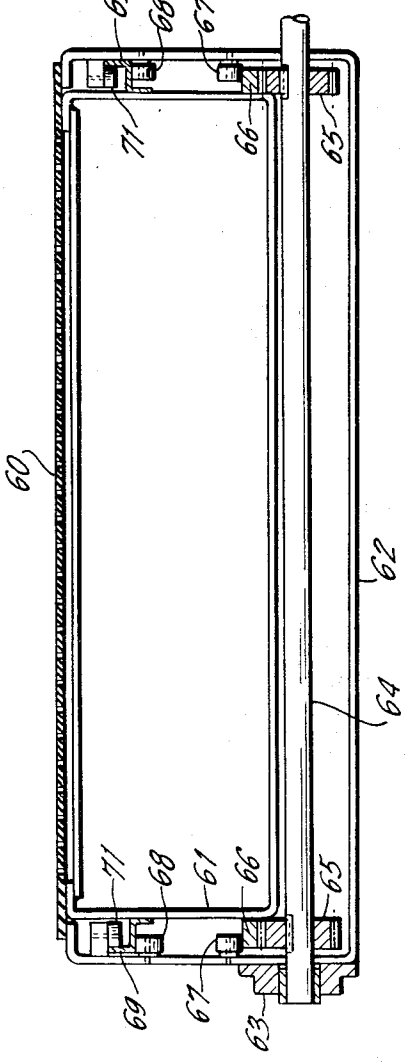


FIG. 5.

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AUTOMATIC POWER FEEDER

This invention relates to sheet conveying apparatus in general and more particularly relates to a power operated mechanism for automatically feeding sheets from the top of a stack into the hopper of a converting machine.

A typical corrugated box plant is provided with converting machines that are utilized to produce flat box blanks from rectangular sheets and to produce folded tubular boxes from these blanks. A stack of plain sheets scored and slotted to form blanks is delivered on a skid to the vicinity of the infeed end of the converting machine, and an operator transfers the sheets from the stack by hand-loading batches of sheets from the stack and placing these batches in the hopper of the converting machine. These batches of sheets are placed in the hopper through the open end thereof, and the sheets are delivered one at a time from the bottom of the hopper by a reciprocating feed slat.

Not only is the loading of the hopper with sheets physically strenuous for the operator but he must be in constant attendance at the feed-in end of the converting machine if the latter is to be operated at reasonably high production speeds.

In accordance with the instant invention, a skid containing a stack of box blanks or sheets is placed on an elevator which raises the stack. When the top sheet of the stack engages a slow speed suction feed roll, this top sheet is moved horizontally over the stack into the nip between a pair of high-speed delivery rolls. The latter draws the sheet away from the feed roll and deposits the sheet on a relatively slow speed suction conveyor belt. The elevator continues to move upward and successive sheets at the top of the stack are removed by the feed roll and transferred by the delivery rollers to the conveyor belt, where the sheets are arranged in shingle-fashion. The discharge end of the conveyor belt is aligned with the hopper of the box-making machine, and as the sheets reach the feed-out end of the conveyor belt, these sheets fall into the hopper entering through the top thereof.

The length of the suction conveyor belt is adjustable so that different length sheets may be handled efficiently. Photoelectric control means automatically halts raising of the elevator when the height of blanks in the hopper reaches a predetermined level.

Accordingly, a primary object of the instant invention is to provide a novel construction for a power operated means which automatically feeds sheets from the top of a stack into the hopper of a converting machine.

Another object is to provide a power operated means of this type, utilizing a relatively narrow suction conveyor belt for the handling of relatively wide sheets.

Still another object is to provide a power operated means of this type utilizing a so-called suction wheel for initially removing sheets from the stack.

These objects as well as other objects of this invention will become readily apparent after reading the following description of the accompanying drawings in which:

FIG. 1 is a side elevation of a power operated automatic sheet feeder constructed in accordance with teachings of the instant invention.

FIG. 2 is an enlarged fragmentary portion of FIG. 1.

FIG. 3 is an end view of the sheet feeder, looking in the direction of arrows 3—3 of FIG. 1.

FIGS. 4 and 5 are cross-sections taken through lines 4—4 and 5—5 of FIG. 2, looking in the directions of the respective arrows 4—4 and 5—5.

Now referring to the figures. The power operated automatic sheet feeder of FIG. 1 delivers sheets or blanks S one at a time from the top of stack 11 to the in-feed hopper of converting machine 14. Generally, the automatic sheet feeder consists of elevator 15 which supports and raises stack 11, suction conveyor belt means 16 extending from the upper end of elevator 15 to hopper 12, and transfer means 17 for removing sheets S one at a time from the top of stack 11 and transferring sheets S to conveyor means 16.

Elevator 15 includes a support platform formed by a plurality of generally horizontal parallel rollers 21 extending in the direction of sheet movement. Rollers 21 are secured to vertically movable horizontal frame 22 having L-shaped brackets 23 adjacent the front edge and at both sides thereof. Pair of rollers 24, 25, extending inboard of brackets 23 and being rotatably mounted thereto, ride in vertical tracks 26 on each side of stationary frame 27 to maintain support platform 21, 22 generally horizontal and guide the latter for vertical movement.

Platform 21, 22 is raised by the actuation of power cylinder 28 having its lower end fixed to frame 27. The upper end of power cylinder extendable arm 29 mounts clevis 31 which rotatably supports double sprocket 32. The latter is in engagement with two chains, both of which are anchored at one end to the right side of frame 27 (FIG. 3) at a point 33 near the mid-region of power cylinder 28. One of these chains extends upward from anchoring point 33 around sprocket 32 and then downward directly to an anchoring point at the right side of movable frame 22. The other chain extends upward from anchoring point 33 over sprocket 32, then down, passing below idler sprocket 34, then horizontally and below idler sprocket 35, then vertically and over idler sprocket 36 at the left side of frame 27, then downward to another anchoring point 37 at the left side of movable frame 22. As arm 29 of power cylinder 28 is extended, double sprocket 32 moves from its lower solid line position of FIG. 3 to its raised position shown in phantom, and while this movement occurs the left and right sides of movable frame 22 are caused to move upward by equal distances. For a reason to be hereinafter explained, with platform 21, 22 in its lowermost position, idler wheels 41 rotatably mounted on trunnions 42 secured to floor 43 of pit 99 extend slightly above platform rollers 21, so that prior to the lifting of platform 21, 22 stack 11 may readily be moved to a desired longitudinal position.

When fluid under pressure is introduced into power cylinder 28, stack 11 rises until the top 11a thereof engages the periphery of suction feed roller 45, which is rotating at a relatively slow speed in a clockwise direction with respect to FIGS. 1 and 2. Suction wheel 45 is driven by chain 6, operating through sprocket 47 and over-running clutch 48. Elongated rectangular duct 49, of inverted U-shaped cross-section, acts as a shield to limit the application of suction to a narrow rectangular region 49 at the bottom of the periphery of suction wheel 45. Continuously operated centrifugal blower 96 provides suction within manifold 51 and suction chamber 61, 62 to be hereinafter described.

Each sheet S moved relatively slowly to the left by suction feed roll **45** is received in the nip between high-speed conveyor rollers **52, 53** driven in the directions of the respective arrows thereon so as to convey sheet S to the left at a relatively high speed. The over-running clutch drive mechanism for suction feed roll **45** permits high-speed movement of sheet S under the influence of conveyor rollers **52, 53** without roll **45** acting as a drag.

Sheet S delivered in the forward direction by conveyor rollers **52, 53** falls on the upper flight of the relatively narrow perforated suction conveyor belt **60**. The latter moves at a relatively slow speed along a closed path defined by driven roller **55** and idler rollers **56, 57, 58** and **59**. Rollers **55, 56** and **59** rotate on fixed axes and, as will hereinafter be seen, rollers **57, 58** rotate on movable axes. The upper flight of perforated belt **60** runs over the open upper surface of a telescoping suction chamber, defined by stationary portion **61** and movable portion **62**. In FIG. **1**, suction chamber **61, 62** is shown in its collapsed position. Power supplied to sprocket **63** on drive shaft **64** by an electric motor and chain drive (not shown), both mounted to movable chamber **62**, is used for adjusting the length of suction chamber **61, 62**.

More particularly, drive shaft **64** extends transversely through movable chamber **62** and is rotatably mounted thereon. Pinnions **65** keyed to shaft **64** near opposite ends thereof engage the teeth along the under surfaces of longitudinally extending racks **66** secured to the outside of fixed chamber **61** at the sides thereof. Inboard rollers **67, 68**, rotatably mounted to horizontal axes on movable chamber **62**, ride on the respective upper surfaces of rack members **66** and the generally horizontal legs of Z-shaped runners **69** secured to opposite sides of stationary chamber **61**. Idler rollers **71** freely mounted on vertical axes carried by movable chamber **62** engage the inboard surfaces of the upper horizontal legs of brackets **69**. Thus, it is seen that rotation of shaft **64**, through the cooperation of pinnions **65** and racks **66**, causes movable chamber **62** to move longitudinally relative to stationary chamber **61**, with idlers **67, 68** and **71** serving to stabilize the movement of chamber **62**.

As suction chamber **61, 62** is elongated, L-shaped arm **73** secured to movable chamber **62** and carrying idler **58** moves to the left with respect to FIG. **1**, carrying idler **58** to the left, thereby shortening the lower flight portion of conveyor belt **60** and increasing the length of the upper flight portion thereof, as required to accommodate the new position of idler **57** mounted to the forward end of movable chamber **62**.

Stationary chamber **61** is pivotally mounted at its rear end to shaft **74** on which drive roller **55** is mounted. The lower end of bracket **75** secured to stationary chamber **61** is pivotally connected at **76** to the forward end of piston rod **77**, extending from power cylinder **78** having its rear end pivotally secured to frame **27**. Thus, as fluid under pressure is introduced into power cylinder **78**, piston rod **77** is extended, causing suction chamber **61, 62** to pivot in a clockwise direction about shaft **74** as a center, thereby raising forward idler **57** and raising the upper flight of suction conveyor belt **60**.

When the suction feeder of FIG. **1** is to be used, support platform **21, 22** is lowered to a position inside of pit **99** and a stack of sheets **11** is placed on platform **21, 22**. At this time rollers **41** support stack **11** and permit movement thereof to the required longitudinal position for front edge **11a** of stack **11**. The forward location of this position is limited by vertical front guide plates **91**. Stack **11** is then raised slightly to a point where it is supported on rollers **21** rather than wheels **41**. After stack **11** is moved to a convenient transverse position, additional pressurized fluid is applied to cylinder **28** of elevator **15** to raise stack **11**. In a manner well known to the art, the back pressure exerted by the engagement of stack **11** with suction feed roller **45** is used to control the application of pressure to power cylinder **28**.

Top sheet S in stack **11** is moved relatively slowly in a forward direction by suction feed roll **45** into the nip between relatively high-speed conveyor rollers **52, 53**, which move the sheet forward onto the upper side of suction conveyor belt **60**. The longitudinal position of forward idler roll **57** is adjusted in accordance with the front to back measurement of sheet S. That is, if sheet S is very long, then rear gauge **12a** defining hopper **12** is in its rightmost position of FIG. **1** and the front of conveyor belt **60** is also in its rightmost position. On the other hand, when very short sheets are being loaded, rear gauge **12*a*** is in the leftmost position of FIG. **1** and idler roll **57** is moved forward to position **57*a*** over rear gauge **12*a*** in its new forward position. In addition, as the stack of sheets **98** in hopper **12** becomes higher, power cylinder **78** is operated to raise the forward end of section conveyor **16**. When the stack in hopper **12** is at the height of photoelectric control device **90**, the latter acts automatically to halt the rise of elevator **15** or halt any other portion of the sheet feeder so that the height of stack will not become too high. This permits operation of the converting apparatus fed from hopper **12** to be halted without additional attention having to be paid to the sheet feeder.

Thus, it is seen that the instant invention provides a novel construction for an automatic sheet feeder for transferring sheets from a stack into the hopper of a converting machine. The incorporation of a suction conveyor belt permits a relatively narrow belt to be used, so that an operator may readily reach any area of the belt to clear jams and remove loose paper. In addition, since the mechanism for raising and lowering the suction conveyor belt acts from below, this mechanism does not serve to limit the width of blanks that may be handled by the feeding apparatus.

Although in the foregoing this invention has been described in connection with preferred embodiments, many variations and modifications will now become apparent to those skilled in the art, and it is therefore preferred that the instant invention not be limited by the specific disclosure contained herein but only by the appending claims.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows:

1. Apparatus for transferring sheets from a stack to a hopper said apparatus including an elevator for receiving and raising a stack of sheets, a continuous moving loop belt conveyor means extending forward of said elevator at the top thereof, transfer means positioned at the top of said elevator in operative position to remove sheets one at a time from the top of a stack being raised

by said elevator and deposit these sheets on an upper flight of said conveyor means in shingled fashion, a plurality of rolls guiding movement of said upper flight and other sections of said conveyor means, said plurality of rolls including first and second rolls at opposite ends of said upper flight and other rolls engaging belt portions of said conveyor means positioned below said upper flight, said conveyor means also including a portion for generating a sheet holding suction applied through said upper flight from below, said portion of said conveyor means including an adjustable length elongated suction chamber means comprising a first chamber section and a second chamber section longitudinally movable relative to said first chamber section, said first roll and a first of said other rolls being connected to said second chamber section for movement together therewith whereby the length of said upper flight is adjusted as the length of said chamber means is adjusted.

2. Apparatus as set forth in claim 1, in which said transfer means includes a sheet holding suction means.

3. Apparatus as set forth in claim 2, in which the transfer means includes a feed wheel rotatably driven on a horizontal axis, said suction means for the transfer means applying suction at the interior of said wheel to generate a holding force acting through aperture means at the lower region of the wheel's periphery.

4. Apparatus as set forth in claim 1, also including height adjusting means for setting the vertical position of said conveyor means at the forward end thereof.

5. Apparatus as set forth in claim 3, in which the height adjusting means is below the conveyor means and engages the latter below said upper flight.

6. Apparatus as set forth in claim 1, in which the transfer means includes a feed wheel driven on a horizontal axis and the suction means applies suction at the interior of said wheel to generate a holding force acting through aperture means at the lower region of the wheel's periphery.

7. Apparatus as set forth in claim 6, in which the transfer means also includes delivery roller means interposed between the feed wheel and the conveyor means, said delivery roller means conveying sheets much faster than either the feed wheel or the conveyor means.

8. Apparatus as set forth in claim 1, in which the conveyor means is substantially narrower than blanks conveyed thereby.

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