Aug. 18, 1959 A. SCHWEBEL 2,900,186

SHEET FEEDER FOR PRINTING AND OTHER SHEET HANDLING MACHINES

Filed May 23, 1956 6 Sheets-Sheet 1

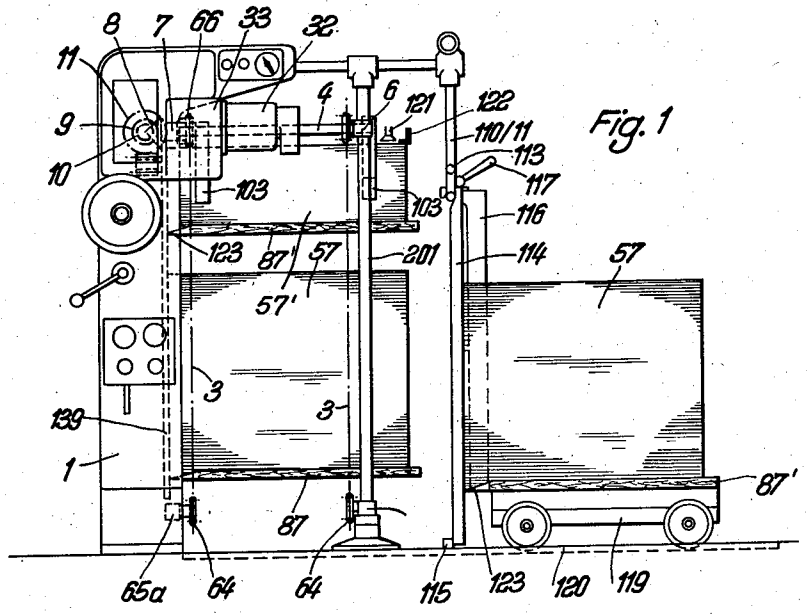


Fig. 1

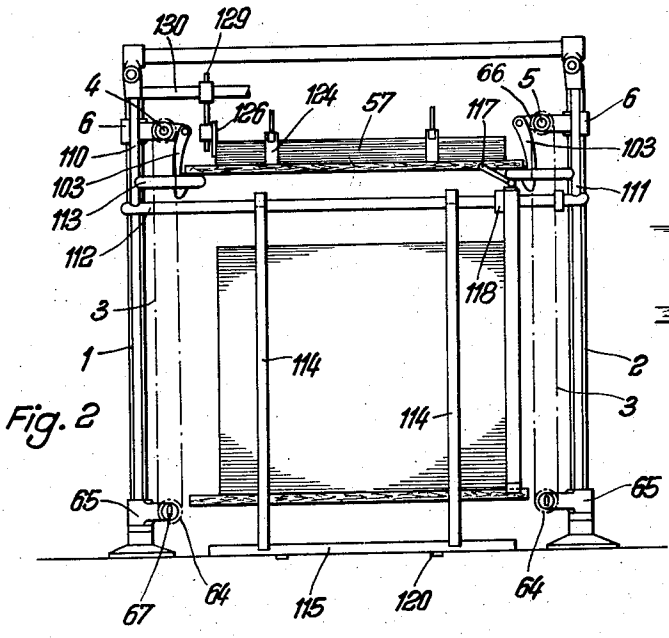


Fig. 2

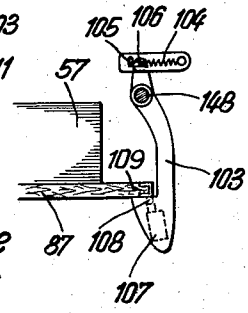


Fig. 3

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SHEET FEEDER FOR PRINTING AND OTHER SHEET HANDLING MACHINES

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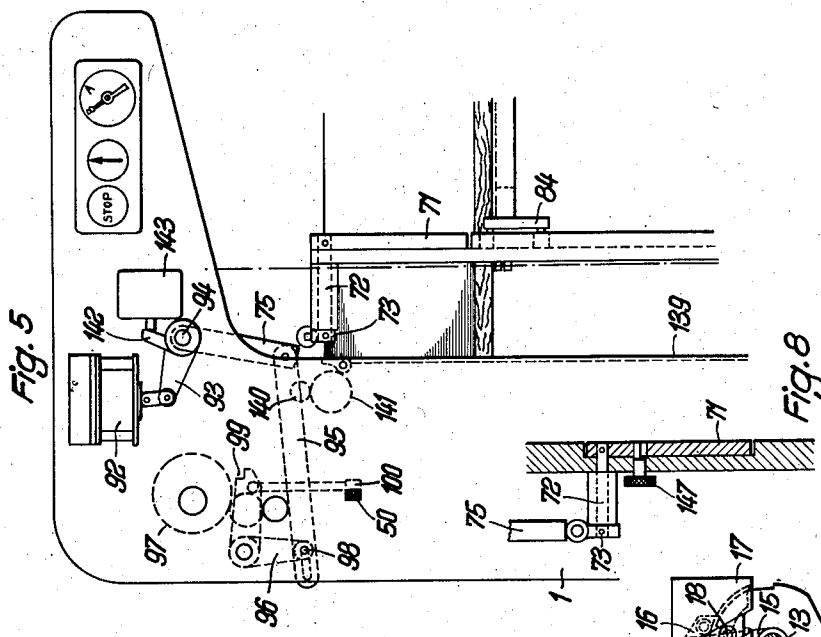


Fig. 5

Fig. 8

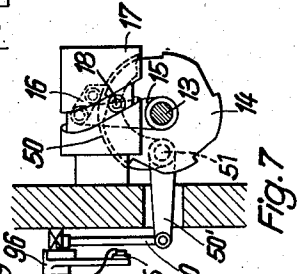


Fig. 7

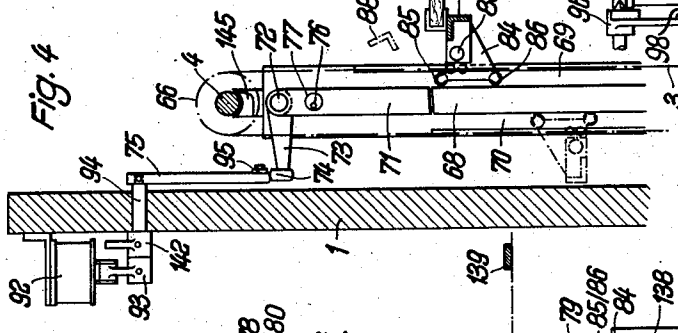


Fig. 4

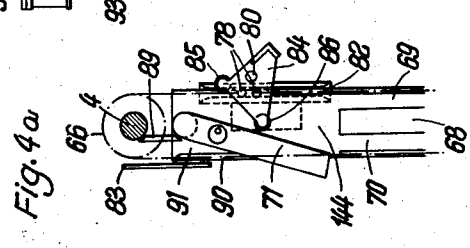


Fig. 4a

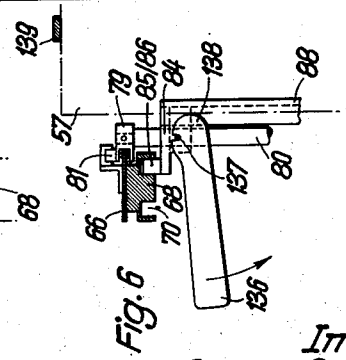


Fig. 6

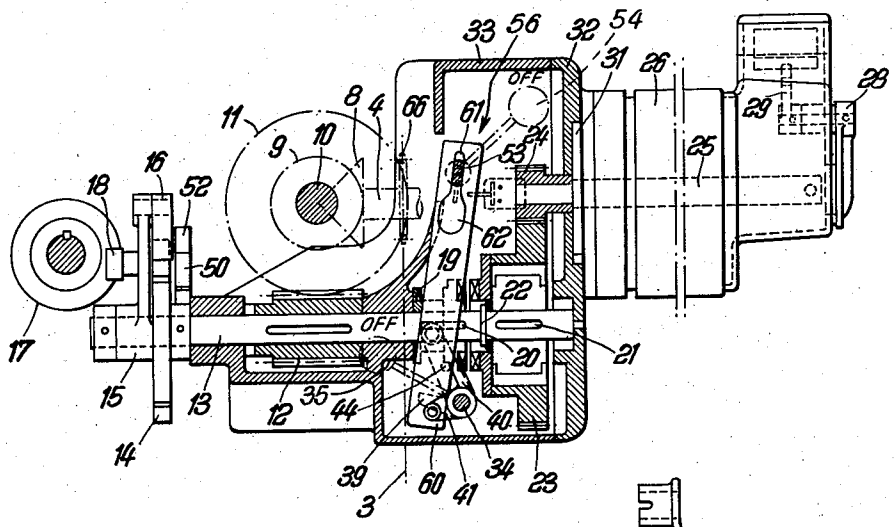
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SHEET FEEDER FOR PRINTING AND OTHER SHEET HANDLING MACHINES

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Fig. 9



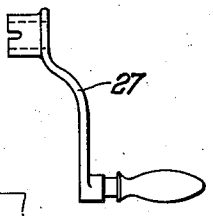


Fig. 10

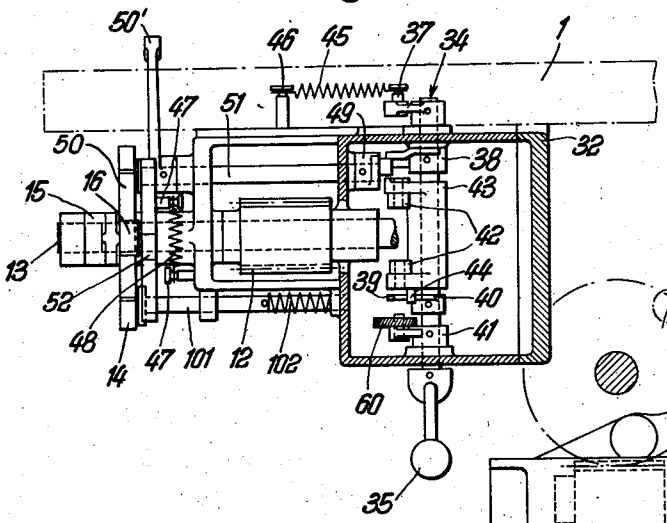
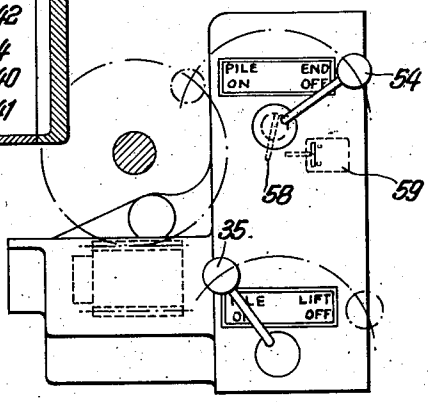


Fig. 11



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Fig. 12

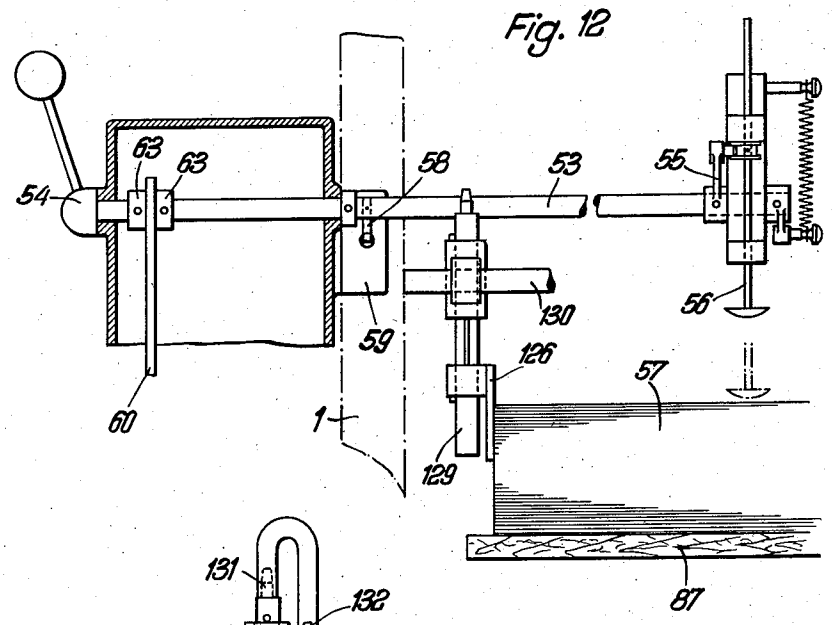


Fig. 13

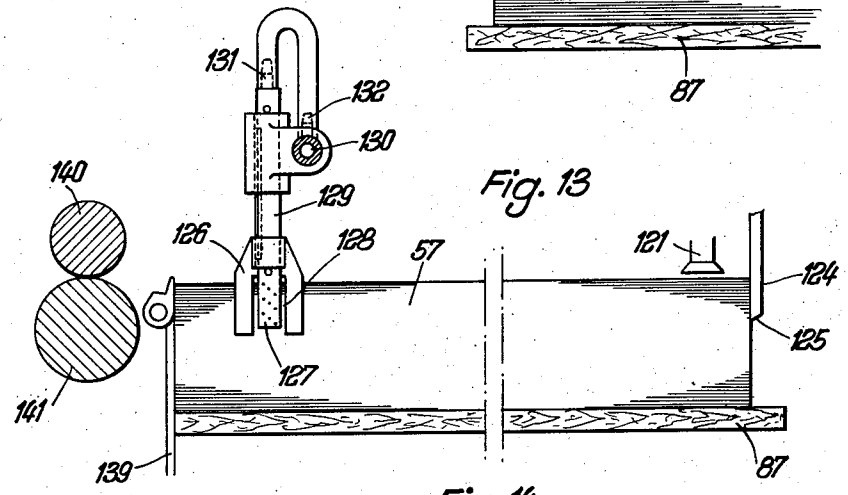
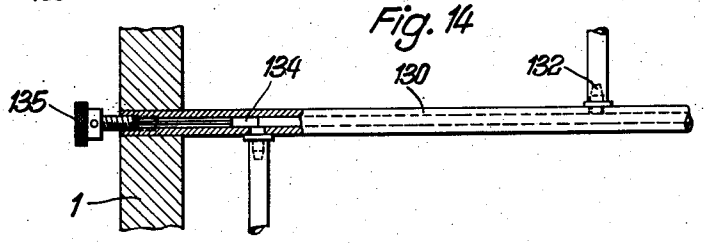


Fig. 14



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SHEET FEEDER FOR PRINTING AND OTHER SHEET HANDLING MACHINES

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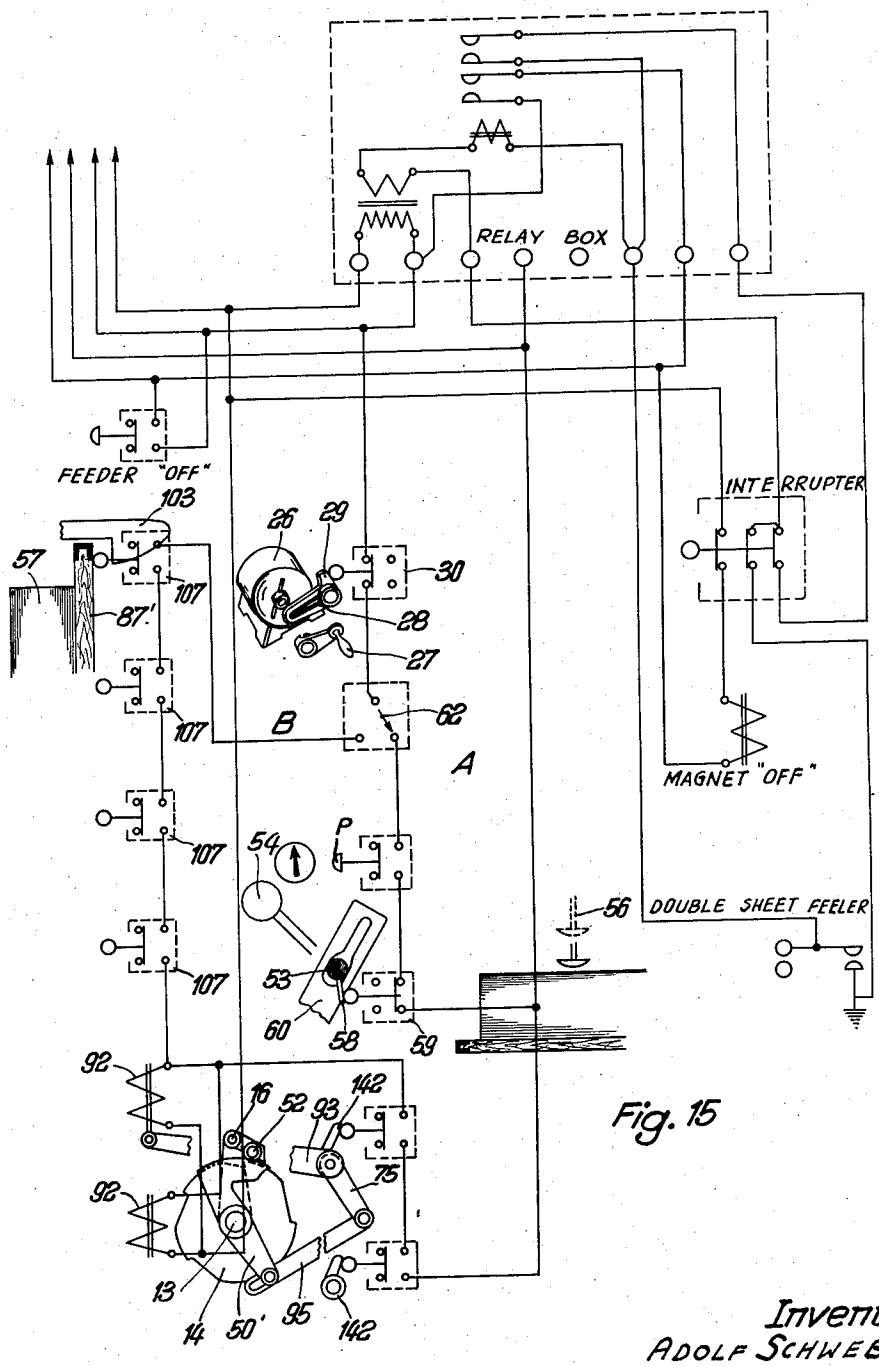


Fig. 15

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SHEET FEEDER FOR PRINTING AND OTHER SHEET HANDLING MACHINES

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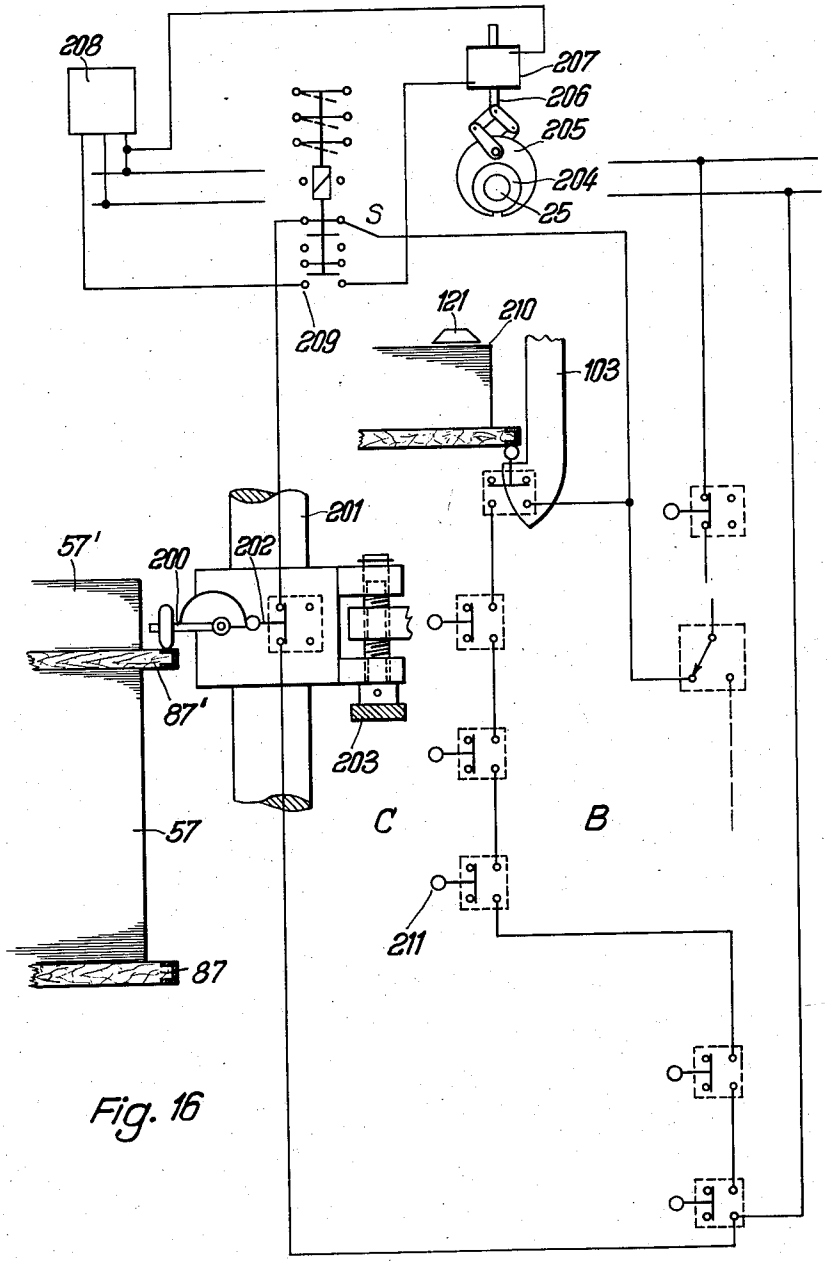


Fig. 16

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United States Patent Office 2,900,186 Patented Aug. 18, 1959

2,900,186

SHEET FEEDER FOR PRINTING AND OTHER SHEET HANDLING MACHINES

Adolf Schwebel, Offenbach (Main), Germany, assignor to MABEG Maschinenbau G.m.b.H., Offenbach (Main), Germany

Application May 23, 1956, Serial No. 586,767

17 Claims. (Cl. 271—62)

This invention relates to a sheet feeding device for use in printing and other sheet handling machines and is of the kind which is provided with pneumatic separating and conveying means and with devices for lifting and uninterruptedly feeding the sheets from piles into the printing or other sheet handling machine, and in which the piles are supported on tables, the rest piles being eventually held in an upper position together with their tables on a set of carrier pawls, and in which a set of vertically movable conveyor chains is also employed.

Devices for the aforesaid and similar purposes are known in which the lifting of the pile is first effected by a primary lifting tackle and in which the pile is then transferred to a secondary lifting mechanism, which continues the lifting operation while the primary lifting tackle is returned for the reception of a new pile.

It is also known to provide a device of the said kind in which the pile table consists of an upper and a lower part and is lifted by a set of conveyor chains or the like, and in which the upper part of the pile table is held in substantially its upper position by retaining pawls. The parts of the pile table, in this case, are so arranged that they are successively removed during their movement, while the conveyor chains alter their direction of movement. In modern printing machines, however, the up and down movement of the chains is controlled automatically.

It is further known to provide a main and an auxiliary lifting means, which simultaneously engage opposite sides of the pile table, and which include toothed racks which move in vertical guides in which they can be lowered for the reception of a new pile.

Similar devices have been proposed for auxiliary transportation of rest piles by means of screw spindles and nuts.

In order to effect continuous feeding of the piles and an uninterrupted feeding of the sheets, these known devices require complicated reversing mechanisms for their conveying means, powerful drives, costly switch and controlling devices, elaborate acoustic or optic signalling installations, and powerful lifting mechanisms. Notwithstanding all this a considerable amount of misprints has to be accounted with, since the attendance of these complicated devices with their numerous auxiliary devices and control means is most difficult and the time available for attending to them is invariably too sort. Another disadvantage of these known devices rests in that skilled operators are required to carry out all these operations.

All these and other disadvantages, including high cost and labor expenditures, are entirely eliminated by a device in accordance with this invention, which provides a cheaper, more reliable and more resistable construction in comparison with the aforesaid known devices. Particularly all hand operations are uncomplicated and can be carried out very easily.

The sheet feeder in accordance with this invention for effecting continuous pile feed is provided with continuously and unidirectedly circulating sets of conveyor

chains having one or more spaced sets of pile table carriers by which the said tables with the piles supported on them are moved upwardly. The carriers are guided on guide rails to which mechanical switches are so connected that, when a rest pile has reached a certain level or height and the supporting pawls have engaged the pile table, they are removed (mechanically, electrically or otherwise) from the guide rails until they come into engagement with an abutment. Simultaneously herewith the lifting motor is automatically set in operation by means of a switch. The table carriers, in the course of their unidirected circulation, drop into a recess which is provided in each of the guide rails and are moved past the pile table by the conveyor chains without the latter having to alter their direction of movement. These carriers as well as the following set of carriers of the succeeding pile table can be accelerated or decelerated at will.

The invention further includes safety mechanisms by which the exact performance of all necessary operations for a continuous pile feed is guaranteed.

The invention, still further, relates to an arrangement for correctly preparing and introducing a pile in accurate registry with the pile lifting and conveying means.

The invention, finally, includes an arrangement by which the interspacing between the uppermost sheet on the pile and the suction nozzles is accurately maintained during the removal of the pile table, and it also includes electric means for disconnecting all parts which are necessary for the continuous operation of the device and to allow the feeder to operate with a single pile or load only.

The accompanying drawings diagramatically illustrate the invention by way of example. It must be understood, that the invention, however, is not restricted to the devices and means shown, but that various alterations may be carried out to suit convenience or requirements.

In these drawings:

Fig. 1 is a side elevation of the sheet feeder and

Fig. 2 a front elevation thereof.

Fig. 3 is a view of the table supporting pawl mechanism.

Fig. 4 illustrates the upper part of the conveyor chain arrangement in front elevation.

Fig. 4*a* shows part of the conveyor chain arrangement of Fig. 4 in a different operating position.

Fig. 5 is a side elevation of the feed control means.

Fig. 6 is a cross sectional view of a guide rail for the table carriers shown in Fig. 4.

Fig. 7 is a cross section through a part of Fig. 5 showing the linkage connecting a ratchet control mechanism.

Fig. 8 illustrates a detail and shows the upper portion of Fig. 4*a* in longitudinal section.

Fig. 9 is a front elevation of the table lifting gear.

Fig. 10 is a plan view thereof.

Fig. 11 is a front view of the hand control means.

Fig. 12 shows the limit switch and side stops in side elevation.

Fig. 13 illustrates the air blast arrangement for loosening the top sheets of a pile during the operation of the device.

Fig. 14 is a detail view, partly in section, of the air controlling means.

Fig. 15 represents a wiring diagram for the machine as shown in Figs. 1 to 14.

Fig. 16 is a similar wiring diagram for a second running combination.

In these drawings, shafts **4** and **5** which drive the conveyor chains **3** are journalled in the frame walls **1** and **2** of the machine in bearings **6** and **7** respectively. These shafts are operated, for example, by a bevel gear **8**, **9** (Fig. 9) of which the wheel **9** is keyed to the worm shaft **10**. A worm **12** is secured to the drive shaft **13** and

adapted to mesh with a worm wheel 11. The pawl feed or ratchet wheel 14 also is secured to the shaft 13. Movably mounted on the worm shaft but not movable therewith is a pawl carrier 15 having a feed pawl 16, which engages in the teeth of the ratchet wheel 14.

A control cam 17 which performs one revolution for every feed of a sheet from the pile, actuates, by means of the roller 18, the pawl carrier 15 so that its pawl 16 advances the ratchet wheel by always the distance of one tooth, with the worm wheel, the bevel gear and the shafts 4 and 5 participating in the movement. A clutch element 19 (Fig. 9) is axially movable on the worm shaft 13 guided by a key 20. A counter clutch element 23 having a toothed rim is splined to the worm shaft by means of a key 21 and held against axial movement thereon by a ring or collar 22. The toothed rim of the clutch element 23 is in engagement with the teeth of the motor pinion 24. The shaft 25 of the motor 26 can be turned by means of a hand crank 27 for the purpose still to be explained. The motor shaft is protected by a cover 28. When the crank 27 is to be applied to the shaft, this cover must be turned back, thereby carrying with it a lever 29 which operates a switch 30 and thereby disconnects the motor circuit from the line. By turning the motor shaft 25 by means of the crank 27, the pile may now be manually lifted without a risk. The motor is so secured on cover 32 of the housing or gear case 33 by means of an eccentric flange 31 that its pinion 24, by a simple hand manipulation, can be made to engage very accurately into the pitch circle of the toothed clutch member 23. A control or pile feed shaft 34 (Fig. 10) is journalled in the housing 33 and has fitted to it a hand lever 35. Further on the said pile feed shaft 34 are a spring-controlled lever 36 with its spring pin 37, a control cam 38, a drive lever 39, 40 and a control lever 41 which are all splined or otherwise secured to the said shaft. Rollers 42 of the clutch lever 43 run in the cam groove of the clutch part 19. The lever 43 can only be driven by the lever 39, 40 acting on pin 44.

In the two end positions of the pile elevator "Off" and "On" (Fig. 11) the pile feed shaft 34 is held in equilibrium by means of the tension spring 45 which is connected to pin 46 and lever 36. The control lever 49 is held in contact with cam 38 (Fig. 10) by means of a tension spring 48 stretched between the two spring pins 47. It is splined to the shaft 51 together with the pawl lifter 50, 50', and the roller 52 of the pawl 16 bearing against the pawl lifter. A limit switch for safeguaring the suction heads and all devices which serve to separate the sheets from the pile may be set in readiness by a hand lever 54 on the control shaft 53 (Figs. 9 and 11). For this purpose, a lever 55 which is splined to shaft 53 brings a disc-like rammer 56 into a ready position close to the top sheet of pile 57. The motor circuit is closed by a contact pin 58 acting on the switch 59 (Fig. 12). By turning the control lever 35 to the position "On," a safety member 60 (Figs. 9 and 12) is raised by lever 41 to such an extent as to cause part 62 of the longitudinal slot 61 of the said member 60 to release the adjacent flattened part of the shaft 53 in order to enable the shaft to be moved by the control lever 54 to the On position of the pile elevator. The safety member 60 is guided on shaft 53 between the two rings 63 (Fig. 12).

When the control hand lever 35 is in the "Off" position, actuation of the control hand lever 54 is rendered impossible by the safety or locking member 60 in the position of Fig. 9.

The sprocket wheels 64 are journalled in bracket bearings 65 and 65*a* at the lower part of the device and the endless chains 3 are passed over these sprockets and the sprockets 66 at the top. Each of the chains may be tensioned individually in the longitudinal slots 67 (Fig. 2) and is provided with a chain guide rail 68 having a double groove 69, 70, (Figs. 4 and 4*a*). A mechanical switch is incorporated in the upper part of the guide rail and pivoted thereto by a pin 72. This turnable switch is provided with an arm 73 extending at right angles thereto and having a roller 74 at its end. Lever or arm 73 is blocked in its lowermost position by a locking lever 75 in such a way, that the turnable switch part 71 keeps the guide groove 69 (Fig. 4*a*) open so as to form an uninterrupted guide together with the guide rail 68. A pin 76 at each side of the pile on the machine frames 1 and 2 engages into a hole 77 of the switch member 71 and limits the movement of the latter. Brackets 79 supporting a horizontal shaft 80 are fixed by means of pins 78 at the left and right hand side of the machine on oppositely disposed chains. The pins 78 carry the rollers 81 which run in the guide rails 82 during the lifting of the pile so as to settle behind the guide rails 83 after having passed the sprocket wheel 66. A table carrier 88 is arranged at either side of the pile and is pivotally mounted on the transverse member 80. Normally these carriers are maintained in a horizontal position in which to transport the pile table 87 by the rollers 85 and 86 of the carrier 84 engaging in the grooves 69. Two guide bars 89 and 90 ensure the entrance of the rollers 85 and 86 into the guide groove 91. It is obvious that more than one pair of table carriers may be provided on the chains 3.

A lever 93 is connected to a solenoid 92 of which several may be provided, and is secured to the same shaft 94, to which the control lever 75 also is secured. The pawl lifter 50 is connected to the control lever 75 by a link which is pivotally connected, by means of a pin 98, to a lever 96 to which periodic movement is imparted by an eccentric 97 during every rotation of same. A device which, however, does not form part of the invention, is controlled by the separating and feeding means at the pile so as to cooperate with the nose 99. The pawl lifter 50 is connected to the bell crank lever 96 by means of the rod 100. A brake 101 is constantly pressed by a spring 102 against the ratchet wheel 14 in order to prevent back rotation of the worm shaft.

On the bearings 6 and 7 supporting pawls 103 are pivotally suspended which serve to support the pile table 87 together with its rest pile 57' and are urged into their engaging positon by springs 104. When the sheet feeder is not used for feeding the pile continuously, then the pawls 103 are held away from the pile table by a locking latch 105 which enters into locking engagement with a pin 106. Each pawl 103 is provided with a control switch 107 having an operating roller 108 which projects beyond the seating surface 109 of the pawl (Fig. 3).

All control switches are connected in series in the circuit of solenoid 92. This solenoid does not become energized unless all control switches are actuated by the pile table bearing on them.

A structure 110, 111, and 112 is suspended in front of the pile 57 (Fig. 2). Stay bolts 113 are provided at the left and right hand side of this frame which is approximately flush with the pawls 103 so as to extend into the space occupied by the pile table 87. The horizontal bar 112 serves to support rear stops 114 which bear against a bottom stop 115. The side bar 116 is clamped by a clamping lever 117; its respective position can be fixed at each side by means of a collar 118 which ensures the lateral position of all piles. This arrangement permits the sheets to be preliminarily piled at the desired side while the separation and feed of the sheets continues uninterruptedly and thereby facilitates the continuous supply of new piles to the sheet feeder.

The pile truck 119 is preferably wheeled into the pile feeder on rails 120 so as to ensure accurate registering of the sheets with respect to the side and front stops.

Special attention obviously has to be given to the mechanisms on the pile table and to the separating and continuous guiding means owing to the high stresses resulting from continuous operation, and in the interest of an incessantly smooth feed. The table 87 between

two superposed piles must be withdrawn when a rest pile is still positioned thereon. The rest pile would drop back from the separating and suction feeding devices, for instance the nozzles **121**, so that the uppermost sheet would no longer be attracted by them. The consequences are known. For this reason, the front part **123** of the table is slanted over its full length. Upon withdrawal of the table the pile feeler **122** now has sufficient time to feel the slowly retreating surface of the pile so that the latter becomes automatically lifted and the removal of the table will have no injurious influence on the separation of the sheets.

The back stops **124** (Fig. 13) are bevelled along their edges **125** by which they are seated on the table **87**, so that upon removal of the table even the last sheet thereon would be retained without fail within the region of the pile. The side stops **126** are provided with air blast nozzles **127** because of the rapid pile operation, and these nozzles serve to blow air through the gaps **128** into the sides of the pile for the purpose of loosening the upper sheets. The sheet stops are loosely and movably mounted on the air pipe **129** and are also movable transversely to the direction of feed along a tube **130**, upon which they may be adjusted according to the size of the sheets under treatment. The tube **130** simultaneously serves as an air supply pipe for the side stops. **131** and **132** designate the air unions. A regulating device is provided on the inlet pipe **130** for the compressed air which comprises a piston **134** operable from the service side of the machine by means of a hand knob **135** so as to more or less throttle the air as required. As already mentioned, very exact preparations are necessary to effect a continuous feed of the pile in an orderly manner. When the pile is wheeled into the device on truck **119** and transferred, together with its table **87**, to the table supports or carriers **88** on the conveyor chains **3**, it is preferably trued or adjusted immediately. This is done by means of a spanner **136**, or similar tool, which is placed over a pin **137** on the table carrier **88**. The back **138** of the spanner is pressed against the side edge of the pile table, whereby the pile is straightened and pushed toward the front stops **139**.

The electrical installation for the sheet feeder comprises circuits A and B (Fig. 15), each of which may be placed in readiness for its respective function by the actuation of a so-called electric point **62**. Circuit B contains all electric control and switching arrangements as are necessary for a continuous feeding operation and includes the control switches **107** on the pawls **103**, the solenoids **92** for the control of the mechanical switch arm **71** (Fig. 4*a*) and the control contacts for the pile elevating motor.

Circuit A contains all the known electric devices which are required for the operation of a sheet feeder for single piles. The interrupter **28** of the elevator motor **26**, which is initiated by the hand crank **27**, is placed facing the electric point **62**.

With this arrangement the feeding device can be immediately converted by hand, with no loss of time and without any structural alterations from a continous pile feeding device to one for normal operation, that is for such operation, in which only small and frequently changing printing orders are carried out, whereas the large and long-period printing orders, which hardly undergo any changes, may be more economically carried out by continuous pile feeding devices. Besides, an installation of this type is rather uncomplicated, it economises material, reduces costs and waste, and also facilitates the inspection and operation of the whole installation.

The aforedescribed device operates in the following manner: Assuming the back stops **114** on the cross bar **112** and the side bar **116** having been set in conformity with the side stops, being propertly suspended and locked in position by means of the clamp lever **117**. At the same time the collar **118** has been shifted into contact with the respective side stop (Fig. 2) in order to fix the position also for the subsequent piles. Now the pile truck **119** is pushed into the device until the table **87'** strikes the back stops **114**. When the sheets have been piled up, the back stops **114** are removed and the pile **57** pushed further on until it contacts with the back stops **139** (Fig. 1) of the feeder. The table supporting pawls **103** are loosened in their locks **105** and moved into readiness for operation. Hand lever **35** (Figs. 10 and 11) is turned into the position "Feeder On," which results in the safety link **60** being lifted, so that the longitudinal slot **61** comes clear of the blocked shaft **53** which now takes a free position in the enlarged position of the slot.

The control lever **54** can now be moved into the pile and "On" position and the rammer **56** brought down close to the pile **57**. Simultaneously the contact pin **58** (Fig. 12) on shaft **53** acts on the switch **59** and closes the circuit for the motor **26**. On turning the hand lever **35**, lever **39**, **40** operates the clutch lever **43** through the pin **44** and causes the clutch element **19** (Fig. 9) to be engaged to the clutch member **23**. Cam **38** rotates together with shaft **34** and by engagement with lever **49** actuates shaft **51** and lever **50'**, so that the latter lifts the pawl **16** out of the teeth of the ratchet wheel **14**. Now the push button can be pressed into the "Start" position, causing the motor **26** to rotate its pinion **24** and to drive the chain and sprocket shafts **4** and **5** over the clutch **19**, **23**, worm **12**, worm wheel **11** and the bevel gear **8**, **9**. The table carrier **88**, fixed to the chains **3**, moves into contact with the newly introduced pile table **87** and carries it upward to the sheet separating means **121**, **122** (Fig. 1). At approximately this position the lifting movement is interrupted.

By means of the hand crank **27** applied to the motor shaft **25**, the pile **57** is moved up into position in relation to the separating means (**121**, **122**) whereupon the hand crank can be removed. Before the application of the crank **27** to the shaft **25** the cover **28** must be removed or opened, whereby the motor switch **30** becomes disconnected and the electric circuit interrupted. Upon removal of the crank the cover **28** returns into its closed position, thus closing the lifting circuit, whereas the circuit through the control switches **107** of the supporting pawls **103** still remains open. The feeding device is now connected to the printing machine, or any other sheet handling machine respectively.

The sheets are separated from the pile in substantially known manner by the suction nozzles **121** and moved to the feed rollers **140**, **141** (Figs. 8 and 13). Simultaneously therewith cam **17** operates the pawl carrier **15** so that the pawl **16** advances the ratchet wheel **14** always by one tooth and, finally, through the worm **12**, worm wheel **11** and bevel gear **8**, **9** turns the sprocket wheel shaft **10** and the conveyor chains **3** so as to lift the pile table stepwise by the height of one sheet. The feeler **122** (Fig. 1), which is known per se, regulates the lifting movement and continuously corrects the clearance between the suction nozzle **121** and the top surface of the pile. When the table **87** has eventually attained the position of the supporting pawls **103**, its lateral edges strike against the heads of these pawls (Fig. 3) and force them back sufficiently to allow the table to pass, until at last they spring under the underside of the table in a position to support the latter. Incidentally the control switch **107** is closed by means of its roller head **108**.

When contact with all control switches has been established, the solenoids **92** (Figs. 4, 5) are energized and their armatures remove the blocking lever **75** from roller **74** of the movable switch part **71**. At the same time the switch lever **142**, secured to shaft **94** is operated and moved into contact with switch **143** so that the circuit for the electrically driven lift is now completely closed. Prior to this, lever **75**, actuated through link **95**, lever **96** and the pawl lifter **50'**, **50** has lifted the pawl **16** out of the teeth of the ratchet wheel **14**.

The blocking of the movable switch member **71** having been released by the arm **75**, the latter swings out as shown in Fig. 4*a* and the rollers **85**, **86** drop into the recess **144**. The table carriers at the right and left hand sides of the pile tilt up and travel past the edges of the table. Simultaneously the chain rollers **78** enter auxiliary channels **82** and thereby cause the chains accurately to maintain their conveying direction and to be safeguarded against displacement. In the continued upward travel the roller **86** finally engages a stop **145** which compels the carrier to travel around the sprocket wheel **66** and into the down-groove **70**. In order to prevent deflection of the chain by the rear parts of the movable switch member **71**, the chain rollers **78** travel behind a shield **83** (Fig. 4*a*) and are led by the member **71** into the groove **70**. In the meantime, while the sheets continue to be fed uninterruptedly, the next pile is prepared and moved into contact with the stop bars **139**, as already described. The next pair of table carriers **84** now approaches the newly introduced pile, travels under its table, and lifts it up until its upper surface contacts the underside of the pile table above and lifts it, together with its rest pile **57'**, off the pawls **103** and thereby releases the contacts **107**. Both the electric circuit and the lifting operation are immediately interrupted, without thereby involving an interruption of the automatic feed of the sheets and the automatic step-by-step movement controlled by the ratchet device **14**.

The table **87**, with its wedge-shaped side **123** directed toward the printing machine, is now slowly withdrawn from the piles. During its withdrawal the table rests on the stay bolts **113**, whereby this operation is safeguarded and facilitated. The wedge-shaped formation of the edge **123** of the pile table ensures that in the slow withdrawal of the table from between the rest pile and the new pile, the prescribed clearance between the suction nozzles and the topmost sheet is not varied, since the lifting device brings the pile surface automatically and incessantly to the required level.

The conventional sheet feeding devices have the disadvantage that, when comparatively thick sheets are to be fed, the space between the top of the pile and the suction nozzle increases so quickly, that eventually the nozzle becomes unable to attract the sheets. The resultant failures in the feed of the sheets almost invariably lead to damages of the machine and of the printing plates. This disadvantage is entirely avoided in a device according to the invention by the provision of a second feeding device, which is put into operation together with the supporting pawls **103** which support the rest pile, and of which the circuit has been interrupted when the newly introduced pile has moved into contact with the rest pile table and has lifted it off the said pawls. This second feeding device then continues the pile lift until the top of the pile has been moved up to the suction nozzles, whereupon its own circuit becomes interrupted.

The rest pile and the new pile have now joined so as to form one single pile, which is lifted until finally the new pile table, also with a rest pile thereon, moves past the lifting pawls **103** which thereupon engage and support the table in the aforedescribed manner. The lifting motor is set in motion by the control switches **108** of the supporting pawls **103**, while the conveyor chains with the table carriers are circulated in their prescribed direction. When, after a certain amount of travel of the pile now in operation, another new pile is introduced into the device, the whole operation will be repeated as aforesaid.

Provided in the circuit of the second feeding device is a brake unit which ensures the interruption in the lift of the pile at always the correct moment. The automatic feed of the sheets by the suction nozzles **121** has continued to lift the pile **57** until it has been worked up to only a small rest of sheets **57'** and until the supporting pawls **103** at both sides of the pile have taken their position underneath the table **87**. With the positioning of the last supporting pawl the circuit B becomes closed and also the circuit C over an auxiliary switch and the contactor S.

The distance between the rest pile **57'** and the suction nozzles **121** has meanwhile become precariously large, which danger, as has already been referred to, is greater with thick sheets than with thin sheets, but the time is too short in which to introduce and raise the next pile thereby to compensate the space between its surface and the nozzles.

When the lower pile **57** strikes the underside of the rest pile **57'**, or of the table **87'** respectively, the latter is lifted off the pawls **103** together with its table, and the circuit B reopened, whereas a contactor arrangement in the system continues to keep the circuit C closed (Fig. 16). This means that the rest pile continues its upward movement until the switch lever **200** of a switch **202** on the column **201** is actuated by the table **87**, whereupon the circuit is interrupted.

In this way the correct position of the pile surface in relation to the suction nozzles has immediately been reestablished even before the automatic feed control has been able to follow, and the dreaded danger of sheets failing delivery is averted.

The extent of the second feed is determined by the thickness of the sheets, for which reason the switch unit **202** is mounted on the column **201** on which it can be raised and lowered as required. A set screw **203** permits of fine adjustment.

The brake unit comprises a brake drum **204** and the brake shoes **205** which are connected to the armature **206** of a solenoid **207**. The brake may be connected to a time relay **208** and to the holding coil **209** of the contactor.

After the control lever **200** has been lifted off the pile table **87'** to break the contact at **202**, the holding coil would have dropped back so as to close the circuit at contact **209** of the time relay **208** and the solenoid **207**. The solenoid becomes energized, its armature **206** attracted and the brake shoes **205** pressed against the brake drum **204**, whereupon the drive shaft **25** immediately comes to rest at the exact moment when the top of the pile has attained the correct height in relation to the separating and sheet feeding means.

What I claim is:

1. A sheet feeder for use in printing machines having mechanism for lifting and uninterruptedly feeding piles of sheets and means for conveying the sheets one by one from the said pile into the printing machine, comprising, a pile end limit switch, a hand lever to actuate said limit switch, a shaft mounting the said hand lever, a safety member to block the said shaft in its "Off"-position when the pile lifting mechanism is in operation, a second switch for connecting the sheet feeder in and out of the pile lifting position, a hand lever for actuating said second switch, a shaft mounting the said hand lever, and means on the said shaft for moving the said safety member into a position in which to lock the hand lever of the said limit switch in its "Off"-position, when the hand lever of the pile lifting switch also is in its "Off"-position and to free it from its locked position when the pile lifting switch is turned into its "On"-position, so that the said limit switch will only be free for actuation when the hand lever for the motor lifting operation is moved into its "On"-position.

2. A sheet feeder for use in printing machines having mechanism for lifting and uninterruptedly feeding piles of sheets and means for conveying the sheets one by one from the said pile into the printing machine, comprising, a pile end limit switch, a hand lever to actuate said limit switch, a shaft mounting the said hand lever, a safety member to block the said shaft in its "Off"-position when the pile lifting mechanism is in operation, the said safety member having the shape of a flat link,

a slot in the said link extending in longitudinal direction thereof, through which the said control lever shaft penetrates and consisting of a wide part and a narrow part, and a flat portion on the shaft of the pile end control lever over which the narrow part of the slot fits when the said safety member has been so moved by the pile lifting switch lever being turned into its "On"-position.

3. A sheet feeder for use in printing machines as set forth in claim 1 and comprising a motor-driven gear in a gear case and a clutch of which one member is secured to a clutch shaft in the said gear, a hand crank to fit on and rotate the said clutch shaft, a cover to the said gear case which has to be opened for the application of the hand crank to the clutch shaft, and an electric contact operable by the said crank when applied to cut off the current to the driving motor while the clutch shaft is being driven by hand through the said crank.

4. A sheet feeder for use in printing machines, comprising a driving motor, a gear case and a clutch in the said gear case, a shaft driven by the said clutch, a ratchet wheel on the said clutch shaft outside the gear case, a pawl carrier pivoted on the clutch shaft adjacent the said ratchet wheel, a pawl on the said pawl carrier, a cam for moving the said pawl carrier to rotate the said ratchet wheel during every actuation of the sheet feeder by the amount of one tooth, a pawl lifter and means operable by the pile lift control lever to move the said pawl out of engagement with the said ratchet wheel.

5. A sheet feeder for use in printing machines as set forth in claim 4, wherein all parts movable for a continuous operation of the feeder, including their control switches, are contained within one electric circuit, a hand operated lever being provided to connect all the said parts into their working positions.

6. A sheet feeder for use in printing machines as set forth in claim 4, wherein all parts movable for continuous operation of the feeder, including their control switches, are contained within one electric circuit, a hand operated lever being provided to connect all the said parts into their working positions, while the driving motor is connected into two circuits.

7. In a sheet feeder for use in printing machines having mechanism for lifting and interruptedly feeding piles of sheets without interruption of the conveyance of the sheets into the printing machine, in which a rest pile is held in an upper position by pawls, and in which pile tables and a set of conveyor chains is employed, the provision of two circuits including a point switch, means for circulating said conveyor chains, spaced table carriers on said chains, a guide rail for the said carriers, two guide grooves along the edges of the said guide rail, a yieldable mechanical switch member to establish an uninterrupted guide path of the said guide grooves and, when said rest pile has reached a predetermined position, to be diverted so as to form a recess in the guide rail and to set a lifting motor in operation by the said switch, the table carrier being moved into said recess and further on without change of direction past the pile table of the rest pile suspended on the said pawls.

8. In a machine for operating on sheets, a sheet feeder having mechanism for lifting and effecting uninterrupted feed of piles of sheets, comprising a table supporting a pile of sheets, a set of conveyor chains for conveying said pile table upwards into its sheet delivery position, top and bottom sprockets over which the said conveyor chains are driven, and means including a set of pawls for holding a table supporting a rest pile in elevated position, table carriers at spaced intervals on the conveyor chains, rollers on each of said table carriers one of them being the leading roller to guide the carrier, a guide rail for guiding said conveyor chains and table carriers, two guide grooves one on each side of said guide rail for guiding the said table carriers, a plurality of lever-like pawls for supporting pile tables with rest piles thereon, spring means urging said pawls into table supporting position, a mechanical switch member yieldingly arranged at the upper part of said guide, control means in cooperation with the said table carriers for displacing said switch member so as to cause a break in the up-groove forming a recess for the entrance of said leading roller of each carrier thereby to tilt the said carrier and to permit its passing the edge of the pile rest supporting table while the latter is being held by the said lever-like pawls, an electric switch on each of the said rest table supporting pawls, a solenoid having an armature adjacent the said mechanical switch member on the machine frame, electric connections between said switch and the solenoid, and mechanical control members responsive to the movement of the said armature to effect the displacement of the said mechanical switch member.

9. In a machine for operating on sheets, a sheet feeder having mechanism for lifting and effecting uninterrupted feed of piles of sheets, comprising a table supporting a pile of sheets, a set of conveyor chains for conveying said pile table upwards into its sheet delivery position, top and bottom sprockets over which the said conveyor chains are driven, and means including a set of pawls for holding a table supporting a rest pile in elevated position, table carriers at spaced intervals on the conveyor chains, rollers on each of said table carriers one of them being the leading roller to guide the carrier, a guide rail for guiding said conveyor chains and table carriers, two guide grooves one on each side of said guide rail for guiding the said table carriers, a plurality of lever-like pawls for supporting pile tables with rest piles thereon, spring means urging said pawls into table supporting position, a mechanical switch member yieldingly arranged at the upper part of said guide, control means in cooperation with said table carriers for displacing said switch member so as to cause a break in the upgroove forming a recess for the entrance of said leading roller of each carrier thereby to tilt the said carrier and to permit its passing the edge of the pile rest supporting table while the latter is being held by the said lever-like pawls, an electric switch on each of the said rest pile table supporting pawls penetrating through the table seating surfaces of the said pawls, a solenoid having an armature adjacent the said mechanical switch member on the machine frame, electric connections between said switch and the solenoid, and mechanical control members responsive to the movement of the said armature to effect the displacement of the said mechanical switch member.

10. In a machine for operating on sheets, a sheet feeder having mechanism for lifting and effecting uninterrupted feed of piles of sheets, comprising a table supporting a pile of sheets, a set of conveyor chains for conveying said pile table upwards into its sheet delivery position, top and bottom sprockets over which the said conveyor chains are driven, and means including a set of pawls for holding a table supporting a rest pile in elevated position, table carriers at spaced intervals on the conveyor chains, rollers on each of said table carriers one of them being the leading roller to guide the carrier, a guide rail for guiding said conveyor chains and table carriers, two guide grooves one on each side of said guide rail for guiding the said table carriers, a plurality of lever-like pawls for supporting pile tables with rest piles thereon, spring means urging said pawls into table supporting position, a mechanical switch member yieldingly arranged at the upper part of said guide, control means in cooperation with the said table carriers for displacing said switch member so as to cause a break in the up-groove forming a recess for the entrance of said leading roller of each carrier thereby to tilt the said carrier and to permit its passing the edge of the pile rest supporting table while the latter is being held

by the said lever-like pawls, an electric switch on each of the said table supporting pawls, a solenoid having an armature adjacent the said mechanical switch member on the machine frame, electric connections between the said switch and the solenoid, an articulated arm on the mechanical switch member, and a control member movable by the armature of the solenoid to maintain the said arm and the switch member in their normal position in which the said switch member takes a position parallel to the said guide rail.

11. In a machine for operating on sheets, a sheet feeder having mechanism for lifting and effecting uninterrupted feed of piles of sheets, comprising a table supporting a pile of sheets, a set of conveyor chains for conveying said pile table upwards into its sheet delivery position, top and bottom sprockets over which the said conveyor chains are driven, and means including a set of pawls for holding a table supporting rest pile in elevated position, table carriers at spaced intervals on the conveyor chains, rollers on each of said table carriers one of them being the leading roller to guide the carrier, a guide rail for guiding said conveyor chains and table carriers, two guide grooves one on each side of said guide rail for guiding the said table carriers, a plurality of lever-like pawls for supporting pile tables with rest piles thereon, spring means urging said pawls into table supporting position, a mechanical switch member yieldingly arranged at the upper part of said guide, control means in cooperation with the said table carriers for displacing said switch member so as to cause a break in the up-groove forming a recess for the entrance of said leading roller of each carrier thereby to tilt the said carrier and to permit its passing the edge of the pile rest supporting table while the latter is being held by the lever-like pawls, an electric switch on each of the said table supporting pawls, a solenoid having an armature adjacent the said mechanical switch member on the machine frame, electric connections between the said switch and the solenoid, an articulated arm on the mechanical switch member, a control member movable by the armature of the solenoid to maintain the said switch member in a position parallel to the guide grooves in the said guide rail, and a pin-and-slot arrangement on the said mechanical switch member for limiting its movement of displacement under the action of the said armature.

12. In a machine for operating on sheets, a sheet feeder having mechanism for lifting and effecting uninterrupted feed of piles of sheets, comprising a table supporting a pile of sheets, a set of conveyor chains for conveying said pile table upwards into its sheets delivery position, top and bottom sprockets over which the said conveyor chains are driven, and means including a set of pawls for holding a table supporting a rest pile in elevated position, table carriers at spaced intervals on the conveyor chains, rollers on each of said table carrier one of them being the leading roller to guide the carrier, a guide rail for guiding said conveyor chains and table carriers, two grooves one on each side of said guide rail for guiding the said table carriers, a plurality of lever-like pawls for supporting pile tables with rest piles thereon, spring means urging said pawls into table supporting position, a mechanical switch member yieldingly arranged at the upper part of said guide, control means in cooperation with the said table carriers for displacing said switch member so as to cause a break in the up-groove forming a recess for the entrance of said leading roller of each carrier thereby to tilt the said carrier and to permit its passing the edge of the pile rest supporting table while the latter is being held by the said lever-like pawls, an electric control switch on each of the said table supporting pawls penetrating through the table seating surface of the said pawl, an eccentric pivot for the said pawl by which the operation of the control switches under the weight of the rest pile and pile table may be adjusted, a pin on the said pawl, a slotted member outside the said pawl through which the said pin projects, and a spring within the said slot to resiliently hold the pawl in its adjusted position.

13. In a machine for operating on sheets, a sheet feeder having mechanism for lifting and effecting uninterrupted feed of piles of sheets, comprising a table supporting a pile of sheets, a set of conveyor chains for conveying said pile table upwards into its sheet delivery position, top and bottom sprockets over which the said conveyor chains are driven, and means including a set of pawls for holding a table supporting rest pile in elevated position, table carriers at spaced intervals on the conveyor chains, rollers on each of said table carriers one of them being the leading roller to guide the carrier, a guide rail for guiding said conveyor chains and table carriers, two guide grooves one on each side of said guide rail for guiding the said table carriers, a plurality of lever-like pawls for supporting pile tables with rest piles thereon, spring means urging said pawls into table supporting position, a mechanical switch member yieldingly arranged at the upper part of said guide, control means in cooperation with the said table carriers for displacing said switch member so as to cause a break in the up-groove forming a recess for the entrance of said leading roller of each carrier thereby to tilt the said carrier and to permit its passing the edge of the pile rest supporting table while the latter is being held by the said lever-like pawls, the edge of the pile table at its introduction side being wedge-shaped throughout its width.

14. A machine as set forth in claim 13, comprising, stops for positioning the residual sheets on the pile table, a gap in at least one of the stops, and air blast nozzles in the said gap for loosening the top sheets of a pile to be fed into the machine.

15. In a machine for operating on sheets, a sheet feeder having mechanism for lifting and effecting uninterrupted feed of piles of sheets, comprising a table supporting a pile of sheets, a set of conveyor chains for conveying said pile table upwards into its sheet delivery position, top and bottom sprockets over which the said conveyor chains are driven, and means including a set of pawls for holding a table supporting a rest pile in elevated position, table carriers at spaced intervals on the conveyor chains, rollers on each of said table carriers one of them being the leading roller to guide the carrier, a guide rail for guiding said conveyor chains and table carriers, two guide grooves one on each side of said guide rail for guiding the said table carriers, a plurality of lever-like pawls for supporting pile tables with rest piles thereon, spring means urging said pawls into table supporting position, a mechanical switch member yieldingly arranged at the upper part of said guide, control means in cooperation with the said table carriers for displacing said switch member so as to cause a break in the up-groove forming a recess for the entrance of said leading roller of each carrier thereby to tilt the said carrier and to permit its passing the edge of the pile rest supporting table while the latter is being held by the lever-like pawls, a frame structure at the side at which new piles enter the feeder, and bolts in the said frame providing a seat for the pile table after its withdrawal from between the main pile and the rest pile, the seating surfaces of the said bolts being approximately flush with the table supporting surfaces of the said lever-like pawls.

16. In a machine for operating on sheets, a sheet feeder having mechanism for lifting and effecting uninterrupted feed of piles of sheets, comprising a table supporting a pile of sheets, a set of conveyor chains for conveying said pile table upwards into its sheet delivery position, top and bottom sprockets over which the said conveyor chains are driven, and means including a set of pawls for holding a table supporting a rest pile in elevated position, table carriers at spaced intervals on

the conveyor chains, rollers on each of said table carriers one of them being the leading roller to guide the carrier, a guide rail for guiding said conveyor chains and table carriers, two guide grooves one on each side of said guide rail for guiding the said table carriers, a plurality of lever-like pawls for supporting pile tables with rest piles thereon, spring means urging said pawls into table supporting position, a mechanical switch member yieldingly arranged at the upper part of said guide, control means in cooperation with the said table carriers for displacing said switch member so as to cause a break in the up-groove forming a recess for the entrance of said leading roller of each carrier thereby to tilt the said carrier and to permit its passing the edge of the pile rest supporting table while the latter is being held by the said lever-like pawls, a frame structure at the side at which new piles enter the feeder, said frame including a transverse member of approximately the height just below the said table supporting pawls, a bottom stop member, rear stop bars joining the said transverse member, a side stop bar for aligning the sheets of the pile laterally, and an adjusting member on the transverse member for adjusting the position of the said side stop bar in accordance with the size of the sheets.

17. In a machine for operating on sheets, a sheet feeder having mechanism for lifting and effecting uninterrupted feed of piles of sheets, comprising a table supporting a pile of sheets, a set of conveyor chains for conveying said pile table upwards into its sheet delivery position, top and bottom sprockets over which the said conveyor chains are driven, and means including a set of pawls for holding a table supporting a rest pile in elevated position, table carriers at spaced intervals on the conveyor chains, rollers on each of said table carriers one of them being the leading roller to guide the carrier, a guide rail for guiding said conveyor chains and table carriers, two guide grooves one on each side of said guide rail for guiding the said table carriers, a plurality of lever-like pawls for supporting pile tables with rest piles thereon, spring means urging said pawls into table supporting position, a mechanical switch member yieldingly arranged at the upper part of said guide, control means in cooperation with the said table carriers for displacing said switch member so as to cause a break in the up-groove forming a recess for the entrance of said leading roller of each carrier thereby to tilt the said carrier and to permit its passing the edge of the pile rest supporting table while the latter is being held by the said lever-like pawls, a table carrier, a pin on said table carrier for the application of a spanner, and a spanner having an extended head portion, said head portion, when applied to the pin, bearing against the pile table and allowing of prizing it in the conveying direction of the sheets.

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