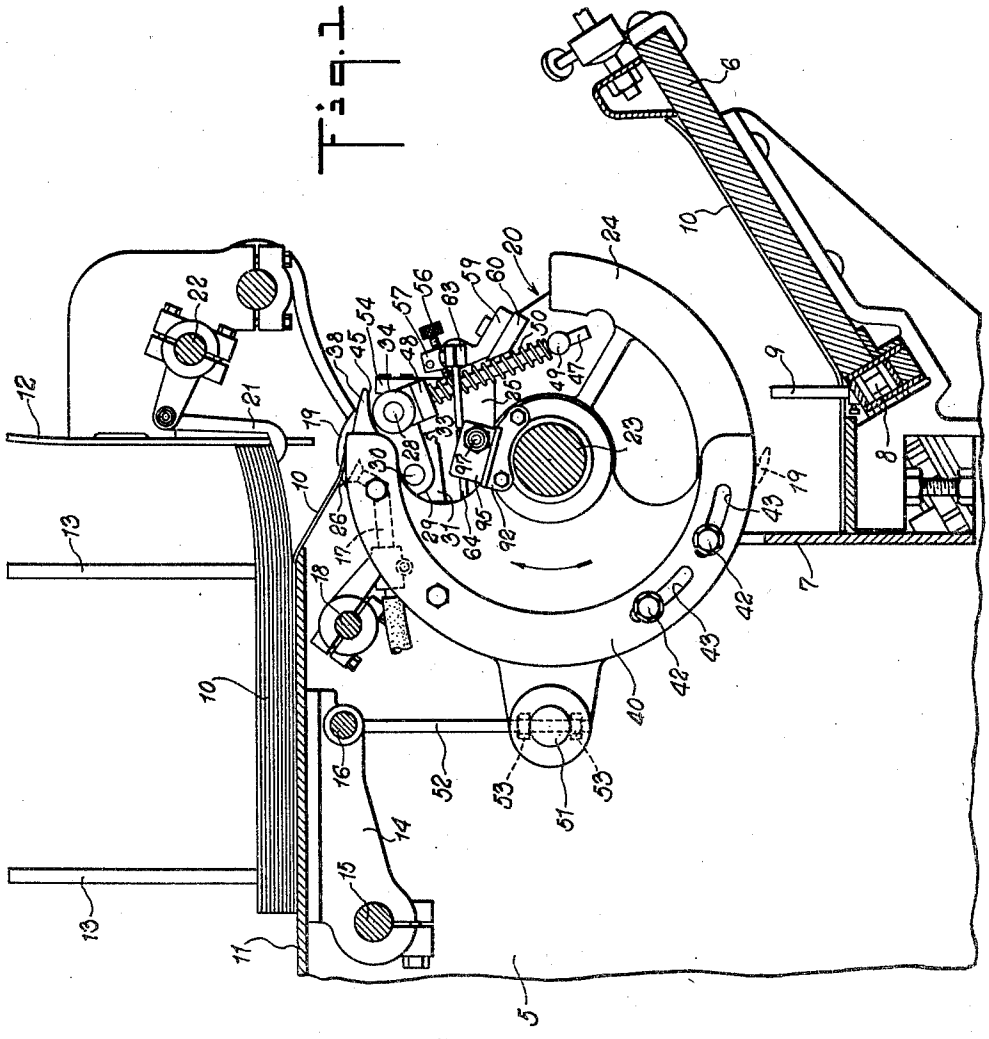
June 23, 1953 L. C. WILLIAMS 2,643,113

SHEET OR SIGNATURE FEEDING MECHANISM

Filed Nov. 22, 1950 3 Sheets-Sheet 1

Fig. 1.



INVENTOR.
LEO C. WILLIAMS
BY
Dale A. Bauer
ATTORNEY

June 23, 1953 L. C. WILLIAMS 2,643,113

SHEET OR SIGNATURE FEEDING MECHANISM

Filed Nov. 22, 1950 3 Sheets-Sheet 2

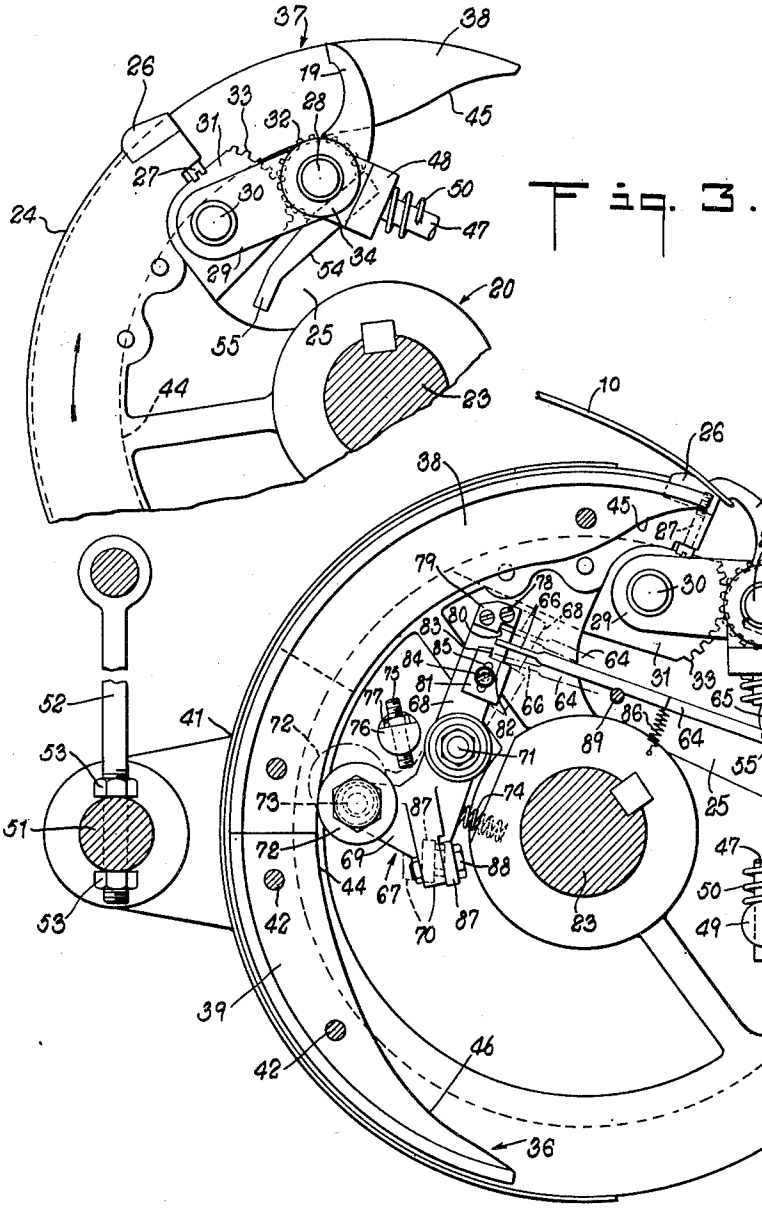


Fig. 3.

Fig. 2.

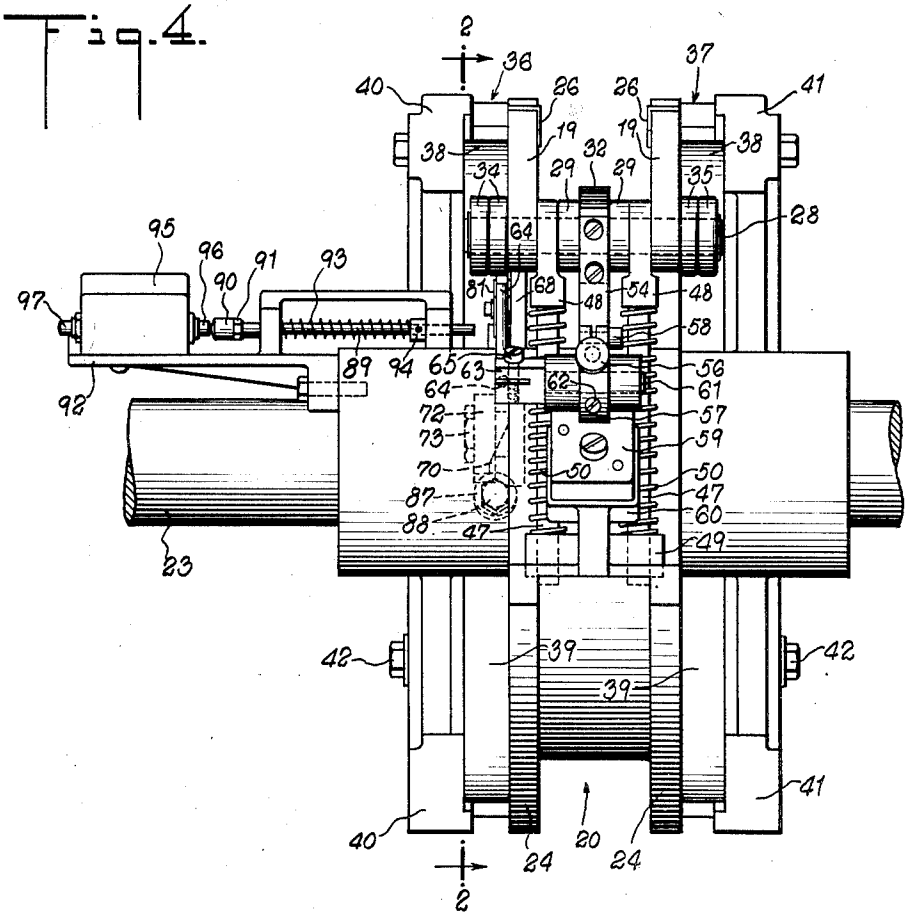
INVENTOR.
LEO C. WILLIAMS
BY
Dale A. Bauer
ATTORNEY

June 23, 1953 L. C. WILLIAMS 2,643,113

SHEET OR SIGNATURE FEEDING MECHANISM

Filed Nov. 22, 1950 3 Sheets-Sheet 3

Fig. 4.



INVENTOR.
LEO C. WILLIAMS
BY
Dale A. Bauer
ATTORNEY

Patented June 23, 1953

2,643,113

UNITED STATES PATENT OFFICE

2,643,113

SHEET OR SIGNATURE FEEDING MECHANISM

Leo C. Williams, Pearl River, N. Y., assignor to Dexter Folder Company, Pearl River, N. Y., a corporation of New York

Application November 22, 1950, Serial No. 197,081

14 Claims. (Cl. 270—56)

1

This invention relates generally to sheet calipering or excess sheet detecting mechanisms, and more particularly to a calipering mechanism which is particularly adapted for embodiment in machines wherein signatures or other sheets in folded condition are successively fed from a supply thereof and transferred by traveling grippers to other devices or instrumentalities for further action thereon.

The invention is particularly, but not exclusively, concerned with the calipering of individual signatures fed successively from a series of supply stacks and assembled in superposed or inset relation to form books or magazines, whereby signatures that are perfect as to the required number of pages therein will only be assembled, and books or magazines that are perfect as to the required number of perfect signatures will only be made. The invention will be particularly described in connection with a signature handling machine suited to such use, but it is to be understood, however, that this particular description is for the purpose of illustration only and does not constitute a limitation upon the natural scope of the invention.

One of the objects of the present invention is to provide a signature calipering mechanism of novel construction which will accurately and reliably detect variations in the thickness of signatures to the degree of a single thickness of paper.

Another object of the invention is to control the results or effects of calipering or detecting operations on signatures as well as plain unfolded sheets by and during performance of traveling grippers engaged therewith.

Another object is to provide a novel signature calipering mechanism which is so constructed and arranged as to enable mounting of the same on a rotatable gripper cylinder and use of the signature engaging gripper on said cylinder as the controlling element thereof, whereby the construction is materially simplified, the necessity of providing other signature gauging rollers, fingers or the like is completely eliminated, and accuracy in the calipering of the signatures is assured.

Another object is to provide a novel calipering mechanism associated with a rotatable gripper cylinder in a manner such that the gripper or grippers on said cylinder may be employed as the means thereof for gauging the thickness of signatures as well as plain unfolded sheets through gripping engagement therewith, and for also detecting the absence of a signature or sheet

2

through failure of said gripper or grippers to seize the same.

A further object is to provide an improved calipering mechanism mounted on and rotatable with a gripper cylinder which will, through such rotation, effectively actuate a normally stationary control member upon engagement of an imperfect signature, too thick or too thin, or a sheet of excess thickness, by the gripper or grippers on said cylinder, and also upon failure of said gripper or grippers to seize a signature or sheet.

Still another object is to provide a calipering mechanism of novel construction wherein all of the component parts thereof are carried by a rotating gripper cylinder and including a timed control actuating feeler member, and an abutment finger operatively associated with said member and movable to various positions by the grippers on said cylinder to prevent or permit movement of said member depending on the thickness of a signature or other sheet engaged by said grippers or the failure of the latter to grip said signature or sheet.

Another object is to provide a novel calipering mechanism mounted on a rotary gripper cylinder which includes a timed control actuating member so novelly arranged that actuation of said member in timed relation with the operation of the grippers on said cylinder is controlled by the same cam means which effects closing and opening of said grippers, thus further simplifying the construction of the calipering mechanism.

Another object is to provide a rotary cylinder having a gripper so arranged thereon in a novel manner that pivotal movement of said gripper into and out of gripping engagement with a signature or other sheet is effected through bodily movement of said gripper relative to said cylinder.

The above and further objects and novel features of the invention will more fully appear from the following detail description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views.

Fig. 1 is a fragmentary end elevational view, partly in section, of one of the units or sections of a signature gathering machine embodying signature calipering mechanism constructed and operated in accordance with the present inven-

tion, said view showing the gripper cylinder in signature gripping position;

Fig. 2 is an enlarged detail end elevational view, partly in section, of the gripper cylinder and signature calipering mechanism mounted thereon, shown in Fig. 1, with the near-side gripper cam supporting bracket removed, and showing the gripper cylinder advanced a short distance beyond signature gripping position, said view being taken substantially from the position indicated by the line 2—2 of Fig. 4;

Fig. 3 is a fragmentary end elevational view of the gripper cylinder, showing the grippers thereon in opened position; and

Fig. 4 is a front elevational view of the gripper cylinder and calipering mechanism, shown in Figs. 1 and 2.

Referring to the drawings, one form of signature calipering mechanism constructed and operated in accordance with the present invention is herein illustrated, by way of example, as being embodied in a signature gathering machine wherein folded sheets, and at times plain unfolded sheets, are successively fed from a series of in-line supply stacks and deposited one upon another on a trough-like conveyor for subsequent stitching and/or other operations to form a complete book or magazine. It will be understood that the novel signature calipering mechanism may also be embodied in other signature handling machines, such as, signature insetting machines wherein the signatures are deposited in opened condition one upon another on an inverted V-shaped saddle-type conveyor for subsequent stitching operations to form a complete saddle-stitched book or magazine, as well as in other machines wherein folded and/or unfolded sheets are presented to devices or instrumentalities for action thereon.

With reference to the drawings, particularly to Fig. 1 thereof, **5** indicates a portion of the framework of a signature gathering machine of conventional form, which suitably supports the usual longitudinally extending signature receiving trough **6** that is inclined upwardly and rearwardly from the horizontal. The trough **6** is provided with a rear wall **7** against which the signatures slide when they are deposited in said trough in a conventional manner by rotating gripper cylinders one of which will be hereinafter described in detail. Associated with the trough **6** is the usual conveyor chain **8** which is continuously driven and is provided at spaced intervals therealong with vertically projecting signature engaging pushers or fingers **9** for advancing the deposited signatures along said trough from station to station and gathering the same flatwise one on top of the other to form a complete book or magazine, as well understood in the art.

In the complete gathering machine, a plurality of independent signature feeding units or sections are arranged in spaced side by side relation along the trough **6**, as well understood in the art, for feeding the signatures from supply stacks thereof and delivering them to said trough in timed relation for engagement by the pushers **9** on the chain **8**. When the books or magazines are composed of assembled signatures and individual unfolded sheets, one or more of the feeding units or sections is employed to feed the unfolded sheets from supply stacks thereof and deliver the same to the trough **6** at a desired point thereon for gathering with the signatures fed from the remaining units or sections. For the sake of simplicity and brevity in illustrating and describing the present invention, and since all of the feeding units or sections are identical in construction and operation, only one of said units and only that portion thereof with which the present invention is actually concerned is herein illustrated.

The present invention is herein illustrated as being embodied in a feeding unit of the conventional bottom feed type wherein the signatures are extracted successively from the bottom of a horizontally disposed stack thereof. It will be understood that this type of feeding unit is not to be construed as a limitation, since the present convention may be embodied in other conventional types of feeding units such as, for example, the on-edge type wherein the signatures are extracted successively from the front of a supply thereof in standing edgewise position.

In the illustrated embodiment, a supply stack of signatures **10**, or of single sheets as the case may be, is supported in the usual hopper comprising a fixed base plate **11**, a fixed front abutment plate **12**, and adjustable vertically extending side bars **13** (Fig. 1). The plate **12** and bars **13** are carried by the framework **5**, and the plate **11** is secured to spaced brackets **14** which, in turn, are carried by spaced parallel shafts **15** and **16** forming part of said framework. The base plate **11** terminates short of the abutment plate **12** so that the front marginal portion of the lowermost signature **10** of the stack is exposed beneath for separation and extraction purposes. The signatures **10** are placed in the hopper with the folded back edges thereof abutting against the abutment plate **12**.

The usual suction device **17** (Fig. 1) is mounted on a rock shaft **18** for swinging movement thereby at predetermined intervals toward and away from the stack of signatures **10** to engage the exposed marginal portion of the lowermost signatures centrally thereof, separate it downwardly away from the stack and bring it into position, as shown in Fig. 1, for operative engagement by two grippers **19, 19** on a rotary extractor cylinder or carrier **20**. Suitable valve means controls the making and breaking of vacuum in the suction device **17** such that vacuum is created therein when moved toward the stack of signatures **10**, and is broken therein just prior to or simultaneously with engagement of the separated marginal portion of the lowermost signature by the grippers **19, 19** on cylinder **20**. The usual stack lifters **21** are mounted on a rock shaft **22** for swinging movement into position beneath the stack of signatures **10**, as shown in Fig. 1, to lift said stack as the lowermost signature is extracted therefrom by the gripper cylinder **20**.

The gripper cylinder or carrier **20** is keyed or otherwise suitably secured to a main longitudinally extending shaft **23** which is driven continuously by suitable driving means and, in the illustrated embodiment, makes one complete revolution for each cycle of operation of the machine. The grippers **19, 19** are operated by suitable means to be presently described, to engage the separated marginal portion of the lowermost signature **10** inwardly of the folded back-edge thereof and press said portion into gripping contact with the peripheral surface of the cylinder **20** as the latter revolves, whereupon the lowermost signature **10** is extracted forwardly and downwardly from the stack, and carried around and rearwardly to the lower side of the cylinder

20 at which point it is released by the grippers 19, 19 to fall flatwise on the trough 6. Although the cylinder 20 is herein shown as having only one set of grippers 19, 19 thereon, said cylinder is sufficiently large in diameter to enable the use of two sets of said grippers arranged diametrically opposite each other, as well known in the art, whereby two successive signatures may be extracted from the stack for each revolution of the cylinder, in which event said cylinder will be driven to make one-half of a revolution for each cycle of operation of the machine. It is, therefore, to be understood that the present invention is not limited to a gripper cylinder having only one set of grippers thereon, but may be employed with equal advantages in connection with a gripper cylinder provided with more than one set of grippers.

As shown, the cylinder 20 is preferably, but not necessarily, in the form of a single casting constructed to provide two axially spaced signature receiving and supporting disks 24, 24. The cylinder 20 has a section thereof removed to provide a recess 25 therein extending axially therethrough and opening outwardly through the peripheral surfaces of the disks 24, 24 for the reception and operation of the grippers 19, 19, and certain parts of the calipering mechanism to be hereinafter described. The cylinder 20 has portions thereof hollowed out to reduce the weight thereof, and is suitably ribbed to increase the strength thereof. The disks 24, 24 are provided adjacent the recess 25 with two axially aligned gripper pads or anvils 26, 26, one on each disk, which are recessed into the peripheral surfaces of said disks and are removably secured thereto by machine screws 27 or the like, said gripper pads being formed of a suitable non-compressible material, such as, "Formica," "Micarta," metal, or the like, having the desired coefficient of friction to extract the signature or sheet.

The grippers 19, 19 are normally disposed wholly within the recess 25 and inwardly of the circle of revolution of the peripheral surfaces of the disks 24, 24, as shown in Fig. 3, and are pinned or otherwise suitably secured to and adjacent opposite ends of a short shaft 28 in accurate alignment with the cooperating gripper pads 26, 26 on the respective disks 24, 24 of cylinder 20. This shaft 28 is journalled in suitable bearings provided in the free forward ends of two axially spaced links 29, 29 which are symmetrically arranged between the grippers 19, 19. The links 29, 29 extend rearwardly from the shaft 28 and are pivotally mounted at their free rear ends on a short pin 30 which is so located that the axis thereof is substantially on a line passing vertically through the center of the axially aligned gripper pads 26, 26. The pin 30 is suitably secured centrally thereof in a toothed segmental plate 31 and projects beyond opposite sides of said plate to receive the links 29, 29. The segmental plate 31 is disposed centrally between the disks 24, 24 in a suitable recess in the cylinder 20 and is pinned or otherwise suitably secured to said cylinder against relative movement, said plate having the toothed portion thereof projecting into the recess 25.

It will thus appear that by virtue of the described mounting of the gripper shaft 28 and grippers 19, 19, and the described location of the pivot pin 30, the shaft 28 and grippers 19, 19 will be bodily swung outward relative to the cylinder 20 in an arcuate path substantially concentric with the signature engaging surfaces of the pads 26, 26. This bodily outward movement of the grippers 19, 19, which is in a direction opposite to the direction of rotation of the cylinder 20, enables the grippers to in effect overtake the separated marginal portion of the lowermost signature 10 as the cylinder revolves and thereby project farther inwardly beyond the folded back-edge of the signature in normal extracting position. In this manner, positive gripping engagement of the signature 10 in or out of normal position within limits by the grippers 19, 19 is always assured, and the possibilities of misses through failure of the grippers to engage a signature in or slightly out of normal position are completely eliminated.

Secured to or formed integrally with the gripper shaft 28 centrally thereof is a segmental gear 32 which is in continuous meshing engagement with the teeth 33 formed on the segmental plate 31. It will thus appear that when the gripper shaft 28 and grippers 19, 19 are swung bodily outward relative to the cylinder 20, as hereinbefore described, the shaft 28 and grippers 19, 19, through such movement and meshing engagement of the segmental gear 32 with the tooth segmental plate 31, will be simultaneously rotated in a counter-clockwise direction, as viewed in Fig. 3, whereupon the grippers 19, 19 will be swung from the wide opened position shown in said figure, to the closed position shown in Figs. 1 and 2 to engage the separated portion of the signature 10 and firmly and uniformly press the same against the pads 26, 26 as the cylinder 20 revolves. This gripping engagement of the signature 10 by the grippers 19, 19 is maintained until the signature, through continued rotation of the cylinder 20, is completely extracted from the supply stack and carried circularly downward and around to the lower side of said cylinder, at which time a reversal of the above described operations is effected to cause the grippers 19, 19 to open substantially at the lowest part of their travel, resulting in release of the signature 10 for flatwise delivery onto the trough 6. As the cylinder 20 continues to revolve after release of the signature 10 by the grippers 19, 19, said grippers are fully retracted bodily into the recess 25 and simultaneously rotated to their wide opened position, as shown in Fig. 3, in readiness for action on the next separated lowermost signature of the stack.

The above described operations of the grippers 19, 19 may be effected in various mechanical ways, and as herein shown is effected at proper timed intervals through rotation of the cylinder 20 by simple mechanism preferably constructed and arranged as follows. Journalled on the gripper shaft 28 at each end thereof are two cam rollers of the same diameter, the rollers at one end being indicated at 34, 34, and the rollers at the opposite end being indicated at 35, 35 (Fig. 4). These rollers 34, 34 and 35, 35 are arranged to engage two stationary semi-circular ring-shaped cams 36 and 37, respectively, which are of identical construction and are disposed adjacent opposite ends of the cylinder 20 at the rear side thereof. The cams 36, 37 extend substantially from the vertical center line of the cylinder 20 at the top thereof to substantially said center line at the bottom of the cylinder. The cams 36, 37 are each made in two sections, i. e. a fixed upper gripper closing section 38 and an adjustable lower gripper opening section 39. The sections 38, 38 of the cams 36, 37 are

bolted or otherwise suitably secured to the inner surfaces of two supporting brackets 40 and 41, respectively, and the sections 39, 39 of said cams are respectively secured to said surfaces by bolts 42 (Fig. 1) which extend through slotted openings 43 in said brackets and are threaded into suitable threaded openings in said sections.

The sections 38, 39 of each cam 36, 37 together provide at their inner edges a relatively long cam surface 44 (Fig. 2) concentric with the axis of rotation of the cylinder 20 and terminating at the upper end thereof in a relatively short gradually tapering-off cam surface 45 and at the lower end thereof in a somewhat longer gradually tapering-off cam surface 46. The bolt and slot mounting 42, 43 of the cam sections 39, 39 provide for adjusting said sections relative to the cam sections 38, 38 to vary the time when and, hence the point in the path of travel of the grippers 19, 19 at which opening of said grippers and release of the signature 10 is desired. The sections 38, 39 of each cam preferably have overlapping adjacent ends in order to maintain the continuous uninterrupted concentric cam surface 44 in all positions of adjustment of the section 39.

The rollers 34, 34 and 35, 35 are yieldingly urged toward the cams 36, 37, respectively, by two spring-pressed rods 47, 47 provided at their upper ends with enlarged heads 48, 48 which are pivotally connected to the gripper shaft 28 and are disposed between the grippers 19, 19 and the links 29, 29. The lower ends of the rods 47, 47 project through suitable openings in a transverse post 49 which is loosely carried in the web of the cylinder 20 and projects beyond opposite ends of said web to receive said rods. The springs for the rods 47, 47 are compression coil springs 50, 50 mounted thereon and having their upper ends engaging against the heads 48, 48 and their lower ends engaging against the post 49. If desired, a single roller of double width may be substituted in lieu of each of the double rollers 34, 34 and 35, 35, the double rollers being employed to minimize wear and reduce maintenance expense.

The cam supporting brackets 40 and 41 are disposed exteriorly of the cylinder 20 adjacent opposite ends thereof and are loosely engaged over the cylinder shaft 23 and connected together rearwardly of said cylinder by a short tie-rod 51 suitably secured therein. The brackets 40, 41 are supported and held against rotary movement about shaft 23 by a vertical rod 52 (Fig. 1) depending from the shaft 16 and having its lower end projecting through a suitable opening in the tie-rod 51. The lower end of rod 52 is externally threaded and has threaded thereon above and below the tie rod 51 two nuts 53, 53. By adjusting the nuts 53, 53, the brackets 40, 41 may be raised or lowered as a unit about the shaft 23 to advance or retard the cams 36, 37 as a unit for gripper timing purposes.

It will thus appear that when the rollers 34, 34 and 35, 35 are engaged with the concentric cam surfaces 44, 44 of the cams 36, 37, as shown in Fig. 3, through rotation of the cylinder 20 in the direction of the arrow, the grippers 19, 19 will be swung wide open and wholly retracted into the recess 25 in said cylinder, as shown in said figure. As the cylinder 20 continues to revolve and the opened grippers 19, 19 approach the folded back-edge of the separated signature 10, the rollers 34, 34 and 35, 35 will ride off the cam surfaces 44, 44, onto and along the cam surfaces 45, 45 and then out of contact with the cams 36, 37, as shown in Fig. 2, whereupon the grippers 19, 19 will be bodily swung reversely out of the recess 25 about the pivot pin 30 and simultaneously rotated inwardly toward the disks 24, 24 to closed position, as shown in Figs. 1 and 2, by the spring actuated rods 47, thus yieldingly gripping the signature against the pads 26, 26 and holding it gripped until it is extracted from the hopper and carried downwardly and rearwardly to the lower side of the cylinder 20. As the grippers 19, 19 approach the lowest part of their travel through continued rotation of the cylinder 20, the rollers 34, 34 and 35, 35 will engage the cam surfaces 46, 46 of cams 36 and 37, whereupon the grippers 19, 19 begin to retract into the recess 25 and to open, thus immediately releasing the extracted signature 10 to fall flatwise onto the trough 6. As the cylinder 20 continues to revolve after release of the signature 10, the rollers 34, 34 and 35, 35 ride farther up on the cam surfaces 46, 46 and into engagement with the concentric cam surfaces 44, whereupon the grippers 19, 19 are again fully retracted into the recess 25 and are swung wide open in readiness for operation on the next separated lowermost signature of the stack, at which time the above described operations are repeated. It is to be noted that the extent of inward rotary movement of the grippers 19, 19 toward the gripper pads 26, 26 is variable depending on the thickness of the signature or sheet being gripped thereby or the absence of said sheet or signature in gripping position, said movement being less for a thick signature than it is for a thin signature or single sheet, and being more when no signature or sheet is present in gripping position and the grippers 19, 19 make direct contact with the pads 26, 26. By modifying the cams 36, 37 so that the cam surfaces 45, 45 thereof taper off more abruptly than shown, the grippers 19, 19 may be caused to project still farther rearwardly beyond the folded back edge of the signature in gripping position.

It is to be understood that when the cylinder 20 is provided with two sets of grippers disposed diametrically opposite each other, as hereinbefore pointed out, the recess 25, the grippers 19, 19 and the described mounting and operating parts therefor are duplicated and arranged in corresponding positions on the cylinder 20, the cams 36 and 37 then serving to operate both sets of grippers to effect extraction of two successive signatures from the stack during each revolution of the cylinder.

It is important during the normal operation of the machine that a signature or sheet and only one signature or sheet at a time is extracted from the supply stack during each cycle of operation, and that only signatures that are perfect as to the required number of pages therein are delivered to the trough 6 or other device. Accordingly calipering mechanism of novel construction is provided for calipering the signatures or sheets prior to delivery thereof to the trough 6 or other device to detect variations in the thickness of the signatures or sheets above and below normal thickness, and for also detecting the absence of a signature or sheet on the gripper cylinder 20 at a time when one should be present thereon, said calipering mechanism, in the illustrated embodiment, effecting actuation of an electrical control switch upon detection of a signature or sheet of abnormal thickness, too thick or too thin, or plural signatures or sheets, or the absence of a signature or sheet in normal position on the cylinder

20. The electrical control switch may be employed either or both to stop the machine and to throw a visual or audible signal.

As herein shown, the novel calipering mechanism is mounted on the gripper cylinder 20 for rotation therewith, and utilizes the grippers 19, 19 themselves as the signature or sheet thickness gauging means thereof, as well as the absent signature or sheet detecting means thereof, since the thickness of the signatures or sheets, as well as the absence of a signature or sheet in gripping position on the cylinder, is reflected in the extent of rotary movement of the grippers 19, 19 into gripping engagement with the signature or sheet, or with the pads 26, 26. The novel calipering mechanism comprises the following elements preferably constructed, mounted and operated as follows.

The segmental gear 32 on the gripper shaft 28 is formed at the front side thereof with a flat face to which is bolted or otherwise suitably secured a depending controlling finger 54 formed at the lower end thereof with a forwardly bent or offset portion 55. The length of the finger 54 is substantially equal to the length of the grippers 19, 19 measured from the axis of the gripper shaft 28. The finger 54 is thus rocked in opposite directions by the shaft 28 with the grippers 19, 19, and the extent of movement of said finger in a direction outwardly toward the peripheral surface of the cylinder 20 is dependent upon and substantially the same as the extent of inward movement of the grippers 19, 19 toward the pads 26, 26, which movement, as hereinbefore pointed out, varies depending on the thickness of the signature or sheet engaged by the grippers, or the absence of a signature or sheet in gripping position.

The portion 55 of finger 54 is arranged to abut against a contact member 56 in the form of a thumb screw which is adjustably carried in the split upper end of a relatively short upstanding arm 57 and is locked in adjusted positions by a clamp screw 58. The lower end of the arm 57 is disposed between the furcations of a bifurcated bracket 59 which is bolted or otherwise suitably secured to a transverse seat 60 formed on the cylinder 20 and located centrally between the ends thereof. A stud 61 extends through and is journalled in suitable aligned bearings formed in the furcations of the bracket 59, and through a suitable opening formed in the lower end of the arm 57 which is split at said end and provided with a clamp screw 62 for securing said arm to said stud. The stud 61 is formed with an enlarged square head 63 which is disposed exteriorly of the bracket 59 at the left hand side thereof, as viewed in Fig. 4. The head 63 on stud 61 is split horizontally for a portion of the length thereof and is provided at the rear side thereof with a socket within which is disposed and seated the front end of a relatively long controlled finger 64 which is immovably secured in said head by a clamp screw 65. The controlled finger 64 projects rearwardly from the head 63 over the cylinder shaft 23 and is in the form of a round rod having its rear end portion flattened to a relatively thin narrow blade 66. By virtue of the proportional lengths of the controlling finger 54, 55, the arm 57, and the controlled finger 64, variations in the thickness of the signatures or sheets and in the extent of rotary inward movement of the grippers 19, 19 are thus multiplied considerably at the extreme rear end of the blade 66 of the controlled finger 64.

Cooperating with the controlled finger 64, 66 is a second controlling member in the form of a bell-crank lever 67 (Fig. 2) having a long upstanding arm 68, a short lower rearwardly extending horizontal arm 69, and a short outwardly projecting arm 70 which is turned at right angles to the arms 68, 69 and is disposed diagonally between the same. The controlling bell-crank lever 67 is disposed at the left-hand end of the cylinder 20, as viewed in Fig. 4, and is mounted for pivotal movement on a shoulder stud 71 which is suitably secured in the web of said cylinder and projects outwardly therefrom to receive said bell-crank lever. A cam roller 72 is journalled on an eccentric stud 73 which is adjustably secured in the free end of the bell-crank arm 69 and projects outwardly therefrom to receive said roller. The roller 72 is arranged to engage the stationary cam 36 as the cylinder 20 revolves, and is yieldingly urged toward and into engagement with said cam by suitable resilient means, such as a compression coil spring 74 having one end thereof seated in a suitable socket formed in the hub of the cylinder 20 and the opposite end engaging against the bell-crank arm 68 at a point below the pivotal axis 71. The spring 74 acts to bias the bell-crank lever 67 in a clockwise direction, as viewed in Fig. 2, and the movement of said lever by said spring in said direction is limited by a stop screw 75 which is engaged by the outer edge of said lever. The stop screw 75 is adjustably carried by a transverse post 76, and is held in adjusted position by a lock nut 77. The post 76 is suitably secured in the cylinder 20 and projects outwardly therefrom.

It will thus appear that as the cylinder 20 revolves, the roller 72 on the bell-crank lever 67 is caused to follow the cam surfaces 44 and 45 on cam 36 by the expanding action of the spring 74. Accordingly, when the roller 72 moves into engagement with the cam surface 45 on cam 36 which occurs after a signature or sheet has been gripped by the grippers 19, 19 and while said signature or sheet is being carried downwardly and around to the lower side of the cylinder 20, the bell-crank lever 67 is rocked by spring 74 about the pivot 71 in a clockwise direction, as viewed in Fig. 2, thus swinging the bell-crank arms 68 and 70 to the broken line positions thereof shown in said figure, for a purpose to be hereinafter explained. When the roller 72 leaves the cam 36 upon continued rotation of the cylinder 20, further or excess pivotal clockwise movement of the bell-crank lever 67 is prevented through engagement of said lever with the stop screw 75. When the roller 72 moves into engagement with the cam surface 46 on cam 36 which occurs after the signature or sheet is released and the grippers 19, 19 are returned to their wide opened position, the bell-crank lever 67 is returned by said cam to its original full line position shown in Fig. 2.

Suitably secured to the bell-crank arm 68 at the upper end thereof, as by machine screws 78, is a feeler block 79 provided in the lower edge thereof with an upstanding shoulder 80 facing the controlled finger 64. Disposed below and in spaced relation with the feeler block 79 is a second feeler block 81 provided in the upper edge thereof with a horizontal shelf 82 and with an upstanding shoulder 83 also facing the controlled finger 64. The feeler block 81 is secured to the bell-crank arm 68 for adjustment toward and away from the feeler block 79 by a machine screw 84 which projects through a slotted opening 85 in said block and is threaded into a suitable threaded opening in said arm. The controlled finger 64 is yieldingly urged by a light extension

coil spring 86 toward the feeler block 81 and into normal position with the blade end 66 thereof resting on the shelf 82 of said block, as shown in broken lines in Fig. 2. The spring 86 has one end thereof connected to the finger 64 and the opposite end connected to the hub of the cylinder 20.

The bell-crank arm 70 is provided with a roller 87 journalled on a shoulder stud 88 which is suitably secured in the free end of said arm. This roller 87 is arranged to engage and actuate a control element under certain conditions through rotation of the cylinder 20 and the bell-crank lever 67 therewith. As shown, the control element comprises a rod 89 (Figs. 2 and 4) which is disposed parallel with the cylinder shaft 23 and is provided at the outer end thereof with a head 90 which is adjustably threaded on said rod and is held in adjusted position by a lock nut 91. The rod 89 is so located that the inner free end thereof projects into the rotary path travelled by the roller 87 when the roller 72 is in engagement with the concentric cam surface 44 of the cam 36, at which time the bell-crank lever 67 will be disposed in the full line position shown in Fig. 2.

The rod 89 is supported and guided for straight-line axial movement by a bracket 92 (Figs. 1 and 4) which is bolted or otherwise suitably secured to the outer surface of the cam supporting bracket 40. The rod 89 is yieldingly urged toward the cylinder 20 by a compression coil spring 93 surrounding said rod and having one end thereof engaging against the bracket 92 and the opposite end engaging against a collar 94 suitably secured to the rod. The collar 94, through engagement with the bracket 92, serves to limit the inward movement of the rod 89 by the spring 93, and to stop said rod in proper axial position for operative engagement by the roller 87.

Bolted or otherwise suitably secured to the outer end of the bracket 92 is a normally closed electric switch 95 which is connected in the electric circuit for the driving motor of the machine, and may, if desired, be also included in an electric circuit for a visual signal, such as a lamp or electrically actuated flag, or an audible signal, such as a bell or buzzer. The switch 95 is of known construction and is of the type which when once actuated will remain in actuated position until manually reset. For this purpose, the switch 95 is provided at one side thereof with a contact actuating plunger 96 which is disposed coaxially with the rod 89 to be engaged and actuated by the head 90 on said rod, and at the opposite side thereof with a second contact resetting plunger 97 which is manually operated.

The eccentric stud 73 provides for accurately setting the bell-crank lever 67 about the pivot stud 71 so that the shoulders 80 and 83 of the feeler blocks 79 and 81, respectively, will be disposed just clear of the arcuate path of movement of the free end of the blade 66 of the finger 64, and that the control-rod-actuating roller 87 on said lever will be spaced radially from the axis of the cylinder shaft 23 the same distance as the control rod 89, with the cam roller 72 in contact with the concentric cam surface 44 of the cam 36. The adjustable feeler block 81 and the adjustable contact screw 56 permits a very fine adjustment of the calipering mechanism so that the control rod or element 89 will be effectively actuated when variations to the degree of a single sheet thickness are detected in the signatures of different thicknesses that may be handled in the machine. This fine adjustment is particularly important and advantageous when handling single sheets and relatively thin signatures, such as four-page signatures.

In the initial make-ready of the described apparatus, a signature 10 of normal or proper thickness is taken from the supply thereof which is to be fed and is placed between the closed grippers 19, 19 and the pads 26, 26. The contact screw 56 is then manually adjusted until the blade-end 66 of the controlled finger 64, through engagement of said screw with the controlling finger 54 and resulting pivotal movement of the arm 57, stud 61 and finger 64, is disposed in the space between the feeler blocks 79, 81 and, hence, out of the path of inward movement of said blocks. This adjustment is augmented by adjusting the feeler block 81 toward or away from the feeler block 79 in accordance with the thickness and type of signature being fed. For thick signatures without single sheet inserts, a wide gap between the feeler blocks 79, 81 is usually employed, such as shown in Fig. 2. For thin signatures without single sheet inserts, and for thick signatures with single sheet inserts, the gap between the feeler blocks 79, 81 is reduced. For thin signatures with single sheet inserts, and for single unfolded sheets, the gap between the feeler blocks 79, 81 is further reduced. In any event, the gap between the feeler blocks 79, 81 must always exceed the thickness of the blade portion 66 of the controlling finger 64.

Assuming now that the above adjustments have been carefully made, that the grippers 19, 19 are in their normal wide opened positions, as shown in Fig. 3, that the bell-crank lever 67 is disposed in its normal full line position, as shown in Fig. 2, through engagement of the roller 72 on said lever with the cam surface 44 of the cam 36, and that the switch 95 is closed, at which time the controlling finger 54 is spaced a considerable distance away from the contact screw 56, as evident from the position thereof shown in Fig. 3, and the controlled finger 64 is disposed by the spring 86 in resting position on the shelf 82 of the feeler block 81, as shown in Fig. 2. The machine is then started, and as the cylinder 20 revolves in the direction of the arrow, the grippers 19, 19 are closed on the separated signature 10, as hereinbefore described, and said signature is extracted from the supply stack. If the signature 10 seized by the grippers 19, 19 is of normal or proper thickness, the controlled finger 64 will be raised from the shelf 82 of the feeler block 81 to the full line position thereof, shown in Fig. 2, under the control of the grippers 19, 19 and through contact of the finger 54 with the contact screw 56. Under these conditions, the bell-crank lever 67 is permitted to swing in a clockwise direction, as viewed in Fig. 2, to the broken line position (Fig. 2) under the action of the spring 74 and engagement of the roller 72 with the cam surface 45 of the cam 36 as the cylinder 20 continues to revolve with the signature gripped thereon. The control roller 87 will thus be displaced radially to the broken line position shown in Fig. 2, and in such displaced position will travel in a displaced rotary path past the control rod 89 sufficiently clear of the latter to completely miss the same. Accordingly, the control rod 89 will not be actuated and the normal operation of the machine will thus proceed as long as the successive signatures taken by the grippers 19, 19 are of normal or proper thickness.

Assuming now that the signature seized by the grippers 19, 19 is of a thickness in excess of the normal or proper thickness, or that two signatures are simultaneously seized by said grippers, result-

ing in a reduced stroke of the grippers. Under these conditions, the controlled finger 64 will not be raised from the shelf 82 of the feeler block 81, or will not be raised sufficiently to clear the shoulder 83 of said block. Accordingly, when the roller 72 on the bell-crank lever 67 begins to ride up on the cam surface 45 of the cam 36 and the feeler blocks 79, 81 feel for the controlled finger 64, inward or clockwise movement of said bell-crank lever is prevented through abutting engagement of the shoulder 83 of the block 81 with the blade end 66 of the finger 64 in the broken line lower position thereof shown in Fig. 2. The bell-crank lever 67 will thus remain in the full line position shown in Fig. 2, and in such position the control roller 87 will engage and actuate the control rod 89 as the cylinder 20 revolves, whereupon the switch 95 will be actuated to break the electric circuit and thereby stop the operation of the machine. It will be noted that contact of the control roller 87 with the control rod 89 is only momentary, but sufficient, however, to actuate said rod and the switch 95, and because of this said roller will travel beyond the control rod 89 before the cylinder 20 is actually stopped, thus enabling resetting of said rod by the spring 93 and manual resetting of the switch 95 to again start the machine after the necessary corrections have been made.

Assuming now that the signature seized by the grippers 19, 19 is thinner than the normal or proper signature thickness, or that the grippers 19, 19 for some reason have failed to seize a signature, resulting in an increased stroke of said grippers. Under these conditions, the controlled finger 64, due to the increased stroke of the grippers 19, 19, will be raised from the shelf 82 of the feeler block 81 to the broken line upper position shown in Fig. 2, an extent sufficient to clear the feeler block 81 but to be disposed in the path of the shoulder 80 of the feeler block 79. Accordingly, when the roller 72 on the bell-crank lever 67 begins to ride up on the cam surface 45 of the cam 36 and the feeler blocks 79, 81 feel for the controlled finger 64, inward or clockwise movement of said bell-crank lever is prevented through abutting engagement of the shoulder 80 of the block 79 with the blade end 66 of the finger 64. The bell-crank lever 67 will thus remain in the full line position shown in Fig. 2, and in such position the control roller 87 will engage and actuate the control rod 89 as the cylinder 20 revolves, whereupon the switch 95 will be actuated to break the electric circuit and thereby cause stoppage of the machine.

The operations of the calipering mechanism as explained above in connection with different signature conditions, likewise occur when single unfolded sheets are fed and the grippers 19, 19 seize an excess thickness sheet or double sheets, or fail to seize a sheet.

It is to be understood that when the cylinder 20 is provided with two sets of grippers arranged diametrically opposite each other, the hereinbefore described parts of the calipering mechanism are so constructed and arranged that they may be duplicated and mounted in corresponding positions on the cylinder 20 to provide a duplicate calipering mechanism for the signatures or sheets taken by the second set of grippers, said duplicate mechanism utilizing the same cam 36 as the operating means therefor, and effecting actuation of the same control rod 89 when an abnormal condition occurs in the handling of the signatures or sheets by the second set of grippers.

The operation of the calipering mechanism constructed and arranged in accordance with the present invention will be clearly understood from the foregoing description, and while said description and the accompanying drawings set forth with more or less particularity one embodiment of the invention, it is to be expressly understood that said invention is not limited to said embodiment or to the particular type of machine or to the rotary type of signature or sheet transfer carrier or cylinder disclosed herein. Various changes may be made therein, particularly in the design and arrangement of the parts illustrated, as well as in the mode of operation and manner of use, some of which have been mentioned in the foregoing specification, without departing from the spirit and scope of the invention, as will now be clear to those skilled in the art. The invention may be embodied with equal advantages in a straight-line traveling gripper carrier, or in a swinging type of gripper carrier. Additionally, the control rod 89 may be relocated for actuation by the control roller 87 when the bell-crank lever 67 is in its broken line, perfect signature or sheet, position, shown in Fig. 2, said rod then actuating a switch or other suitable mechanism which will prevent stoppage of the machine, or a second control rod may be provided for actuation by the roller 87 when the bell-crank lever 67 is in its broken line, perfect signature or sheet, position, said second rod then actuating a perfect signature or sheet counting device, electric or mechanical, or another mechanical or electrical device for a desired purpose.

What is claimed is:

1. In apparatus of the character described, a movable carrier having a sheet or signature supporting surface, a gripper movably mounted on said carrier, means for moving said gripper toward said surface from a normal open position to closed position on a sheet or signature, control means independent of said carrier and arranged to be actuated, a member mounted on said carrier for movement therewith and for relative movement to two positions only, namely, an operative position and an inoperative position, said member with said gripper in normal opened position being disposed in its operative position so as to engage and actuate said control means during movement of said member with said carrier, means for moving said member to its inoperative position in synchronism with the closing operation of said gripper, and means mounted on said carrier for relative movement under the control of said gripper to one position for permitting movement of said member to its inoperative position so that engagement of said member with said control means is avoided when the gripped sheet or signature is of proper thickness, and to another position for holding said member in its operative position and against movement to its inoperative position so that said member will engage and actuate said control means when the thickness of the gripped sheet or signature is in excess of or less than the proper thickness and when no sheet or signature is gripped by said gripper.

2. Apparatus as defined in claim 1, wherein said control means comprises a fixed electrical switch, and a slidably mounted switch-operating push-rod having one end thereof disposed in the path of movement of said member when in oper-

ative position to be engaged and operated by said member.

3. In apparatus of the character described, a rotary carrier having a circular sheet or signature supporting surface and mounted to rotate about a fixed axis, a gripper pivotally mounted on said carrier, means for swinging said gripper from a normal open position toward said surface to closed position on a sheet or signature, control means independent of said carrier and arranged for actuation adjacent one end of said carrier, an element mounted on said carrier at said end for rotary movement therewith and for relative pivotal movement in opposite directions to two positions only, namely, an operative position and an inoperative position, respectively, said element with said gripper in normal opened position being disposed in its operative position so as to engage and actuate said control means during rotation of said element with said carrier, means for moving said element to its inoperative position in timed relation with the closing operation of said gripper, and means mounted on said carrier for relative pivotal movement under the control of said gripper to one position for permitting movement of said element to its inoperative position so that engagement of said element with said control means is avoided when the gripped sheet or signature is of proper thickness, and to another position for holding said element in its operative position and against movement to its inoperative position so that said element will engage and actuate said control means when the thickness of the gripped sheet or signature is in excess of or less than the proper thickness and when no sheet or signature is gripped by said gripper.

4. Apparatus as defined in claim 3, wherein said control means comprises a fixed electrical switch, a slidably mounted switch actuating push-rod disposed parallel with the axis of rotation of said carrier and having one end thereof projecting into the path of rotary movement of said element when in operative position to be engaged and actuated by said element, and spring means for yieldingly urging said push-rod toward said carrier and into position for operative engagement by said element.

5. In apparatus of the character described, a movable carrier having a sheet or signature supporting surface, a gripper movably mounted on said carrier, means for moving said gripper toward said surface to closed position on a sheet or signature, a lever mounted on said carrier for rotary movement therewith and for relative pivotal movement, a member on said lever and movable thereby to two positions only, namely, an operative position and an inoperative position, control means independent of said carrier and arranged for actuation by said member, means for moving said lever in one direction prior to the closing operation of said gripper to dispose said member in its operative position whereby it may engage said control means during movement of said lever with said carrier, means for moving said lever in the opposite direction subsequent to the closing operation of said gripper to dispose said member in its inoperative position whereby it may avoid contact with said control means during movement of said lever with said carrier, and a gripper controlled finger mounted on said carrier for pivotal movement into the path of movement of said lever in said opposite direction for holding said member in its operative position and against movement to its inoperative position when the thickness of the gripped sheet or signature is in excess of or less than the proper thickness and when no sheet or signature is gripped by said gripper.

6. Apparatus as defined in claim 5, wherein said member is in the form of a roller journalled on said lever, and said control means comprises a fixed electrical switch, and a slidably mounted spring-pressed switch actuating push-rod having one end thereof projecting into the path of movement of said roller when in operative position to be engaged and operated by said roller.

7. Apparatus as defined in claim 6, wherein said electrical switch is provided with a contact actuating plunger engageable by said push-rod, and with a manually operable contact resetting plunger.

8. Apparatus as defined in claim 5, wherein said lever is provided with two relatively spaced blocks each having an abutment shoulder thereon engageable with the gripper controlled finger whereby movement of said lever in said opposite direction is prevented, and said finger is positioned under the control of said gripper for engagement by the abutment shoulder of one of said blocks when the thickness of the gripped sheet or signature is less than proper thickness and when no sheet or signature is gripped by said gripper, and for engagement by the abutment shoulder of the other of said blocks when the thickness of the gripped sheet or signature is in excess of the proper thickness, and between said blocks when the gripped sheet or signature is of proper thickness.

9. In apparatus of the character described, a movable carrier having a sheet or signature supporting surface thereon, a gripper movably mounted on said carrier, spring operated means on said carrier for moving said gripper toward said surface to closed position on a sheet or signature during movement of said carrier, a stationary cam for controlling the operation of said gripper by said spring operated means, a lever mounted on said carrier for relative pivotal movement, a member on said lever and movable thereby to operative and inoperative positions, control means independent of said carrier, a roller journalled on said lever and engageable with said stationary cam during movement of said carrier for moving said lever in one direction prior to the operation of said gripper to dispose said member in its operative position whereby it may engage said control means, resilient means for moving said lever in the opposite direction under the control of said stationary cam subsequent to the operation of said gripper to dispose said member in its inoperative position whereby it may avoid contact with said control means, and a gripper controlled finger mounted on said carrier for pivotal movement into the path of movement of said lever in said opposite direction for preventing movement of said member to inoperative position when the thickness of the gripped sheet or signature is incorrect and when no sheet or signature is gripped by said gripper.

10. Apparatus as defined in claim 9, wherein said roller is journalled on an eccentric stud adjustably carried by said lever.

11. In apparatus of the character described, a movable carrier having a sheet or signature supporting surface thereon, a gripper movably mounted on said carrier, means for moving said gripper toward said surface to closed position on a sheet or signature, a lever mounted on said carrier for relative pivotal movement, an element

on said lever and movable thereby to operative and inoperative positions, control means independent of said carrier, cam means for moving said lever in one direction prior to the operation of said gripper to dispose said element in its operative position whereby it may engage said control means during movement of said lever with said carrier, yieldable means for moving said lever in the opposite direction subsequent to the operation of said gripper to dispose said element in its inoperative position whereby it may avoid contact with said control means, upper and lower blocks secured to said lever in spaced relation and each having an abutment shoulder thereon, a relatively long finger pivotally mounted on said carrier and resting at its free end on said lower block in abutting relation with the shoulder on said block, and means actuated by said gripper through movement thereof to closed position for selectively moving said finger from said lower block to a position between said blocks when the gripped sheet or signature is of proper thickness and thereby permit movement of said lever in said opposite direction, or to a further position when the thickness of the gripped sheet or signature is less than the proper thickness or when no sheet or signature is gripped by said gripper whereby movement of said lever in said opposite direction is prevented through engagement of the shoulder on said upper block with said finger, said last-named means upon gripping engagement by said gripper of a sheet or signature of a thickness in excess of the proper thickness having a movement imparted thereto insufficient to move said finger clear of the shoulder on said lower block thereby preventing movement of said lever in said opposite direction.

12. Apparatus as defined in claim 11, wherein said movable carrier comprises a continuously rotating member having a circular sheet or signature engaging surface and mounted to rotate about a fixed axis.

13. Apparatus as defined in claim 11, wherein said last-named means comprises a controlling finger connected to said gripper for movement thereby and depending therefrom, a stud journalled on said carrier and supporting said long finger, a relatively short arm secured to said stud, and a contact element adjustably threaded in said arm and engageable by said controlling finger.

14. In apparatus of the character described, a movable carrier having a sheet or signature supporting surface, a gripper movably mounted on said carrier, means for moving said gripper toward said surface to closed position on a sheet or signature, a member mounted on said carrier for relative movement in opposite directions a predetermined extent so as to occupy a predetermined invariable position in each of said directions, a cam and spring operated means for moving said member in said directions to said positions, control means independent of said carrier and arranged to be engaged and actuated by said member in one of its positions during movement thereof with said carrier, and means actuated by said gripper for controlling the positioning of said member at said positions and the operation of said control means thereby in accordance with the thickness of the sheet or signature being gripped by said gripper.

LEO C. WILLIAMS.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
761,496	Juengst	May 31, 1904
1,738,180	Frazier	Dec. 3, 1929
2,020,321	Kleineberg	Nov. 12, 1935
2,145,520	McFarlane	Jan. 31, 1939