

Nov. 22, 1932.

R. KLEMM

1,888,271

METHOD OF AND MECHANISM FOR AUTOMATICALLY FEEDING INDIVIDUAL
SIGNATURES INTO A SIGNATURE HANDLING MACHINE

Filed Nov. 3 1930

10 Sheets-Sheet 1

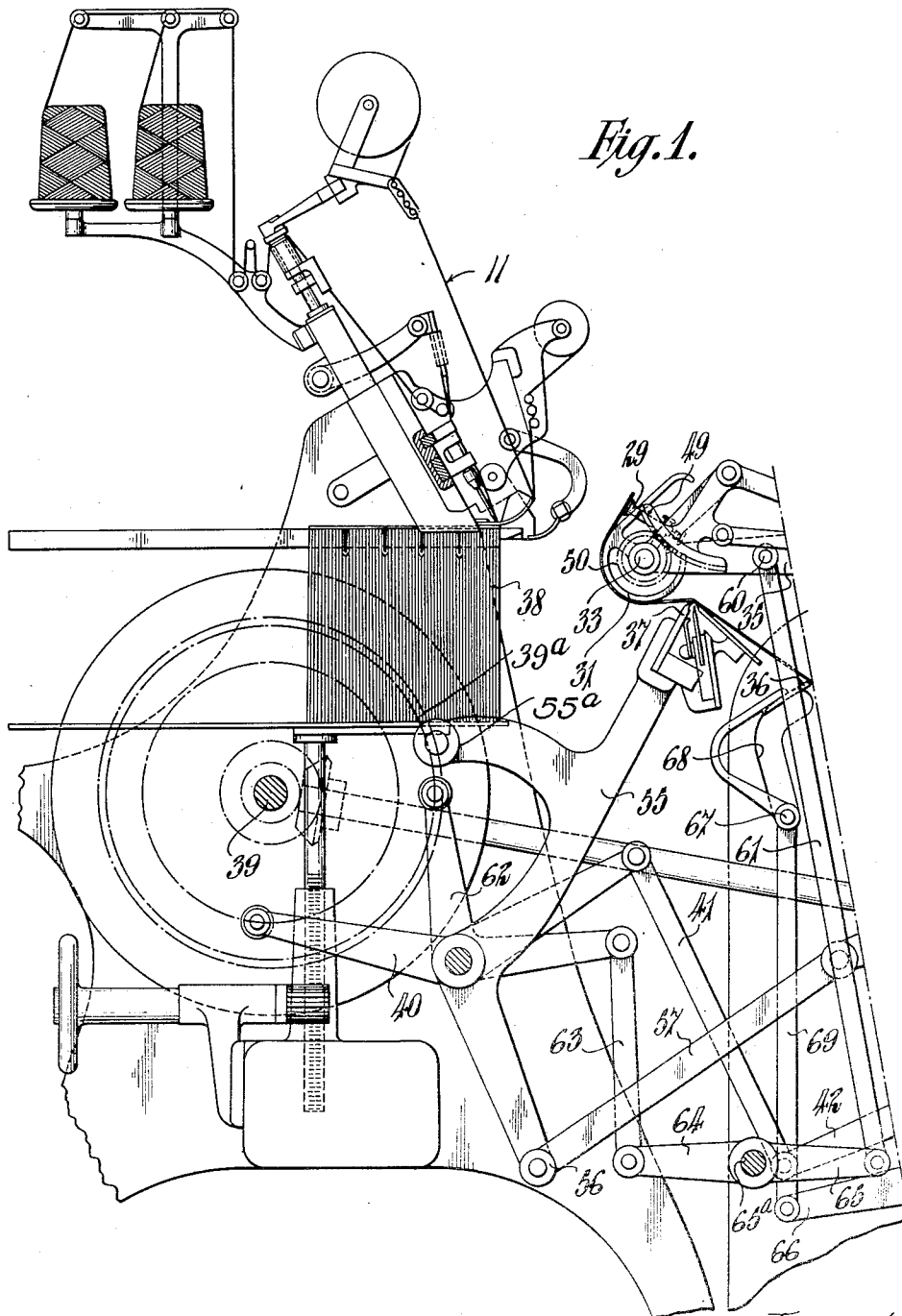


Fig. 1.

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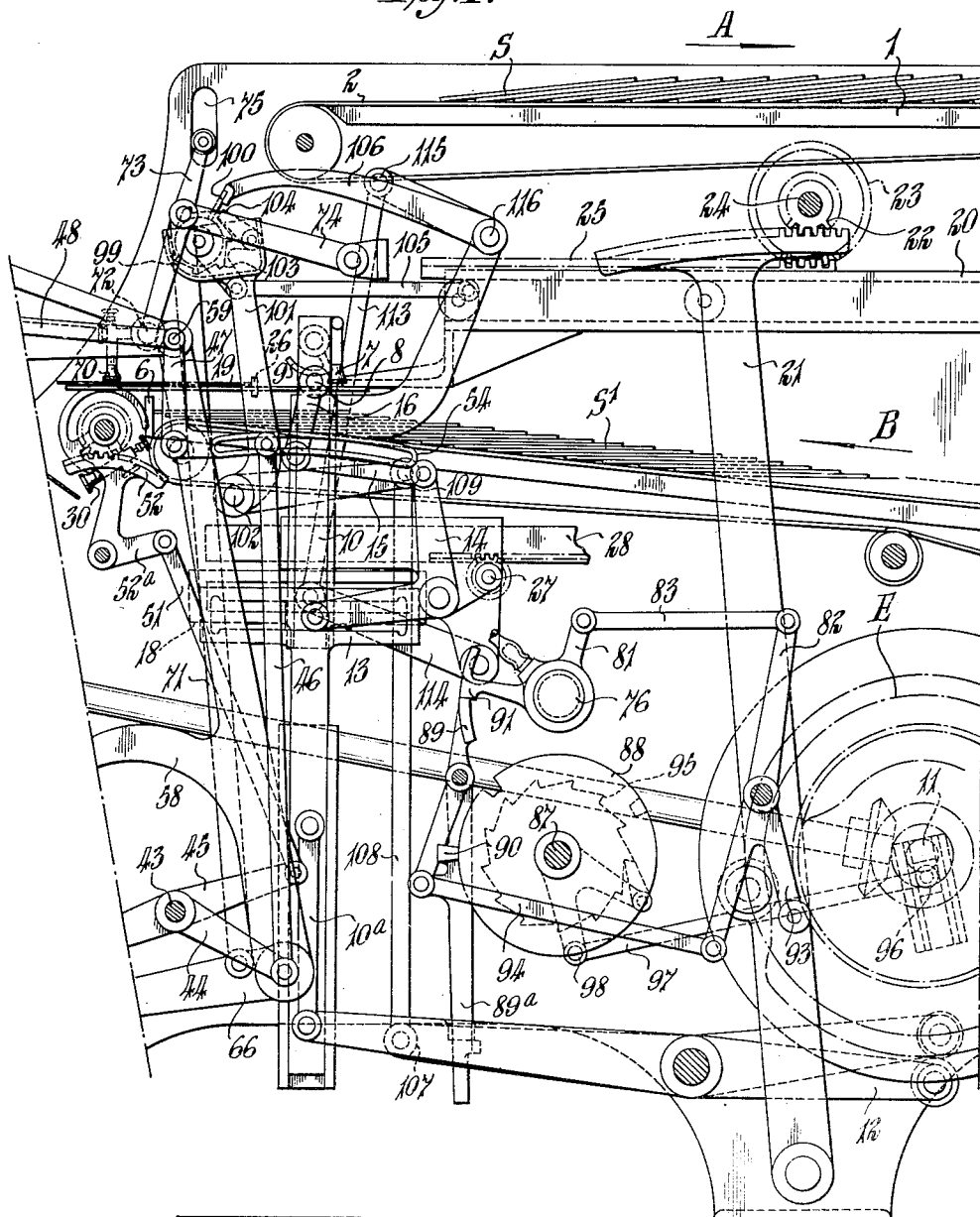
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10 Sheets-Sheet 2

Fig. 1.



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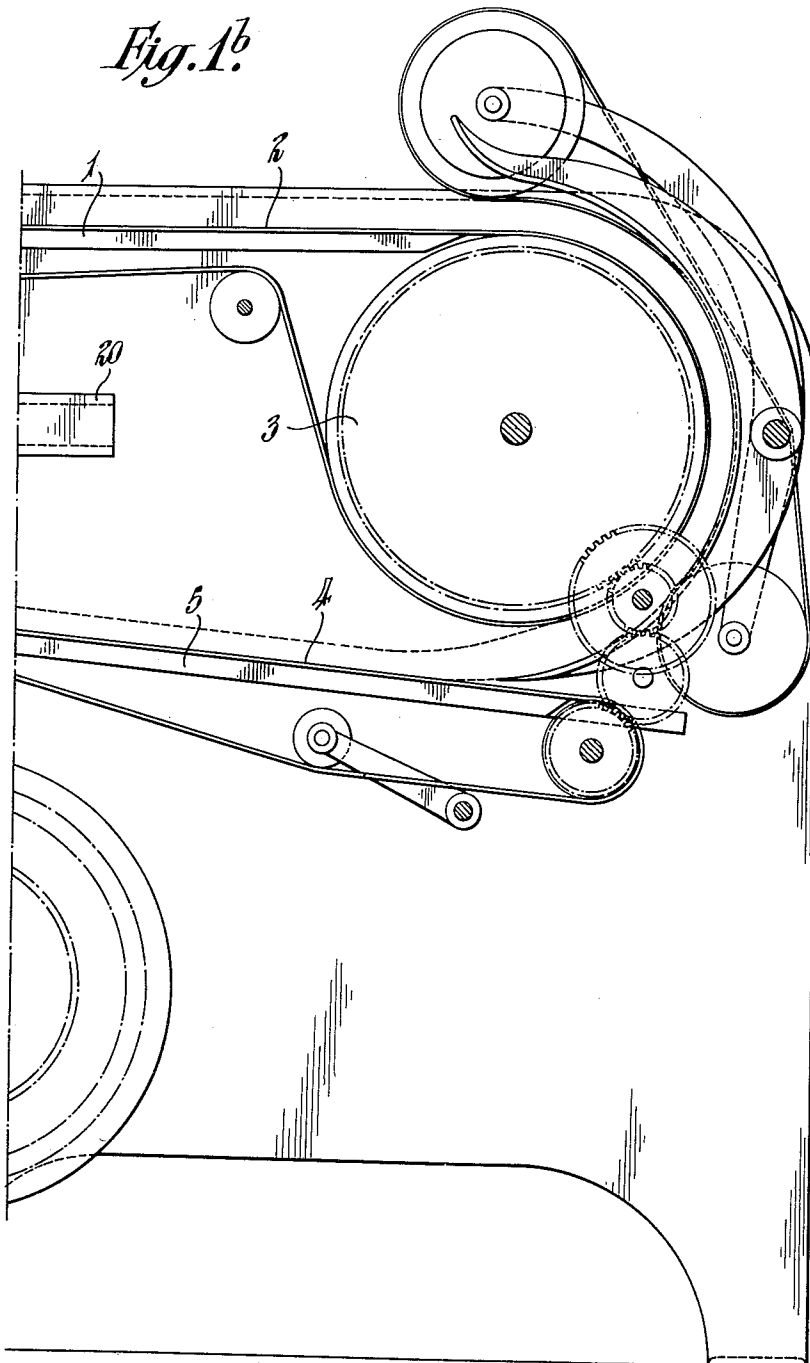
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10 Sheets-Sheet 3

Fig. 1^b



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10 Sheets-Sheet 4

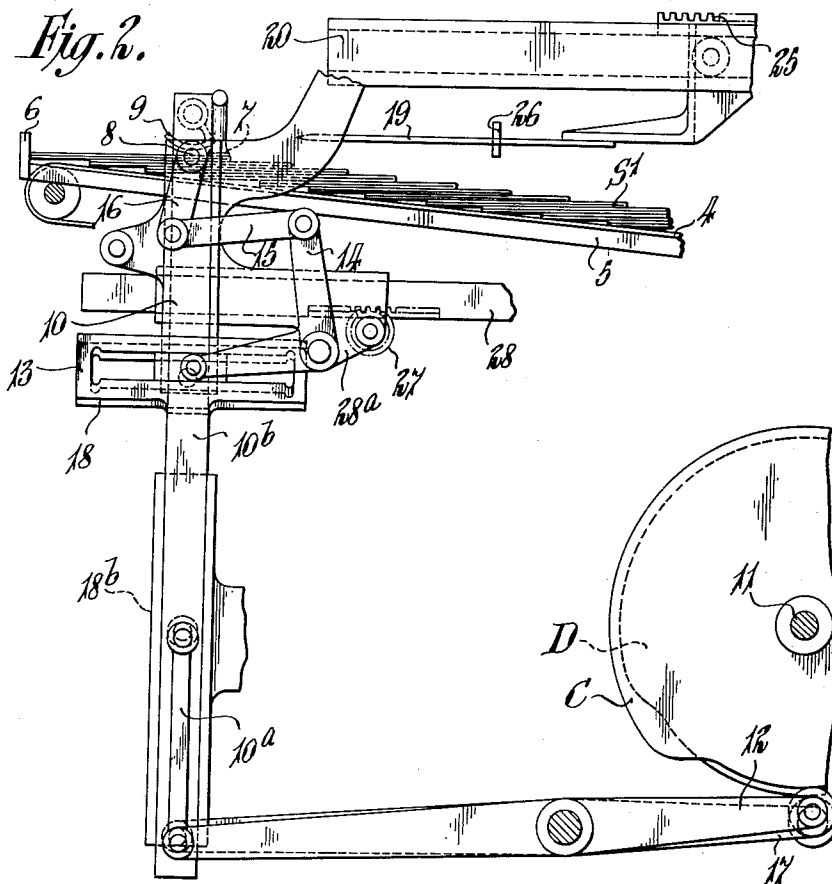
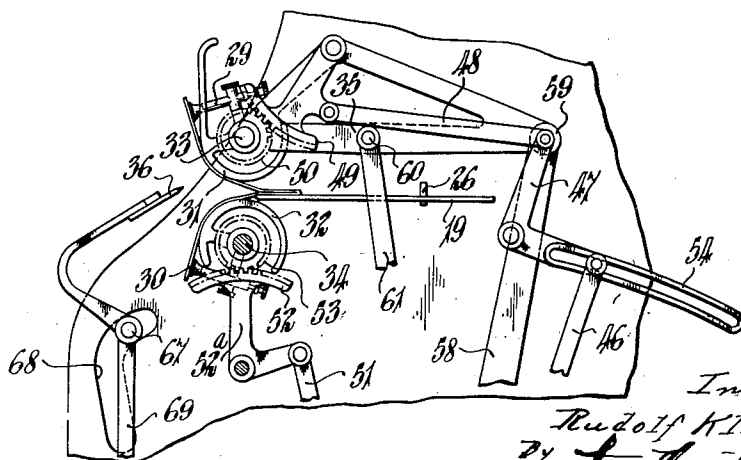


Fig. 6.



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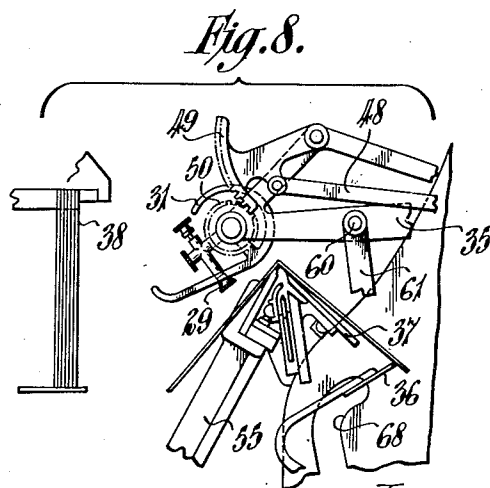
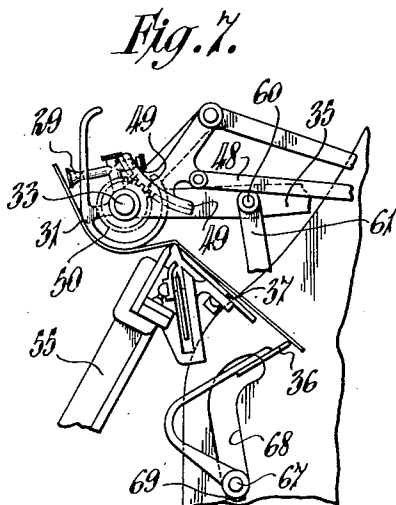
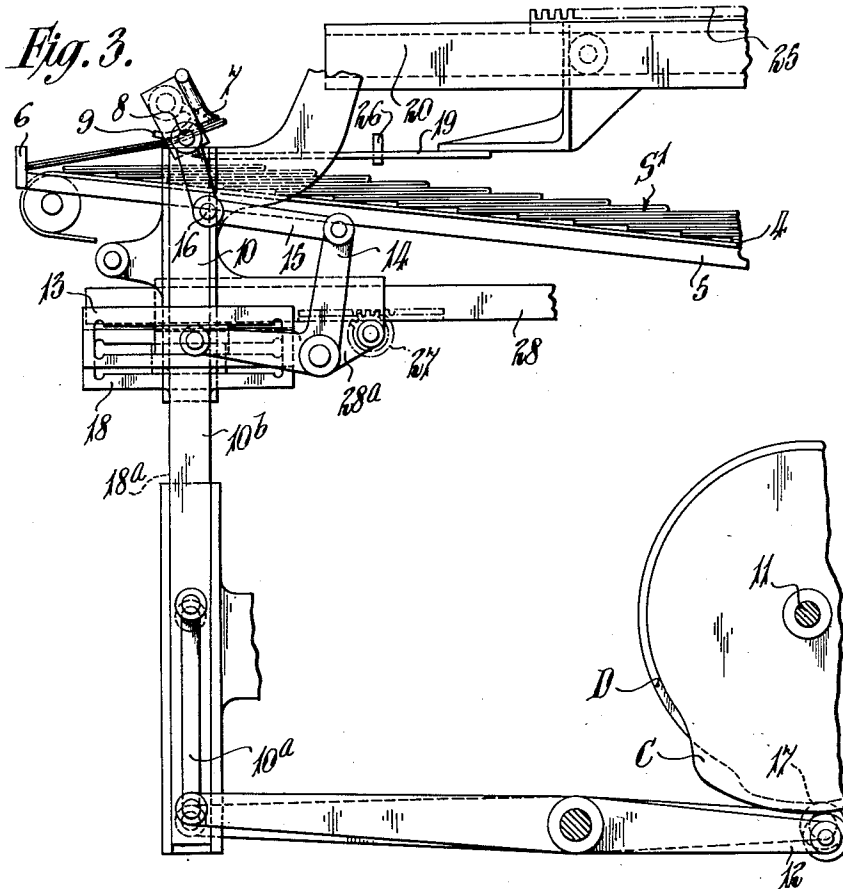
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10 Sheets-Sheet 5



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10 Sheets-Sheet 6

Fig. 4.

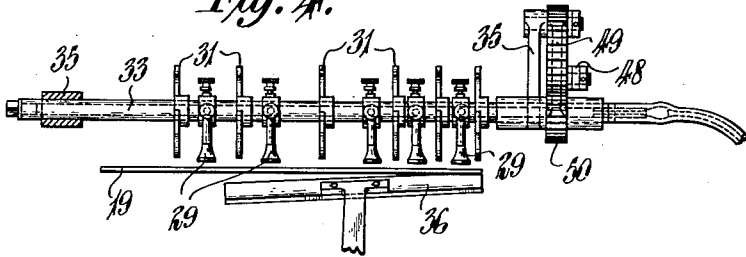
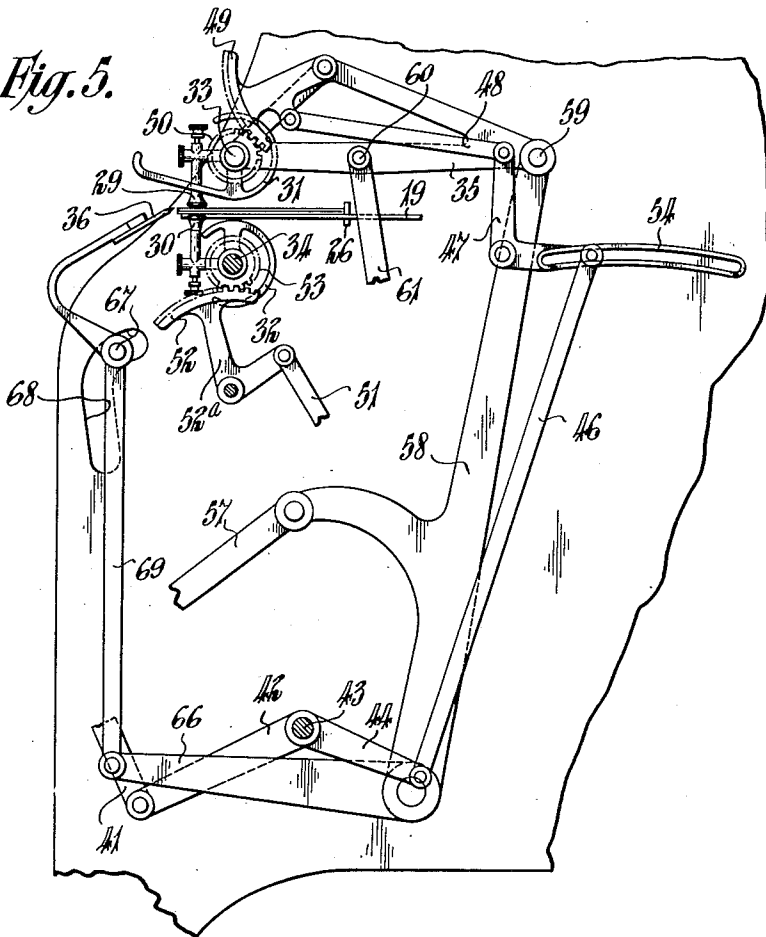


Fig. 5.



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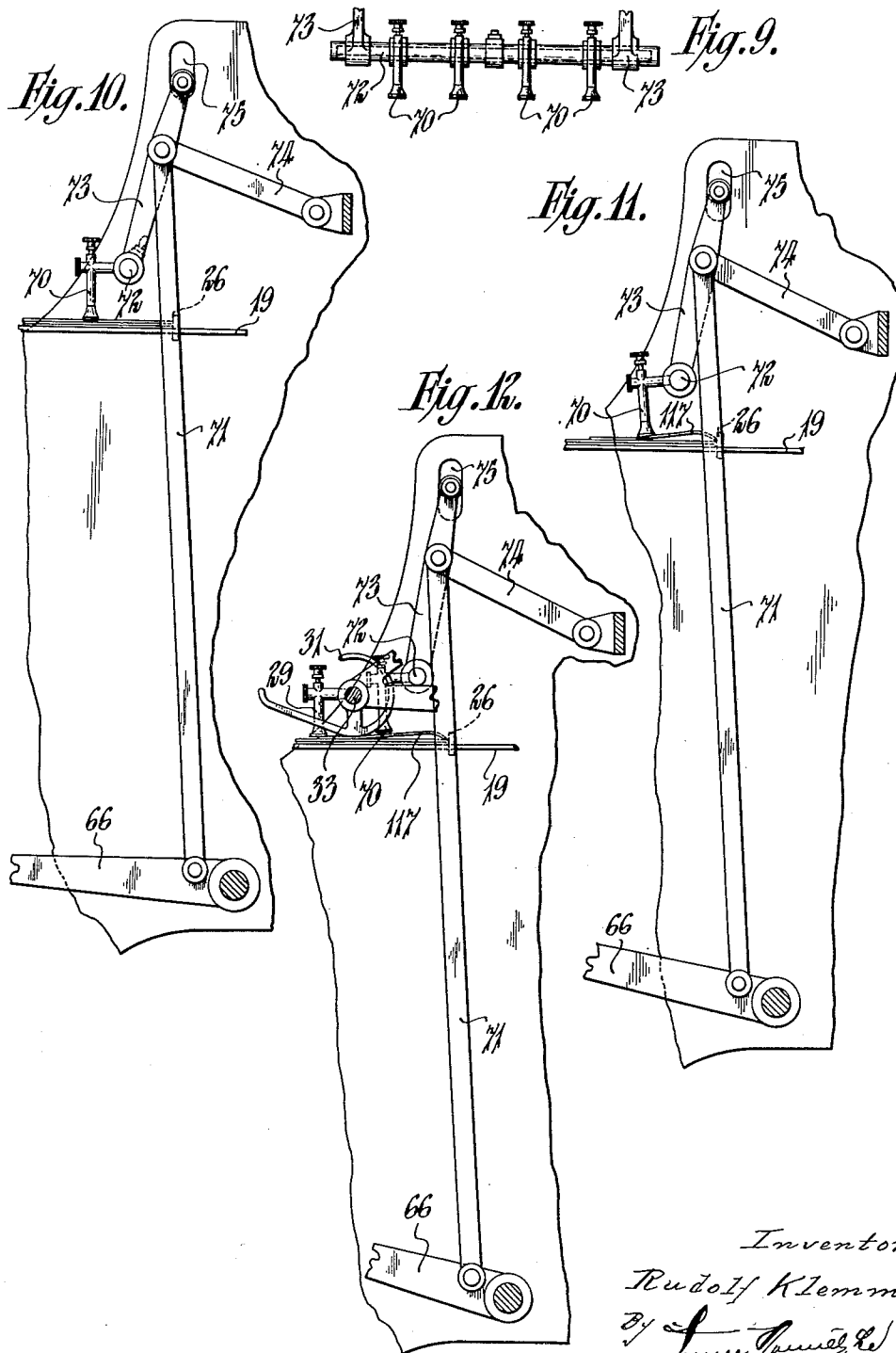
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10 Sheets-Sheet 7



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10 Sheets-Sheet 8

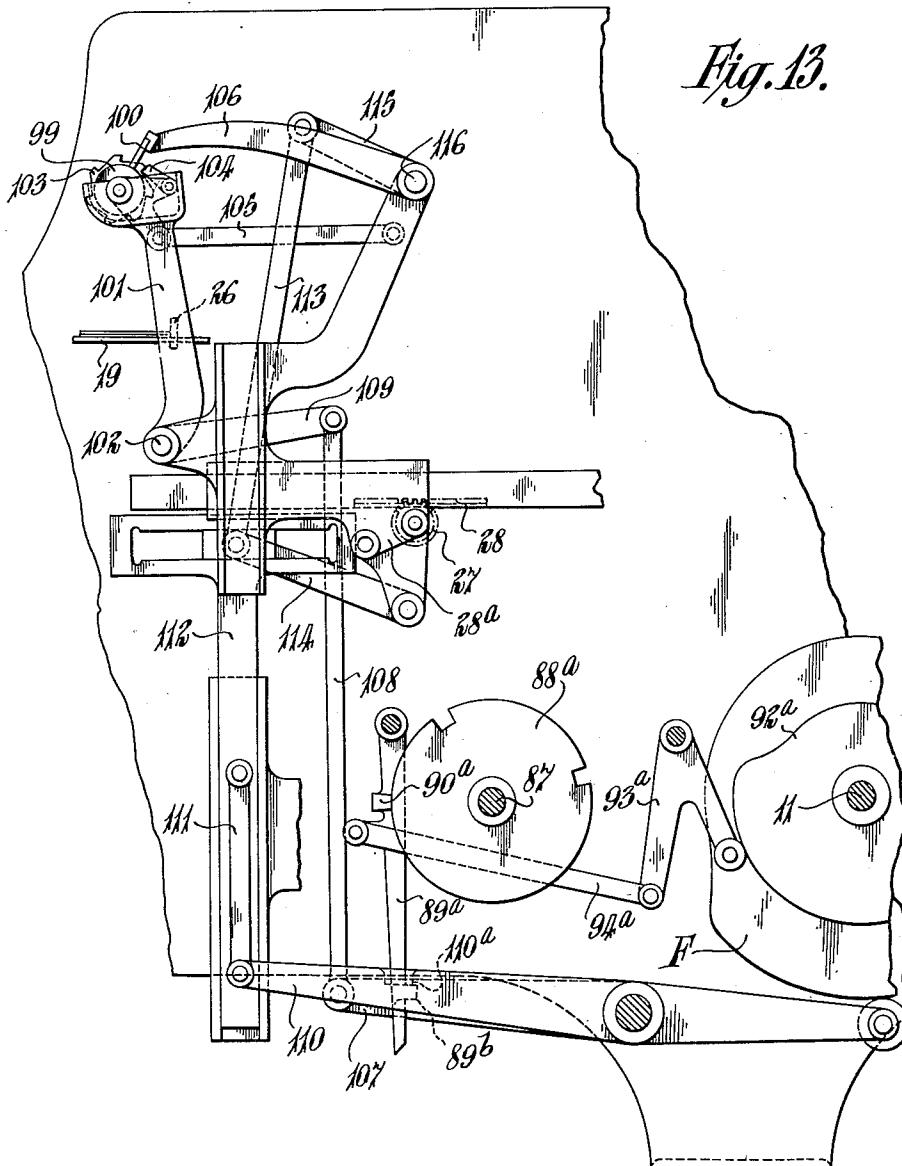


Fig. 13.

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10 Sheets-Sheet 9

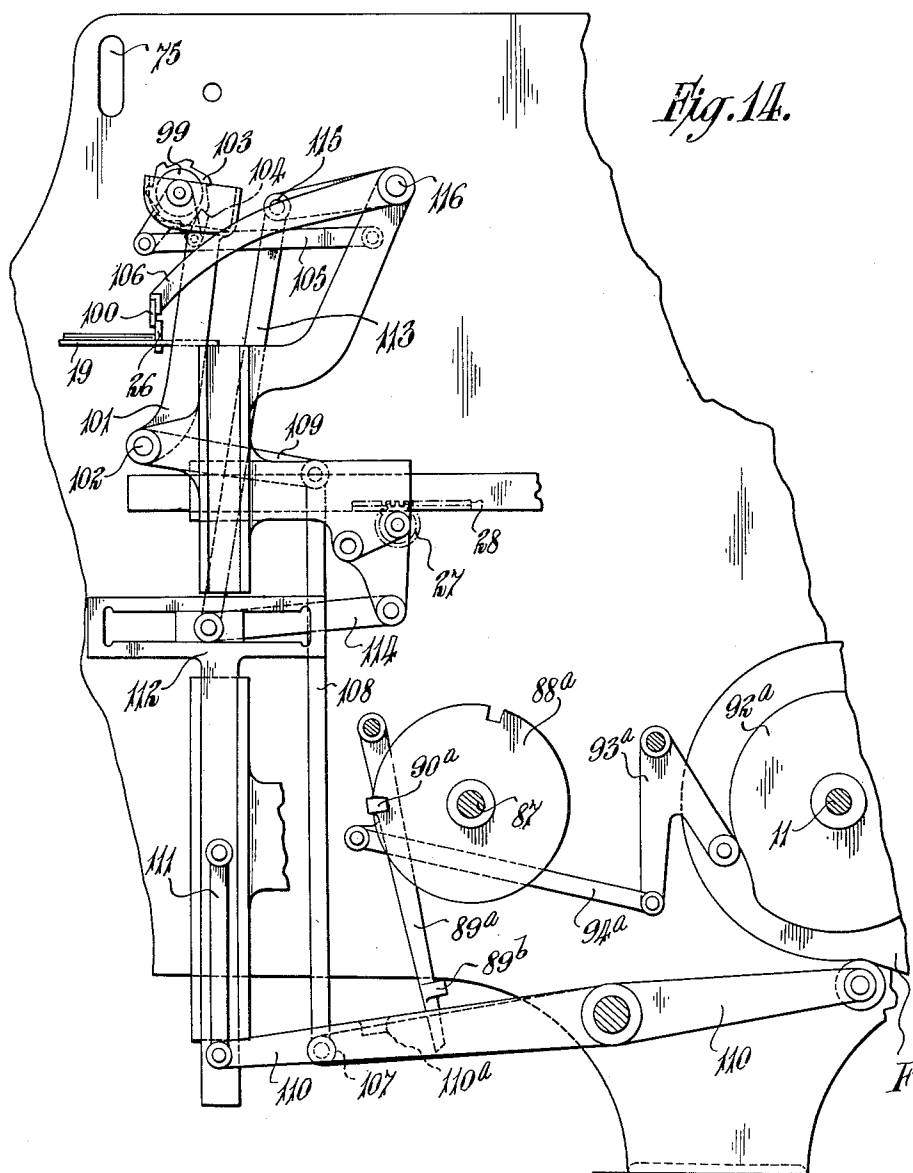


Fig. 14.

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METHOD OF AND MECHANISM FOR AUTOMATICALLY FEEDING INDIVIDUAL
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10 Sheets-Sheet 10

Fig. 15.

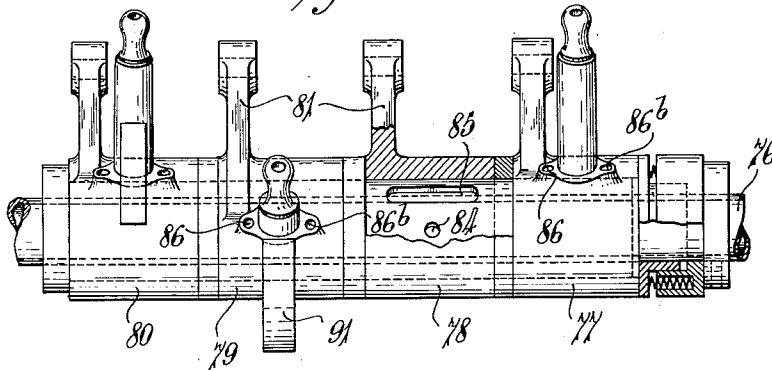
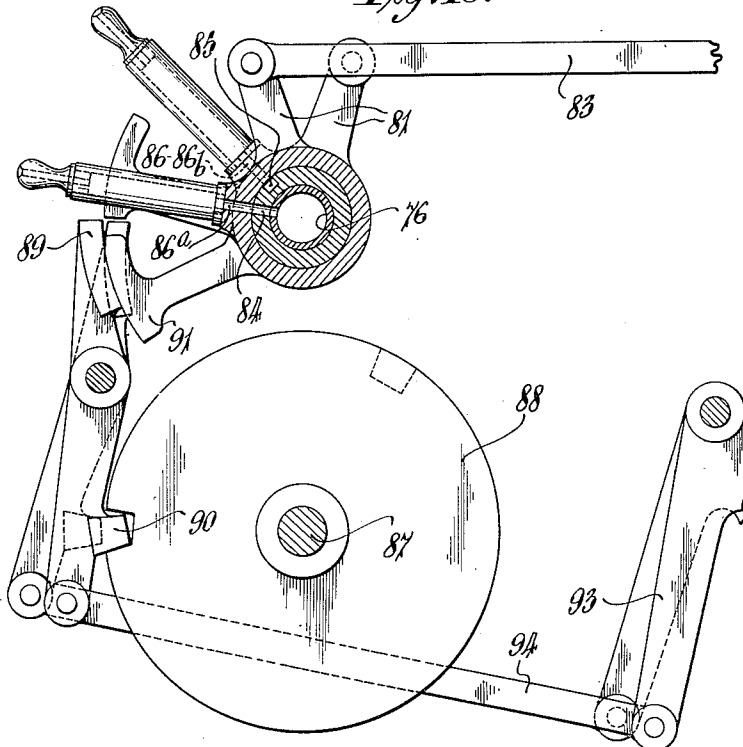


Fig. 16.



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UNITED STATES PATENT OFFICE

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METHOD OF AND MECHANISM FOR AUTOMATICALLY FEEDING INDIVIDUAL
SIGNATURES INTO A SIGNATURE-HANDLING MACHINE

Application filed November 3, 1930, Serial No. 493,114, and in Germany May 8, 1930.

The present invention relates to signature handling machines and is more particularly concerned with the method of and mechanism for automatically feeding signatures to such machines.

The object of the invention is to provide for the automatic positioning of folded signatures in close piled formation for their further handling and is adapted for use in all cases where the signatures are conveyed individually and straddlewise to be thereafter subjected to some further operation.

According to this invention a method of automatically supplying folded signatures in close piled formation to a signature operating machine is carried into effect by mechanism whereby the upper and lower leaves or sections of a signature separated from a fanned-out bank are seized by one or more rotatable and intermittently moved suction members opened by the inverse rotation of the latter and thereafter turned about the edge of one section and placed straddlewise on a table or like support for further handling.

The above described method may be used for instance for feeding individual already gathered layers successively into wire stitching machines or thread sewing machines and, by way of example, the utility of the invention is herein described in association with a thread binding machine, since the latter necessitates certain constructive developments which lie within the scope of the invention and for that reason are to be included therewith. By so incorporating the invention, however, the scope of the application of the latter should not be deemed to be exhausted. In the place of an oscillating saddle upon which the straddling layers are conveyed to the stitching machines, use could be made, for instance, of a chain onto which the layers conveyed to it by this method are placed in an opened-out position for their further handling.

The application of this method of sheet feed to thread binding machines may, in some cases, call for the use of further controlling mechanism so that, for example, after each completed book-stitching operation an idle stitch is made (a so-called "blind" stitch) in

order to enable a full stitch to be present in the last layer after cutting away the stitched book from the stitcher head. To this end it is necessary, at a suitable moment, to interrupt the suction, applied as hereinafter described, by a mechanically controlled operation of the automatic sheet-feed mechanism of the machine.

When the layers or signatures, to be handled by this method, are provided with pre-pasted top sheets, as is known in the art, it is necessary to provide means for opening out the layer so that seizure by the lifting suction members takes place not only of the top sheet but also of the upper leaf or section of the layer. During the feed of the sheets this is effected by the use of an auxiliary suction member by which the top sheet is somewhat retracted to enable the lifting sucker to seize, side by side with the top sheet, also the layer proper by the portion thereof thus exposed. Since these special top sheets only occur at each end of the book, i. e. on the first and last layer, as is the case also with the "blind" stitch above referred to, the devices requisite for their manipulation may be either operable by hand at the requisite moment or, as shown in the constructional example herein to be described mechanically operated by adjustable and periodically operated devices.

The scope of this method of sheet feed to stitching machines must be deemed to include, moreover, in addition, means for providing the last sheet of each assembled book with a strip of adhesive along its folded edge in order to impart to the book a firmer hold in the binding. To this end provision is made of an adjustable glueing mechanism actuated in cycle with the sheet feed mechanism and which must be operated likewise periodically.

The invention is illustrated in the accompanying drawings in association with a thread binding machine in which:

Figs. 1, 1a and 1b show in side elevation the automatic sheet feeding mechanism in a thread binding machine.

Fig. 2 is a fragmentary view showing a sheet-lifting sucker in the gripping position.

Fig. 3 is a similar view showing the same

sucker after bending and lifting the folded edge of a signature.

Fig. 4 shows, in end elevation, the top opening-out suckers.

Fig. 5 shows in side elevation the upper and lower opening-out suckers and actuating mechanism in the engaging or sucking position.

Fig. 6 is a view of the upper and lower opening-out suckers in the act of opening out the signature engaged thereby.

Fig. 7 shows the upper opening-out suckers and separating blade positioned to transfer the signature to the stitching blade of the thread binding machine.

Fig. 8 shows the signature positioned upon the stitching blade after being released by the upper opening-out suckers.

Fig. 9 is a front elevation of the top-sheet suckers.

Fig. 10 shows a top-sheet sucker and the controlling mechanism thereof with the sucker engaging the top sheet.

Fig. 11 shows the top sheet retracted by the sucker mechanism.

Fig. 12 is a view of the upper opening-out sucker engaging the top sheet and simultaneously the upper leaf of the signature.

Fig. 13 is a view of the pasting device and controlling mechanism therefor in the locked operative position.

Fig. 14 is a similar view showing the pasting device in operation.

Fig. 15 shows the arrangement of the suction control mechanism, and

Fig. 16 is a part sectional elevation of the suction control mechanism.

The signatures S to be automatically fed to the thread-binding machine are, by preference, banked in a fanned out condition in a known manner as illustrated in Fig. 1a. They are placed on the conveyor bands 2 which latter act in conjunction with the upper feed table 1, and are arranged so that their folds are at the bottom (directed to the left in Fig. 1).

The conveyor bands 2 travelling in the direction of the arrow "A", are driven in a known manner over a drum 3 (Fig. 1b) and transfer the signatures S by means of suitable sheet-guiding arrangements, to the conveyors 4 running over the lower table 5 towards the sheet separating mechanism in the direction of the arrow B. Owing to the change in the direction of travel of the signatures the latter, on reaching the table 5 as shown at S', have the folded edge thereof at the top (to the right), the open end of each signature being thus directed towards the separating device (Fig. 1). The lower feed table 5 and conveyor belts 4 are inclined to the horizontal so that the piled signatures are conveyed to the sheet-separating device in a substantially horizontal position. At the end of the lower conveyor table 5, the signatures

come to rest against a stationary abutment 6 (Fig. 1a). From the position thus determined by the abutment 6 the sheets are raised individually from the bank and then conveyed to the opening-out devices (Figs. 1, and 4 to 8) by which they are opened out and transferred to the thread binding machine.

The raising of the individual layers or signatures from the bank is effected by bending the fold along its whole length, lifting the signature along the fold and inserting a plate or table 19 into the space between the raised signature and bank. The bending of the fold is effected by suction nozzles or lifting suckers 7 which are rotatably journaled about a pivotal shaft 8 and are aided by oscillable curved guide members 9 (Figs. 1, 2 and 3). The raising of the signature is effected by the upward movement of slide bars 10 which carry the pivots 8 and thereby lift the suckers 7 together with the adhering signature (Fig. 3). The movement of the mechanism for the bending of the fold is initiated by a cam C mounted on the cam shaft 11. The cam C engages a follower roller carried by a lever 12 which later is pivoted intermediate its length and is connected, by means of a connecting rod 10a, to a vertically movable guide rod 10b carrying a cross head 13. The latter member is engaged by one arm of a bell crank lever 14 which is pivotally mounted upon a horizontally slidable supporting member 28a. The other arm of the bell crank lever is linked by a connecting rod 15 to an oscillable lever 16 which is also mounted on the shaft 8 and rigidly secured to the sheet lifting members 7, 8 and 9. In this manner the latter members are caused to turn about the pivot 8 and so bend the attached edge of the signature.

The movement of the mechanism for the lifting of the signature is brought about in a similar manner by a cam D on the cam shaft 11. The cam D engages a follower roller carried by a lever 17 which latter is pivoted intermediate its length and is connected to a vertically movable guide rod 18a carrying a slotted guide or cross-head 18 with which the slide bars 10 adjustably engage. The slide bars 10 are slidably supported by the member 28a.

The table 19, Figs. 1, 2 and 3, which moves forward to support the raised signature after the horizontal displacement of the latter, then carries it forward to the sheet-opening means. The table is supported from a frame which is journaled on rollers set in guides 20 and receives its movement from a cam E on the cam shaft 11. The cam E engages a toothed segment lever 21 pivoted to the main frame of the machine. Gear wheels 22 and 23 keyed to the shaft 24 engage respectively, the toothed segment and a toothed rack 25 attached to the frame of the table 19, Fig. 1. After the table 19, in its forward movement,

has reached the abutment 6 the signature is released by the suckers 7 and so deposited on the table with the fold lying against an adjustable stop 26 for its further conveyance.

5 The stop 26 (Figs. 1, 2 and 3) is adjustable according to the width of the signature to be handled. The travel of the table 19 is longitudinally invariable and signatures of equal size positioned against the stop 26 are thus
10 always carried with their fold to the same precise position relatively to the opening-out mechanism (Figs. 4 to 8). As the signatures must be seized by the suckers 7 (Fig. 2) at a short distance from the fold, it is necessary to adjust the position of the bending
15 and lifting mechanism according to the size of the signatures. The adjustment of these parts is effected jointly by rotation of the toothed gear 27, mounted on the member 28a and engaging with the toothed guide rail 28 (Figs. 1, 2 and 3). The member 28a which carries the slide bar 10 and suckers 7, is slidably mounted upon the guide rail 28 and by the rotation of the gear wheel 27, is traversed to the position required according to the
20 size of the signature.

At the end of the forward movement of the table 19 the open edge of the signature, raised from the bank, is brought between the upper
25 opening-out nozzles 29 and the lower opening-out nozzles 30 (Fig. 5). These opening-out nozzles 29, 30, being in vertical juxtaposition, seize the signature from above and below close to the forward or open edge thereof.
30 The table 19, at that part at which the lower opening-out nozzles are located when the table is in this position, is provided with slots enabling the nozzles to pass through to the table surface and so engage the signature.
35 The suction nozzles 29 and 30, together with their sheet-guiding members 31 and 32 are securely mounted on rotatable suction pipes 33 and 34 respectively, (Figs. 4 to 8). The upper suction pipe 33 is rotatably journaled
40 in the extremities of horizontal carrier brackets 35 and is adapted to perform therewith, specially controlled vertical and horizontal movements. Prior to the attachment of the signature to the upper and lower opening-out nozzles 29 and 30, the latter are rotated so that the mouthpieces of these nozzles are in the horizontal engaging position (Fig. 5). The nozzles 29 are moved down
45 vertically until they and the lower nozzles 30 exert a slight pressure, from above and below, upon the signature. In this position suction is exerted both on the upper and lower leaves or sections of the signature. The upper sucker now parts the sections by a slight vertical upward movement. At the end of this
50 upper movement of the signature and the upper sucker, the opening out both of the upper and of the lower sheets of the signature takes place simultaneously by the rotation of the upper and lower suction pipes
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(Fig. 6). The opening out of both sections is effected with equal velocity and the leaves or sections suitably guided onto the upper and lower guide straps 31 and 32. By preference, the suction nozzles are so distributed
60 that one nozzle and one lay strap operates above and below as close as possible to the lateral edge of the signature.

By the opening out of the signatures, the falling apart of a thin, multiple cross-folded signature in its further transit to the blade 37 (Fig. 1) of the thread binding machine is prevented. In order to secure a correct opening and passing on of the signature and to prevent the inner sheets from falling out, the separating blade 36 (Figs. 5 and 6) is arranged in front of the forward edge of the signature.
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The blade 36 is movable in an upward and downward direction and during the opening out of the signature assumes a position in which its edge is level with the fold of the signature. Moreover, the blade is inclined towards the forward edge of the signature so as to be as close as possible to the fold of the latter. By this arrangement of the blade, the inner sheets of a signature, formed from thin paper that may have become fanned out, are safely supported on the upper edge of the blade until they are taken up by the stitcher blade 37 (Fig. 7). After the opening out of the signature, the upper suction pipe 33 carrying the suckers 29 is moved towards the stitcher blade 37 and over-runs the upper edge of the latter until the fold line of the opened-out signature is positioned precisely on the upper edge of the blade 37 (Fig. 7). As the positions of the upper suction pipe 33 and of the blade 37 are precisely limited it is necessary, in the opening out of the signature, for the fold thereof to be arranged at a definite distance relative to the centre of the suction pipe 33 in order to prevent the fold from being carried too far either to the front or the rear of the upper edge of the blade during the transference of the sheet to the blade. During the travel of the suction pipe over the upper edge of the blade, the suction pipe moves downwardly so that the curved lay straps 31, in passing the signature on to the blade, lie with their curvature below the upper edge of the latter, thus causing the signature to overhang on the blade.
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In this position the suction nozzles 29 are caused to release the signature and the lay straps 31 are rotated inversely to their direction of rotation when opening the signature so that the tangential terminals of the lay straps 31 push the released section of the signature into the space between the blade and the stacker trough 38 (Fig. 8). The suction nozzles 30 release the lower section of the signature a little earlier, i. e. when the signature, during its conveyance to the blade 37,
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has been completely opened between the rotated upper and lower suction nozzles.

During the conveyance of the signature to the blade 37, the separating blade 36 is moved downwardly in a slightly oblique path of travel, and in this movement, as the lower section of the signature must glide over the edge of the separating knife this section of the signature is held open and prevented from drooping as shown in Figs. 7 and 8, the blade 36 thereby assisting the correct positioning of the signatures on the upper edge of the blade 37. The rotation of the suction pipes 33, 34 and of the suction nozzles 29 and 30 as well as of the lay straps 31 and 32 for opening out the signature is initiated by a cam disc on the cam shaft 39 (Fig. 1). The throw of the cam is transmitted through a bell crank roller lever 40, connected by means of a rod 41 to a lever 42 rigidly mounted on a shaft 43 (Fig. 1) and also mounted on the latter connected to the lever 42 are levers 44 and 45. The lever 44 transmits its movement to the upper suction pipe 33 through a connecting rod 46 adjustably connected to a bell crank lever 47, which latter is linked by a connecting rod 48 to a toothed segment 49 engaging a toothed wheel 50 (Figs. 1 and 5). The toothed wheel 50 is rigidly mounted upon the pipe 33 and so rotates the latter together with the suction nozzles 29 and straps 31. The lever 45 transmits its movement to the lower suction pipe 34 through a connecting rod 51, connected to a bell crank lever 52a carrying a toothed segment 25 which engages a toothed wheel 53. The member 53 is rigidly mounted upon the pipe 34 and so rotates the latter together with the nozzles 30 and straps 32.

As already mentioned, in the positioning of the signature on the straps 31 the fold line of the signature must be maintained at the same distance from the centre of the suction pipe irrespective of the size of the signature being thus handled. In order to attain this, it is necessary to vary the throw of the toothed section 49 (Fig. 5) according to the particular width of a signature. The regulation of the throw of the toothed segment is effected by adjusting the point of attachment of the connecting rod 46 in the slotted shank 54 of the bell crank lever 47 (Figs. 1 and 5). For a signature of greater width the point of attachment of the rod 46 should be nearer to the fulcrum of the bell crank lever 47 and for a signature of narrower width it is set so as to be more remote from said fulcrum. The toothed wheel 50 is adjustably connected with the suction pipe 33 and the suction nozzles must be adjusted for each variation of the throw of the toothed segment 49 by a rotation of the suction pipe in the hub of the toothed wheel 50 (Fig. 4) so that the mouth of each suction nozzle is horizontal when about to engage the signature (Fig. 5).

The horizontal movement of the carrier arms 35 and the suction pipe 33, whereby the signature is conveyed to the blade 37, is effected positively with the movement of the arms 55 carrying the blade 37. The latter is moved in known manner from a cam on the cam shaft 39 (Fig. 1). This movement is briefly as follows:

An offset portion of one or both carrier arms 55 has rotatably mounted thereon a cam roller or follower 55a which is adapted to engage in and follow the contour of a cam slot formed in a disc 39a mounted on the drive shaft 39.

It is obvious that the rotation of the cam slotted disc 39a will oscillate the stitcher blade 37 and so cause the latter to place each signature carried thereby in turn under the stitcher head H and against the last stitched signature of the assembled book-pad 38. If the signature is provided, prior to such assembly with a strip of adhesive near one folded edge thereof as will hereinafter be described, it will become attached to the adjacent previously stitched signature and in common with all of the signatures forming the book-pad will thereupon be stitched by the usual stitching needles associated with the stitcher head H but not herein described or shown in the accompanying drawings.

When the signature carried by the stitching blade 37 is assembled with and attached to the previously assembled book-pad 38 the stitcher blade, in the course of its above described oscillatory movement, draws away from the pad and by lifting during this movement the outer leaf of the folded sheet or signature frees itself from the last attached signature. The pivoted lever arms 55 are connected at 56, by a connecting rod 57, with the rocking levers 58. The latter are rotatably connected at 59 to the carrier arms 35 (Figs. 1-5). The carrier arms 35 are supported at 60 in a rotatable manner by connecting rods 61 (Fig. 1) through which vertical movement is imparted to the carrier arms 35. This vertical movement of the carrier arms 35 is initiated by a cam on the cam shaft 39 (Fig. 1). The latter engages a roller carried by one arm of a bell crank lever 62, the other arm of which is connected by means of a connecting rod 63 to a lever 64 which is mounted together with a lever 65 on a shaft 65a. The latter lever is linked to the arms 35 by the connecting rod 61.

The separating blade 36 is also positively moved up and down by the movement of the blade 37 through levers 66 (Figs. 1 and 5) which are connected with the rocking levers 58 by being rigidly mounted on the same shaft as the latter. The blade 36 is journalled on the displaceable shaft 67 and can be adjusted thereon according to the level of the signature. The shaft 67 is guided by rollers in a guide slot 68 (Figs. 1, 5 and 6).

and is connected to the levers 66 by connecting rods 69. The connecting rods 69 are rigidly connected to the shaft 67 but pivotally connected to the levers 66.

lifting suckers and the auxiliary suckers respectively. Each sleeve is adapted to be connected with its respective suckers through the conduits above mentioned.

The first and the last signature of the book is, in most cases, provided with so-called foreset sheets 117 (Figs. 11 and 12). These sheets 117 are connected to the signature by a narrow strip of paste close to the fold. Since the sheet 117 of the top layer on the table 19 lies above the top section of the signature the upper suction nozzle 29 would be prevented from seizing the top section of the signature as it would contact with and seize the sheet 117. In order, therefore, to render possible the opening out of a signature provided with a foreset sheet, an auxiliary sucker 70 is employed (Figs. 9 and 10). This auxiliary sucker seizes the foreset sheet 117, prior to the return of the top opening-out suckers from the preceding operation, and retracts the forward edge of the foreset sheet sufficiently to enable the nozzles of the opening-out suckers to contact with their terminals partly on the signature and partly on the forward edge of the foreset sheet at the same time (Fig. 12).

The controlling sleeves are rotatably jour-
nalled upon re-enforcing flanged collars on
the vacuum pipe 76 and each is connected to
a controlling lever 81 (Fig. 15). The opera-
tive movement is imparted to each control-
ling sleeve from cams mounted on the cam
shaft 11 (Fig. 1a) in conjunction with a
roller lever 82, one arm of which is linked by
means of a connecting rod 83 to the lever 81.
In order to regulate the suction and release
periods of the sucker members the vacuum
pipe 76 is provided centrally in regard to the
longitudinal operating faces of the control-
ling sleeves and re-enforcing collars there-
for, which suction openings 84 (Fig. 16) and
the collars also provided with axially
arranged grooves 85, which latter do not com-
municate with the vacuum pipe. The con-
trolling sleeves 77, 78, 79 and 80 are each
provided with three radial openings 86, 86a
and 86b, which are arranged side by side in
the same longitudinal plane, the middle
opening 86a of the three openings to which,
in each case, a connecting nozzle and con-
duit leading to the suckers is attached, is in
the same radial plane as the corresponding
suction opening 84.

After the signature with its foreset sheet has, in this way, been seized by the opening-out sucker, the auxiliary sucker 70 is caused to release the foreset sheet and the opening-out operation takes place as in the case of the ordinary intermediate signatures.

The actuation of the auxiliary sucker is effected positively also from the movement of the blade 37 by linking the suckers 70 to the levers 66 (Fig. 10). The sucking nozzles are rigidly connected to a suction pipe 72 which is journaled in a pendulum lever 73. The latter is pivotally connected to an oscillating lever 74 and at its upper end is provided with a roller which is guided in stationary slot guides 75 (Figs. 10, 11 and 12). Connecting rods 71 serve to link the levers 66, 73 and 74. Through this link-motion device the movement of the connecting rod 71 imparts an oblique rearwardly rising motion to the sucker nozzles 70 (Fig. 11). By reason of the sheet lay stop 26, the signature is held stationary while the foreset sheet is retracted as shown.

During the suction period of each set of suckers the controlling sleeve thereof is so actuated as to cause the central opening 86a therein to coincide with the opening 84 communicating with the suction means. When the sleeve is in this position, suction is applied suddenly and intensively through the suckers and so cause the latter to seize the signature. When it is required to release the signature from the suckers, the controlling sleeve is rotated to bring the outer openings 86 and 86b into communication with the groove 85 in the collar mounted on the vacuum pipe. In this operation the vacuum pipe 76 first overruns the suction opening 84 thereby closing the latter while the signature is still held on the suckers by the vacuum maintained in the connecting hose. When the controlling sleeve has been rotated so far as to bring the openings 86 into register with the grooves 85, connection is established by the latter between the individual atmospheric openings 86 and 86b and the sucker conduit through the opening 86a. The signature is thus released from the sucker nozzles by the air inrush which destroys the vacuum existing in the connecting hose. The movement of the controlling sleeve 77 for the upper opening-out sucker as well as that of the controlling sleeve 78 for the lower opening-out sucker is effected as above described in continuity with the operation of the machine.

The four suction devices hereinbefore described, namely, the lifting sucker (Figs. 2 and 3), the upper opening sucker and the lower opening sucker (Fig. 5) and the auxiliary sucker (Fig. 10) are all connected by suitable conduits to a common vacuum pipe 76 (Fig. 1a) from which the suction-seizure and release of the signatures individually is positively controlled.

Arranged on the vacuum pipe 76 side by side (Figs. 15 and 16) are a controlling sleeve 77 for the upper opening-out suckers, a controlling sleeve 78 for the lower opening-out suckers and similar sleeves 79 and 80 for the

The movement of the controlling sleeve 79 for the lifting sucker 7 and of the controlling

sleeve 80 for the auxiliary sucker 70 are periodically interrupted according to an arbitrarily adjustable number of working cycles corresponding to the number of signatures of the book to be stitched.

The working cycle of the mechanism of the lifting sucker 7 is interrupted by one operation, after the stitching of the last signature of the book, for the execution of an idle stitch. The auxiliary sucker, however, is operated only during the handling of the first signature and works idly during the stitching of the remaining signatures and also during the idle stitch.

The automatic throwing in and out of operation of the suction controlling sleeves, during the stitching of a number of signatures constituting a book, is attained by a counting shaft 87 (Figs. 1a and 16). This counting shaft is fitted with notched discs 88 for controlling the lifting and the auxiliary suckers. Co-operating with these notched discs 88 are locking levers 89 (Figs. 1a and 16) provided with fingers 90 which latter engage the circumferential notches in the discs 88. The upper shank of each locking lever 89 serves for locking the movement of the controlling sleeve associated therewith by engaging a lug on the extremity of the lever 91 which latter forms part of the controlling sleeves. Each locking lever is actuated from a cam 92 on the cam shaft 11 which engages a cam follower carried by a lever 93 which latter is rigidly connected to the lever 82 (Fig. 1a). The arm 93 is linked by the connecting rod 94 to the lever 89. The latter is held against movement by the notched disc 88 and released when, during the rotation of the counting shaft 87, a finger 90 enters a notch in the disc. During the entry of the finger into the notched disc the controlling sleeve is liberated to the action of its drive, through the lever 82, and the suckers then in connection are operated.

In order to adapt the operating periods of the controlling sleeves to the number of the signatures of the book it is necessary to adjust the ratio of revolution of the counting shaft to that of the cam shaft according to the number of signatures to be stitched.

It is necessary also that the number of revolutions of the cam shaft during the stitching of a book should be equal to the number of signatures plus one revolution for the idle stitch. During this number of revolutions the counting shaft 87 must make one revolution. The adaptation of the rotation of the counting shaft 87 to the rotation of the cam shaft 11 is attained by the use on the counting shaft of an exchangeable ratchet wheel 95 having a number of teeth equal to the requisite number of revolutions of the cam shaft or divisible by it.

The actuation of the counting shaft 87 is effected from the cam shaft 11 by means of an

adjustable crank 96 (Fig. 1a), a pitman 97 and a pawl lever 98. The throw of the crank 96 must be adapted to the variable number of teeth on the ratchet wheel 95 employed.

For the purpose of relieving the binding stitch in the first and last signature of a book and for more securely holding the book in the binding the two first and the two last signatures are mutually connected by a strip of paste applied to the fold thereof.

To this end in the present instance the second and the last signature after removal from the lower bank table 5 and when in position on the transfer table 19 are automatically provided with a strip of paste. The paste is taken from a paste roller 99 (Fig. 13) by a paster bar 100 and applied to the signatures, above mentioned, by a downward motion of the paster bar 100 (Fig. 14). The periodical application of paste to the signature edge must likewise be controlled in accordance to the number of signatures forming the book and this is effected in a similar manner to that described in connection with the periodical functioning of the suckers.

The paster roller 99 is oscillably journaled at 102 by means of arms 101. It is oscillated in cycle with the above described operations of the machine to apply paste to the paster bar as required. In the oscillation of the paste roller the latter is rotated, by means of a ratchet wheel 103, mounted thereon and engaged by a pawl 104 carried by an actuating rod 105, so as to cause the roller to be constantly refreshed with paste when about to contact with the paster bar. The connecting rod 105 is pivoted on the bracket which supports the paster bar levers 106 so that with the linkage of the connecting rod 105 and the oscillation of the paste roller 99 about the pivot 102, the paste roller is intermittently advanced by the engagement of the ratchet 103 with the pawl 104.

The oscillation of the paste roller is initiated by a cam disc on the cam shaft 11 (Figs. 13 and 14) through roller lever 107, connecting rod 108 and link 109 which latter is rigidly connected to the supporting arms 101.

The paster roller 99 oscillates about the pivot 102 towards the pivot of the arms 106 until the path of travel of the paster bar 100 has been cleared (Fig. 14). The oscillation of the paster bar 100 is brought about by a cam F likewise mounted on the cam shaft 11 and adapted to actuate a roller lever 110 from which the movement is transmitted to a slotted guide or cross-head 112 by a connecting rod 111. Engaged in the guide 112 is a connecting rod 113 guided within the slot by means of a lever 114. The connecting rod 113 is connected to a lever 115 which is rigidly secured to the shaft 116 carrying the arms 106 thus transmitting the vertical movement of the slotted member 112 to the paster bar.

The cam actuated lever 110 is periodically

locked by the pivoted locking lever 89a which is operated from a cam 92a, mounted on the shaft 11 and engaging a crank lever 93a the latter being connected to the locking lever 89a by a connecting rod 94a. The lever 89a is associated with a notched disc 88a also mounted on the counting shaft 87 and carries a lug or finger 90a which is adapted to engage the notches provided on the perimeter of the disc 88a. The lever 89a is also provided at its lower extremity with a lug 89b which is caused to engage a lug 110a provided on the lever 110, when the lug 90a is not engaged in a notch on the disc 88a. In this manner, the lever 110 is held from following the movement of the cam F until the disc 88a is stepped round, according to the number of signatures handled, and so allows the lug 90a to enter one of the notches above referred to. The movement of the locking lever in so engaging the notch liberates the roller lever 110 and the application of paste by means of the paster bar 100 is then effected. The pasting device above described is adjusted in common with the lifting sucker 7 through the toothed wheel 27 and the toothed guide rail 28 according to the width of the signature as previously described. In this constructional form which has been evolved for the automatic feed of a blade stitching machine the feed of the closed signatures takes place as described in horizontal direction while the suckers adapted to open the signatures by an intermittent rotary movement are juxtaposed in a vertical plane and special means are employed to effect the positioning of the signatures on to the carriers of the blade stitching machine.

I claim:

1. A method of automatically supplying folded signatures to a signature-handling machine, which includes seizing the upper section of a signature by at least one rotatable and intermittently moved suction member, seizing the lower section of the said signature by at least one rotatable and intermittently moved suction member, inversely rotating the said suction members to open the said signature, and thereafter turning the said signature about the edge of one section and then depositing the signature straddlewise for its further handling upon a conveyor member.

2. A method of handling folded signatures provided with a foreset sheet, which includes mechanically displacing the foreset sheet, seizing the said foreset sheet and the adjacent section of the signature by at least one rotatable and intermittently moved suction member, seizing the complementary section of the said signature by at least one rotatable and intermittently moved suction member, inversely rotating the said suction members to open the said signature, and thereafter turning the signature about the edge of one section and depositing the signature straddle-

wise upon a conveyor member for its further handling.

3. A method of automatically supplying folded signatures to a signature-handling machine, as claimed in claim 1, which includes periodically interrupting, by mechanical means, the feed of the signatures to the stitching mechanism to cause an idle stitch to be formed after each completed book.

4. A method of handling folded signatures provided with a foreset sheet, as claimed in claim 2, which includes periodically interrupting, by mechanical means, the feed of the signatures to allow the stitching means to provide an idle stitch after each completed book.

5. Sheet-handling apparatus comprising means for separating a signature from a fanned out bank of signatures, means for opening apart the upper and lower sections of the said signature, means for turning the signature about the edge of one section thereof, and means for positioning the said opened signature straddlewise upon a conveyor member.

6. Sheet-handling apparatus comprising means for separating a signature provided with an attached outer sheet from a fanned out bank of signatures, means for displacing the said attached sheet, at least one suction member to seize the said attached sheet and adjacent section of the signature, at least one suction member to seize the complementary section of the signature, means for inversely moving the said suction members to open apart the said sections, means for turning the signature about the edge of one section, and means for depositing the signature straddlewise upon a conveyor blade.

7. Sheet-handling apparatus as claimed in claim 6, which includes an auxiliary suction member, means for operating the suction member, and means for automatically controlling the operation of the said suction member.

8. Apparatus for use in a signature-handling machine, which comprises means for lifting the folded edge of the uppermost signature of a fanned out bank of signatures, a member adapted to separate the said signature from the bank, suction members to engage the upper section of the signature, suction members to engage the lower section of the said signature, means for inversely moving the said suction members, means for turning the signature about the edge of one section thereof, and means for releasing the said signature from the suction members at a predetermined point of its travel through the machine.

9. Apparatus for use in a signature-handling machine, comprising at least one pivotally mounted suction member, means for engaging the said suction member with the folded edge of the uppermost signature of a

horizontally fanned out bank of signatures, means for lifting the suction member together with the signature held thereby, a dividing member, means for engaging the dividing member with the lifted signature, at least one upper rotatable suction member, at least one lower rotatable suction member, means for engaging the upper section of the said signature with the upper rotatable suction member, means for engaging the lower section of the said signature with the lower rotatable suction member, a conveyor blade, means for rotating the said suction members to open the signature, means for advancing towards the conveyor blade the upper suction member together with the section of the signature held thereby, means for segregating the lower section of the signature from the upper section, and means for depositing the said signature straddlewise upon the said conveyor blade at a predetermined point of the travel of the said signature through the machine.

10. Apparatus for use in a signature-handling machine, comprising means for separating the topmost signature from a fanned out bank of signatures, upper rotatable suction members, lower rotatable suction members, curved sheet guides associated with the said rotatable suction members, means for engaging the said suction members with the said signature, means for adjustably rotating the upper suction members and sheet guides associated therewith, means for rotating the lower suction members, and sheet guides associated therewith, a conveyor blade, a drive shaft, means controlled from the drive shaft for advancing the said upper suction member and sheet held thereby towards the said conveyor blade, and means for depositing the said signature straddlewise upon the said conveyor blade.

11. Apparatus for use in a signature-handling machine, comprising means for separating the topmost signature from a fanned out bank of signatures, an upper rotatable suction pipe, at least one suction member mounted on the said pipe, a curved sheet guide mounted adjacent each suction member on the said pipe, a lower rotatable suction pipe, at least one suction member mounted on the lower suction pipe, a curved sheet guide mounted adjacent each suction member on the said lower suction pipe, a conveyor blade, means for engaging the said signature with the said upper and lower suction members, adjustable means for rotating the said upper suction pipe and members carried thereon, means for rotating the said lower suction pipe and members carried thereon, means for advancing the said upper suction pipe and signature engaging members mounted thereon towards the said conveyor blade, and means for automatically

controlling the suction periods of the said suction members.

12. Apparatus for use in a signature-handling machine, which comprises means for separating the topmost sheet from a fanned out bank of signatures, upper rotatable suction members to engage the said signature, lower rotatable suction members to engage the said signature, a suction valve device to regulate the operation of the said suction members, a drive shaft, timing mechanism actuated from the drive shaft to control the said valve device, means for rotating the said suction members to open the said signature, a conveyor blade, and means for positioning the said opened signature straddlewise upon the said conveyor blade.

13. Apparatus for use in a signature-handling machine, which comprises at least one upper suction member, at least one lower suction member, means for separating a signature having an attached foreset sheet from a fanned out bank of signatures, means for advancing the said signature between the said upper and lower suction members, at least one auxiliary suction member, means for engaging the auxiliary suction member with the said foreset sheet, means for causing the said auxiliary suction member to displace the said foreset sheet, a drive shaft, timing mechanism actuated from the drive shaft to control the operation of the said auxiliary suction member, means for engaging the upper suction member with the said foreset sheet and upper section of the said signature, means for engaging the lower suction member with the lower section of the said signature, a conveyor member, means for opening the signature, and means for depositing the said opened signature straddlewise upon the conveyor member.

14. Apparatus for use in a signature-handling machine, which comprises at least one upwardly reciprocating supporting member, means for adjusting the horizontal position of the supporting member, a suction member rockably mounted on each supporting member, an upwardly movable cross head member slidably mounted, means for adjustably connecting the said supporting member with the said cross head member, a drive shaft, means for operating the cross head member from the drive shaft, means operated from the drive shaft for rocking the said suction member, signature opening members, means for positioning the signature between the said opening members, a conveyor member and means for placing the opened signature straddlewise upon the said conveyor member.

15. Apparatus for use in a signature-handling machine, which comprises means for lifting the folded edge of the topmost signature of a fanned out bank of signatures, a forwardly reciprocating plate adapted to engage and lift the said signature, an adjust-

able lay stop for the said plate, means for slidably supporting the said plate in guide members, a rack member forming part of the said plate supporting means, a pinion engaging the said rack, a drive shaft, and means for actuating the said pinion from the drive shaft.

16. Apparatus for use in a signature-handling machine, which comprises means for separating a signature from a fanned out bank of signatures, means for lifting and advancing the said signature for further handling, means for applying a strip of adhesive to the requisite edge of the said signature and means for adding the said signature to an assembled book-pad.

17. Apparatus for use in a signature-handling machine, which comprises means for separating a signature from a fanned out bank of signatures, means for lifting and advancing the said signature for further handling, an adhesive applying member, means for supplying the said adhesive-applying member with adhesive, actuating means to cause the adhesive applying member to contact with the said signature, timing mechanism to control the said actuating means, a drive shaft, adjustable means for operating the said timing mechanism from the said drive shaft and means for adding the said signature to an assembled book-pad.

18. In automatic signature-handling mechanism having means for transporting a fanned out bank of signatures and means for separating the topmost signature from the said pile, signature opening members comprising upper rotatable suction members, lower rotatable suction members, a suction pipe common to the said suction members, reinforcing grooved sleeves mounted on and having apertures communicating with the said pipe, a rotatable collar mounted on each sleeve and having apertures communicating with the aperture in the sleeve and the atmosphere and groove in the sleeve respectively, means for connecting the said collar to a corresponding suction member, a drive shaft, and means for actuating the suction control mechanism from the drive shaft for the purpose set forth.

19. In automatic signature-handling mechanism having means for transporting a fanned out bank of signatures, at least one vertically movable suction device adapted to engage the folded edge of the topmost signature of the bank and comprising suction members, means for rockably mounting the said suction devices on a vertically reciprocating slide member, means for actuating the said slide member, a suction valve device common to the said suction members, means for connecting the said valve device to the said members, a drive shaft, means for operating the said valve device from the said drive shaft, an auxiliary shaft, a ratchet mounted

on the said auxiliary shaft, a pawl engaging the said ratchet, adjustable means for operating the said pawl from the drive shaft, a notched timing disc mounted on the said drive shaft, cam actuated locking mechanism driven from the drive shaft, and means for engaging the suction control valve at predetermined intervals with the locking mechanism for the purpose set forth.

20. In automatic signature-handling mechanism having means for transporting signatures of which at least one is provided with a foreset sheet, selectively operated means for retracting the said foreset sheet of each signature so provided comprising at least one suction member, a supporting arm for the suction member, guiding means for the supporting arm engaging a slot in the main frame, link mechanism connected to the said supporting arm, a drive shaft, means for operating the said link mechanism from the drive shaft, a suction control device, means for connecting each suction member to the said control device, a second drive shaft, means for operating the suction control device from the second mentioned drive shaft, an auxiliary shaft, a ratchet mounted on the auxiliary shaft, a pawl engaging the said ratchet, adjustable means for operating the said pawl from the said second mentioned drive shaft, a notched timing disc mounted on the said drive shaft, cam actuated locking mechanism driven from the second mentioned shaft, and means for engaging the said suction control device with the said locking mechanism at predetermined intervals for the purpose set forth.

21. In automatic signature-handling mechanism having means for transporting a fanned out bank of signatures and means for segregating and advancing the topmost signature of the said bank, means for selectively applying a strip of adhesive to the requisite edge of a signature, comprising a pivotally mounted adhesive-applying member, a pivotally mounted adhesive-supply member, a slidably mounted cross-head member, means for adjustably connecting the said adhesive-applying member to the said cross-head member, a drive shaft, means for reciprocating the said cross-head member from the said drive shaft, an auxiliary shaft, a ratchet mounted on the said auxiliary shaft, a pawl engaging the said ratchet, adjustable means for actuating the said pawl from the drive shaft, a notched disc mounted on the said auxiliary shaft, a pivoted locking arm, a lug mounted on the said locking arm, means for actuating the said locking arm from the said drive shaft, means for engaging the said reciprocating means for the cross-head member with the said locking arm, and means for engaging the said lug in one of the said notches to allow the adhesive applying member to actuate for the purpose set forth.

22. Apparatus for use in a signature-handling machine, which comprises in combination, means for transporting a fanned out bank of signatures, means for engaging and lifting the folded edge of the topmost signature of the bank, means for separating and advancing the said topmost signature from the bank, upper rotatable suction members, lower rotatable suction members, means for engaging the said signature with the said suction members, means for rotating the said suction members, a signature conveyor blade, means for oscillating the said blade, means for advancing the upper suction member together with the section of the signature held thereby, means for segregating the upper and lower sections of the said signature, means for positioning the opened signature above the said conveyor blade, and means for placing the said opened signature straddlewise upon the said blade.

23. Apparatus for use in a signature-handling machine, which comprises in combination, means for transporting a fanned out bank of signatures, means for positioning the signatures with their open edges facing the direction of travel, vertically movable lifting members, means for engaging the folded edge of the topmost signature with the said lifting members, means for adjusting the position of the said lifting members, relative to the size of the signatures, means for lifting and rocking the said lifting members, a slidable separating plate, a lap stop mounted on the said separating plate, means for adjusting the said lap stop relative to the size of the signature, means for reciprocating the said separating plate in timed relation to the operation of the machine to engage and advance the topmost signature, upper rotatable suction members, lower rotatable suction members, sheet tensioning members associated with the upper suction members, sheet tensioning members associated with the lower suction members, means for engaging the said suction members with the said signature, means for rotating the upper suction members and tensioning members, means for adjusting the rotation of the said upper suction members and tensioning members relative to the size of the signature, means for adjusting the position of the said suction members relative to the extent of the rotary travel thereof, means for rotating the lower suction members, means for advancing the upper suction members and tensioning members together with the section of the signature held thereby, a conveyor blade and means for depositing the said signature straddlewise upon the said conveyor blade.

24. A signature-handling machine which comprises, in combination, means for transporting a horizontal fanned out bank of signatures, at least one stitching head, an

oscillatory conveyor blade adapted to position signatures beneath the stitcher head, means for positioning the signatures with their open edges facing the sheet conveyor blade, means for lifting and separating the topmost signature from the fanned out bank, upper rotatable suction members, lower rotatable suction members, means for advancing the segregated signature to a position between the upper and lower suction members, means for applying a strip of adhesive to the folded edge of the said signature, means for opening the said signature, means for depositing the said signature straddlewise upon the conveyor blade, and means for applying the said signature to the preceding signature beneath the stitching head.

25. A signature-handling machine which comprises in combination, means for transporting a fanned out bank of signatures a number of the latter having, if desired, fore-set sheets, at least one stitching head, an oscillatory conveyor blade adapted to position the signatures beneath each stitching head, means for positioning the signatures with their open edges facing the conveyor blade, means for lifting the folded edge of the topmost signature, means for separating and lifting the said signature from the bank, timing mechanism to control the said lifting means, upper rotatable sheet engaging members, lower rotatable sheet engaging members, means for advancing a segregated signature between the said rotatable members, means for applying a strip of adhesive to the folded edge of the signature, timing mechanism to select automatically the requisite signature to which adhesive is to be applied, means for displacing the foreset sheet of the said signature, timing mechanism to control automatically the actuation of the said displacing means, means for engaging the said foreset sheet and upper section of the said signature with the said upper rotatable members, means for engaging the lower section of the said signature with the lower rotatable members, means for opening the said signature, and means for placing the said signature straddlewise upon the said conveyor blade for the purpose set forth.

In testimony whereof I affix my signature.
RUDOLF KLEMM.