Nov. 2, 1965 A. MALAMOOD ETAL 3,215,014

FEEDING APPARATUS FOR LIFTS OF LIMP SHEETS

Filed Oct. 16, 1962 4 Sheets-Sheet 1

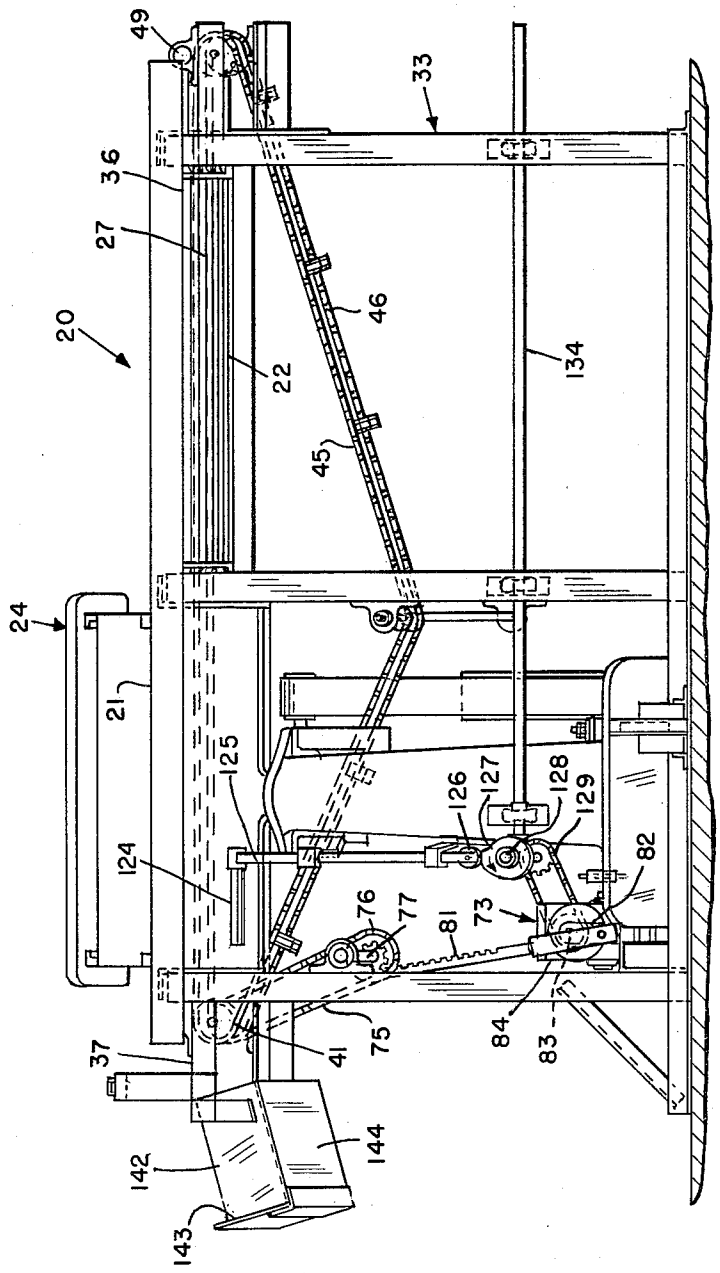


Fig. 1.

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Filed Oct. 16, 1962 4 Sheets-Sheet 2

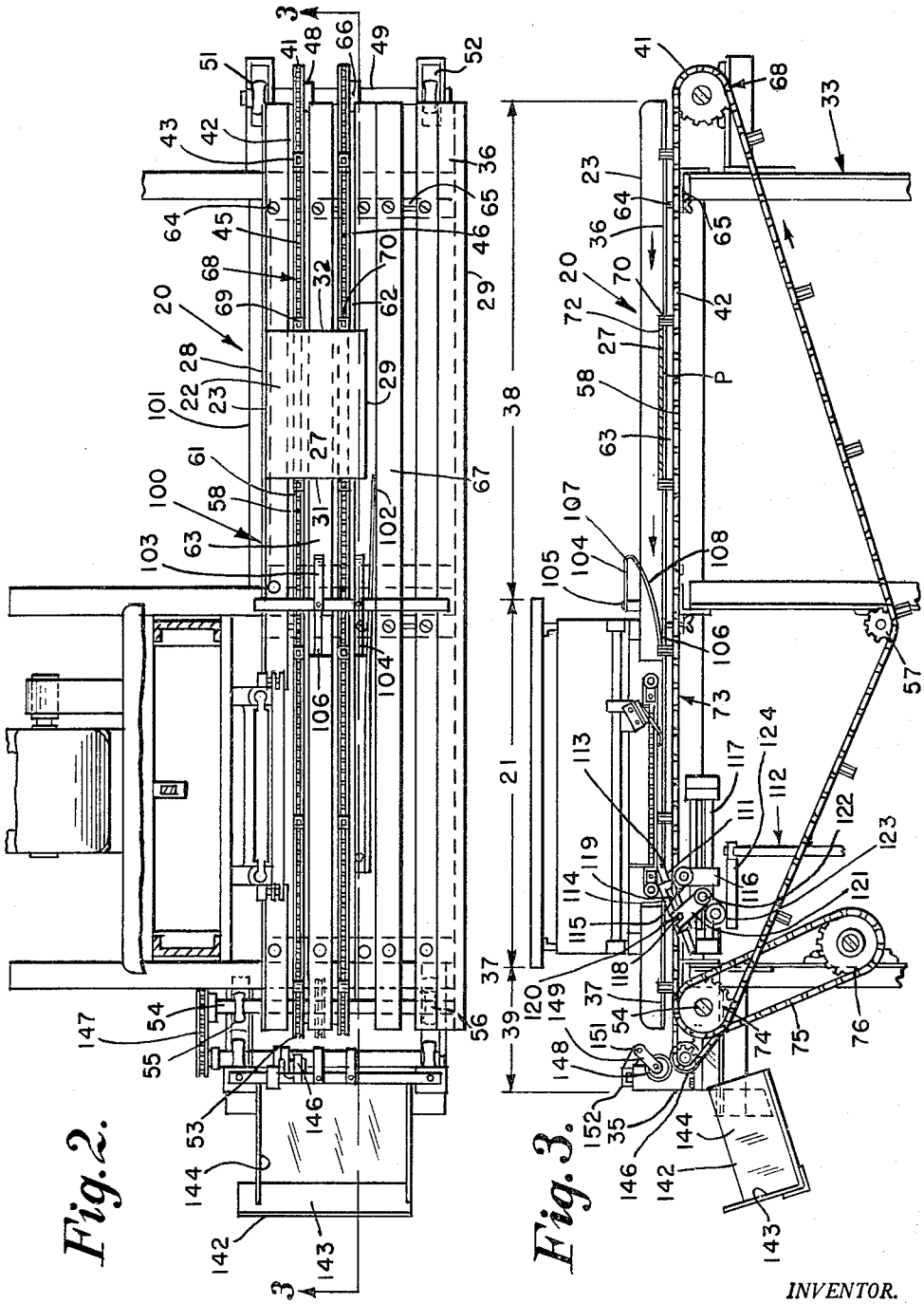


Fig. 2.

Fig. 3.

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FEEDING APPARATUS FOR LIFTS OF LIMP SHEETS

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Fig. 4.

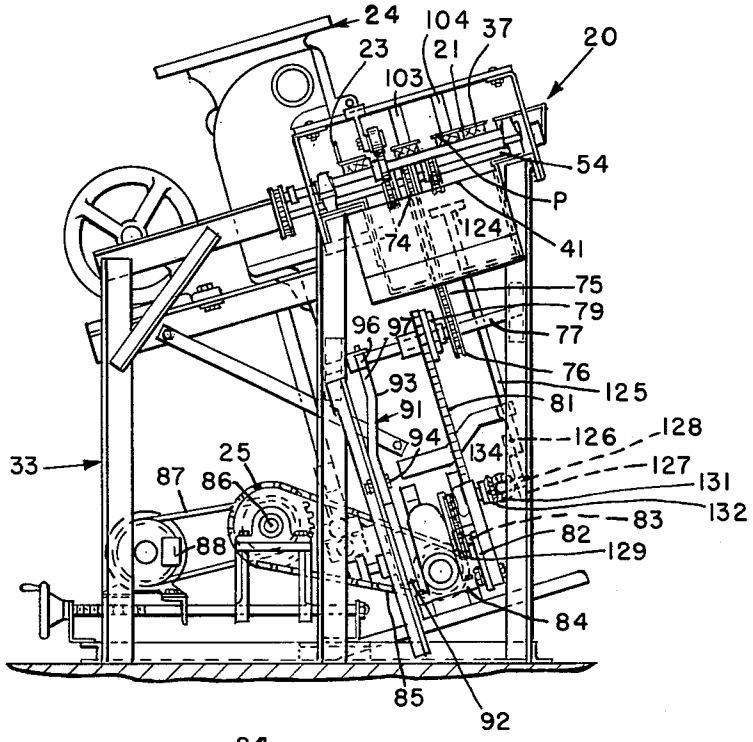
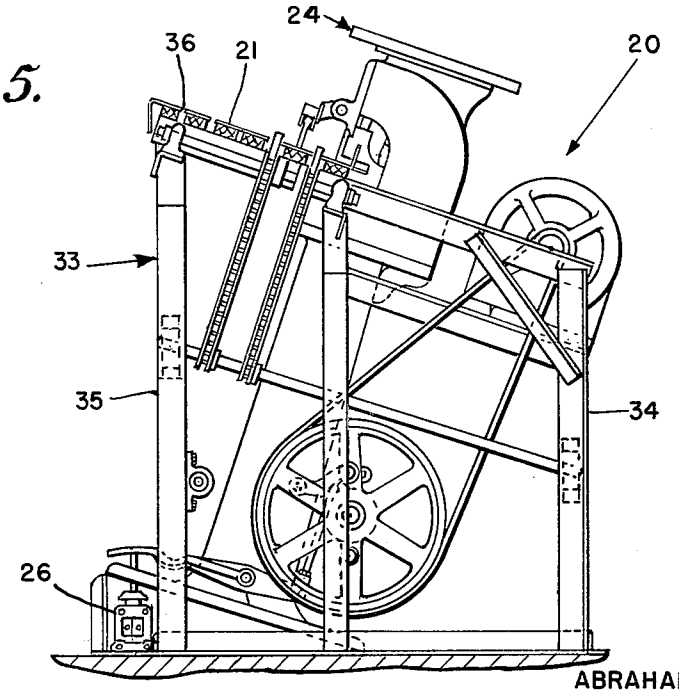


Fig. 5.



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Filed Oct. 16, 1962 4 Sheets-Sheet 4

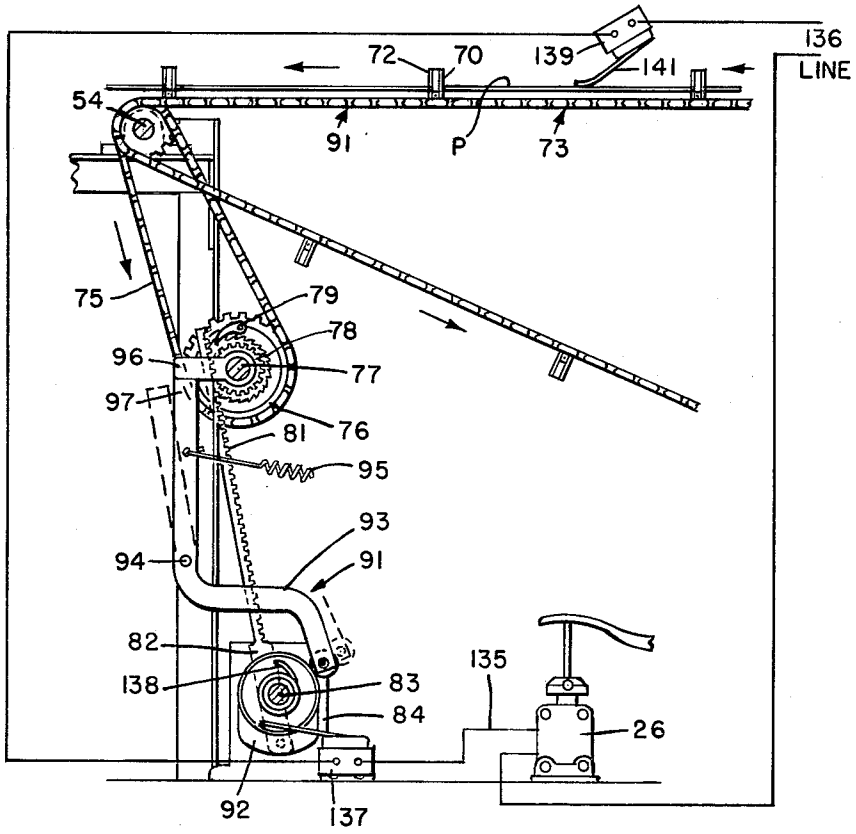


Fig. 6.

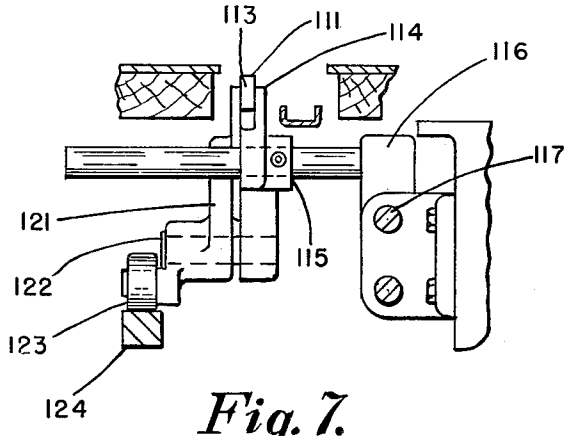


Fig. 7.

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United States Patent Office 3,215,014 Patented Nov. 2, 1965

3,215,014
FEEDING APPARATUS FOR LIFTS OF LIMP SHEETS

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Filed Oct. 16, 1962, Ser. No. 230,929
6 Claims. (Cl. 83—155)

This invention relates to apparatus for feeding lifts of paper sheets to an automatic paper treatment machine, in registration, for the performance of a punching, tabbing, indexing, perforating, round cornering, drilling or like register operation.

The lifts may consist of any desired number of sheets, depending on the capacity of the automatic machine and the sheets are usually relatively flimsy, limp and flexible so that the lift cannot be handled by ordinary feed apparatus. In addition, despite the thin, limp nature of the sheets in the lift, it is essential that the edges of the sheets in the lift be flush and in exact registration with each other at the time the registered treatment operation takes place.

It has heretofore been proposed, as in U.S. Patent No. 2,641,321 to Cruzan of June 9, 1953, to advance successive lifts between continuously travelling tapes across the bed of a treatment machine, to intercept each lift at the bed by a movable end stop for registering the leading edge, and to then push the lift laterally toward the back gauge of the machine for registering the side edges of the lift. Among the disadvantages of such a feed and registration apparatus are the fact that the impact of each lift against the end stop may tend to mark or crumple the leading edges of the sheets, the tapes are frictionally urging the upper and lower sheets forwardly during the treatment operation and the lateral movement of each lift is accomplished against the frictional resistance of the tapes and against the frictional resistance of the end stop.

In many binding operations, some paper sheets are shorter than the other sheets, but must still be treated in registration with the back gauge of the treatment machine. In a paricular lift, if the short sheets are spaced from the back gauge edge of the lift but flush with the opposite edge of the lift, a lateral push on the said opposite edge toward the back gauge will have no effect in aligning the important back gauge edges for punching or other treatment. Thus the machines of the prior art do not properly orient short sheets for treatment.

Similarly many sheets used in binding operations are of the coated enamel type with glossy, slippery surfaces. Friction tapes tend to slip on such surfaces and to result in an inaccurate registration of forward and trailing edges when operable with an end stop. In the apparatus of this invention short sheets are oriented laterally by gravity and oriented longitudinally first by a push on the trailing edge and then by a push on the forward edge, whereby short sheets and slippery sheets are under control and accurately registered.

The principal object of this invention is to accomplish the registration of the side edges of each such lift while the lift is advancing toward the treatment station, and by gravity, so that there is no undue impact or frictional resistance and so that the lift is in longitudinal, or side, registration with the back gauge upon arrival at the treatment station.

Another object of the invention is to accomplish the registration of the leading and trailing edges of each such lift by halting the trailing edges exactly in registration on the bed of the machine, without impact, and then jogging the leading edges of the individual sheets in the lift rearwardly toward the register line established by the trailing edges.

A further object of the invention is to provide an intermittent, register chain, feed for an automatic punching machine which includes a positive stop mechanism for halting the register chain lugs exactly at the treatment station and flexible pressure members for holding each lift in contact with its lugs during the deceleration of the register chain to prevent over run.

Still another object of the invention is to provide an automatic feed for a punching machine in which each successive lift of limp sheets is registered laterally and longitudinally without undue impact and is punched, or otherwise treated, at a time when it is not engaged by any moving parts of the machine.

Other objects and advantages of the invention will be apparent from the claims, the description of the drawings and from the drawings in which:

FIG. 1 is a rear elevation of a machine constructed in accordance with the invention;

FIG. 2 is a plan view, normal to the bed, or table surface, of the machine shown in FIG. 1;

FIG. 3 is a front elevation in section on line 3—3 of FIG. 2;

FIG. 4 is an end elevation, from one end of the machine;

FIG. 5 is an end elevation, partly in section, from the other end of the machine;

FIG. 6 is a detail view illustrating the positive stop and control circuit of the invention; and

FIG. 7 is an enlarged, fragmentary end elevation showing the leading edge jogger of the invention.

In the drawings, **20** designates a conventional automatic punching machine well known in the art and having a bed, or table, **21** for supporting a lift **22** of limp sheets and having an upstanding side edge gauge **23** for registering the adjacent edges of the lift as it is punched by the unit **24**. The drive mechanism **25** of the machine **20** is well known, and not described in detail, but in this invention it includes a punch tripping solenoid **26**. Energization of solenoid **26** causes the multiple punching unit **24** to descend toward the bed **21** to punch a lift and then to return to its normal position.

Each lift **22** may consist of one or two dozen sheets, such as **27**, of relatively flexible, limp, thin paper of the note book type, both the sheets and the lifts lacking sufficient rigidity to be handled in the manner of paperboard or the like. When in register on the bed **21** the opposite edges of the lift, parallel to the side edge gauge **23**, are termed side, or longitudinal, edges **28** and **29** while the other pair of opposite edges of the lift are termed leading and trailing edges, or lateral edges **31** and **32**.

Conventionally, the plane of the bed **21** is horizontal and the path of the multiple punch unit **24** is vertical. However, in this invention, frame means **33** is provided for tilting the automatic punching machine **20** at an angle so that a lift of sheets on the bed **21** will tend to slide by gravity downwardly into contact with the side edge gauge **23**.

The frame means **33** also includes a frame structure **34** and **35** for supporting a bed extension **36** in advance of the bed **21** and a bed extension **37** in rear of the bed **21**. The bed extensions **36** and **37** are coplanar with bed **21** and jointly form a longitudinally extending path which includes a lift deposit station **38**, the treatment station formed by the bed **21**, and a lift discharge station **39**. The longitudinally extending path, or paper line P of the apparatus **41** of this invention is thus in a plane tilted on a longitudinal axis downwardly toward the side edge gauge **23** with the lower extremity and the higher extremity at uniform, but different, heights above floor level.

The apparatus **41** includes conveyor means **42** which includes an endless conveyor **43** having a working stretch extending along the tilted paper line P from station **38**,

across bed **21** to station **39**. Preferably the conveyor **43** is in the form of a pair of parallel, endless chains, **45** and **46**, each chain such as **45**, being trained around a sprocket **48** on shaft **49** journalled in bearings **51** and **52** at one end of the paper line P, and trained around a sprocket **53** on shaft **54** journalled in bearings **55** and **56** at the other end of the paper line P. Suitable tension sprockets such as **57** are provided for the non working stretches of the chains and the working stretches **58** and **59** are contained in longitudinal slots **61** and **62** formed by a plurality of longitudinal bars such as **63**.

Each bar **63** is transversely adjustable by means of the set screws **64** which are slidable in the slotted transverse plates **65** and each sprocket **48**, **49** and **53** is transversely adjustable on its keyed shaft by a set screw **66** so that the chains are movable laterally to conform to various widths of lifts. The upper faces **67** of the longitudinally extending, laterally spaced bars **63** are smooth for supporting each individual and successive lift with a minimum of friction as the lifts are individually and successively advanced along the paper line P.

The lateral edge registration means **68** of the invention includes a plurality of registration lugs, or dogs, such as **69** and **70** spaced around the chains **45** and **46**, and arranged to project well above the plane of the smooth faces **67** of the bars **63** when the lugs are advancing, unidirectionally, along the paper line P. Each pair of lugs **69** and **70** is laterally, or transversely, aligned in a straight line normal to the side edge gauge **23**, when at the treatment station formed by the bed **21** and each pair of lugs is arranged to engage the trailing lateral edge **32** of one of the lifts manually, or automatically deposited on the conveyor **43** at the lift deposit station **38**. The leading face **72**, of each lug **69** or **70** is smooth and relatively broad to avoid marking the trailing edges of the sheets in the lift while permitting the lift to slide sidewise and downwardly toward the side edge gauge **23**, as it advances along the paper line P.

The lateral, or transverse, edge registration means **68** also includes intermittent, or indexing, drive means **73** for advancing the working stretch of the registration chains unidirectionally along the paper line P and halting the chains temporarily with each successive pair of lugs exactly aligned at the bed **21** to position the lift for the treatment operation. A sprocket **74** carried by the shaft **54** is driven by a chain **75** and sprocket **76**, the sprocket **76** being carried on shaft **77**, the shaft **77** being driven by the ratchet gear **78**, pawl **79** and gear rack rod **81**. Gear rack rod **81** is reciprocated by pivotal connection at its lower end to the crank arm **82** rotated by the shaft **83** of reducer **84**. Reducer **84** is driven by the power train **85**, jack shaft **86**, power train **87** and electric motor **88**.

The gear rack rod **81** and unidirectional, ratchet and pawl mechanism **78** and **79** are arranged to advance the conveyor **43** in indentical increments of travel between stations with halts at each station. Preferably, to assure exact registration of the lugs, and the trailing edges of each lift, at the bed **21** positive stop mechanism **91** is provided. Mechanism **91** includes the stop arm cam **92** on reducer shaft **83**, the cam follower arm **93**, pivoted at **94** to the frame, the follower arm spring **95** and the lug **96** fixed on the shaft **77** which carries the ratchet and pawl drive of the conveyor. Thus the upper end **97** of follower arm **93** is normally held out of the path of the lug **96**, by the cam **92** to permit the lug **96** and its shaft to rotate while the chains advance. When the gear rack rod **81** has reached the end of its power stroke, the cam **92** permits the spring **95** to move the end **97** into the path of lug **96** to positively bar further rotation of the conveyor shafts and sprockets and to assure the halting of each successive pair of lugs at the correct lateral registration line, relative to the bed **21**.

The longitudinal edge registration means **100** of the invention includes the frame means **33** for tilting the paper line P downwardly toward the side edge gauge **23** and also includes an extension **101** of the side edge gauge **23** in advance of the bed **21** and preferably extending longitudinally from the lift deposit station **38** to the bed **21**. The side edge gauges **23** and **101** form an upstanding guide normal to the plane of the tilted path of the lifts for contacting and aligning the adjacent edges of the sheets in each lift as the lift is advanced along the paper line P by the conveyor **43**. Preferably an upstanding, longitudinally extending deflector **102** is mounted for lateral adjustment on the opposite side of the paper line P from the side edge gauges **23** and **101**, the deflector **102** being angled toward the gauges and engaging the adjacent, or upper, edges of the sheets in each lift to urge them into registration in advance of the bed **21**. Thus each successive individual lift on the conveyor **43** will be advanced to the bed **21**, and halted at the bed **21** with the longitudinally extending edges flush and firmly against the side edge gauge **23**, with no lateral movement necessary at the treatment station.

At least one, and preferably several, flexible resilient strips of thin metal, or the like, such as **103** or **104** are provided above, and in advance of bed **21** to retard the advance of each successive lift and prevent overrunning of the lift relative to the registration lugs.

One end of each strip such as **103** is fixed to the side edge gauge extension **101** above the paper line P at **105**, the strip extending downwardly to a free terminal tip **106** in the path of the advancing lifts but being readily flexed upwardly by a lift to ride on the upper sheet and exert a holddown and braking effect on the lift. The strips **103** and **104** have been found to operate especially well when bent rearwardly as at **107** and then downwardly and forwardly as at **108**, the resulting flexibility avoiding any marks on the sheets.

Preferably the apparatus **41** includes a leading edge jogger **111**, normally below the path of the lifts **22** on paper line P and in rear of the bed **21**. Means **112** is provided for pivoting the jogger **111** upwardly and rearwardly to above the level of the paper line and into engagement with the leading, lateral edges **31** of each lift **22** which has halted at the bed **21**. In the event of overrun of the lift, when the stop mechanism **91** positively stops the lugs of the conveyor **43**, or in the event that one or more sheets in the lift are not flush with the remaining sheets in the lift, the jogger re-orients the sheets and the lift relative to the lugs, as a back gauge, so that the lift is perfectly aligned both laterally and longitudinally on the bed **21**.

The leading edge jogger, or pusher, **111** is a metal rod of quadrangular cross section having a lift engaging tip **113** and slidable in a bracket **114**, the bracket being pivoted at **115** to a carriage **116** slidable longitudinally on tracks **117**. The jogger **111** includes a stud **118** projecting through a slot **119** in bracket **114**, and recessed in the bifurcated end **120** of a bell crank lever **121**. Lever **121** is pivoted to the frame at **122** and includes a roller follower **123** riding on the cross head **124**. Thus as cross head **124** is raised, the jogger **111** slides upwardly and rearwardly while the bracket pivots on the movable carriage.

The cross head **124**, is synchronized with the speed of the conveyor **43**, and with the stop mechanism **91**, by means of the cross head pusher rod **125** which carries a roller follower **126** at its lower end actuated by the cam **127** mounted on the jack shaft **128**. Shaft **128**, in turn, is connected by the power train **129** to the shaft **83** of the reducer **84**.

Jack shaft **128** by means of the bevel gears **131** and **132**, drives the longitudinally extending shaft **134** which extends to the lift deposit station for driving an automatic lift segregation mechanism forming no part of this invention and, therefore, not described herein.

An electric control circuit **135** is preferably provided which includes a source of current **136**, a limit switch **137** actuated by a cam **138** on the shaft **83**, a stock sensing limit switch **139** having a switch arm **141** arranged to close the circuit when a lift is in treatment position on bed **21** and the punch tripping solenoid **26**. The control circuit **135** is thus closed to energize the solenoid **26** only when switch **139** is closed by the presence of a lift on the bed **21** and only when the switch **137** is closed by the cam **138** to indicate that the positive stop mechanism **91** has assured the exact positioning of the registration lugs at the bed **21**.

The solenoid **26** actuates the punching machine **20** in the conventional manner to cause the multiple punching unit **24** to punch the lift **22** on the bed, in exact registration and the continued rotation of reducer shaft **83**, then causes cam **138** to open switch **137**, release the positive stop mechanism and move the gear rack rod **81** through another cycle to advance the next pair of registration lugs up to the bed, or treatment station, **21**.

A hopper **142** is provided at the lift discharge station **39** which is not only tilted on a longitudinal axis, but also on a lateral axis so that each lift advanced across the bed **21** drops into the hopper with its leading edges bearing against the end wall **143** and its lateral edges bearing against the side wall **144** and thereby forming a stack in which all sheets and lifts have flush, aligned edges. A friction roll **146** is journalled in the frame structure **35**, at the lift discharge station **39** for advancing each individual and successive lift from the conveyor **43** into the hopper **142**. Roll **146** is driven by the shaft **54**, through a power train **147**. A holddown roll **148** carried on an arm **149** pivoted at **151** to a roll bracket assembly **152** is also provided, the roll **148** being freely revolvable.

We claim:

1. In combination with an automatic machine having a bed for the performance of a registered operation on successive lifts of paper sheets, feed and registration apparatus comprising

frame means including oppositely disposed extensions to said bed, said means supporting said machine with the bed thereof and with said bed extensions, forming a tilted longitudinal path for said lifts inclined from the horizontal toward one side of said path and extending from a lift deposit station, through a lift treatment station to a lift discharge station;

an upstanding side edge gauge normal to said tilted bed and bed extensions along said one side of said path to accurately register the adjacent side edges of said lifts on said bed;

a pair of parallel endless, chains supported on said frame, each having a working stretch extending along said tilted longitudinal path continuously from said deposit station through said treatment station to said discharge station and having transversely aligned registration lugs spaced therealong in successive, laterally spaced pairs, each pair transversely aligned normal to said gauge and advancing said lifts by engagement with the transverse trailing edge of successive lifts;

intermittent drive means indexing said chains unidirectionally, said means temporarily fixing successive transversely aligned pairs of lugs of said chains in exact position at said treatment station to register the transverse trailing edge of the lift engaged thereby normal to said gauge with said lift in exact position on said bed for said operation;

a leading edge jogger, mounted on said frame, in rear of said treatment station on said bed and out of said path;

and means, synchronized with said indexing means, for actuating said jogger to push the leading edges of the sheets in each successive lift, halted in registration at said treatment station, toward the lugs engaging the trailing edge thereof after said lugs have been temporarily fixed at said station and before said operation is accomplished.

2. Apparatus for feeding lifts of paper sheets to an automatic paper punching machine and for registering said lifts relative to the punches, side edge gauge and bed of said machine, said apparatus comprising

frame means supporting said machine in tilted position for registering a lift on said bed against said side edge gauge by gravity;

a pair of laterally spaced, endless chains mounted on said frame means, said chains having parallel working stretches extending in a plane normal to said side edge gauge from a lift deposit station, across the punch bed of said machine to lift discharge station and having a plurality of pairs of lift advancing lugs spaced therearound, each pair defining a transverse line normal to said side edge gauge on said stretch for engaging the trailing edge of a lift;

intermittent drive means advancing said conveyor working stretches unidirectionally from said deposit station across said punch bed to said discharge station and periodically halting each successive pair of transversely aligned lugs on said bed with the trailing edge of the lift engaged thereby normal to said side gauge and the lift in exact registration with said punches;

positive stop mechanism associated with said intermittent drive means, for positively halting each successive pair of lugs in exact registration on said bed; and

electric control circuit means, including a switch closed by the actuation of said positive stop mechanism for actuating the punches of said machine during the periodic halts of said conveyor means.

3. Apparatus as specified in claim **2** plus leading edge jogger means operable on the leading edges of the sheets of each lift halted on said bed to jog the sheets in said lift into alignment against the pair of lugs engaging the trailing edge of said lift.

4. Apparatus as specified in claim **2** plus a longitudinally extending stationary side edge deflector mounted on said frame means in advance of said bed, said deflector being angled toward said side edge gauge to urge sheets in each said lift transversely of said conveyor means into engagement with said side edge gauge.

5. Apparatus for feeding lifts of paper sheets to the bed of an automatic paper treatment machine having a side edge guide, said apparatus comprising:

an endless conveyor including a pair of laterally spaced chains having parallel working stretches extending along a path through a lift deposit station, a treatment station on said bed and a lift discharge station;

lateral edge registration means associated with said working stretches, said means comprising:

a plurality of pairs of registration lugs spaced around said conveyor, each pair of lugs being laterally aligned normal to said path and to said side edge guide when on said bed at said treatment station to engage the trailing edge of a lift;

and intermittent drive means advancing said working stretches unidirectionally between stations and halting said working stretches temporarily with one pair of said lugs in predetermined position at said treatment station to register the trailing edge of the lift being advanced thereby;

a leading edge jogger pivoted to said machine below said path in rear of said treatment station;

means for pivoting said jogger upwardly above said path and rearwardly toward the pair of lugs halted at said station for engaging and aligning the leading edge of the lift halted at said station;

longitudinal edge registration means associated with said working stretches, said means comprising:

an upstanding side edge gauge extension extending

longitudinally along one side of said path, parallel to said working stretches from said lift deposit station to, and coplanar with, said side edge guide for engaging and guiding one side edge of the lifts being advanced by said lugs;

and a frame, associated with said conveyor, tilting the plane of said working stretches, and the plane of the bed of said machine, on a longitudinal axis downwardly toward said side edge guide to cause gravity to register the side edge of said lifts thereon, in advance of, and at, said treatment station.

6. Apparatus for feeding lifts of paper sheets to the bed of an automatic paper treatment machine having a side edge guide said apparatus comprising:

an endless conveyor including a pair of laterally spaced, chains having parallel working stretches extending along a path through a lift deposit station, a treatment station on said bed and a lift discharge station;

lateral edge registration means associated with said conveyor, said means comprising:

a plurality of pairs of registration lugs spaced around said conveyor, each pair of lugs being laterally aligned normal to said path and to said side edge guide when on said bed at said treatment station to engage the trailing lateral edge of a lift;

and intermittent drive means advancing said working stretches undirectionally between stations and halting said working stretches temporarily with one pair of said lugs in predetermined position at said treatment station to register the lateral trailing edge of the lift being advanced thereby;

and longitudinal edge registration means, associated with said conveyor, said means comprising:

an upstanding side edge gauge extension extending longitudinally along one side of said path, parallel to said working stretches from said lift deposit station to, and coplanar with, said side edge guide for engaging and guiding one side edge of the lifts being advanced by said lugs;

a frame, associated with said conveyor, tilting the plane of said stretches, and the plane of the bed of said machine on a longitudinal axis downwardly toward said side edge gauge to cause gravity to register the longitudinal edge of said lifts thereon in advance of and at treatment station;

and an electric control circuit including a source of current, a switch closed by the presence of a lift at said treatment station, a switch closed by the halting of said conveyor and a solenoid actuating said automatic paper treatment machine;

whereby said solenoid is energized only when said conveyor is halted with a lift at said treatment station.

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