

# United States Patent

[11] 3,598,397

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[32] Priority **June 13, 1968**  
[33] Sweden  
[31] **9140/68**

[56]

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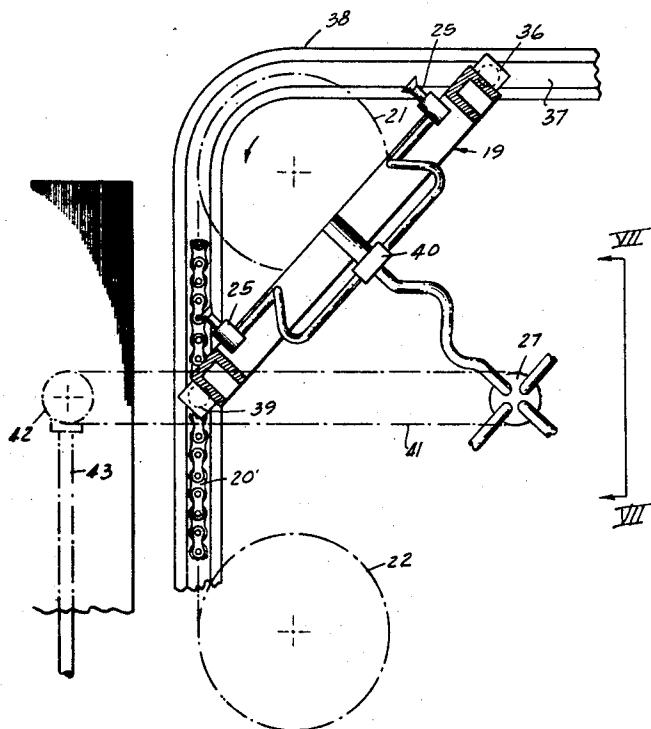
Primary Examiner—Joseph Wegbreit

Attorney—Hill, Sherman, Meroni, Gross & Simpson

[54] **SHEET FEEDER**  
10 Claims, 14 Drawing Figs.

[52] U.S. Cl. ..... 271/12,  
271/26  
[51] Int. Cl. ..... B65h 5/08  
[50] Field of Search ..... 271/12, 26,  
27

**ABSTRACT:** Sheet feed mechanism particularly adapted to pick off individual sheets from vertical stock of such sheets one at a time and carry them to and deposit them in a horizontal position. The sheet feed apparatus comprises a flat sucker unit which is carried by a pair of endless chains which, in turn, are trained over a series of sprockets.

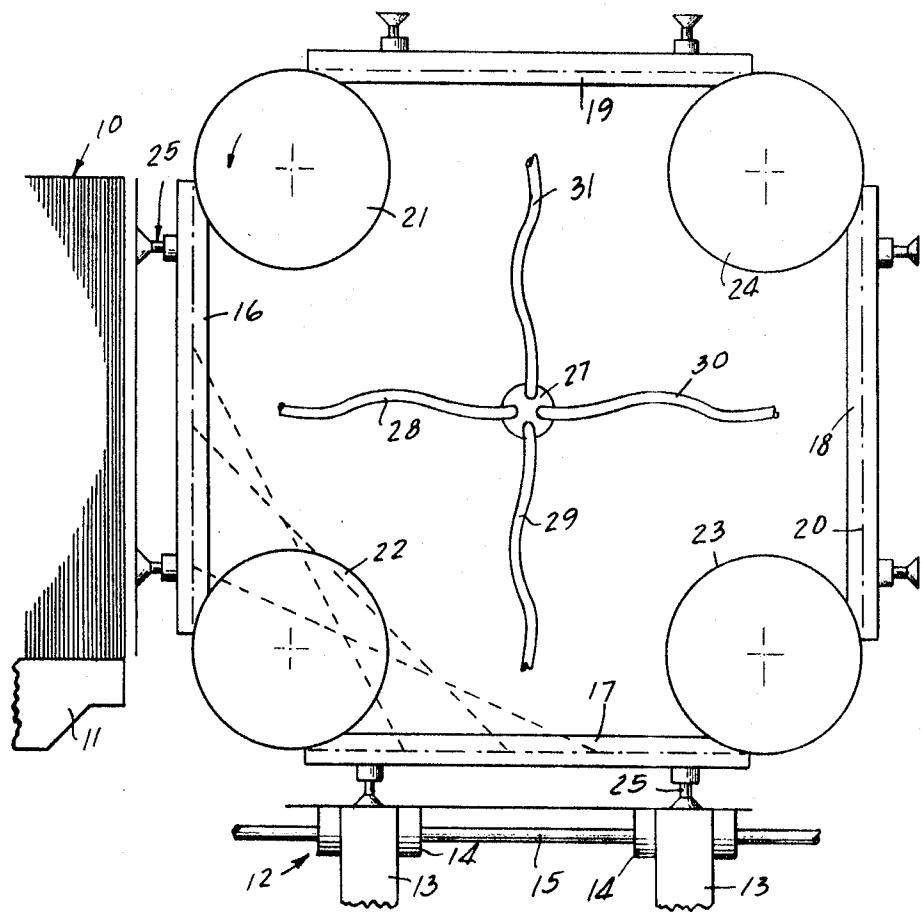


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Fig. 1



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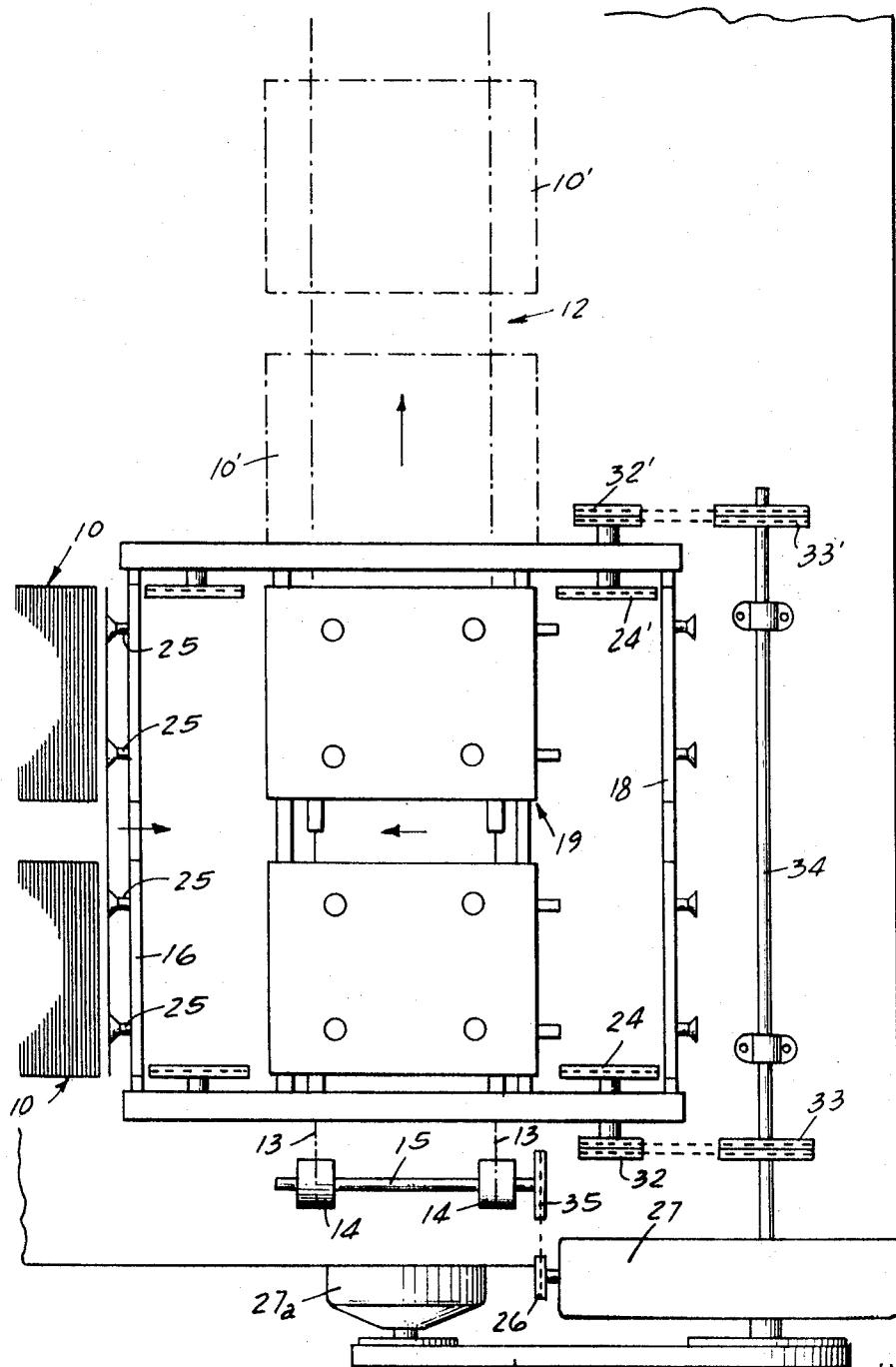
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Fig-2



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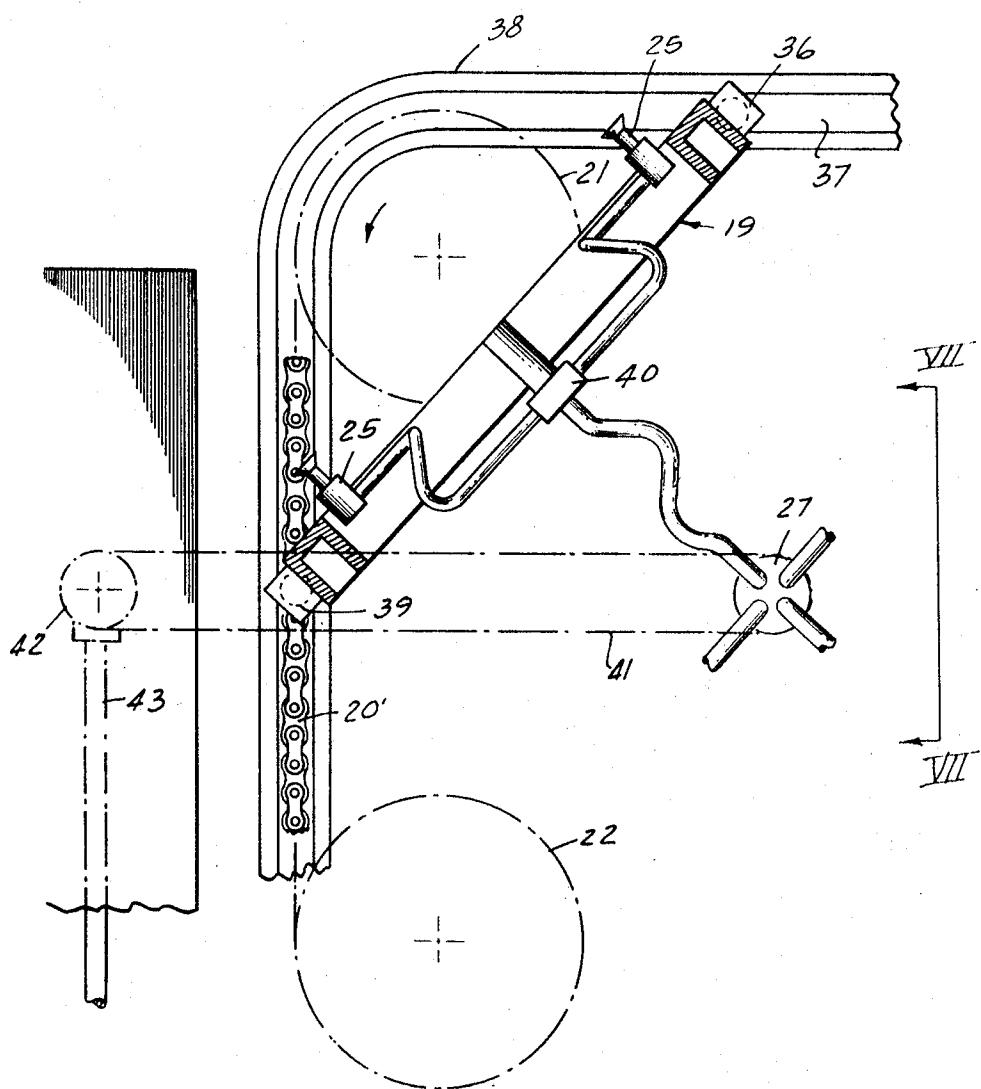
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Fig. 4

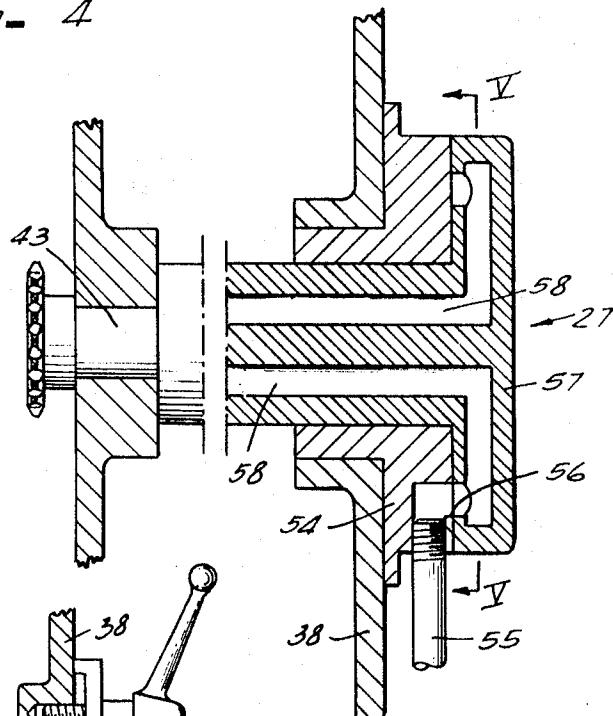
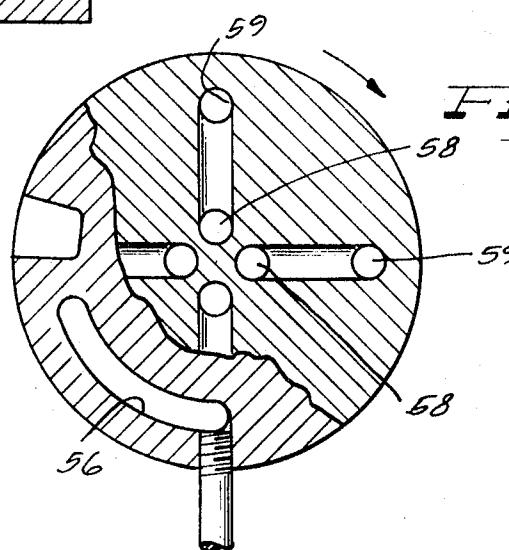
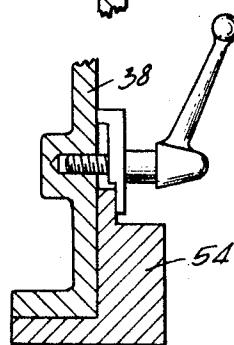


Fig. 6



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Fig-7

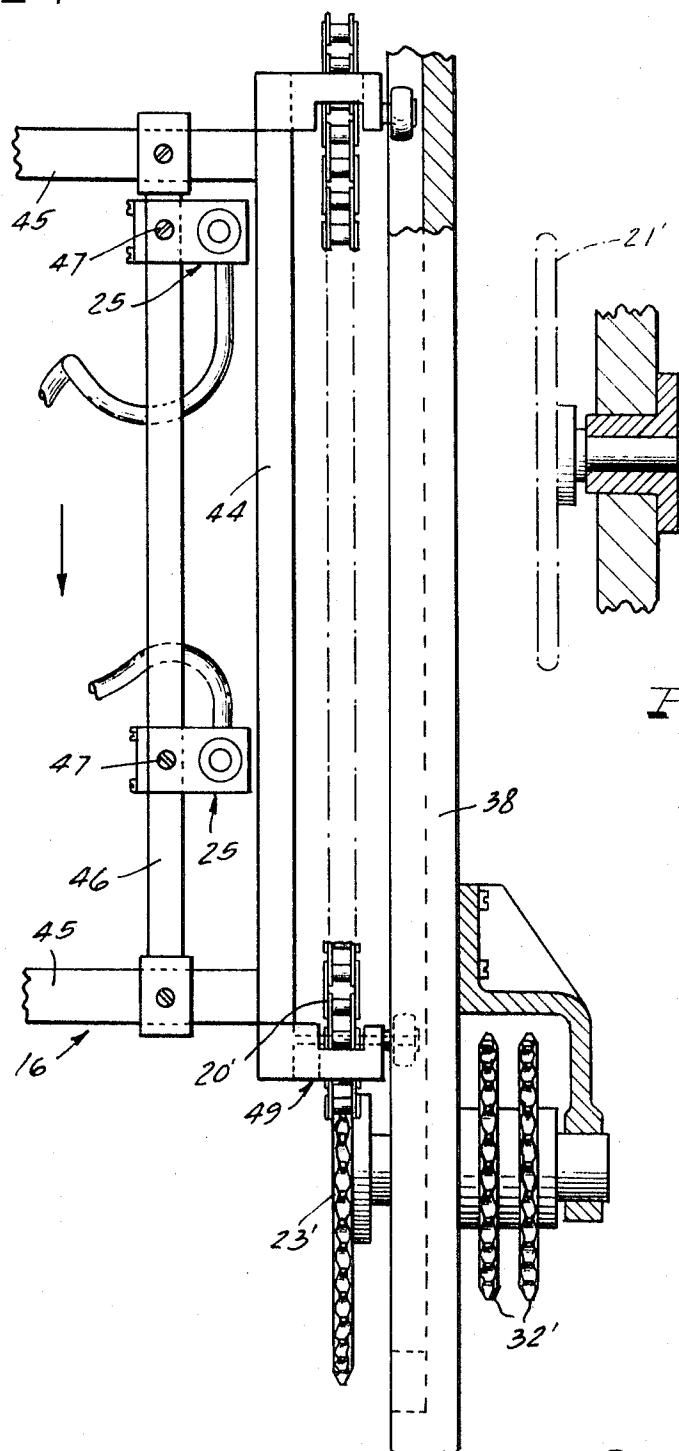


Fig-8

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FIG- 9

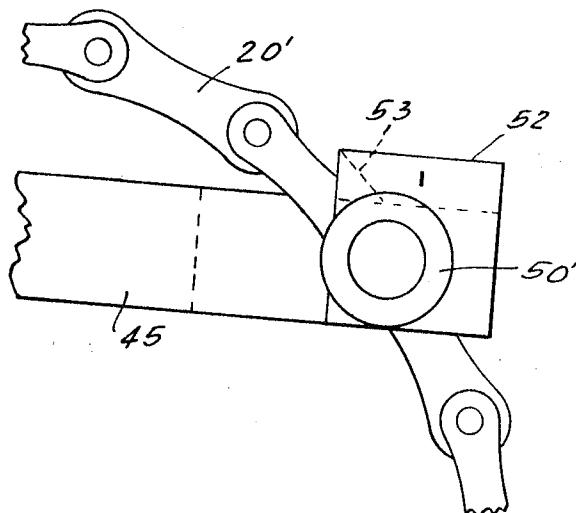
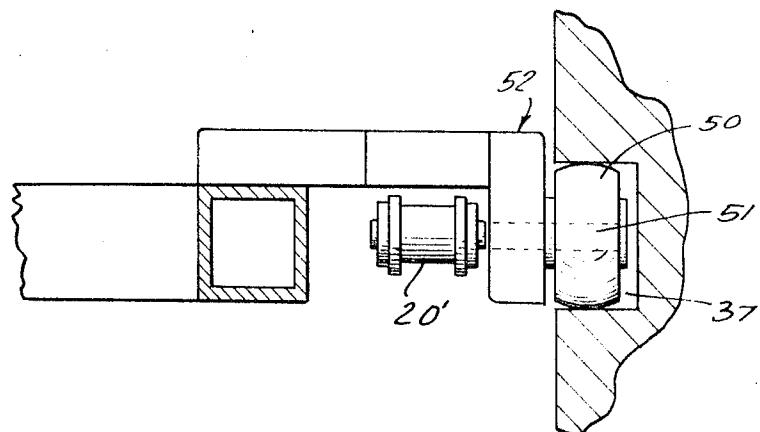


FIG- 10

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Fig. 11

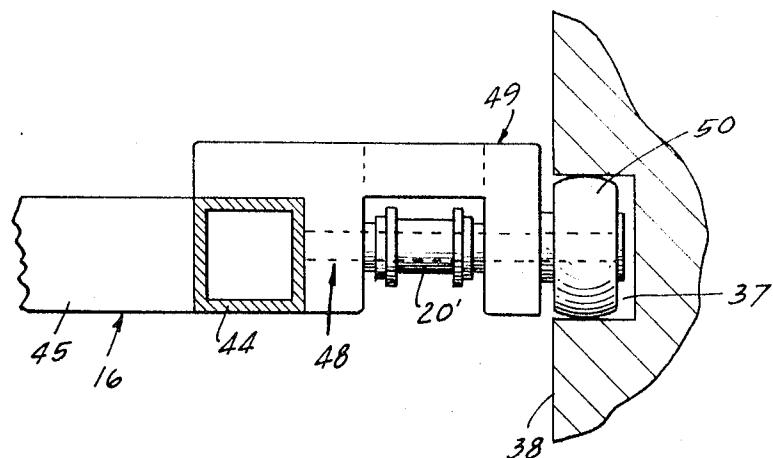
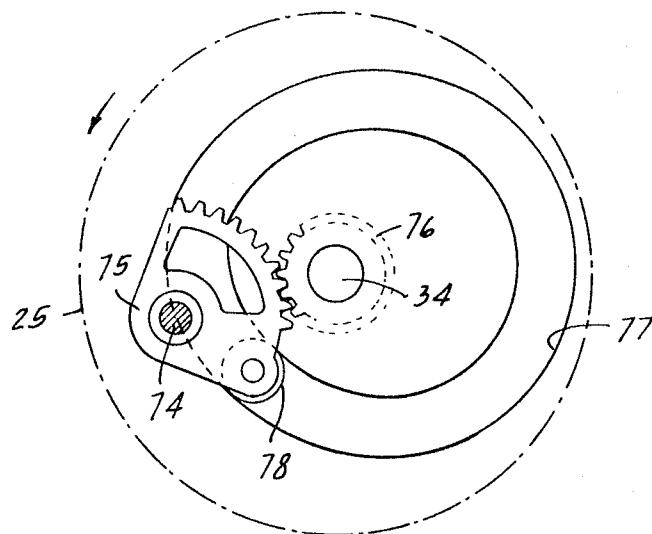


Fig. 12



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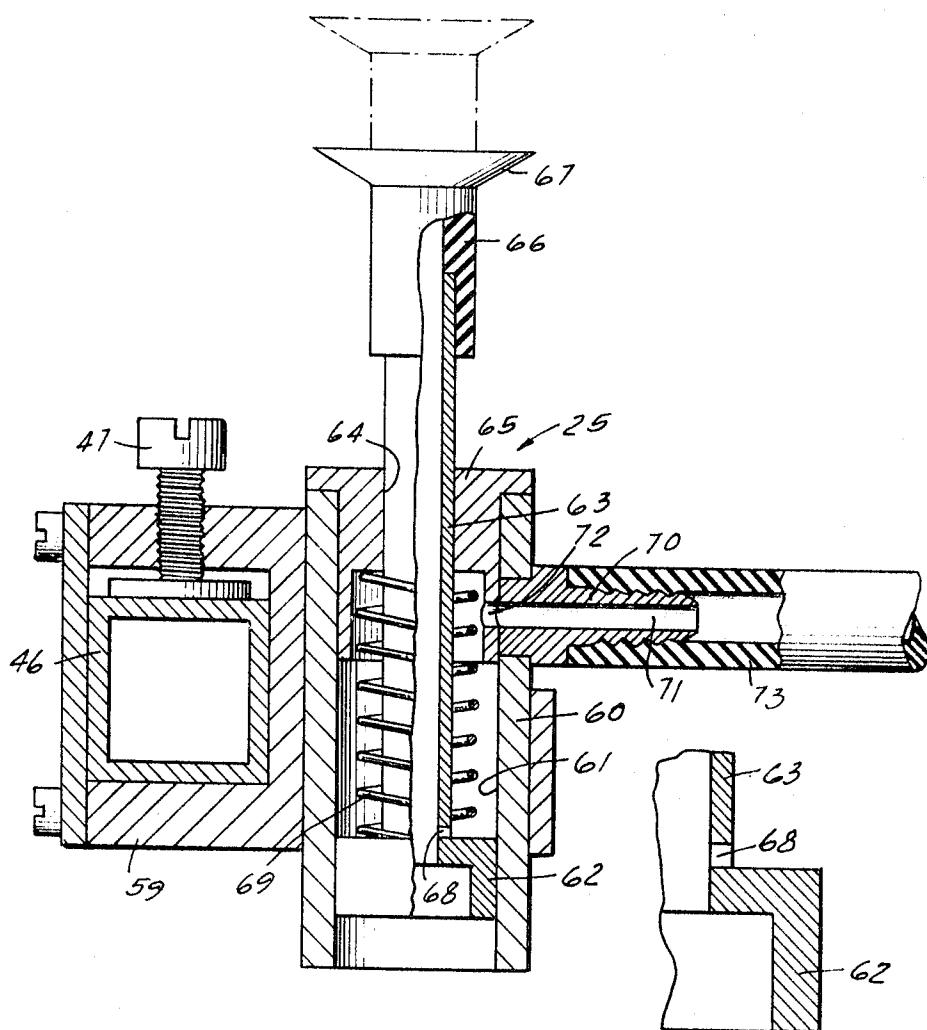
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## SHEET FEEDER

## BACKGROUND OF THE INVENTION

Sheet feed mechanisms such as die cutters, gluing machines, printing machines and the like require a rapid, accurate and efficient means for successively feeding individual sheets from a stack into the machine mechanism for processing as desired. In some types of sheet feed mechanism, such as in gluing machines, it is desirable to provide a sheet feed apparatus which will be effective to convey individual sheets from a vertically oriented stack of such sheets resting on their sides or ends to a horizontal conveyor assembly. While not so limited the present invention is particularly suited to such use.

Further, in many instances it is either necessary or particularly desirable that the sheets be retained in their original flat condition while they are conveyed from their vertical to their horizontal positions.

## SUMMARY OF THE INVENTION

The device herein illustrated and constructed in accordance with the invention comprises a plurality of frames movable successively through positions wherein they are coplanar with and adjacent the vertically stacked sheets and contiguous position wherein they are coplanar with and spaced slightly above a horizontal conveyor. The frames each have a plurality of vacuum suckers carried on their working faces which carry the sheets from one position to another.

The frames are carried around a closed multisided circuit by a pair of endless chains and the chains in turn are driven and stopped intermittently so that the frames come to rest when they are disposed respectively in their vertical and horizontal working position.

In operation, a frame is brought to rest adjacent a vertical sheet, the suckers on that frame are actuated to draw one sheet to that frame and the chains are then driven to carry the frame to a horizontal rest position. When the frame is thus momentarily disposed in the horizontal rest position, the suckers in that frame are deactivated and the sheet is dropped.

The frames are carried on the chains in a manner such that they remain at all times during their movement in a flat condition and yet within the dihedral angle defined by the contiguous vertical and horizontal positions of the chain.

In the most practical embodiment of the invention the mechanism defines a square profile about a horizontal axis so that in any chain rest period two frames will occupy horizontal positions and two will occupy generally vertical positions.

It is therefore a principal object of the invention to provide a sheet feed mechanism particularly adapted for carrying individual sheets from a stack of such sheets to another location neither coplanar to or in a parallel plane to the original sheet stack.

A more specific object of the invention resides in the provision of a sheet feed mechanism comprising a plurality of frames having sheet suckers distributed over their faces, wherein the frames are carried by a plurality of endless chains and may be particularly adapted to pick up a sheet from a vertical stack and deposit it in a horizontal position without causing the sheet to bend in the process.

Yet another object of the invention pertains to the means whereby such action can most expeditiously be accomplished and wherein the frames can be carried always within the dihedral angle defined by the chains and the starting and stopping of the chains as well as the activation and deactivation of the suckers can be accomplished.

These and other objects, features and advantages of the invention will become apparent from time to time as the following specification proceeds and with reference to the accompanying drawings illustrating one preferred embodiment only of the invention wherein:

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic side elevational view of the sheet feed mechanism;

5 FIG. 2 is a diagrammatic plan view of the mechanism of FIG. 1 and showing two vertical sheet stacks and a horizontal conveyor;

10 FIG. 3 is a fragmentary side elevational view of a portion of the mechanism illustrating the manner in which the frames are fixed to the chains and guided for movement and wherein the suckers are connected to a vacuum source;

15 FIG. 4 is an axial cross section of the device for periodically supplying the suckers with suction;

FIG. 5 is a cross section along the lines V-V of the device illustrated in FIG. 4;

15 FIG. 6 is a partially sectioned, partially elevational view of the means for adjusting the mechanism of FIG. 4;

20 FIG. 7 is a fragmentary side elevational view of a frame illustrating its mounting on the chain and the means whereby the frame is guided for movement and also showing the means by which the chain is driven;

25 FIG. 8 is a sectional view illustrating a chain idler wheel mounting;

FIG. 9 illustrates the means by which the trailing end of the frames are associated with the chains and guides;

30 FIG. 10 illustrates the arrangement of FIG. 9 from the side;

FIG. 11 is similar in nature to FIG. 9 but for the fact that it illustrates the leading end of the frame and the manner in which it is connected to the chain;

35 FIG. 12 illustrates diagrammatically the variable-speed drive mechanism whereby the chains are successively started and stopped;

FIG. 13 is a diagrammatic vertical sectional view of the sucker assembly; and

FIG. 14 is an enlarged fragmentary view of a portion of the device of FIG. 13.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

40 Referring initially to FIGS 1 and 2, a vertically oriented stack of sheets 10 is shown as being supported on a table 11. A horizontal convey or assembly indicated generally by the numeral 12 has a pair of belts 13 trained over wheels 14 which wheels are carried on a shaft 15. Similar means are provided for supporting the belts 13 throughout the length of the conveyor assembly and the mechanism is used for carrying individual sheets into some sort of working apparatus such as a gluing machine.

45 A plurality of frame 16, 17, 18 and 19 are carried on two endless chains (illustrated diagrammatically in FIG. 1 at 20) and these chains are in turn trained over sprocket wheels. In FIG. 1 sprocket wheels 21, 22, 23 and 24 are illustrated diagrammatically as carrying the chain 20 and it will be understood that like sprocket wheels on the opposite side of the machine 21', 221, 23' and 24' carry an identical endless chain.

50 The frames each have sucker assemblies 25 fitted thereon which are actuated when the frame 16 is at a rest position adjacent the vertical stack of sheets 10 and which sucker assemblies are deactivated when the frame has moved to a position occupied by the frame 17 in FIG. 1 to drop the sheet on the conveyor 12.

55 The frames each have sucker assemblies 25 fitted thereon which are actuated when the frame 16 is at a rest position adjacent the vertical stack of sheets 10 and which sucker assemblies are deactivated when the frame has moved to a position occupied by the frame 17 in FIG. 1 to drop the sheet on the conveyor 12.

60 A vacuum distributor 27 is shown in FIG. 1 as having four flexible hoses 28, 29, 30 and 31 extending therefrom. The distributor head rotates as the chains move intermittently about their path around the sprockets and the outer ends of the hoses are connected respectively to the sucker assemblies 25 on each of the four frames.

65 Double sprocket wheels 32 and 32' are directly coupled to sprocket wheels 23 and 23'. The drive for the chains comes through these double sprocket wheels 32, 32' through similar enlarged double sprocket wheels 33 and 33' mounted on and connected to drive shaft 34 for corotation. The shaft 34 has a flywheel 25 connected to the outer end thereof which is driven

through a belt 26a from the main motor 27a. The double sprockets 32 and 33 are connected through chains or belts as are the sprockets 32' and 33'.

The motor 27a can be used to drive the conveyor 12 also through means of a sprocket 35 mounted on the shaft 15 and connected by belt or chain to the drive wheel 36 which is connected through suitable pulleys or gearing in the gearbox 27 to the drive shaft 34.

Referring now more specifically to FIG. 3, the frame (19 for example) is preferably a gridlike structure presenting a flat outer surface and has a roller 36 fitted on one end thereof which is guided within a slot 37 formed in a rectangular side guide frame 38. The chain 20' is trained over sprocket wheels 21 and 22 and normally runs in the direction of the arrow. The opposite end of the frame 19 is connected to the chain at the point 39 so that this end of the frame is pulled along by the chain with the trailing end of the frame 19 being guided by the wheel 36 riding within the slot 37. The sucker assemblies 24 are each connected through suitable tubing to a manifold 30 which, in turn, is connected through suitable flexible tubing 31 as heretofore noted to the vacuum distributor 27. The vacuum distributor head 27 is connected to and driven by a chain 41 which, in turn, is driven and stopped intermittently as the chain is driven and stopped through the means of the wheel 42 and shaft 43. The frame 16 (and each of the frames) comprises generally a pair of side frames 44 having pairs of frame parts 45 interconnecting the side frames and frame members 46 extending between the frame parts and carrying the sucker assemblies 25.

The sucker assemblies are movably positioned on the frame members 46 so that they can be located in any position therealong as desired and screws 47 or some other similar means are provided so that once the sucker assemblies have been positioned, they can be fixed in that position.

An understanding of the particular means by which the frames may be connected to the chains and guided for movement about the mechanism can best be understood by viewing FIGS. 7, 10 and 11 together.

The frame 16 at its leading end is shown as being directly connected to the chain 20'. This connection is made by means of a pin 48 which extends through one link of the chain and then through a U-shaped portion 49 of the frame 16 to pivotally interconnect the frame with the chain. In the embodiment of the invention illustrated in the drawings, the pin 48 is also shown as having a roller or wheel 50 carried on its outer free end which roller is adapted to ride within the track or slot 37 formed in the side guide frame 38 of the sheet feed mechanism. In practice, it may be found desirable to simply connect the forward or leading end of the frame to the chain without providing the guide wheel 50.

The rear end or trailing end of the frame 16 is not connected to the chain as can be seen from FIGS. 9 and 10 but a pin 51 does extend from the U-shaped frame part 52 which, in turn, embraces but is not connected to the chain 20' and this pin has a roller 50' carried thereon which also rides within the track or slot 37. It will be noted in FIG. 10 that the U-shaped end 52 of the frame 16 is chamfered at the point 53 to permit the frame to extend over and above the chain 20' without contacting the chain.

The suction distributor 27 is mounted on the side frame 38 and comprises a part 54 having a vacuum supply pipe 55 connected thereto. The vacuum supply pipe 55 opens to one end of the part 54 through a port or slot 56 which is a semicircular slot as can best be seen in FIG. 5. The slot 56 extends through an arc of something less than 90°. A movable distributor head 57 is associated with the part 54 and has four separate air passages 58 formed therein which open through circular ports 59 to the interface between distributor head 57 and part 54. The ports 59 are spaced radially outwardly from the common axis of the distributor member 57 and part 54 the same distance as the arcuate slot 56 so that the distributor head 57 is rotated the different passages 58 will each successively be brought into fluid communication with the arcuate port 56 to

communicate first one and then the others of the passages with that arcuate port 56.

The passages 58 are connected through suitable means not shown with the flexible tubes 28, 29, 30 and 31 and these tubes have their opposite ends connected to the frames 16, 17, 18 and 19, respectively. The distributor head 27 is drivingly connected with shaft 43 which, in turn, is driven intermittently as the chains are driven so that the distributor head 27 moves with and stops with the chains. The mechanism illustrated in FIG. 6 is provided for the purpose of adjusting the position of the part 54 slightly as desired so that suction can be applied to the appropriate sucker assemblies slightly earlier or slightly later in the cycle as desired to provide the most efficient and smooth operation. It consists simply of a clamp 38a and a threaded member 38b having a handle thereon for tightening the clamp down on the part 54.

FIG. 13 illustrates in more detail a sucker assembly 25 including a bracket 59 extending over frame member 46 and having screw 47 threaded therein and engaging the frame part to fixedly mount the sucker assembly in a desired position on the frame member.

The sucker assembly comprises a main body part 60 carried within the bracket 59 and defining a cylinder 61. The cylinder 61 has a piston 62 guided for rectilinear slidable movement along the wall of the cylinder and formed integrally with a tubular section 63 extending through a radially reduced bore 64 formed in the upper end of the tube guide 65 which, in turn, is fitted within the upper end of the body part 60. The tubular member 63, in turn, has a sucker head 66 fitted on the outer end thereof which may be formed of resilient material and which at least terminates in an outwardly flared skirt 67. A small-diameter port 68 is formed through the wall of the tubular section 63 adjacent the piston 62.

A spring 69 is interposed between the guide 65 and the piston 62 to bias the tubular member 63 and the associated sucker head 66 to the full line position illustrated in the drawings.

A connecting nipple 70 is fitted within the body part 60 and has a passageway 71 extending therethrough which opens through a port 72 to the space between the wall of the tubular member 63 and the cylinder wall 61. A rubber hose 73 is fitted on the nipple 70 and is connected with an intermittently applicable vacuum source. When vacuum is applied to the passageway 71, the space between the cylinder wall 61 and tubular member 63 is evacuated. The effective flow area of the passage 71 and the port 72 is greater than the effective flow area through the port 68 and as a consequence the piston 62 is drawn upwardly within the cylinder 61 against the opposing bias of the spring 69 immediately upon the application of suction. The sucker head 66 moves upwardly to the broken line position illustrated in FIG. 13 and at such time the flared skirt 67 contacts the sheet to be processed. When the skirt contacts the sheet, the interior of the tubular member 63 previously open to atmosphere through the sucker head 66 is now closed by the sheet and the interior of the tubular member 63 is also evacuated causing the sucker to return to the position illustrated in full lines. Vacuum application then ceases and the sucker remains in the retracted, full line position until vacuum is again applied. A stop of some sort is provided to prevent the sucker piston 62 from moving below the point illustrated in full lines in the drawing. FIG. 14 illustrates in an enlarged view that portion of the sucker piston 62 and sucker tubular member 63 adjacent the small bleed opening 68.

Lastly, the mechanism for effecting intermittent drive of the chains is illustrated in FIG. 12. The flywheel 25a is driven at constant speed by the motor 27a through the belt 26a. The flywheel 25a carries an axle shaft 74 at a point spaced radially outwardly from the axis of the flywheel and this axle shaft 74, in turn, carries a toothed sector 75. The diagrammatic view of FIG. 12 shows the axle shaft 74 as being carried directly on the flywheel 25a although it will be understood that this axle could simply be carried an arm fixed to the hub of the flywheel 25a and contained within the gearbox 27.

The toothed sector 75 is arranged to mesh with toothed pinion wheel 76 which, in turn, is connected to the shaft 34 for corotation. A fixed groove 77 is formed within the gear case 27 and its configuration is such as shown that it is eccentric of the axis of shaft 34. A roller 78 is carried on one end of the toothed sector 75 at a point spaced radially outwardly of the axle shaft 74 and this roller is carried within the groove 51. The roller just fits within the groove 51 so that as the flywheel 25a rotates carrying the axle shaft 74 with it, the roller 78 will move along and within the groove 77 causing the toothed sector 75 to pivot back and forth about the axle shaft 74.

It will be understood that with this arrangement the drive to the shaft 34 is from the flywheel 25a through the toothed sector 75 and the gear wheel 76 and that the speed of drive is varied as the toothed sector pivots about the axle shaft. For instance, at one point in the cycle of rotation of the flywheel 25a, the toothed sector 75 is "backpedaling" at the same rate that the axle shaft is moved in an opposite direction so that the gear shaft 34 actually stops. It is at such a time that the chains 20 also stop to permit sheets to be picked off the vertical stack by one frame and dropped on the horizontal conveyor by another frame. The mechanism of FIG. 12 thus is effective to vary the speed of drive from the flywheel to the shaft 34 to the point of stopping the shaft 34 and rapidly accelerating its angular velocity again.

I claim:

1. A sheet feed frame, sprocket comprising:  
a closed circuit guide frame, sprocket wheels disposed at the corners of said guide frame and having a chain trained thereover, a movable frame having one end guided for movement within said guide frame and its opposite end connected to said chain,  
an intermittently actuatable sucker assembly connected to said movable frame,  
means stopping said movable frame when it is in a generally vertical position and again when it is in a generally horizontal position, and  
means applying suction to said sucker assembly between said vertical and horizontal positions and releasing said suction when said frame is in a generally horizontal position.

2. A sheet feed mechanism constructed in accordance with claim 1 wherein said guide frame is rectangular in configuration and said sprocket wheels are disposed at the corners of said rectangular guide frame and wherein two sets of coaxial sprocket wheels are provided with chains trained over each set and wherein said movable frame has its leading end supported by both chains and its trailing end guided within grooves formed in guide frames adjacent each set of chains.

3. A sheet feed mechanism constructed in accordance with claim 1 wherein at least one sprocket wheel is driven from a drive shaft and wherein said drive shaft is drivingly connected with a continuously running flywheel through an intermittent drive gear mechanism.

4. A sheet feed mechanism constructed in accordance with claim 1 wherein at least one sprocket wheel is driven from a drive shaft and wherein said drive shaft is drivingly connected with a continuously running flywheel through an intermittent drive gear mechanism and wherein said intermittent gear drive mechanism comprises a pinion connected to and corotatable with said drive shaft and a toothed sector gear drivingly engaged with said pinion and carried on an axle shaft spaced radially outwardly of the axis of said drive shaft and carried by said flywheel and wherein a cam groove is provided eccentric of the axis of said drive shaft and said toothed sector has a follower spaced radially outwardly of said axle shaft movable within said cam groove whereby to effect pivotal movement of said toothed sector as said follower runs within said groove.

within said cam groove whereby to effect pivotal movement of said toothed sector as said follower runs within said groove.

5. A sheet feed mechanism constructed in accordance with claim 1 wherein said movable guide frame is rectangular and has a groove formed therein and wherein said movable frame has a groove follower connected to one end thereof which rides within said groove and wherein said chain runs a course immediately adjacent said groove throughout the length of each and wherein the sheet-engaging surfaces of said movable frame and sucker assembly for each given frame are coplanar to provide a flat sheet pickup surface and wherein such coplanar relation is retained irrespective of the position or movement of said chain.

6. A sheet feed mechanism constructed in accordance with claim 1 wherein said sucker assembly comprises a body part defining a cylinder having a closed end with a relatively smaller diameter bore extending through said closed end, a piston slideable along the wall of said cylinder having a tubular member extending therefrom and slidably carried within said bore, a sucker head fitted on said tubular member and having a flared skirt to contact a sheet to be processed and having an opening formed through said sucker head communicable with the interior of said tubular member, a bleed port formed through a wall of one of said piston and sucker and tubular members to communicate the interior said tubular member with the space intermediate said cylinder wall and said tubular member and means intermittently applying suction to said space between said tubular member and said cylinder wall.

7. A sheet feed mechanism constructed in accordance with claim 1 wherein the means for intermittently actuating said sucker assembly comprises a body part having an arcuately shaped port opening through one wall thereof, a distributor head mating with said body part and having a port opening through a wall thereof to the interface between said distributor head and said body part and spaced radially outwardly from the axis of said body part and distributor head, means communicating the port within said distributor head with said sucker assembly, and means driving said distributor head for rotation about its axis and stopping it as said chain is driven and stopped so as to periodically communicate said sucker head with said arcuate port and means supplying said arcuate port with a source of vacuum.

8. A sheet feed mechanism constructed in accordance with claim 7 wherein said body part is manually positionable to advance or retard the point at which the passage within said distributor head and said arcuate port communicate with one another.

9. A sheet feed mechanism constructed in accordance with claim 2 wherein at least one sprocket wheel is driven from a drive shaft and wherein said drive shaft is drivingly connected with a continuously running flywheel through an intermittent drive gear mechanism.

10. A sheet feed mechanism constructed in accordance with claim 2 wherein at least one sprocket wheel is driven from a drive shaft and wherein said drive shaft is drivingly connected with a continuously running flywheel through an intermittent drive gear mechanism and wherein said intermittent gear drive mechanism comprises a pinion connected to and corotatable with said drive shaft and a toothed sector gear drivingly engaged with said pinion and carried on an axle shaft spaced radially outwardly of the axis of said drive shaft and carried by said flywheel and wherein a cam is provided eccentric of the axis of said drive shaft and said toothed sector has a follower spaced radially outwardly of said axle shaft movable within said cam groove whereby to effect pivotal movement of said toothed sector as said follower runs within said groove.

UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 3,598,397

Dated August 10, 1971

Inventor(s) Roland Preisig

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 26, after "and", second occurrence, insert  
-- a --.

Column 2, line 42, change "convey or" to read --conveyor--.

Column 4, line 11, change "ban" to --can--.

Column 5, line 27, after "feed" delete "frame, sprocket" and insert --mechanism--.

Signed and sealed this 25th day of July 1972.

(SEAL)

Attest:

EDWARD M.FLETCHER, JR.  
Attesting Officer

ROBERT GOTTSCHALK  
Commissioner of Patents