June 5, 1934. W. STEINMANN 1,961,401

MECHANISM FOR FEEDING SIGNATURES

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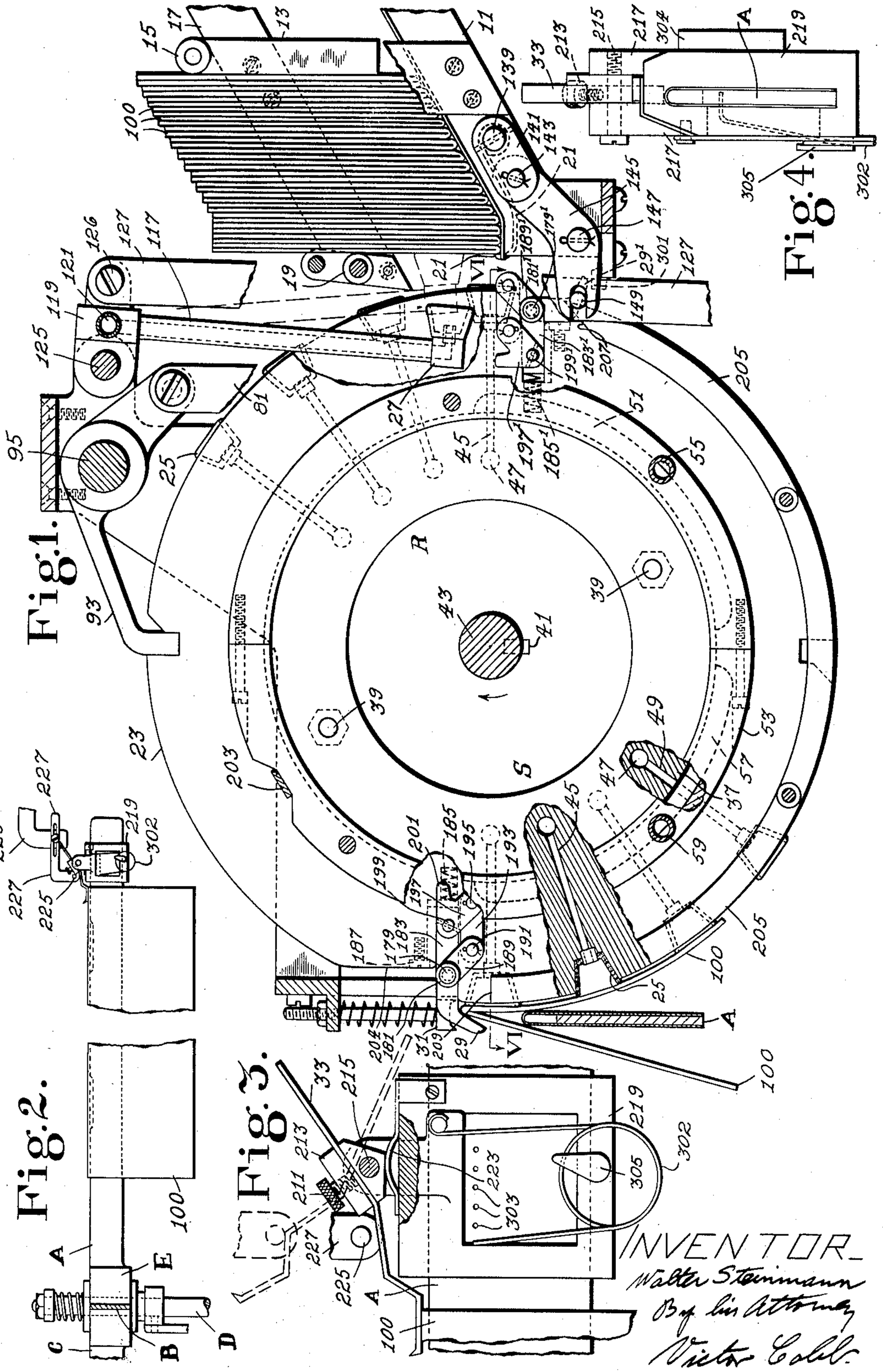

Fig. 1.

Fig. 4.

Fig. 2.

Fig. 3.

INVENTOR
Walter Steinmann
By his Attorney
Victor Cobb

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Fig. 5.

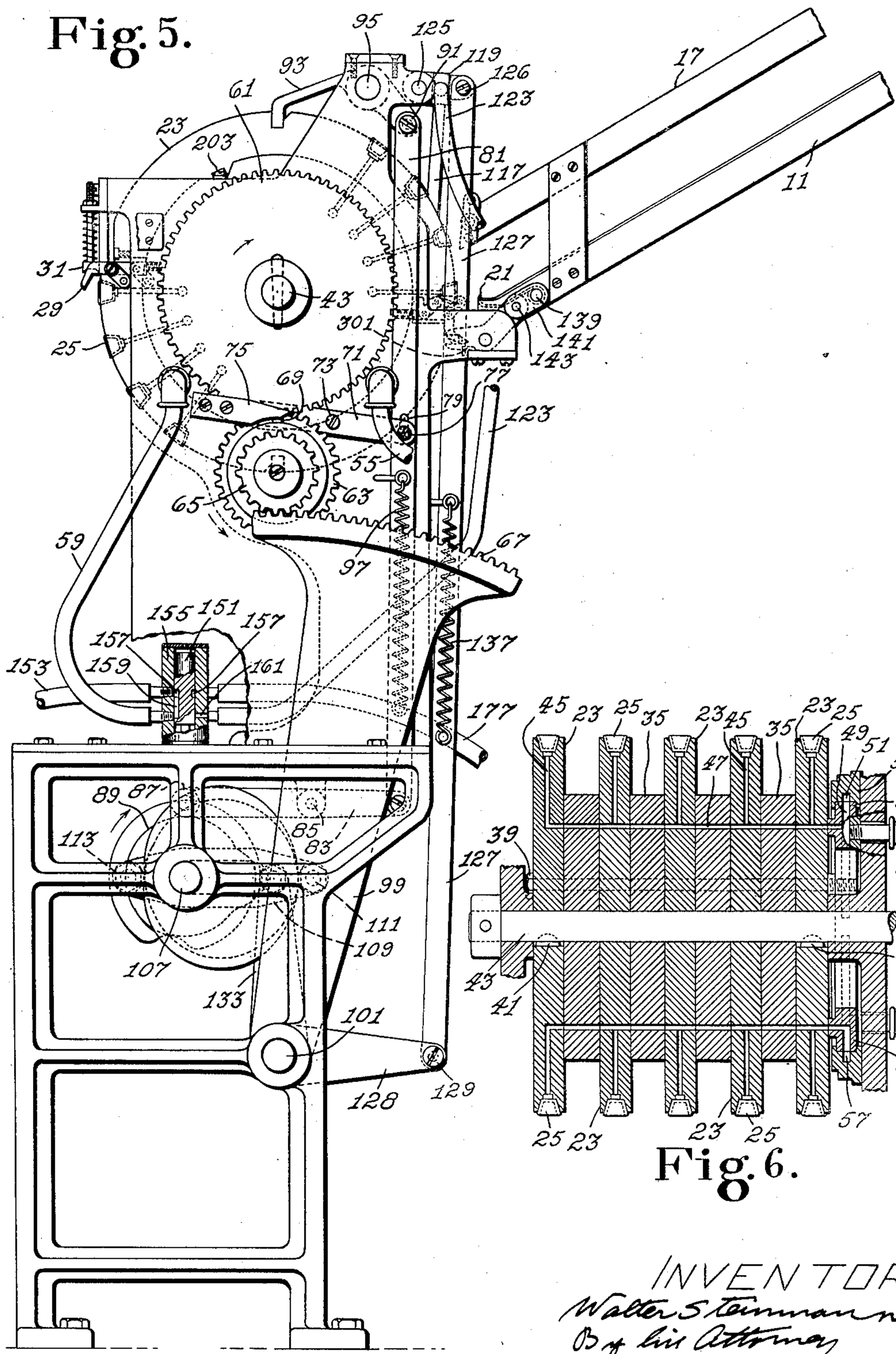

Fig. 6.

INVENTOR
Walter Steinmann
By his Attorney
Victor Colet

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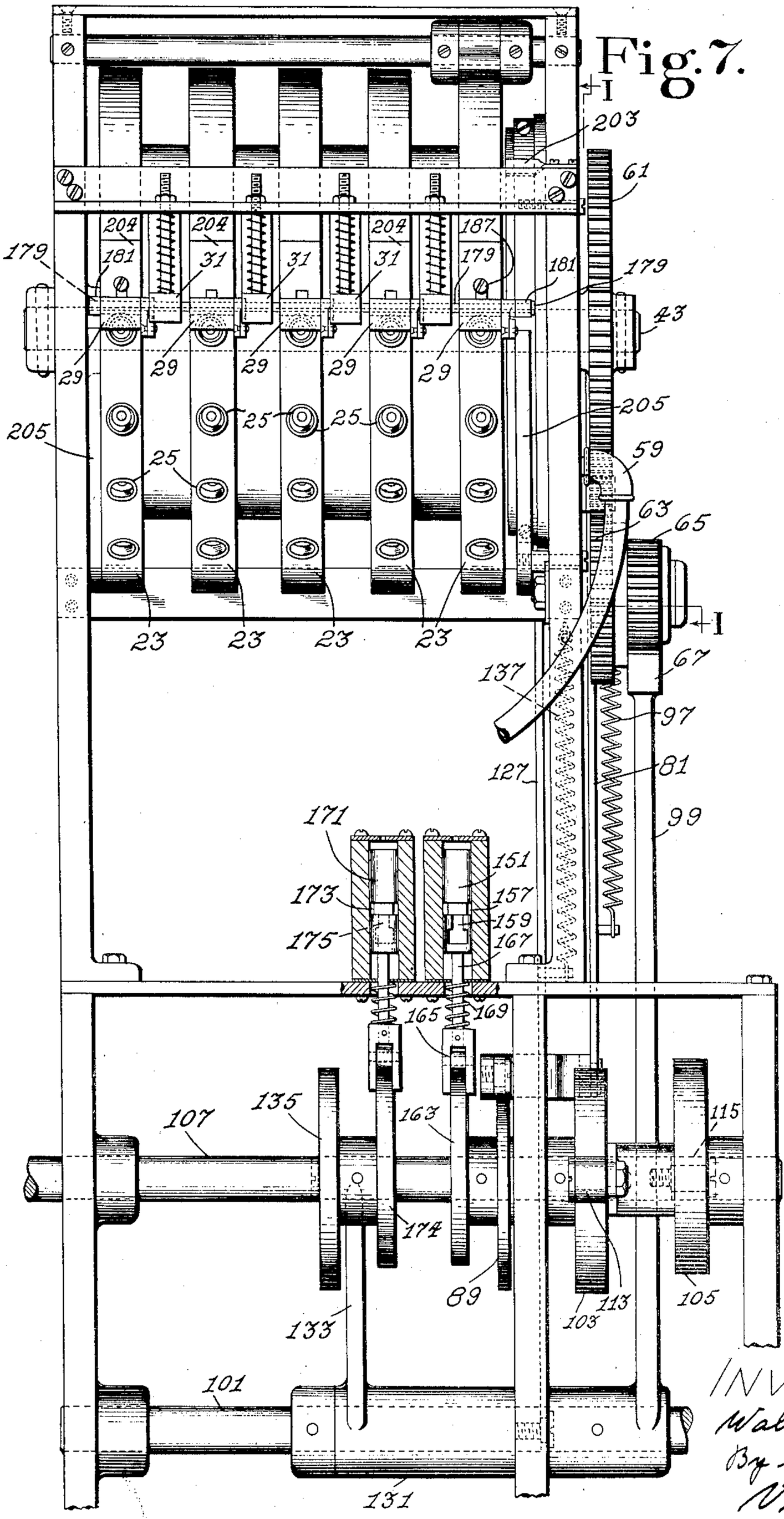
Fig. 7.



INVENTOR
Walter Steinmann
By his Attorney
Victor Cobb

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UNITED STATES PATENT OFFICE

1,961,401

MECHANISM FOR FEEDING SIGNATURES

Walter Steinmann, Bloomfield, N. J., assignor to United Shoe Machinery Corporation, Paterson, N. J., a corporation of New Jersey

Application October 17, 1932, Serial No. 638,125

19 Claims. (Cl. 270—53)

This inventiion relates to mechanism for use in connection with book-sewing machines, and is herein illustrated as embodied in mechanism for feeding signatures to the signature-supporting arms of a book-sewing machine which present the signatures in succession to sewing mechanism.

One type of book-sewing machine in common use is disclosed in Letters Patent No. 220,312, granted October 7, 1879, upon an application filed in the name of David M. Smyth, said machine comprising four signature-supporting arms or bars which are alternately rotated through ninety degrees and then moved up and down, each upward movement of the arms causing one of the arms to present the signature carried by it to mechanism for sewing the folded backs of a plurality of signatures together preparatory to making them into a book. For convenience the invention will be described as adapted to feed signatures to the arms of a machine of this general type although it is not limited to such use.

It is desirable that the signatures be placed rapidly and accurately, one at a time, upon the arms with their folded backs engaged by the tops of the arms and their two leaves, each of which may of course consist of several uncut sheets, hanging down one on each side of the arm. To this end, there is provided, according to one feature of the invention, a magazine for a stack of signatures, an intermittently rotated drum one locality in the path of the periphery of which is located adjacent to the magazine and another locality adjacent to the path of up-and-down movement of a signature-supporting arm, and means acting once for each partial rotation of the drum for transferring a signature from the magazine to the drum and from the drum to the arm. In the illustrated construction, the signatures are stacked with their folded backs down, and suction cups on the drum engage one leaf of a signature, carry the signature through the lower half of the path of rotation of the drum whereby the leaves of the signature are opened, and release the opened signature above an upwardly moving arm which rises between the open leaves and engages, from inside the signature, the folded back thereof.

In order to press the backs of the signatures firmly against the tops of the arms, there is provided, according to another feature of the invention, means for so pressing the backs. In the illustrated construction this pressing means takes the form of a plurality of spring-pressed members located in the path of upward movement of the arms so that, during the last part of the upward movement of the arms, the backs of the signatures are forced against these yielding members.

After an arm has moved up to engage a signature in the manner described, it moves down and is rotated through ninety degrees. In order to ensure that a signature shall not become displaced on its arm before the arm reaches the sewing mechanism of the book-sewing machine, each arm is provided, according to another feature of the invention, with a clamp which is open when an arm rises to receive a signature from the signature-feeding mechanism, and is closed upon the signature during the latter part of said upward movement. In the illustrated construction, these clamps are pivotally mounted on blocks which are adjustably fastened to the arms, the clamps being moved to operative positiions by encountering an abutment on the frame of the signature-feeding mechanism.

These and other features of the invention including certain details of construction and combinations of parts will be described as embodied in an illustrated mechanism and pointed out in the appended claims.

Referring now to the accompanying drawings,

Fig. 1 is a vertical section of a portion of the mechanism on the line I—I of Fig. 7, and shows a signature 100 being placed upon an arm A (Fig. 1) of a book-sewing machine,

Fig. 2 is an elevation of a portion of a book-sewing machine showing the arm A as viewed from the left in Fig. 1,

Fig. 3 is an elevation of the outer end of the arm A together with the clamp for holding the signature on the arm,

Fig. 4 is an end elevation of the arm A and its clamp,

Fig. 5 is a side elevation of the whole mechanism,

Fig. 6 is a horizontal section through the drum on the line VI—VI of Fig. 1, and

Fig. 7 is an end elevation of the machanism.

The purpose of the machanism, as has been stated, is to feed signatures one by one to a signature supporting arm, for example to the arms of a book-sewing machine of the type disclosed in U. S. Letters Patent No. 220,312. The patented machine has four arms located ninety degrees apart which are carried at their inner ends by a hub rotatably and slidably mounted

on an upright spindle. One of these arms is shown in section at A in Fig. 1 as it is rising to receive a signature 100 from the signature-feeding mechanism. In Fig. 2 this same arm and part of the sewing machine are shown as viewed from the left of Fig. 1. Fig. 2 also shows two other arms B and C and the upright spindle D upon which the common hub E of the four arms is rotatable and slidable. It will be understood that the sewing machine and applicant's mechanism are set up side by side and driven, preferably from a common drive shaft, in timed relation so that the signatures will be placed one by one upon the arms of the sewing machine in a manner presently to be described. When so set up, and viewed as in Fig. 1, the arm A will be pointing toward the observer with the spindle D located behind it and the sewing machine partly obscured by applicant's mechanism. Assuming that the sewing machine is so placed, the sewing mechanism will be above the fourth arm of the sewing machine which is in line with the arm B, said fourth arm being in the course of moving up to present a signature to the sewing mechanism. During this upward movement the signature 100 will be placed on the arm A. After the sewing operation, the hub E will move down, then rotate ninety degrees and then move up to bring the arm A into operative relation to the sewing mechanism. Thus the four arms will be moved through a cycle of movements in which they are first lowered, then rotated through ninety degrees and raised and held raised while the sewing of the signature on one arm takes place, then lowered again, the sewed signature remaining with the sewing mechanism so that the arm which carried the signature is empty when it is lowered. Thus at each upward movement of the hub E one of the arms is moved up into operative relation to the sewing mechanism. The purpose of the present mechanism is to place a signature upon each arm while the arm is in the angular position of the arm A in Fig. 1 and just before it reaches the limit of its upward movement.

The signatures are stacked with their folded backs resting upon the inclined bottom of a magazine 11, being urged to the left by weights, one of which is shown at 13, suspended from rollers one of which is shown at 15, said rollers running on inclined upper bars of the magazine, one of which is shown at 17. They are held from being pushed out of the magazine by a bar 19 and a small catch or separator 21 which engages the lower portion of the left-hand signature (Fig. 1) and is operated, as will be presently described, to permit only one signature at a time to be removed from the stack. The signatures are carried one by one from the stack into position to be placed on a signature-supporting arm by a drum comprising five sections 23 (Fig. 7) with spacers 35 between them, each section carrying two groups of suction cups 25, four in each group, the groups being located at diametrically opposite localities on the sections of the drum. There are four suction pickers for transferring signatures one by one from the stack to the drum, these pickers being located one between each two adjacent sections 23 of the drum. They are not shown in Fig. 7 because they are behind the drum, but one of them is shown at 27 in Fig. 1. Also carried by each section 23 of the drum are two signature grippers located at diametrically opposite localities on the section. One of the sets of five grippers is indicated at 29 in Fig. 7, the other set of five being hidden by the drum. Inasmuch as each section of the drum with its two sets of suction cups and its two grippers is substantially like the others and the suction pickers are all alike, the general operation of the machine will be described with reference to Fig. 1 wherein is shown one section of the drum with its suction cups and grippers and one suction picker.

The drum makes half-revolutions intermittently and is shown in Fig. 1 in its position of rest. As it makes a half-revolution, the parts are moved in the following manner: The suction pickers 27 move to the right to engage the signature in the manner indicated in dotted lines and suction is applied to them, after which they move to the left to transfer the signature to the drum, and the suction is cut off. Just before the suction pickers move to the left, the separator 21 is moved down to permit a signature to be withdrawn and is then moved up to engage the back of the next signature. The suction cups 25 of the group marked R in Fig. 1 engage in succession one leaf of the signature, suction being applied to them in succession, first to the leading cup and then to the other three. During this time, the grippers 29' have engaged the folded back of the signature and clamped it to the drum. During the half-revolution of the drum in the direction indicated by the arrow, the suction is momentarily cut off from each suction cup and then reapplied to it for a purpose presently to be described, but the signature is at all times firmly held. When the signature reaches the location of the signature 100 at the left of Fig. 1, the drum has come to rest, and the grippers have been released. The suction is now cut off from the suction cups, and the upwardly moving arm A pushes the back of the signature first against the grippers which can then swing up, as will presently be described, and then pushes the signature against yielding spring-pressed abutments 31 to seat the back of the signature firmly upon the top of the arm A. Just as this occurs, a signature clamp 33 (Fig. 3) carried at the outer end of the arm is moved from dotted line to full line position to clamp the signature firmly to the arm. This arm with the signature upon it descends, due to downward movement of the hub E (Fig. 2) of the sewing machine. When the hub E is rotated ninety degrees, the next arm B is brought into the angular position occupied by the arm A in Fig. 1; and, when the hub rises, this arm B will receive a signature. Thus the signatures are placed one by one upon the four arms while they are in the position of the arm A in Fig. 1.

Referring more particularly to Figs. 5, 6 and 7, the drum and the mechanism for rotating it intermittently will be described. Referring first to Fig. 6, the sections 23 and the spacers 35 of the drum, together with an annular valve member 37, are fastened firmly together by bolts 39. The two outer sections are keyed at 41 to the shaft 43 which is intermittently rotated. The suction cups 25 are arranged in rows of five each. Referring to the upper row as viewed in Fig. 6, these cups are connected by ports 45 to a common port 47 extending horizontally, the right-hand end of said port communicating with a right-angled port 49 in the annular valve member 37, the outwardly extending branch of the

port 49 communicating at times with a segmental suction channel 51 in a fixed annular member 53, this segmental channel being shown in dotted lines in Fig. 1. Into this segmental channel leads one end of a pipe 55 through which air is sucked to produce a partial vacuum at all times in the channel 51. As the drum rotates, the port 49 moves out of communication with the suction channel 51 and into communication with another segmental suction channel 57 in the member 53 in which vacuum is produced at the proper times by suction applied through a pipe 59. Each row of suction cups 25 has ports like the ports 45 which lead into a common horizontal port like the port 47; and each port 47 at its right-hand end (Fig. 6) communicates with the inner end of a right-angled port like the port 49. Referring now to Fig. 1 and assuming that the drum is rotated in the direction indicated by the arrow, the leading suction cup 25 of the group marked R is in communication with the suction channel 51. As the drum rotates, the other suction cups of the group R will successively be connected with the suction channel 51. When a horizontal row of suction cups 25 reaches its lowermost position, the suction in these cups will be momentarily cut off as they move from a position in which they are in communication with the suction channel 51 into a position in which they are in communication with the suction channel 57. This momentary breaking of the vacuum will have no effect upon the signature which is being carried because the other suction cups of the group R will hold it firmly. It is necessary to provide the two suction channels 51 and 57 so that suction may be maintained at all times in the channel 51 but may be cut off when desired from the channel 57.

Referring now to Figs. 5 and 7, the shaft 43 has fast to it a large gear 61 which meshes with a small gear 63 rotatably mounted on a short shaft. Also rotatably mounted on this short shaft is a pinion 65 which is oscillated by a segmental rack 67. Between the pinion 65 and the small gear 63 is a one-way clutch, so that oscillation of the pinion 65 is effective in one direction only (in a counterclockwise direction as viewed in Fig. 5). This one-way clutch has not been shown since any suitable clutch of this type may be used. In the illustrated machine the clutch is of the Horton type, and a spring-pressed pin 69 carried by the driven member is held frictionally against a finger 75 by its compressed spring while the segmental rack 67 is making its idle swing (its swing to the left as viewed in Fig. 5) so as to ensure that no movement will be imparted at that time to the gear 65. The finger 75 with its curved pin-engaging face is fast to one end of a lever 71 pivoted at 73 to the frame and at its other end by a pin 77 and slot 79 to a vertical link 81. To the lower end of the link is pivoted the outer end of a lever 83 which is pivoted near its middle at 85 to the frame and has at its inner end a roll 87 running on a cam 89. The upper end of the link 81 is pivoted at 91 to the tail of a stop latch 93, this latch being pivoted near its middle at 95 to the frame and being adapted to enter one or the other of two sockets formed in one of the sections 23 at the end of each half-revolution of the drum.

When the segmental gear 67 (Fig. 5) has finished moving to the left, during which time the drum remains stationary and the pin 69 is operative, the link 81 is pulled down against the tension of a spring 97 which normally holds it up. This downward movement raises the finger 75 from the pin 69 and also lifts the stop latch 93 out of its slot. On the right-hand swing of the segmental rack 67, the drum is rotated through a half-revolution clockwise. Near the end of this movement the spring 97 is permitted to lift the link 81 so that the latch 93 rides on the periphery of the section 23 of the drum until it drops into one of the two diametrically opposite sockets in the section 23. At the same time the finger 75 is swung down and engages the spring-pressed pin 69 as shown in the figure. The segmental rack 67 is mounted on the upper end of an arm 99 the hub of which is pivoted about a rod 101. This arm is operated from two cams 103, 105 (Fig. 7) one of which swings it in one direction and the other in the other direction. These cams, like the cam 89, are fast to the driving shaft 107. A link 109 (Fig. 5) pivoted at one end at 111 to the arm 99 has in it a longitudinal slot through which the driving shaft 107 extends and is provided at its outer end with a roll 113 engaging the cam 103. A roll 115 (Fig. 7) mounted for rotation about the axis of the pivot 111 of the link 109 engages the cam 105. The rolls 113, 115 are thus located 180 degrees apart about the axis of rotation of the driving shaft 107, the cams 103, 105 being alike but oppositely disposed so that one cam and one roll rock the arm 99 in one direction and the other cam and the other roll rock it in the other direction.

The suction pickers, one of which is shown at 27 in Fig. 1, are mounted respectively at the lower ends of hollow stems, one of which is shown at 117 in Figs. 1 and 5. There are four of these pickers which are mounted to swing in the spaces between the sections 23. The upper ends of the stems 117 are fast to a bar 119, the ports through the stems being all in communication with a port 121 in the bar, a suction pipe 123 being provided whereby suction may be applied at the proper time to the suction pickers. The bar 119 is pivoted at one end to the frame at 125 and at the other end at 126 to a vertical link 127 the lower end of which is pivoted at 129 to the outer end of an arm 128, said arm having a hub 131 (Fig. 7) which is loosely mounted on the rod 101. Integral with the hub is an upstanding arm 133 having at its upper end a roll which runs on a cam 135 fast to the driving shaft 107. A tension spring 137 fast at one end to the link 127 and at the other end to the frame urges the link upward at all times and holds the roll on the arm 133 against the cam 135. This mechanism swings the suction pickers 27 first to the right and then to the left as viewed in Fig. 1 to transfer a signature from the magazine to the drum, the suction being controlled through the pipe 123.

Before the suction pickers move to the left to withdraw a signature from the stack, it is necessary to lower the catch or separator 21 to free the signature which is to be taken from the magazine; and this is accomplished also by vertical movement of the link 127. To this end the stem of the separator 21 (Fig. 1) is fast to a rock-shaft 139 to which is also fast one end of a short link 141 the other end of which is pivoted at 143 to one end of a bent lever 145, pivoted to the frame at 147, the other end of the bent lever having a fork to receive a pin 149 on the link 127. When, therefore, the link

127 moves up, the separator 21 is pulled down to permit a signature to be removed from the magazine, and when the link moves down the separator moves up again.

The mechanism for applying suction to the various ports and passages will now be described. Suction is applied continually to the segmental channel 51 to maintain a partial vacuum therein. To this end the pipe 55 is at all times in communication with an apparatus, not shown, which for convenience will be termed the "vacuum supply", any suitable apparatus for producing a partial vacuum being provided. The suction in the segmental channel 57 is controlled by a valve 151 (Fig. 5) the casing 155 of which is connected by the pipe 59 to said channel and is connected by another pipe 153 to the vacuum supply. The valve 151 is vertically reciprocable in a vertical bore in said casing. It has near its middle a small channel 157 which extends entirely around its periphery. A short vertical channel 159 communicates with this annular channel; and the casing 155 has a small horizontal port 161. The valve is moved up and down (Fig. 7) by a cam 163 on the shaft 107 against the periphery of which is held a small roll 165 carried by a fork fast to the lower end of the stem 167 of the valve, the roll, stem and valve being urged downwardly by a compression spring 169. Returning now to Fig. 5, the valve 151 is up, and suction is being applied through the pipe 59 to the segmental channel 57, the vacuum supply pipe 153 being connected with the annular channel 157. When it is desired to cut off the suction from the segmental channel 57, the valve 151 is moved down until the annular channel 157 is at the level of and in connection with the small port 161 which leads to the atmosphere. This closes the end of the pipe 153 and puts the pipe 59 into communication with the atmosphere thus breaking the partial vacuum in the segmental channel 57 (Fig. 1).

The suction in the suction pickers 27 is controlled by a valve 171 (Fig. 7) which is just like the valve 151 being provided with an annular channel 173 and a vertical channel 175 and being operated by a cam 174 of the shaft 107. This valve 171 and its casing is directly behind the valve 151 as viewed in Fig. 5; but the pipes which lead to it are shown. The pipe 123 leads from the suction pickers into the lower part of the casing, and a pipe 177, like the pipe 153 of the other valve, leads from the casing to the vacuum supply, a small port, not shown, corresponding to the port 161 being provided to break the suction in the suction pickers at the proper times.

It has been explained that there are two sets of grippers, five grippers in each set. One set is shown in Fig. 7, and the right-hand gripper of this set is also shown in the left-hand portion of Fig. 1. Of the other set of grippers one appears in the right-hand portion of Fig. 1. Inasmuch as the individual grippers are all substantially alike and the two sets are mounted in substantially the same manner, only one gripper of one set, its mounting and the mode of operation will be described in detail. Referring to Fig. 7, the grippers 29 of one set are all fast to a slender rock-shaft 179 which carries two small rolls 181, one at each end, and passes loosely through five blocks, one associated with each gripper, one of these blocks being shown at 183 in Fig. 1. This block is slidably mounted in a radial guideway in the section 23, being urged continually to move outwardly by a compression spring 185, the limit of outward movement being determined by the head of a screw 187 threaded into the section 23 and having a portion of its head in the path of movement of a portion of the sliding block. The hub of the gripper 29 is fast to the rock-shaft 179 and has integral with it an arm 189 pivoted at 191 to one end of a link 193, the other end of which is pivoted at 195 to the lower end of a link 197, the upper end of which is pivoted at 199 to the block 183. The link 197 has a tail 201 which will be engaged during the next half-revolution by a stationary abutment 203 to rotate the link 197 and with it the link 189 and the gripper 29 clockwise so that, when the half-revolution has been completed, the gripper 29 will be in the position occupied by the gripper 29′ of the other set which appears in the right-hand portion of Fig. 1. In order to permit the grippers to swing clockwise, each section 23 of the drum is cut away as indicated at 204 in Fig. 1 in a locality adjacent to the grippers. Referring now to the gripper 29′ and to its associated parts which correspond to similar parts of the gripper 29 and bear the same numerals each marked with a prime, it will be seen that the gripper 29′ is in open position ready to be swung counterclockwise about the axis of its rock-shaft 179′ and pulled inwardly of the drum to grip the back of a signature after said signature has been transferred from the magazine to the drum. In order to swing the gripper counterclockwise about the axis of the shaft 179′, there is fast to the frame an abutment 301 (Fig. 1) which engages the moving grippers. In order to pull the grippers inwardly of the drum against the springs 185′, there are provided two cam-tracks 205 located at opposite ends of the drum. These cam-tracks are alike, and consequently only one of them will be described. Referring to Fig. 1, the cam-track 205 has an incline 207 at its right-hand end up which the roll 181′ runs to move the sliding block 183′ inwardly. Thus the abutment 301 and the cams 205 swing the gripper up into engagement with the back of a signature and cause the gripper to hold said back firmly against the section 23 of the drum. This gripping relation will continue until the drum has almost completed its half-revolution. Just before the completion the roll 181′ will ride across the abrupt horizontal face 209 at the left-hand end of the track 205, and the gripper 29′ will release the signature and occupy the position of the gripper 29. In this manner the two sets of grippers alternately engage the backs of signatures transferred from the magazine to the drum and hold them firmly until just before the arm of the sewing machine reaches the upper limit of its movement. It will be noted that because the signatures are stacked with their folded backs down and are engaged by one leaf and swung through the lower portion of the path of the periphery of the drum, the signature will be opened to permit the arm of the sewing machine to move upwardly between the two leaves of the signature. A blast of air may be blown across the bottom of the drum, if desired, to ensure the proper opening of the signature.

When each arm of the sewing machine is in the angular position of the arm A in Fig. 1 and has risen to seat the back of the signature upon it, the arm then descends, as has been described, rotates through ninety degrees and rises again.

In order to prevent the signature from being displaced during the time that an arm is carrying a signature to the sewing mechanism of the sewing machine, the clamp 33 referred to above is provided. This clamp (Figs. 2, 3, 4) is adjustably fastened by a set screw 211 in a slot in a carrier 213 pivoted at 215 to upstanding ears 217 of a block 219 slidably mounted upon the outer end of the arm and yieldingly held in adjusted position in a manner presently to be described. The pivoted carrier 213 is adapted to be rocked so as to move the clamp 33 at the proper times into the clamping position shown in full lines and into the inoperative or open position shown in dotted lines in Fig. 3. In order to hold it in either of these two positions, the lower part of the carrier 213 is V-shaped in cross-section, and a spring 223 fastened to the block 219 is adapted to engage one face or the other of the V depending upon the angular position of the carrier. It will be understood that there are four of these clamping mechanisms, one at the outer end of each arm of the sewing machine. When the arm is in the position of the arm A in Fig. 1 and is moving up, the clamp is being held open in the dotted line position of Fig. 3. Just before the arm completes its upward movement an abutment in the form of a horizontal pin 225 carried by the frame of the signature-feeding mechanism is encountered. The carrier 213 is thus swung past dead center, whereupon it snaps into the position shown in full lines in Fig. 3 and the clamp 33 engages the signature. The pin 225 is carried by an angle iron 227 adjustably fastened by a screw-and-slot connection to a stationary bracket 229 mounted on the frame of the signature-feeding mechanism. When the signature on the arm is presented to the sewing mechanism of the book-sewing machine, it is of course necessary to release the clamp; and this may be accomplished by an abutment pin, not shown, similar to the abutment pin 225, said pin being mounted on the frame of the sewing machine and adapted to engage the tail of the clamp 33 and swing the clamp from the full line position to the dotted line position of Fig. 3.

It is desirable that the signature 100 be properly located longitudinally of the arm A before it is presented to the sewing mechanism of the sewing machine so that its ends shall be properly alined with the ends of the signatures which have been previously sewed together. To this end the block or header 219 is mounted for movement along the arm A to the left, as viewed in Figure 3. The block or header 219 is yieldingly held in position upon the arm A by a coiled spring 302 having one of its ends bent around a pin on the block 219 and its other end bent horizontally and extending into a selected one of a series of holes 303 in the arm A. The tension of the spring tends to move the block to the right (Fig. 3) along the arm A, the extent of this movement being limited by engagement of the left-hand wall of the square opening in the block with the left-hand end of the spring 302. A clip 305 carried by the block 219 and having a groove on its far side to receive a portion of the spring prevents the left-hand end of the spring from coming out of the hole 303 into which it extends. By putting the left-hand end of the spring into a selected one of the holes 303, the position in which the block 219 is yieldingly held on the arm A may be varied.

The block is thus held in the desired position but may be moved to the left (Fig. 3) to push the signature 100 along the arm. To accomplish this, just after the clamp 33 has been released as the arm A is rising beneath the sewing mechanism, a member (not shown) of the sewing machine engages an abutment 304 formed on the block 219 and moves the block a predetermined distance to the left (Fig. 3) thereby moving the signature against the force of the spring 302 into the desired position lengthwise of the arm A. To ensure that each signature shall thus be engaged and pushed along the arm, the block 219 is always given a predetermined extent of sliding movement; and the signature is placed upon the arm with its end adjacent to the block located nearer to the block than the extent of sliding movement of the block so that each signature is properly alined with those held by the sewing mechanism of the sewing machine.

Although the invention has been set forth as embodied in a particular machine, it should be understood that the invention is not limited in the scope of its application to the particular machine which has been shown and described.

Having described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. The combination with a movable signature-supporting arm, of a rotatable signature-carrying drum having one locality in the path of movement of its periphery adjacent to the arm, a magazine for a stack of signatures located adjacent to another locality of said path, means for imparting partial rotations to the drum intermittently to carry a signature, back foremost, below the axis of the drum, and means acting once for each partial rotation to transfer a signature from the magazine to the drum and to present a signature with its back uppermost and its leaves spread apart in position to straddle the arm.

2. The combination with a movable signature-supporting arm adapted to receive signatures with their backs uppermost and their leaves spread apart, of a rotatable signature-carrying drum having one locality in the path of movement of its periphery adjacent to the arm, a magazine for a stack of signatures located adjacent to another locality on said path, means for imparting partial rotations to the drum intermittently always in the same direction, and means acting once for each partial rotation to transfer a signature from the magazine to the drum and to present a signature in position to straddle the arm.

3. The combination with a signature-supporting arm, of a rotatable signature-carrying drum, two sets of devices for holding signatures on the drum, a magazine for a stack of signatures, means for rotating the drum intermittently through partial revolutions, and means for operating the two sets of holding devices alternately, one during each partial revolution, to receive a signature from the stack, to hold it for an interval on the drum and to release it in position to be received on the signature-supporting arm.

4. The combination with a signature-supporting arm which is moved up and down, of a rotatable signature-carrying drum, two sets of devices for holding signatures on the drum, a magazine for a stack of signatures, means for rotating the drum intermittently through

partial revolutions in timed relation to the movements of the arm, and means for operating the two sets of holding devices alternately, one during each partial revolution, to receive a signature from the stack, to hold it for an interval on the drum and to release it in position to be received on the signature-supporting arm.

5. The combination with a signature-supporting arm which is moved up and down, of a rotatable signature-carrying drum, two sets of devices for holding signatures on the drum, a magazine for a stack of signatures arranged on edge with their backs down, means for rotating the drum intermittently through partial revolutions in timed relation to the up-and-down movements of the arm, and means for operating the two sets of holding devices alternately, one during each partial revolution of the drum, to receive a signature from the stack, to hold it for an interval upon the moving drum in such manner that it is opened and to release it in position to be received upon the upwardly moving arm.

6. The combination with a movable signature-supporting arm, of a signature-carrying drum having one locality in the path of its periphery adjacent to the arm, a magazine for a stack of signatures located adjacent to another locality in said path, means for rotating the drum intermittently, a set of grippers movably mounted on the drum, and means for operating the grippers when adjacent to the magazine to grip a signature and for operating them when adjacent to the arm for releasing the signature.

7. The combination with a movable signature-supporting arm, of a signature-carrying drum having one locality in the path of its periphery adjacent to the arm, a magazine for a stack of signatures with their backs down located adjacent to another locality in said path, means for rotating the drum intermittently through partial revolutions, two sets of grippers movably mounted on the drum, and means for operating the grippers when adjacent to the magazine to grip a signature and for operating them when adjacent to the arm for releasing the signature.

8. The combination with a movable signature-supporting arm, of a signature-carrying drum having one locality in the path of its periphery adjacent to the arm, a magazine for a stack of signatures located adjacent to another locality in said path, means for rotating the drum, means for engaging one side of a signature and presenting that side to the drum, and means on the drum for holding the signature upon the drum until it reaches a locality adjacent to the arm and there releasing it.

9. The combination with a movable signature-supporting arm, of a signature-carrying drum having one locality in the path of its periphery adjacent to the arm, a magazine for a stack of signatures located adjacent to another locality in said path, means for rotating the drum intermittently, means for engaging a portion of a signature and presenting it to the drum during one of the pauses in the intermittent movement, and means on the drum for holding the signature upon the drum until it reaches a locality adjacent to the arm and there releasing it.

10. The combination with a movable signature-supporting arm, of a signature-carrying drum having one locality in its path adjacent to the arm, a magazine for a stack of signatures located adjacent to another locality in said path, means for transferring a signature from the magazine to the drum, means for rotating the drum to carry the signature from the magazine into a position above the arm and for there releasing it with one leaf of the signature on one side and the other leaf on the other side of the arm, and means for pressing the back of the signature against the top of the arm to seat the signature firmly upon the arm.

11. The combination with a movable signature-supporting arm, of a signature-carrying drum having one locality in its path adjacent to the arm, a magazine for a stack of signatures located adjacent to another locality in said path, means for transferring a signature from the magazine to the drum, means for rotating the drum to carry the signature from the magazine into a position above the arm and for there releasing it with one leaf of the signature on one side and the other leaf on the other side of the arm, a clamp carried by the arm, and means for causing the clamp to engage the signature.

12. The combination with a movable signature-supporting arm, of a rotatable signature-carrying drum having one locality in the path of movement of its periphery adjacent to the arm, a magazine for a stack of signatures located adjacent to another locality in said path, means for rotating the drum intermittently through partial revolutions, two sets of suction cups spaced apart on the periphery of the drum so that when one set is adjacent to the magazine, the other set is adjacent to the arm, and means for applying suction to the set adjacent to the magazine and for cutting off suction from the set adjacent to the arm.

13. The combination with a movable signature-supporting arm, of a rotatable signature-carrying drum having one locality in the path of movement of its periphery adjacent to the arm, a magazine for a stack of signatures located adjacent to another locality in said path, means for rotating the drum intermittently through partial revolutions, two sets of suction cups spaced apart on the periphery of the drum so that when one set is adjacent to the magazine, the other set is adjacent to the arm, a set of suction pickers for engaging a signature and presenting it to the drum, and means for applying suction to the set of suction cups adjacent to the magazine and for cutting off suction from the set adjacent to the arm.

14. The combination with signature-supporting arms to which are imparted alternately partial rotation about a vertical axis and vertical movements up and down, of mechanism operated in timed relation to the movement of said arms for delivering signatures to said arms, said mechanism comprising a magazine for a stack of signatures, means for taking signatures one by one from the stack and for placing them upon the arms in succession during upward movement of the arms, signature clamps carried by the arms, and means for closing the clamps upon the signatures.

15. The combination with signature-supporting arms to which are imparted alternately partial rotation about a vertical axis and vertical movements up and down, of mechanism operated in timed relation to the movement of said arms for delivering signatures to said arms, said mechanism comprising a magazine for a stack of signatures, means for taking signatures one by one from the stack and for placing them upon

the arms in succession during upward movement of the arms, signature clamps carried by the arms, and means for closing the clamps upon the signatures during the upward movement of the arms.

16. The combination with signature-supporting arms to which are imparted alternately partial revolutions about a vertical axis and vertical movements up and down, of mechanism operated in timed relation to the movements of said arms for delivering signatures to said arms, said mechanism comprising a magazine for a stack of signatures, means for taking signatures one by one from the stack and for placing them upon the arms in succession during the upward movement of the arms, and means in the path of upward movement of the arms for seating the backs of the signatures firmly upon the tops of the arms.

17. The combination with signature-supporting arms to which are imparted alternately partial revolutions about a vertical axis and vertical movements up and down, of mechanism operated in timed relation to the movements of said arms for delivering signatures to said arms, said mechanism comprising a magazine for a stack of signatures, means for taking signatures one by one from the stack and for placing them upon the arms in succession during the upward movement of the arms, means in the path of upward movement of the arms for seating the backs of the signatures firmly upon the tops of the arms, signature clamps carried by the arms, and means for closing the clamps upon the signatures during the upward movement of the arms.

18. The combination with a signature-supporting arm, mechanism for placing signatures one by one upon said arm, and a header mounted upon the arm and movable to locate the signatures accurately lengthwise of the arm.

19. The combination with a signature-supporting arm, mechanism for placing signatures one by one upon said arm preparatory to presenting the arm with a signature upon it to mechanism for operating upon the signature, and means movably mounted on said arm and adapted to be actuated to move the signature along the arm to locate the signature properly with respect to signatures which have been previously operated upon.

WALTER STEINMANN.