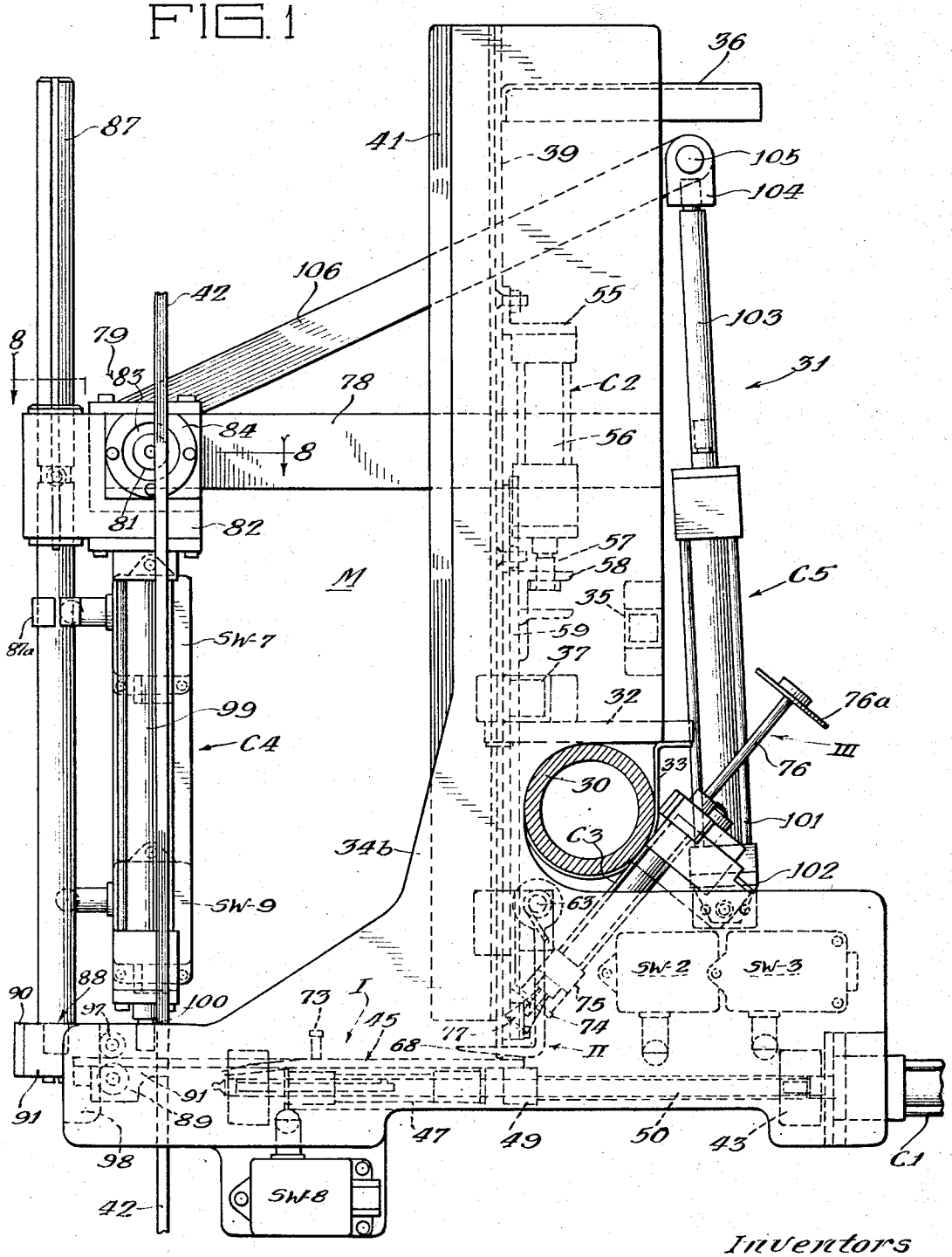
Dec. 20, 1966 K. A. KLINGLER ETAL 3,292,820

APPARATUS FOR FEEDING PACKS OF SHEETS

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FIG. 1



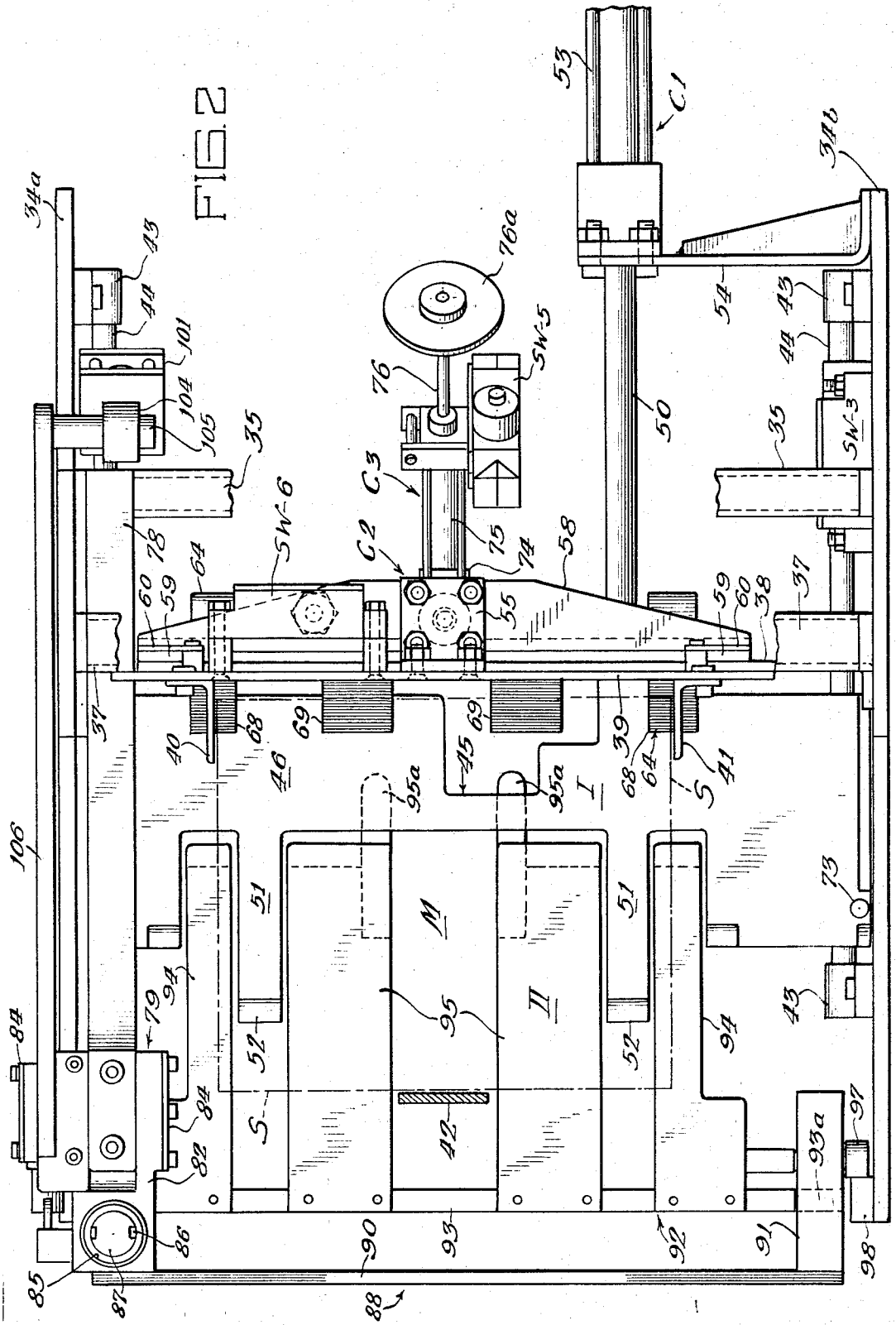
Inventors
Karl A. Klingler
Kermit E. Swanson
By: Hofgren, Wegner, Allen, Stellman & McCord
Attorneys

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FIG. 2



APPARATUS FOR FEEDING PACKS OF SHEETS

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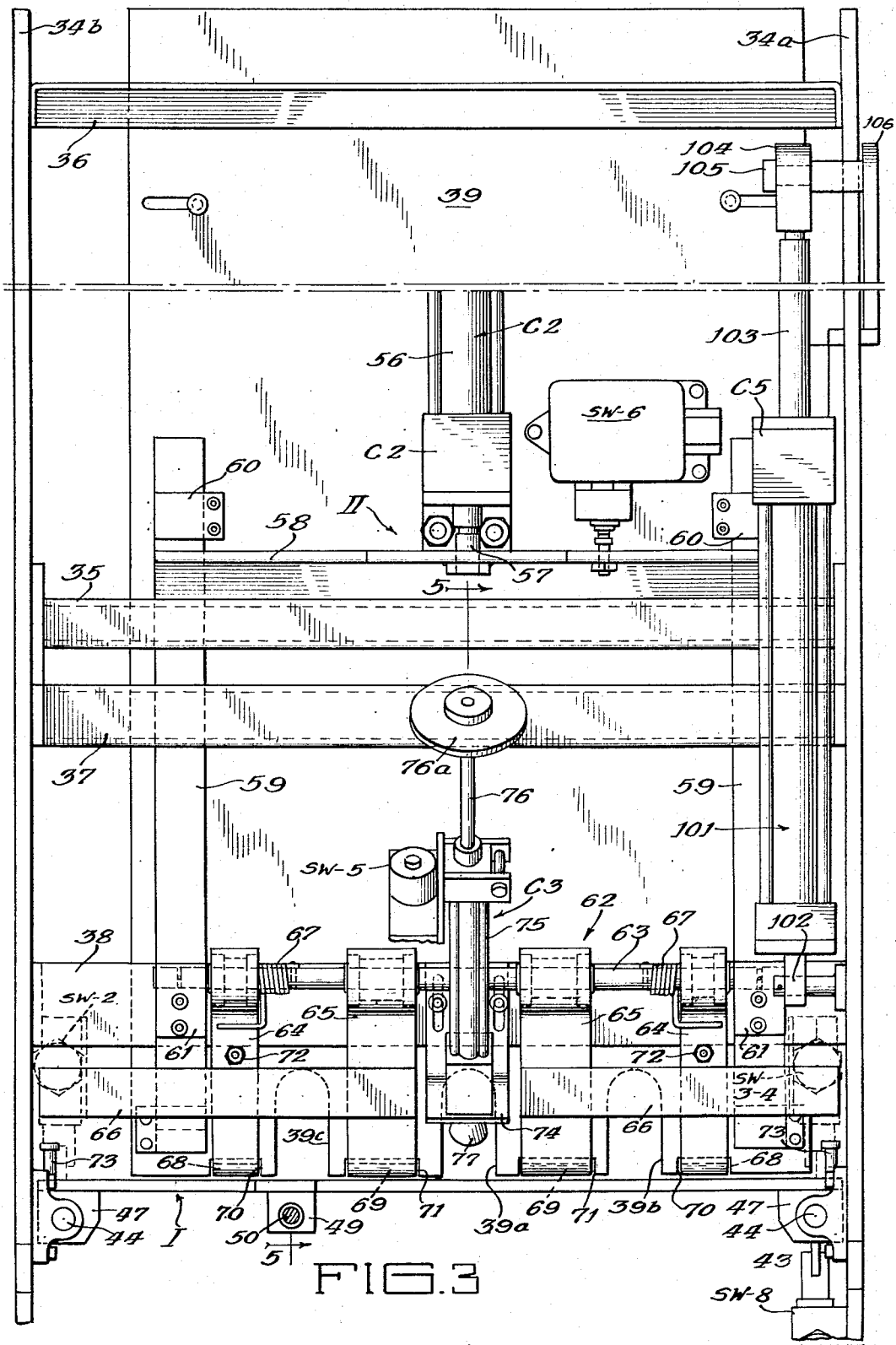


FIG. 3

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APPARATUS FOR FEEDING PACKS OF SHEETS

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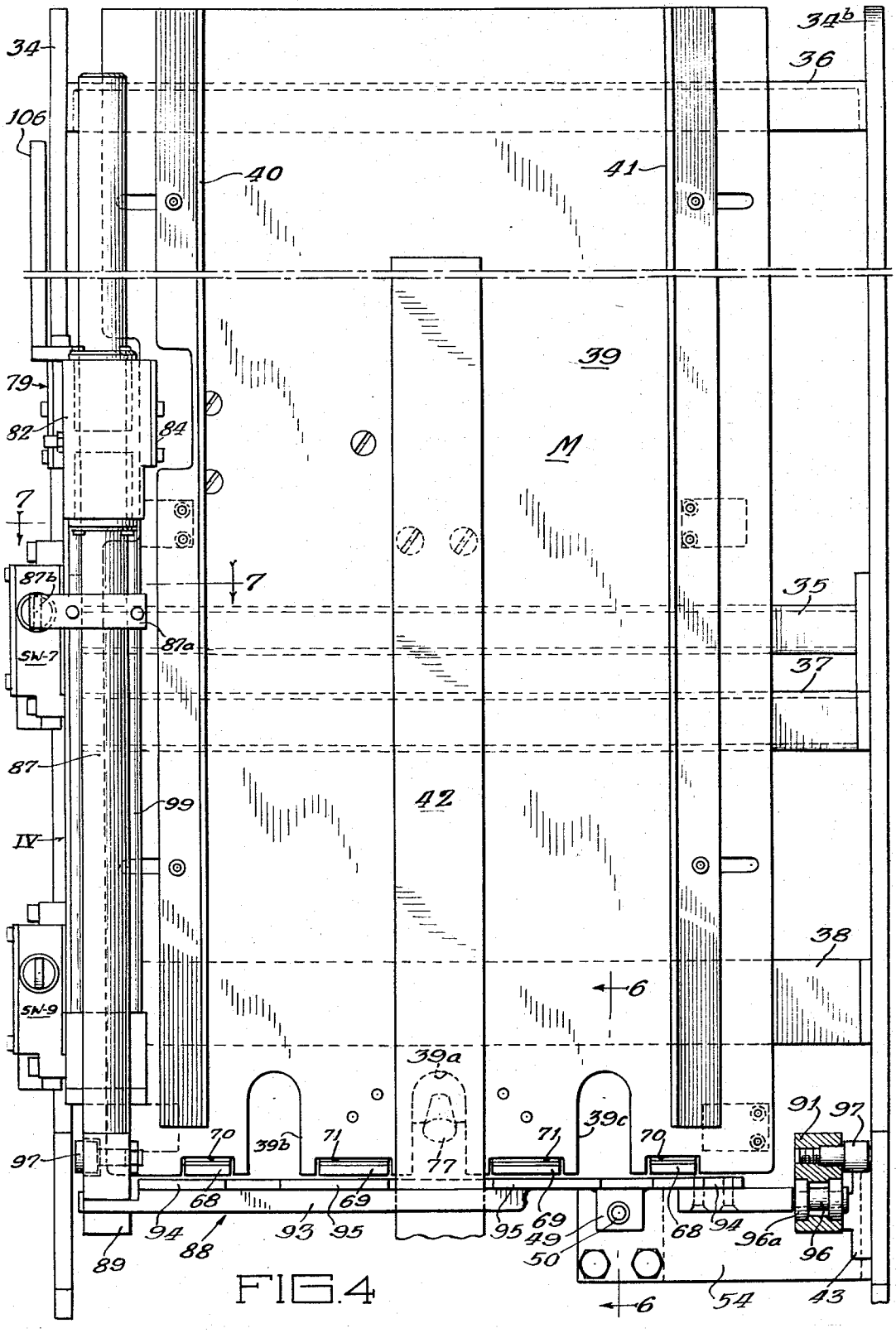


FIG.4

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FIG. 5

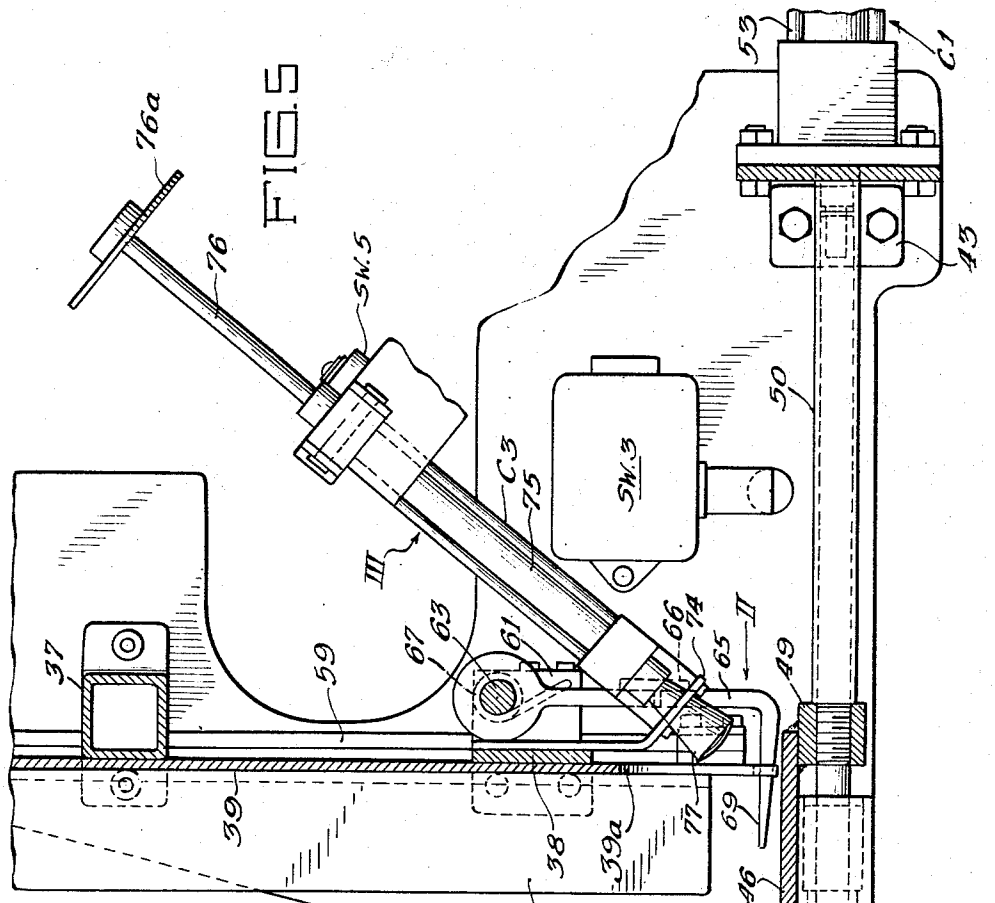


FIG. 6

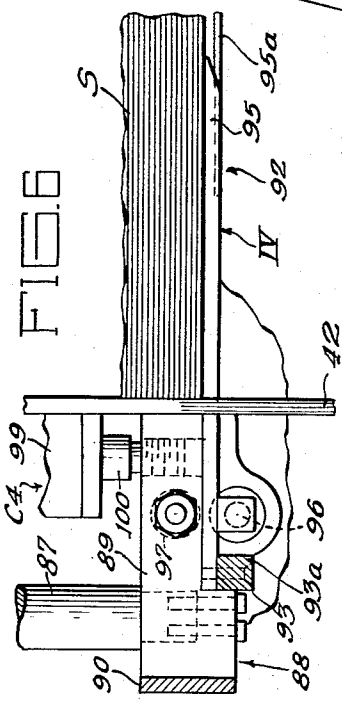


FIG. 7

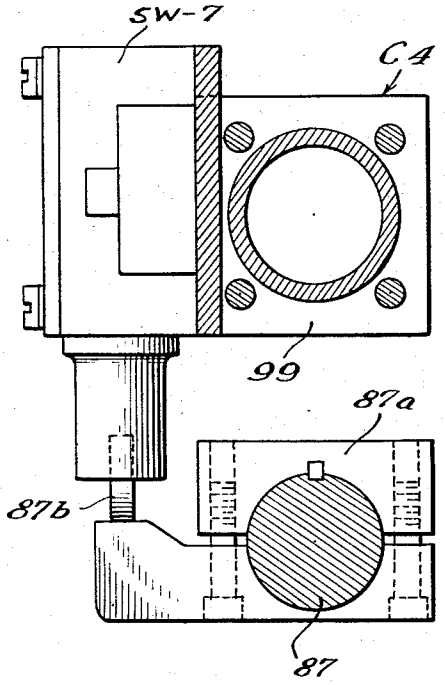


FIG. 9

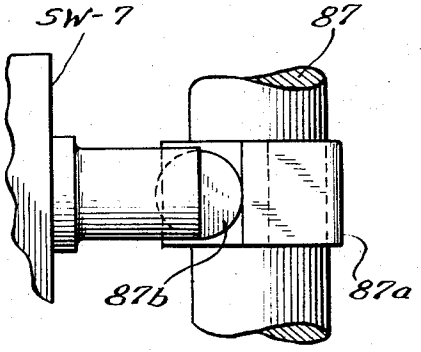
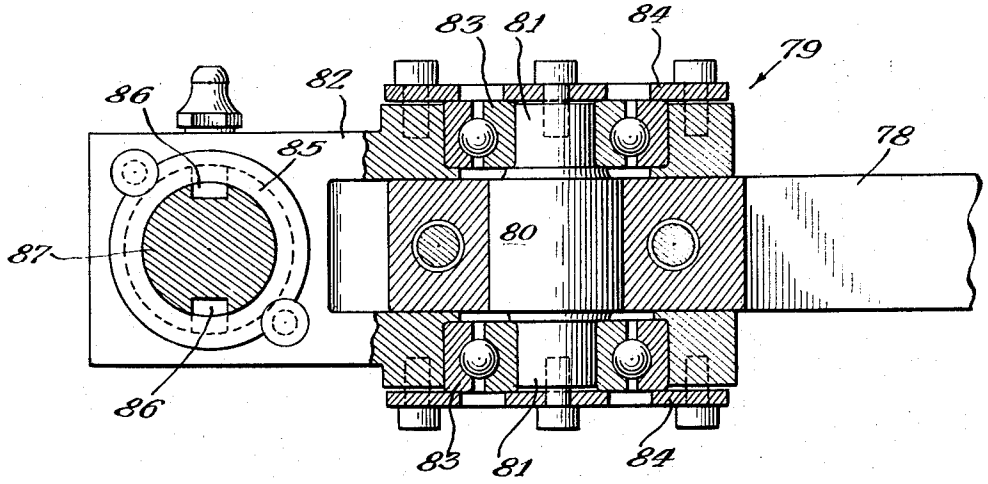


FIG. 8



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FIG. 10

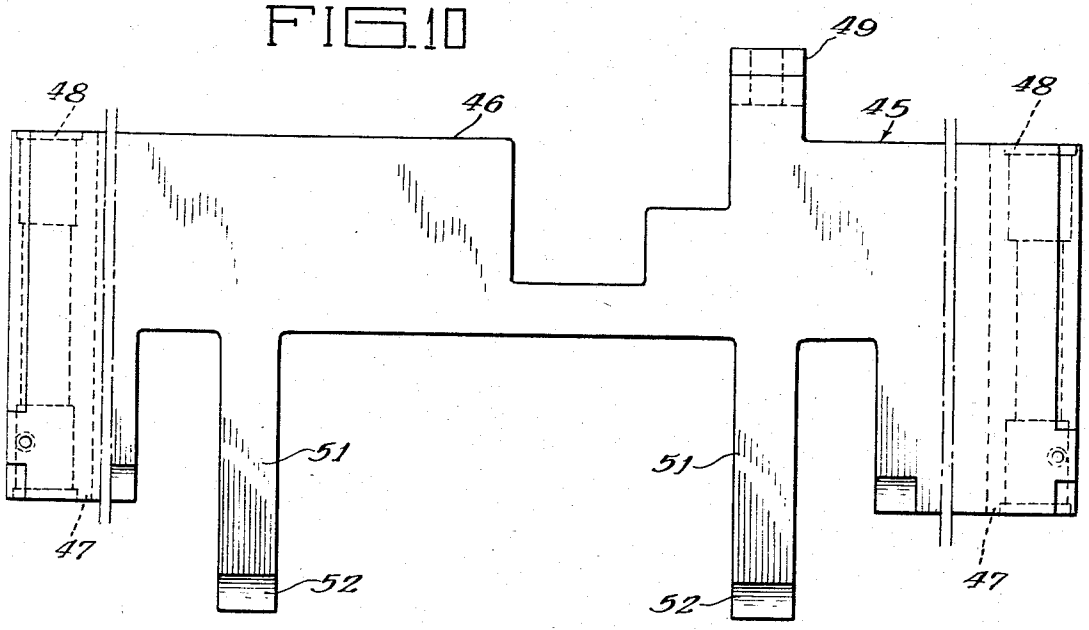
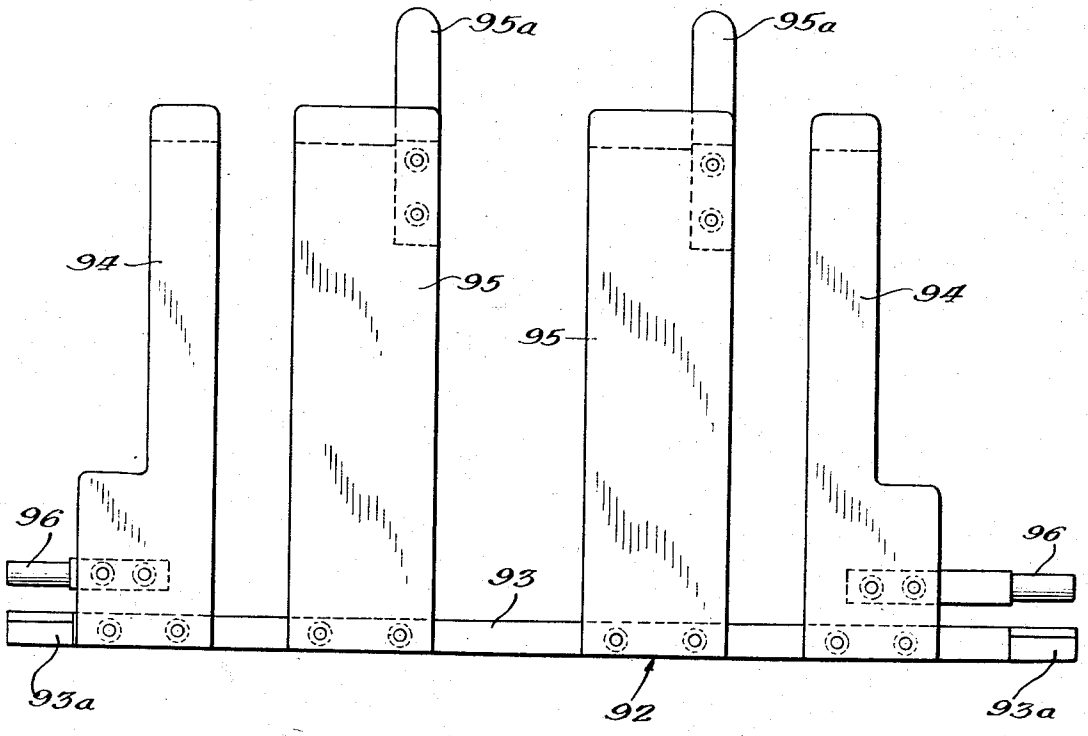


FIG. 11



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FIG. 13

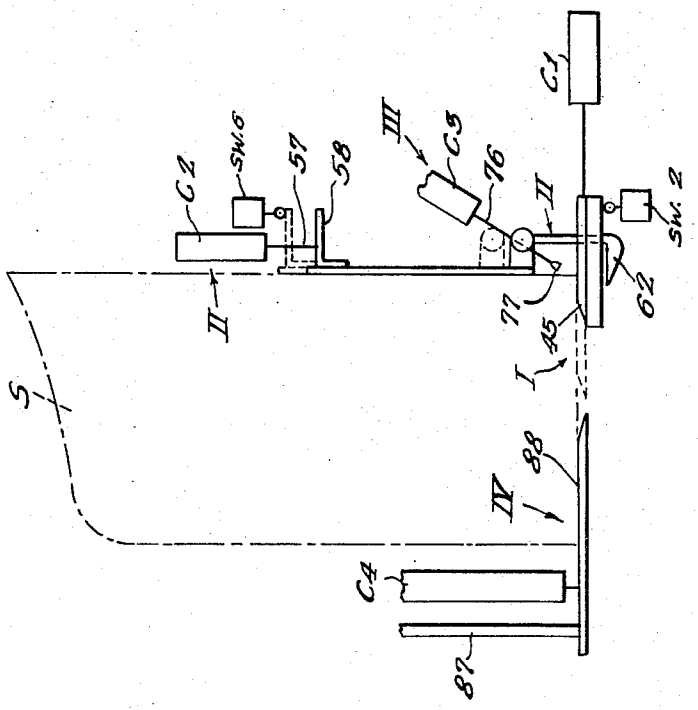


FIG. 12

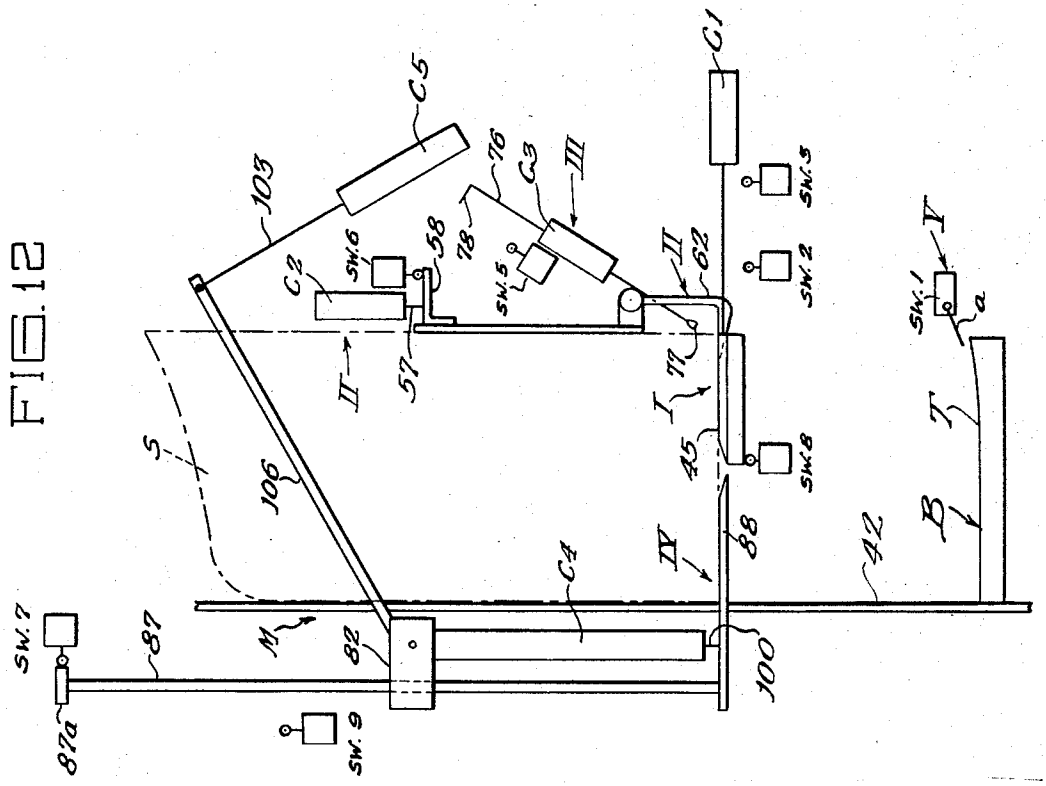


FIG.15

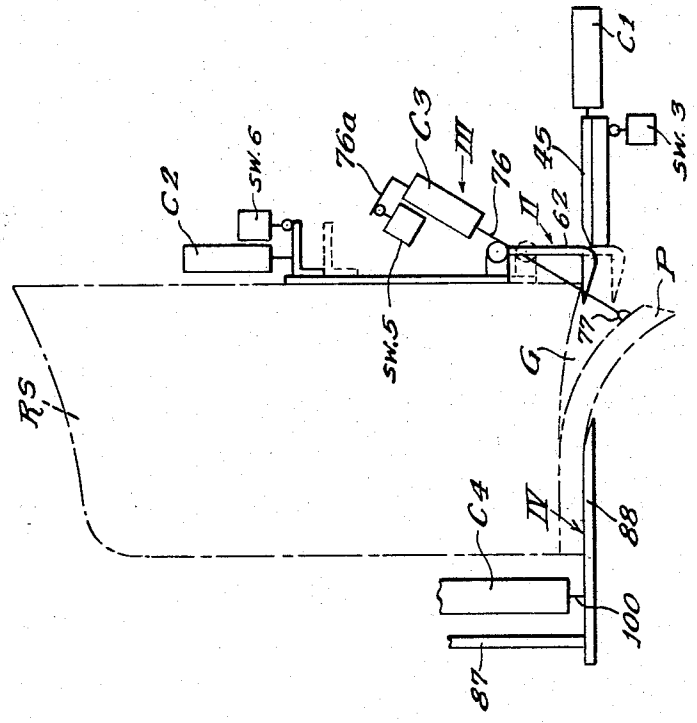
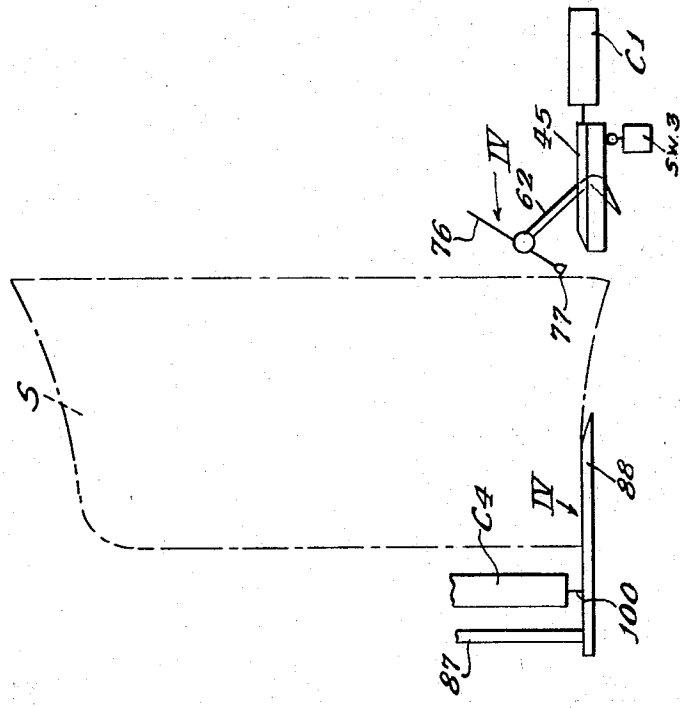

C1
SW.3
45
62
II
76
III
C3
76a
SW.6
C2
SW.5
77
G
P
RS
C4
IV
88
100
87

FIG.14


C1
SW.3
45
IV
62
76
77
S
C4
88
100
87

APPARATUS FOR FEEDING PACKS OF SHEETS

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FIG. 17

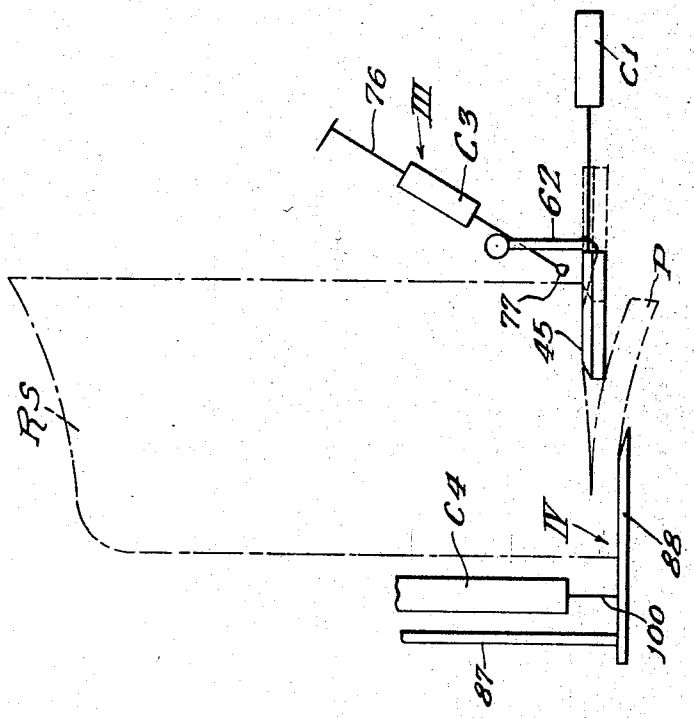
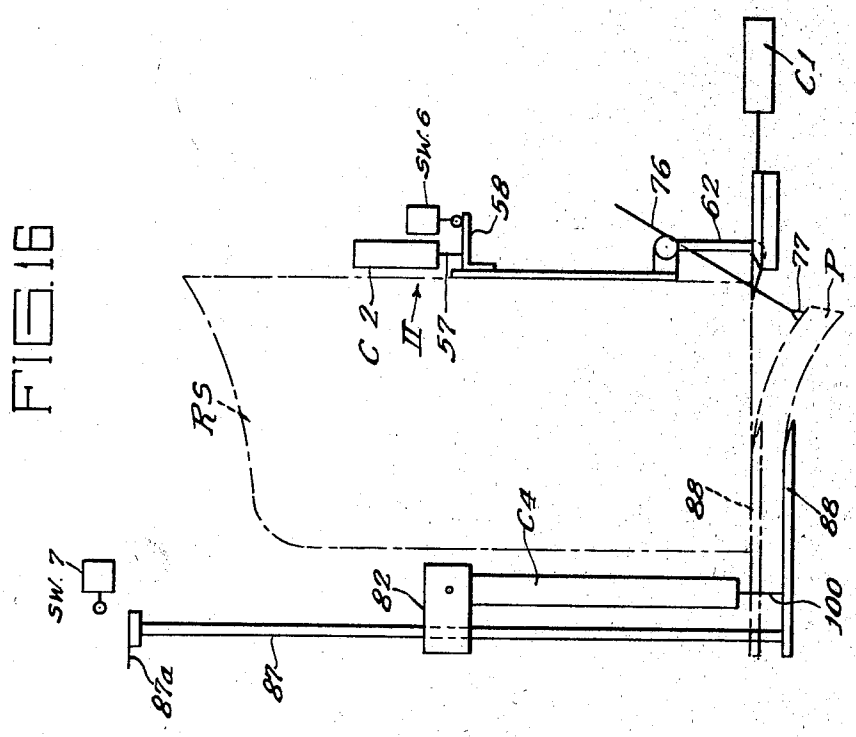


FIG. 16



APPARATUS FOR FEEDING PACKS OF SHEETS

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FIG. 19

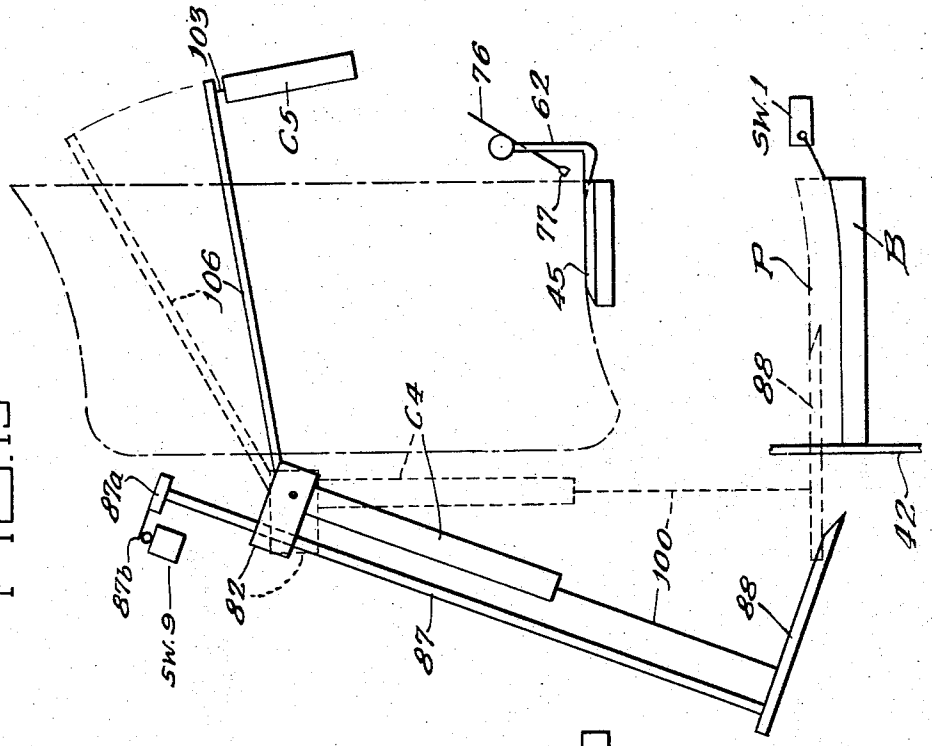
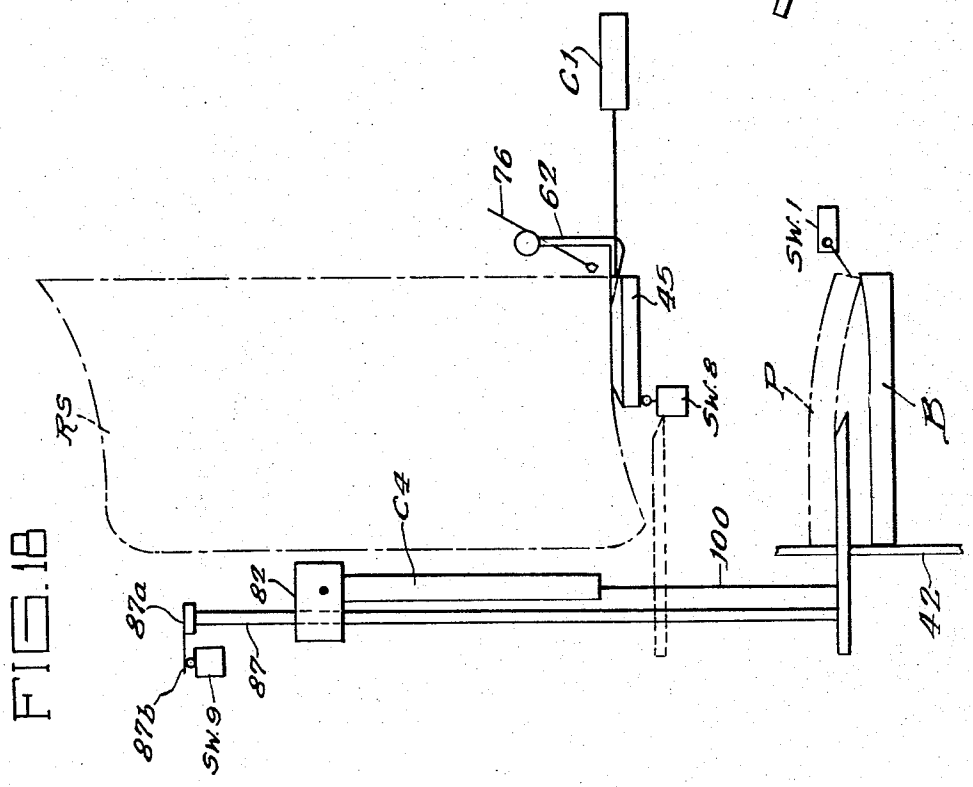


FIG. 18



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FIG. 21

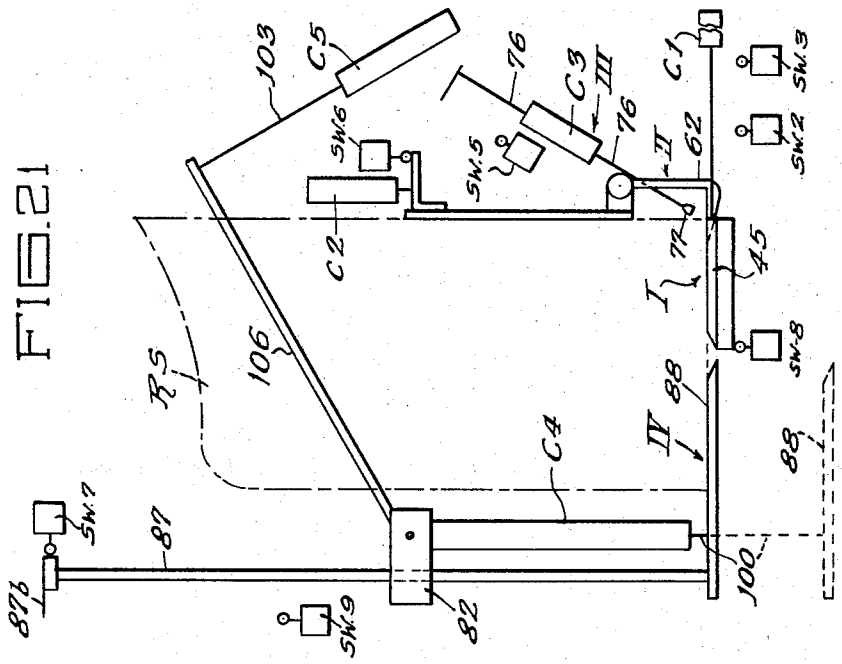


FIG. 20

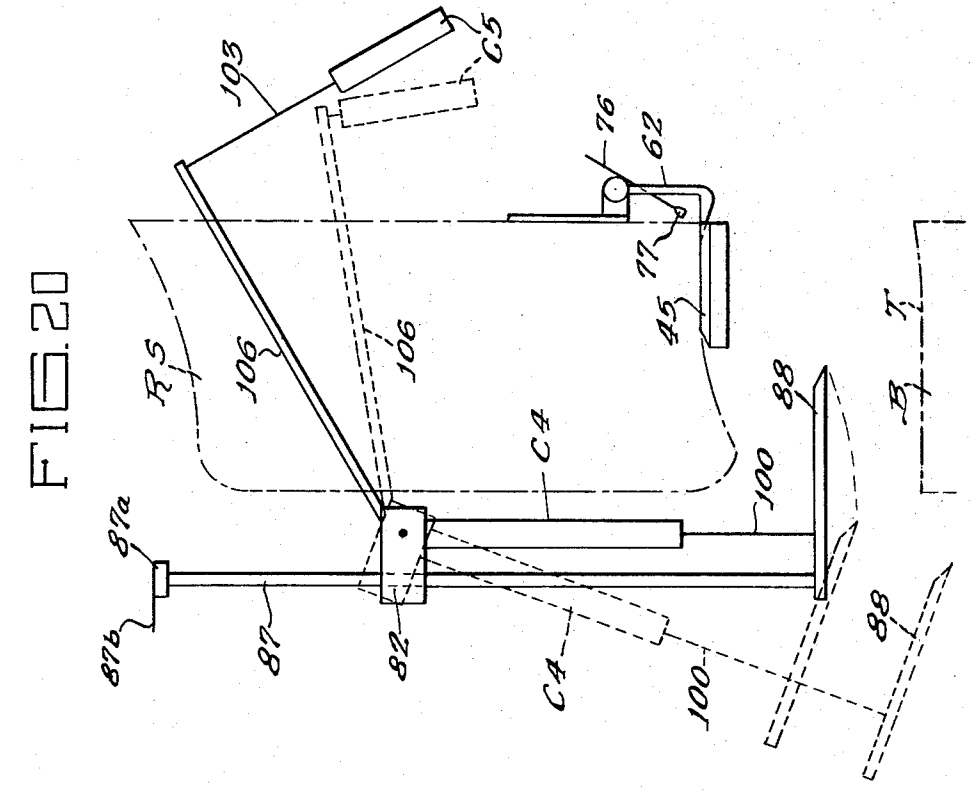


FIG. 22

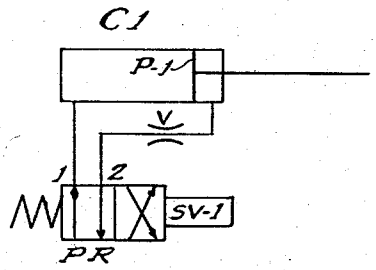


FIG. 23

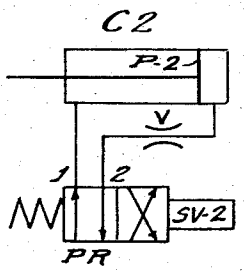


FIG. 24

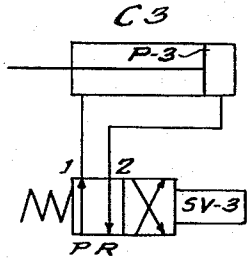


FIG. 25

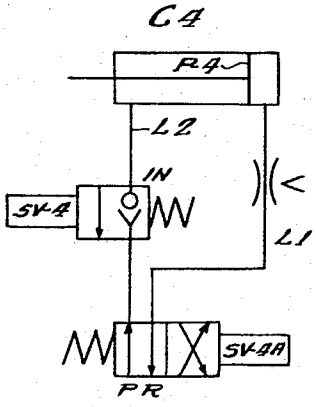
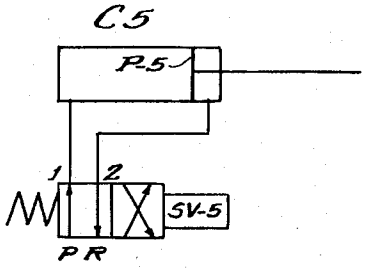


FIG. 26



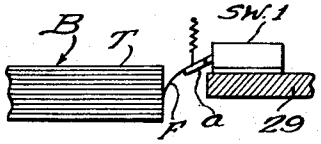
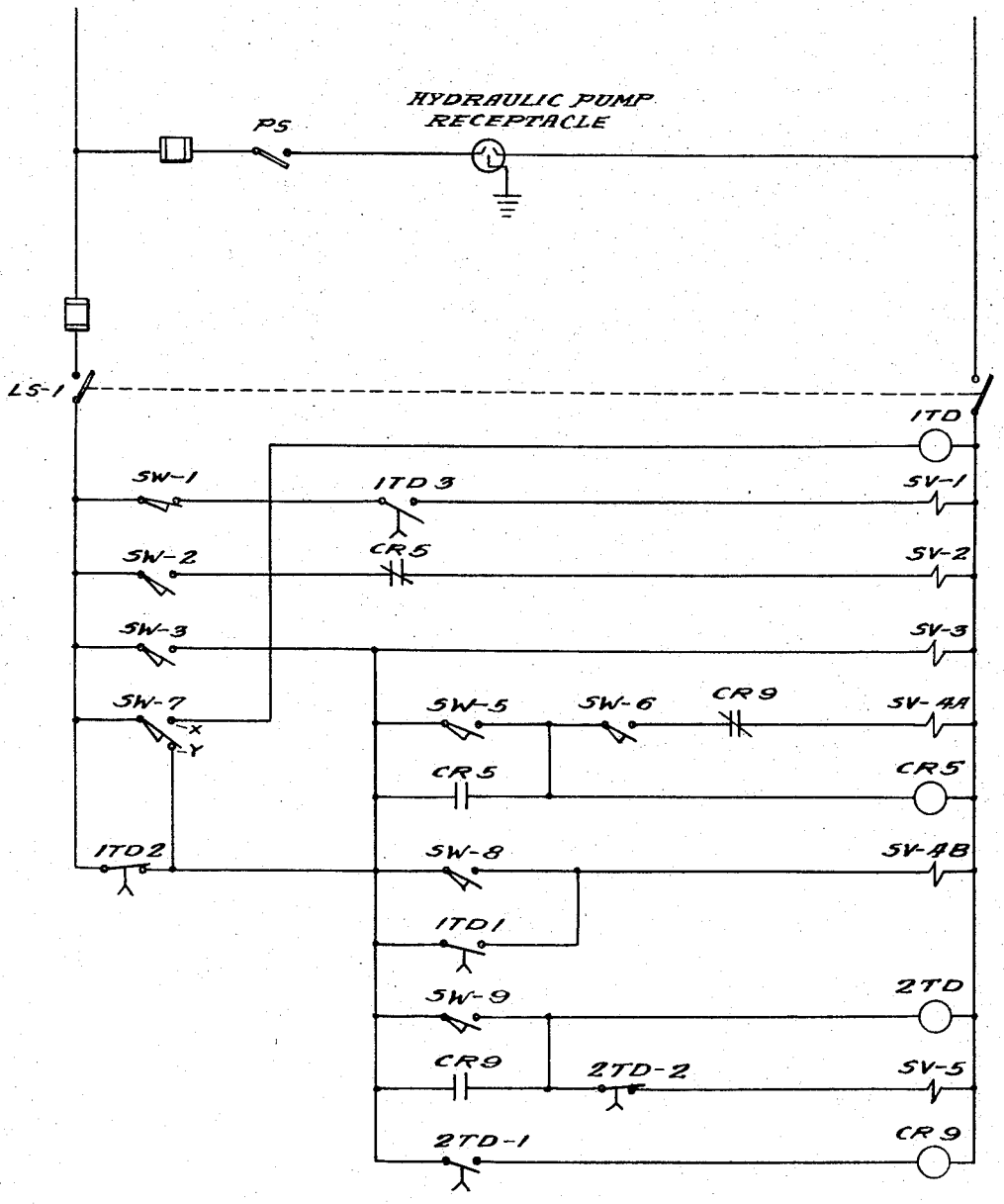


FIG. 27

FIG. 28


HYDRAULIC PUMP RECEPTACLE
PS
LS-1
1TD
SW-1
1TD 3
SV-1
SW-2
CR5
SV-2
SW-3
SV-3
SW-7
-X
-Y
SW-5
SW-6
CR9
SV-4A
CR5
CR5
1TD2
SW-8
SV-4B
1TD1
2TD
SW-9
CR9
2TD-2
SV-5
2TD-1
CR9

United States Patent Office 3,292,820 Patented Dec. 20, 1966

3,292,820

APPARATUS FOR FEEDING PACKS OF SHEETS

Karl A. Klingler, Frankenthal, Germany, and Kermit E. Swanson, Naperville, Ill., assignors to R. R. Donnelley & Sons Company, a corporation of Delaware

Filed Mar. 1, 1965, Ser. No. 436,182
20 Claims. (Cl. 221—293)

This invention relates to apparatus for feeding packs of sheets or signatures, and in particular it relates to apparatus for feeding packs of sheets or signatures from a large stack of signatures in a magazine to the signature supply box of a gathering machine used in book binding.

As is well known in the art, it is necessary in the binding of a book to gather a complete set of the different signatures which make up the book, and this operation is performed by a gathering machine that has a moving endless carrier which passes in front of a line of signature supply boxes. The gathering machine feeds a signature from each supply box onto each station on the carrier so that, when any particular carrier station reaches the end of the gathering machine it has received one signature from each supply box and has a complete set of signatures required for binding into a book.

It is always necessary for a large gathering machine to be attended by one or two skilled operators who are able to take care of any malfunction; but it is also necessary in high speed bindery operations to have several unskilled helpers whose sole job is to take packs of signatures which are stored behind the signature supply boxes and place them in the boxes. The boxes must have a relatively small capacity to permit easy feeding of signatures from the bottom of the supply, and with a high speed machine it is necessary to have an unskilled helper for about every six signature supply boxes. Such articles as mail order catalogs and metropolitan telephone directories may contain anywhere from 90 to 130 signatures and thus require that many signature boxes in the gathering machine; and accordingly this type of bindery operation requires a large number of unskilled workers to fill the signature supply boxes of the gathering machines from the storage pool adjacent the machines, which usually consists of signatures stacked on pallets.

The present invention provides apparatus that has a magazine to hold a relatively large stack of signatures—for example, from two to four times the number of signatures that can be accommodated in a gathering machine supply box. Periodically the apparatus separates a relatively small pack of signatures from the bottom of a large stack in the magazine and feeds the pack downwardly onto the top of the signatures in the gathering machine supply box. Separation of a pack of signatures from the bottom of the stack is initiated by a sensing means associated with the signature supply box, so that when the top of the supply of signatures in the box is lowered to a certain level the sensing means automatically causes a new pack of signatures to be added to the supply.

By providing each signature supply box of a gathering machine with the apparatus of the present invention, it is practical for one helper to handle the supply signatures to 8 or 10 gathering machine boxes, rather than only 4 or 5.

The invention is of particular value to printing and binding establishments which produce large mail order catalogs and metropolitan telephone directories, because each of the very large books which requires upward of 90 signature supply boxes is only printed once or twice a year, so that it is necessary for the bindery to hire large numbers of temporary unskilled laborers whose services are required for only a few days while a single large catalog or telephone directory is being printed. The vast

majority of the work in any bindery requires a gathering machine having no more than about thirty signature supply boxes, and even with conventional equipment this means only five or six helpers to the machine. For the periodic large binding jobs from ten to twenty-five extra helpers may be required on each shift, or thirty to seventy-five extra helpers a day. It is obviously very desirable in a printing and binding operation to eliminate, to the greatest possible extent, the need for this type of extra hiring which necessarily draws upon people from the lowest levels of the labor force, who are often very undependable floaters.

The present invention is illustrated in a preferred embodiment in the accompanying drawings in which:

FIG. 1 is a side elevational view of apparatus embodying the invention, with a part of one power cylinder broken away;

FIG. 2 is a plan view of the apparatus with a magazine guide in section and a signature in the magazine illustrated in broken lines;

FIG. 3 is a front elevational view taken from the right of FIG. 1, which is the side of the apparatus toward the gathering machine conveyor;

FIG. 4 is a rear elevational view with parts in section or broken away;

FIG. 5 is a fragmentary section taken substantially as indicated along the line **5**—**5** of FIG. 3;

FIG. 6 is a fragmentary section taken substantially as indicated along the line **6**—**6** of FIG. 4;

FIG. 7 is a fragmentary section on an enlarged scale taken substantially as indicated along the line **7**—**7** of FIG. 4;

FIG. 8 is a fragmentary section on enlarged scale taken substantially as indicated along the line **8**—**8** of FIG. 1;

FIG. 9 is a fragmentary elevational view taken substantially as indicated along the line **9**—**9** of FIG. 7;

FIG. 10 is a plan view of a table of a stack supporting means;

FIG. 11 is a plan view of a platform of a pack carrying means;

FIGS. 12 to 21, inclusive, are generally schematic views of the apparatus which provide an operating sequence through a single cycle;

FIGS. 22 to 26, inclusive, are hydraulic valve diagrams of the valves which control the operation of the five power cylinders in the apparatus;

FIG. 27 is a fragmentary, generally schematic view showing the limit switch in the sensing means when the sheet supply is partially filled;

FIG. 28 is an across the line wiring diagram of the electrical control circuit for the apparatus.

Referring to the drawings in greater detail, and referring first to FIG. 12, the apparatus consists generally of a magazine M for a stack S of sheets or signatures which must be loaded with their folded edges forward; stack supporting means I which includes a stack supporting table **45** and means in the form of a cylinder and piston power unit C1 for reciprocating said table; lifting finger means II that includes a lifting finger assembly **62**, together with fluid cylinder and piston power means C2; pack separator means III that includes fluid cylinder and piston power means C3 having a piston rod one end of which carries a separator tip **77**; pack carrying means IV which includes a pack carrying platform **88**, fluid cylinder and piston power means C4 for reciprocating the platform, and fluid cylinder and piston means C5 for rocking the platform; and cycle control means, indicated generally at V, which includes sensing means having a switch SW1 for sensing the level of the top surface T of a supply of signatures B in a gathering machine supply box (not shown), and

a group of control limit switches (see FIGS. 27 and 28) which are actuated by movement of the various mechanical components of the apparatus so as to energize relays and solenoid valves (see FIGS. 22 to 26) which control the operation of the five power units.

The detailed description of the mechanical structure and control components of the apparatus will be most understandable in the light of a general description of its sequence of operations through a single machine cycle which is performed in about six seconds; and accordingly, a description of a single cycle follows with reference to FIGS. 12 to 21, inclusive, and FIGS. 22 to 28, inclusive.

FIG. 12 illustrates the position of parts of the apparatus in a normal, or rest position, in which the stack supporting table **45** of the means I and the pack carrying platform **88** of the means IV cooperate to support a stack S in the magazine M, with the folded edges of the signatures forward.

FIG. 28 shows the electrical control circuit with all components in their normal positions; while in FIGS. 12 to 21 any contact of a mechanical element with a switch indicates that the switch is in actuated position. As seen in FIGS. 22 to 26, all of the power units are of the type in which the piston is moved both ways by fluid pressure, and all of the solenoid valves are of the spring loaded type which return automatically to a normal position as soon as the valve solenoid is deenergized.

Referring now particularly to FIGS. 12 and 27, the switch SW1 is mounted upon a member **29** which is a part of the gathering machine frame and has a switch arm *a* which carries a flexible sensing finger *f* that is contacted by the forward margin of the supply of signatures B in the gathering machine supply box. Switch arm *a* is spring urged upwardly toward the normally closed position of the switch, and contact of the end of the supply of sheets B in the gathering machine supply box holds the arm *a* of SW1 down as seen in FIG. 27 so that the circuit through the switch is open. As soon as the level of the top surface T of the signature supply B drops below the tip of the sensing finger *f*, the switch arm *a* moves up to its normally closed position.

As seen in FIG. 12, a switch actuator cam **87***a* at the top of supporting rod **87** holds a two-way switch SW7 against a contact *x* so as to complete a circuit to a time delay relay **1TD**, thus energizing said relay to hold relay contacts **1TD1** and **1TD3** closed while holding relay contact **1TD2** open. Accordingly, the closing of SW1 energizes SV1 to admit fluid in front of the piston **P1** of power unit **C1** and thus withdraw the stack supporting table **45** from the magazine M.

Movement of the table **45** first releases SW8 to its normally open position, conditioning one circuit to SV4B for a later step in the cycle.

Continuing movement of the table **45** actuates normally open SW2 to close a circuit through normally closed relay contact CR5 and thus energize SV2 so as to admit fluid above the piston **P2** of cylinder **C2** and lower the lifting finger assembly **62** to the position illustrated in FIG. 13—a travel of one inch. The downward movement of the lifting finger assembly causes bracket **58** of that assembly to free SW6 for movement to its normally open position, so that subsequent closing of SW5 will not energize SV4A until SW6 is again closed.

Continued movement of the table **45** to its fully retracted position, as seen in FIG. 14, swings the lifting fingers **62** forwardly out of the magazine and at the same time actuates normally open SW3 to close the circuit to SV3 and admit fluid above the piston **P3** of the power unit **C3**, thus extending the piston rod **76** so that the separator tip **77** may open a gap in the stack of signatures as seen in FIG. 15. This also closes a circuit through closed (normally open) contact **1TD1**,

to energize SV4B and open return line **L2** (FIG. 25). In the fully extended position of FIG. 15, a switch actuator **76***a* on the piston rod **76** of the power unit **C3** closes normally open SW5 so as to energize CR5, thereby opening the normally closed CR5 contacts to deenergize SV2, and closing the normally open CR5 contacts to close a holding circuit to CR5. Opening of the circuit to SV2 deenergizes that valve, admitting fluid below the piston **P2** of power unit **C2** to return the lifting fingers **62** to their original position.

Return of piston **P2** to its original position again closes SW6 so that there is a closed circuit to SV4A (see FIG. 25) through the closed contact CR5, closed SW6, and a normally closed contact CR9. Energization of SV4A admits fluid to line **L1** and moves piston **P4** of power unit **C4** down, thus moving the pack carrier **88** down as seen in FIG. 16. Such downward movement immediately causes switch actuator **87***a* of a platform supporting rod **87** to release SW7, thus opening the circuit through the contacts *x* to deenergize 1TD, and permitting SW7 to close the Y contacts. Deenergization of 1TD releases the normally open contacts **1TD3** so as to deenergize SV1 and thus admit fluid behind the piston **P1** of the power unit **C1** to extend the stack supporting table **45** into the magazine M.

At the same time, normally open contact **1TD1** is released for movement to open position thus deenergizing SV4B (FIG. 25) to close the return line **L2** and thus stop downward movement of the pack carrier **88** in spite of the fact that SV4A is still energized.

Return of table **44** releases SW3 which returns to its normally open position and deenergizes SV3 so that piston **P3** is returned to retract the pack separator tip **77**. This releases SW5 for return to its normal, open position, leaving SV4A energized only through closed CR5, SW6 and normally closed CR9.

Deenergization of 1TD also permits normally closed contacts **1TD2** to close, so that when the table **45** reaches its full return position in the magazine and again closes SW8 the circuit to SV4B is closed through **1TD2** and SW8 to again energize SV4B, open the line **62**, and cause the piston **P4** to complete its travel to the extended position of FIG. 18. During this time the remaining stack RS is supported entirely on the stack supporting table **45** and the lifting fingers **62**.

When the piston **P4** of the cylinder **C4** reaches its most extended position, the switch actuator **87***a* contacts a normally open switch SW9 and closes it so as to complete a circuit through normally closed time delay contact **2TD2** to a solenoid valve SV5 which admits fluid above a piston **P5** of power unit **C5** so as to retract a piston rod **103** of said power unit and thus swing the pack carrying platform **88** to the position of FIG. 19. This deposits the pack P on the top of the supply B in the signature box, and contact of the forward edge of the pack P with the sensing finger F opens the switch SW1.

Closing SW9 also energizes a two-step time delay relay **2TD**. Upon completion of the first time interval, normally open contact **2TD1** is closed so as to energize CR9 which opens the normally closed CR9 contacts to deenergize SV4A and thus return the piston **P4** of cylinder **C4** by passage of fluid through SV4B and line **L2**, with return through **L1** and SV4A. The second step of the two-step time delay opens normally closed **2TD2** so as to deenergize SV5 and return piston **P5** of cylinder **C5** to its normal position.

Return of cylinder **C4** to its normal position again moves SW7 from the contact Y to the contact X, thus again energizing 1TD which is also a two-step time delay relay. The first step of 1TD closes the contact at **1TD1**, thus continuing energization of SV4B. The second step instantaneously opens **1TD2** and closes **1TD3**, returning the system to its original condition and allowing the entire hydraulic system to be re-pressurized.

Referring now to FIGS. 1 to 4 for a detailed description of the structure of the apparatus, **30** (FIG. 1) is a main tubular frame member of a conventional signature gathering machine upon which the apparatus of the present invention, indicated generally by the reference numeral **31**, is mounted by means of brackets **32** and clamps **33** which are positioned between base frame side plates **34***a* and **34***b*. The side plates **34***a* and *b* are fastened between upright frame members (not shown) which are parts of the gathering machine. As best seen in FIG. 3, the side plates **34** are connected by a central tie-bar **35**, and bolted between the side plates are back plate supports **36**, **37** and **38**.

The magazine M is defined by a back plate **39** which is secured to the supports **36**, **37** and **38** to form the front of the magazine, and by angle iron side guides **40** and **41** which are bolted to slots in the back plates so as to be laterally adjustable to accommodate sheets of different lengths. As seen in FIGS. 1, 12, 18 and 19, at the back of the magazine M is an upright guide bar **42** the lower end of which is secured to an adjusting bracket (not shown) which is movably mounted adjacent the signature supply box so the guide **42** may be moved relative to the back plate **39** for accommodating sheets of different widths. As seen in FIGS. 1 and 2, the stack supporting table **45** and the pack carrying platform **88** extend into the bottom of the magazine M from the front and from the rear of the machine, respectively, and cooperate to support a stack S of signatures confined between the back plate **39** and the guide bar **42**, and between the side guides **40** and **41**. The guide bar guides a pack P of signatures as the platform **88** moves down, as well as confining the stack S.

The structure of the stack supporting means I is best seen in FIGS. 1 to 3, 5 and 10. Referring first to FIGS. 2 and 5, on the side frames **34***a* and **34***b* are mounting blocks **43** for fixed carrier rods **44** on which a stack carrying table, indicated generally at **45** is slidably supported for reciprocation into and out of the magazine by the cylinder and piston power unit **C1**. As best seen in FIG. 10, the stack supporting table includes a central plate **46** at the sides of which are depending bosses **47** having bores **48** to receive the carrier rods **44**. At the front of the table is a fitting **49** which is threaded to receive a piston rod **50** of the cylinder and piston power unit **C1**; and at the rear of the table are stack support arms **51** having downwardly inclined extremities (see FIG. 5) with beveled tips **52**. As best seen in FIG. 2, the cylinder **53** of the power unit **C1** is supported upon a bracket **54** which is secured to the side frame **34***b*.

The lifting finger means II is best seen in FIGS. 1 and 3 to include a bracket **55** which is secured to the back plate **39** and carries the cylinder **56** of the cylinder and piston power unit **C2**. A piston rod **57** of the unit **C2** has its outer end threadedly connected to a slide bracket **58** secured to the ends of which are vertical slide bars **59** which are slidably confined between the back plate **39** and the slide clips **60**. Secured to the lower ends of the slide bars **59** are shaft brackets **61** that support a lifting finger assembly which is generally indicated at **62**.

The lifting finger assembly **62** includes a cross shaft **63** which is carried in the shaft brackets **61**, and two sets of hook-shaped lifting fingers each of which consists of a pivoted finger **64** and a pivoted finger **65** that are connected by a tie plate **66**. A coil spring **67** on the shaft **63** biases each set of lifting fingers so that rearwardly extending lower ends **68** of the fingers **64** and rearwardly extending lower ends **69** of the fingers **65** project, respectively, through slots **70** and **71** in the bottom of back plate **39** and into the magazine M where they may cooperate with the stack supporting table **45** and the pack-carrying platform **88**. Each of the lifting fingers **64** is provided with an adjustable stop screw **72** which bears against the back plate **39** so that the lifting fingers are parallel to the back plate as seen in FIGS. 1 and 6.

As heretofore mentioned, cooperation between the stack supporting table **45** and the lifting fingers requires that the fingers be rocked counterclockwise about the shaft **63** (as seen in FIG. 1) so as to withdraw their rearwardly extending portions from the magazine as the supporting table is withdrawn from the magazine. This is accomplished by upright contact pins **73** at the two sides of the table which contact the end portions of the lifting finger tie bars **66** as the table is withdrawn from the magazine and the lifting fingers are lowered by extension of the piston rod **57** of the power unit **C2**. When the supporting table **45** returns to its supporting position in the bottom of the magazine the return motion of the piston rod **57** has already elevated the lifting fingers so that the pins **73** pass beneath the tie bars **66**.

The pack separator means III is best seen in FIGS. 1 to 3 to include a bracket **74** which is mounted for vertical adjustment upon the lower end of the back plate **39** and has an inclined flange to which the cylinder **75** of power unit **C3** is secured, and the power unit is of a type in which a piston rod **76** extends entirely through the cylinder so that one end of the piston rod may extend through a hole in the bracket **74** to receive a separator tip **77**, while the other end of the piston rod **76** carries a disc **76***a* which serves as a switch actuator for **SW5**. When the piston rod **76** is extended it moves the separator tip **77** between the two sets of lifting fingers and against the unsupported fanned marginal portions of the signatures so as to open a marginal gap between a pack P of signatures and the remainder R of the stack.

Reference to FIG. 3 shows that the pack separator piston rod **76** and separator tip **77** are ordinarily projected through an opening **39***a* at the bottom of the back plate **39** to open the gap in the stack of signatures. However, when the apparatus is to be used for handling closed end signatures it is necessary to open the gap near the closed end, because of the stiffness of that end of such a signature. Accordingly, the back plate **39** has additional openings **39***b* and **39***c* through which the piston rod **76** and separator tip **77** may be projected, and the bracket **74** may be mounted on the back plate aligned above either the opening **39***b* or the opening **39***c*, depending upon whether the closed heads of the signatures are to the right or to the left as seen in FIG. 3.

When the separator means III is moved to either side of the apparatus for the handling of closed head signatures, it is necessary to re-arrange the lifting fingers so that the space between the two sets of fingers is aligned with the piston rod **76**. This may be accomplished by removing the tie bar **66** from the lifting finger set behind the piston rod, and substituting an elongated tie bar for the other bar **66** so that the finger **65** nearest the piston rod **76** may be connected to the elongated tie bar. Under these conditions there is a single lifting finger **64** to one side of the piston rod **76**, and a set of three connected lifting fingers to the other side of said rod.

The pack carrying means IV may be best understood by reference to FIGS. 1, 2, 4, 6 to 9 and 11. As best seen in FIGS. 1, 2 and 8, a supporting bracket **78** is bolted to the side plate **34***a* and carries at its outer end a combined rocker and suspension assembly, indicated generally at **79**. As best seen in FIG. 8, the assembly **79** includes a fixed pin **80** that is clamped into the end of bracket **78** and has reduced end portions **81** upon which a guide block **82** is pivotally mounted by means of ball bearing assemblies **83** and cover plates **84** which bolt over the bearing assemblies. Opposite the end of support bracket **78** the guide block **82** has a bore provided with a bushing **85** having keys **86** so that a supporting rod **87** may be non-rotatably slidable in the bushing. Secured at the lower end of the support rod **87** is the pack carrying platform, indicated generally at **88**, the structure of which is best seen in FIGS. 2, 4, 6 and 11. Referring first to FIGS. 2 and 6, secured to the bottom of the rod **87** is a platform support corner fitting **89** which cooperates with a crossbar **90** and a corner fitting **91** to provide a generally U-shaped support for

a pack carrying platform, indicated generally at **92**, which is seen in FIGS. 4 and 11 to include a crossbar **93**, a pair of outer pack supporting fingers **94**, a pair of inner pack supporting fingers **95**, pivot pins **96** by which the platform is pivotally mounted in bearing assemblies **96***a* in the support fittings **89** and **91**, and extensions **93***a* of the crossbar **93** which bear upon the undersides of the fittings to position the platform normally horizontal. As seen in FIGS. 1 and 2, cam roller **97** in the fittings **89** and **91** bear upon cam blocks **98** in the side frame members **34***a* and **34***b* when the platform is in the elevated position of FIGS. 1 to 11. The cam blocks have arcuate lower margins which guide the platform to the position of FIG. 1 as it returns from depositing a pack P on the supply B. As best seen in FIG. 1, a cylinder **99** of the cylinder and piston power unit C4 is secured to the underside of the pivoted guide block **82**, and a piston rod **100** of the unit C4 is seen in FIG. 6 to be threaded into the platform support fitting **89** to provide for vertical reciprocation of the pack carrying platform **88**, as heretofore described.

The inner pack supporting fingers **95** are provided with spring extension fingers **95***a* which are important in the operation of the apparatus. Said spring fingers **95***a* are stiff enough to support the forward portion of the pack P of signatures and prevent it from drooping. At the same time, the spring fingers are flexible enough to bend down slightly as the pack separator tip **77** contacts the signatures to open the gap between the pack P and the remainder R of the stack. Likewise, the flexibility of the spring fingers permits them to bend up slightly as the platform is rocked to deposit the pack on the supply B, thus preventing damage to the signature on top of the supply.

The assembly for rocking the pack carrying platform **88** is best seen in FIG. 1 to include a power unit C5, a cylinder **101** of which has its lower end supported in a trunnion **102**, while the piston rod **103** of the unit C5 is pivotally connected by a clevis **104** to a pin **105** of an operating arm **106** the opposite end of which is rigidly connected to the pivoted guide block **82** in such a way that retraction of the piston rod **103** pivots the guide block about the pins **81** to swing the pack carrying platform **88** clockwise as viewed in FIG. 1. When the platform is swung by the power unit C5 (FIG. 19) it is initially almost on the signature supply B, and pivots counterclockwise on its pivot pins **96** as it swings rearwardly about the pin **80**. During this motion the guide bar **42** holds the pack P on top of the supply B, and the platform slides out from under the pack, with the spring fingers **45***a* flexing as they traverse the top of the supply B.

For convenience, the diagrammatic views of FIGS. 12 to 21 show the switches SW7 and SW9 in positions different from those actually occupied by them; and FIGS. 1 and 4 show the true locations of said switches, while FIG. 7 shows their mounting on the cylinder **99** of the power unit C4. The switch actuator **87***a* is provided with a roller **87***b* that actuates both SW7 and SW9.

The foregoing detailed description is given for clearness of understanding only and no unnecessary limitations should be understood therefrom, as modifications will be obvious to those skilled in the art.

We claim:

1. Apparatus for feeding packs of sheets periodically onto a supply of sheets therebelow, said apparatus comprising, in combination: a frame; a sheet stack magazine in said frame; movable stack supporting means on the frame beneath the magazine; movable pack carrying means on the frame beneath the magazine, said stack supporting and said pack carrying means cooperating to support a stack of sheets in the magazine; means for moving said stack supporting means from beneath the magazine to leave the stack supported only on the pack carrying means; means for forming a gap between a pack of sheets at the lower end of the stack and the remaining stack; means for inserting the stack supporting means in said gap to support the remaining stack while leaving the pack on the pack carrying means; means for moving the pack carrying means downwardly to permit the pack thereon to be deposited on said supply of sheets; and means for returning said pack carrying means to a position cooperating with the stack supporting means to support the stack.

2. The apparatus of claim **1** which includes means for sensing the position of the top of the supply, means controlled by said sensing means for initiating the separation of a pack of sheets from the bottom of the stack, and control means for sequentially operating the means for moving the pack carrying means to the supply of sheets and the means for returning said carrying means to a position adjacent the bottom of the stack.

3. Apparatus for feeding packs of sheets periodically onto a supply of sheets, said apparatus comprising, in combination: a frame; a sheet stack magazine in said frame; movable stack supporting means on the frame beneath the magazine; movable pack carrying means on the frame beneath the magazine, said stack supporting and said pack carrying means cooperating to support a stack of sheets in the magazine; means for moving said stack supporting means from beneath the magazine to leave the stack supported only on the pack carrying means; means for moving a marginal portion of a pack away from the lower end of the remaining stack to form a gap at said marginal portion; movable temporary stack supporting means; means for moving said temporary stack supporting means into said gap to support a marginal portion of the remaining stack above said gap; means for moving the stack supporting means into the gap to support the remaining stack independently of the pack carrying means; means for moving said pack carrying means from a position adjacent the lower end of the stack to permit the pack of sheets to be deposited on said supply of sheets; and means for returning said pack carrying means to a position adjacent the lower end of the stack.

4. The apparatus of claim **3** in which the pack carrying means supports the stack with a marginal portion of the stack unsupported, the means for moving a marginal portion of a pack downwardly comprises a separator positioned to push said unsupported marginal portion of the pack to bend it away from said portion of the remaining stack, and in which the apparatus includes lifting means for moving said temporary stack supporting means to lift the unsupported marginal portion of the remaining stack immediately after the gap is formed between the pack and the remaining stack.

5. The apparatus of claim **4** in which the stack supporting means and the temporary stack supporting means cooperate to support the remaining stack during movement of the pack carrying means toward and from the supply of sheets.

6. The apparatus of claim **5** which includes means controlled by operation of the lifting means to initiate movement of the stack supporting means into the gap between the pack and the remaining stack.

7. The apparatus of claim **6** which includes means for sensing the position of the top of the supply, means controlled by said sensing means for initiating movement of the stack supporting means to leave the stack supported only on the carrying means, and control means for sequentially actuating the means for moving the pack supporting means, the separating means, and the means for moving the temporary stack supporting means into the gap, to automatically carry out the sequence of operation set out in claim **6**.

8. Apparatus for feeding packs of sheets periodically onto a supply of sheets, said apparatus comprising, in combination: a frame; a sheet stack magazine in said frame; movable stack supporting means on the frame which supports a stack of sheets in the magazine; means for separating a pack of sheets at the lower end of the stack from

the remaining stack; normally horizontally oriented pack carrying means for supporting said pack independently of said stack supporting means; means for moving said pack carrying means from a position adjacent the lower end of the stack to a position adjacent said supply of sheets; means for tilting said pack carrying means to deposit the pack of sheets on top of the supply of sheets; and means for returning said pack carrying means to a position adjacent the lower end of the stack.

9. Apparatus for feeding packs of sheets periodically onto a supply of sheets, said apparatus comprising, in combination: a frame; a sheet stack magazine in said frame; movable pack carrying means on the frame which supports a stack of sheets in the magazine with a marginal portion of the stack positioned for movement relative to the pack carrying means; separating means for contacting a pack of sheets at the lower end of the stack to bend said marginal portion of the pack away from the remaining stack to form a marginal gap; stack supporting means adjacent said unsupported marginal portion; means for moving said stack supporting means into said gap and contacting the remaining stack to support said remaining stack; means for moving said pack carrying means to deposit the pack of sheets on the supply of sheets; and means for returning said pack carrying means to a position supporting the stack in the magazine.

10. The apparatus of claim **9** in which the pack carrying means and the stack supporting means are on opposite sides of the frame and have parallel bars with the bars of the carrying means alternating with the bars of the supporting means.

11. The apparatus of claim **10** in which the pack carrying means includes flat spring fingers that form extensions of the bars on said carrying means, said fingers providing flexible support for the relatively movable marginal portions of the stack.

12. Apparatus for feeding packs of sheets periodically onto a supply of sheets from the lower end of which sheets are continually removed, said apparatus comprising, in combination: a frame; a magazine in said frame for a stack of sheets; pack carrying means and stack supporting means in the magazine which are independently movable, have opposed, intermeshing bars, and are adapted to support a stack of sheets either jointly or independently, said pack carrying means being constructed to carry the stack independently of the supporting means with a marginal portion of the stack positioned for movement relative to the pack carrying means; means for withdrawing said stack supporting means from the magazine to leave the stack carried only on the pack carrying means; separating means for contacting a pack of sheets at the bottom of the stack to bend said marginal portion of the pack away from the remaining stack; means for returning said stack supporting means to the magazine to carry the remaining stack; means for moving the pack carrying means with the pack thereon to deposit said pack on the sheet supply; means for withdrawing said pack carrying means from beneath said pack; and means for returning the pack carrying means to a position where it cooperates with said stack supporting means to support the remaining stack.

13. The apparatus of claim **12** which includes means for sensing the position of the top of the supply, means controlled by said sensing means for initiating the withdrawal of the stack supporting means from the magazine, and control means for sequentially actuating the separating means, the means for returning the stack supporting means, and the means for moving the pack carrying means to automatically carry out the sequence of operations set out in claim **9**.

14. The apparatus of claim **12** which includes temporary supporting means adjacent the stack supporting means, lifting means for moving said temporary supporting means to lift the relatively movable marginal portion of the remaining stack, and means actuated by movement of said lifting means to initiate return of the stack supporting means to the magazine.

15. The apparatus of claim **12** which includes two control members which are actuated sequentially by return of the stack supporting means to the magazine, the first of said control members activating the means for moving the pack carrying means to move said pack carrying means a short distance toward the sheet supply during the final part of the return movement of the stack supporting means, and the second of said control members further activating said moving means to move the pack carrying means to the sheet supply.

16. The apparatus of claim **12** which includes means for rocking the pack carrying means, and control means actuated upon arrival of the pack carrying means adjacent the sheet supply to activate said rocking means for sliding the pack off the carrying means onto the top of the sheet supply.

17. The apparatus of claim **16** in which the pack carrying means includes flat spring fingers that form extensions of the bars on said carrying means, said fingers providing flexible support for the relatively movable marginal portions of the stack.

18. Apparatus for feeding packs of sheets periodically onto a supply of sheets, said apparatus comprising, in combination: a frame; a magazine in said frame for a stack of sheets; pack carrying means and stack supporting means in the magazine which are independently movable, opposed, intermeshing, and adapted to support a stack of sheets either jointly or independently, said pack carrying means being constructed to carry the stack independently of the supporting means with a marginal portion of the stack unsupported; first power means for reciprocating the stack supporting means; second power means for reciprocating the pack carrying means; third power means for rocking the pack carrying means; means for sensing the position of the top of the sheet supply; first control means actuated by said sensing means for activating said first power means to withdraw the stack supporting means and leave the stack carried only on the pack carrying means; separating means adjacent the bottom of the unsupported marginal portion of the stack; fourth power means; second control means actuated by withdrawal of the stack supporting means to activate the fourth power means and drive said separating means against a pack of sheets at the bottom of the stack to bend the unsupported marginal portion of the pack away from the stack; third control means operated sequentially after the operation of said fourth power means to activate said first power means and return the stack supporting means to the magazine where it supports the remaining stack; fourth control means actuated by return of the stack supporting means to activate the second power means to move the pack carrying means downwardly toward the sheet supply; fifth control means actuated by downward movement of the pack carrying means to activate the third power means and rock the pack carrying means to deposit the pack of sheets on the sheet supply; and sixth control means actuated by rocking of the pack carrying means to activate the second and third power means and return the pack carrying means to a position where it cooperates with the stack supporting means to support the stack.

19. The apparatus of claim **18** which includes temporary supporting means, fifth power means for reciprocating said temporary supporting means so that the latter may selectively support the marginal portion of the remaining stack, and seventh control means which is operated by movement of the separating means to activate said fifth power means for elevating the temporary supporting means to lift said unsupported marginal portion of the remaining stack before the stack supporting means returns to the magazine.

20. The apparatus of claim **19** in which the fourth control means includes two control members which are

actuated sequentially by return of the stack supporting means to the magazine, the first of said control members activating the second power means to move the pack carrying means down a short distance during the final part of the return movement of the stack supporting means, and the second of said control members further activating the second power means to move the pack carrying means down to the sheet supply.

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