Dec. 5, 1950 P. E. KLEINEBERG 2,532,626

SIGNATURE HOPPER MECHANISM

Filed July 31, 1946 3 Sheets-Sheet 1

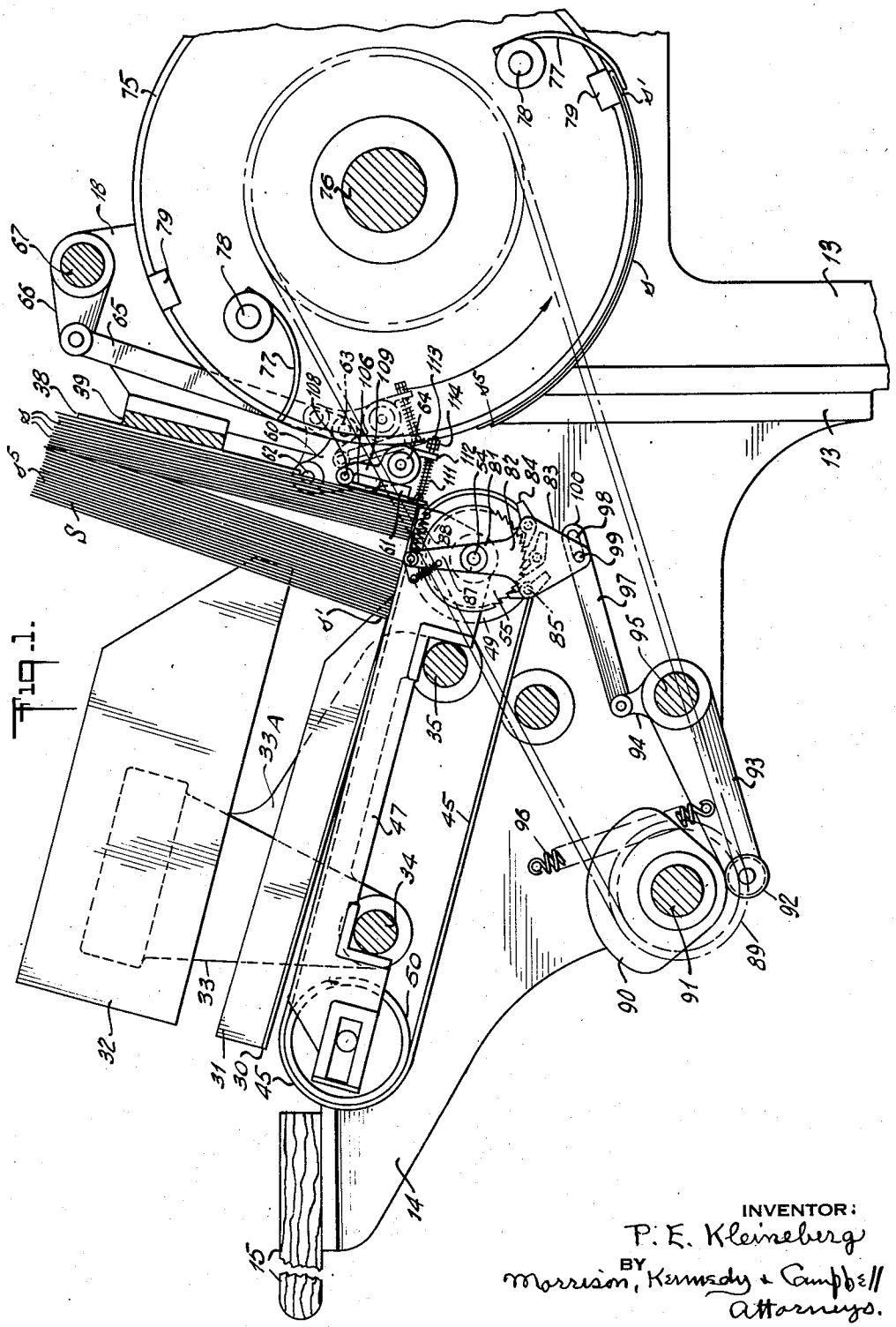


Fig. 1.

INVENTOR:
P. E. Kleineberg
BY
Morrison, Kennedy & Campbell
Attorneys.

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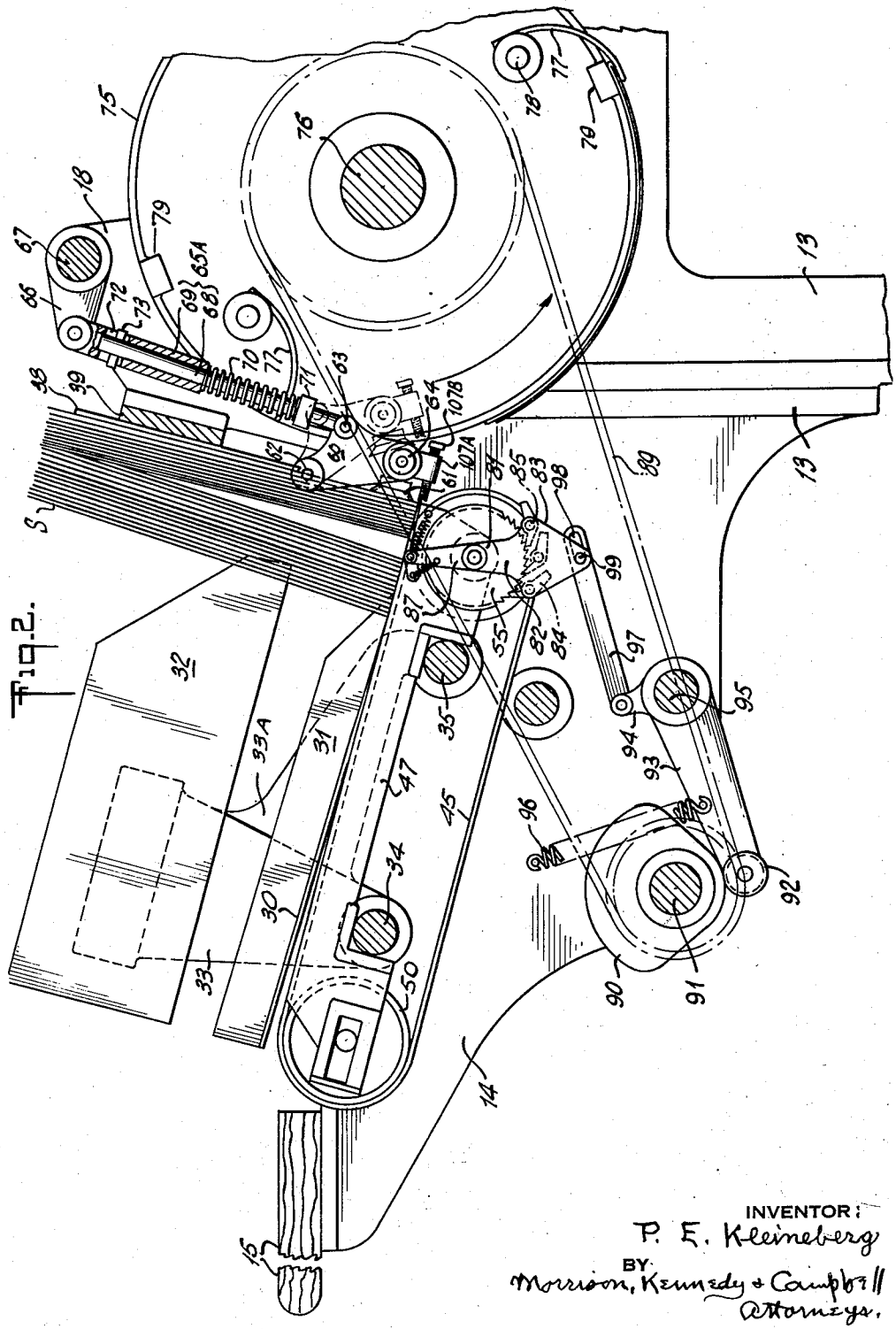


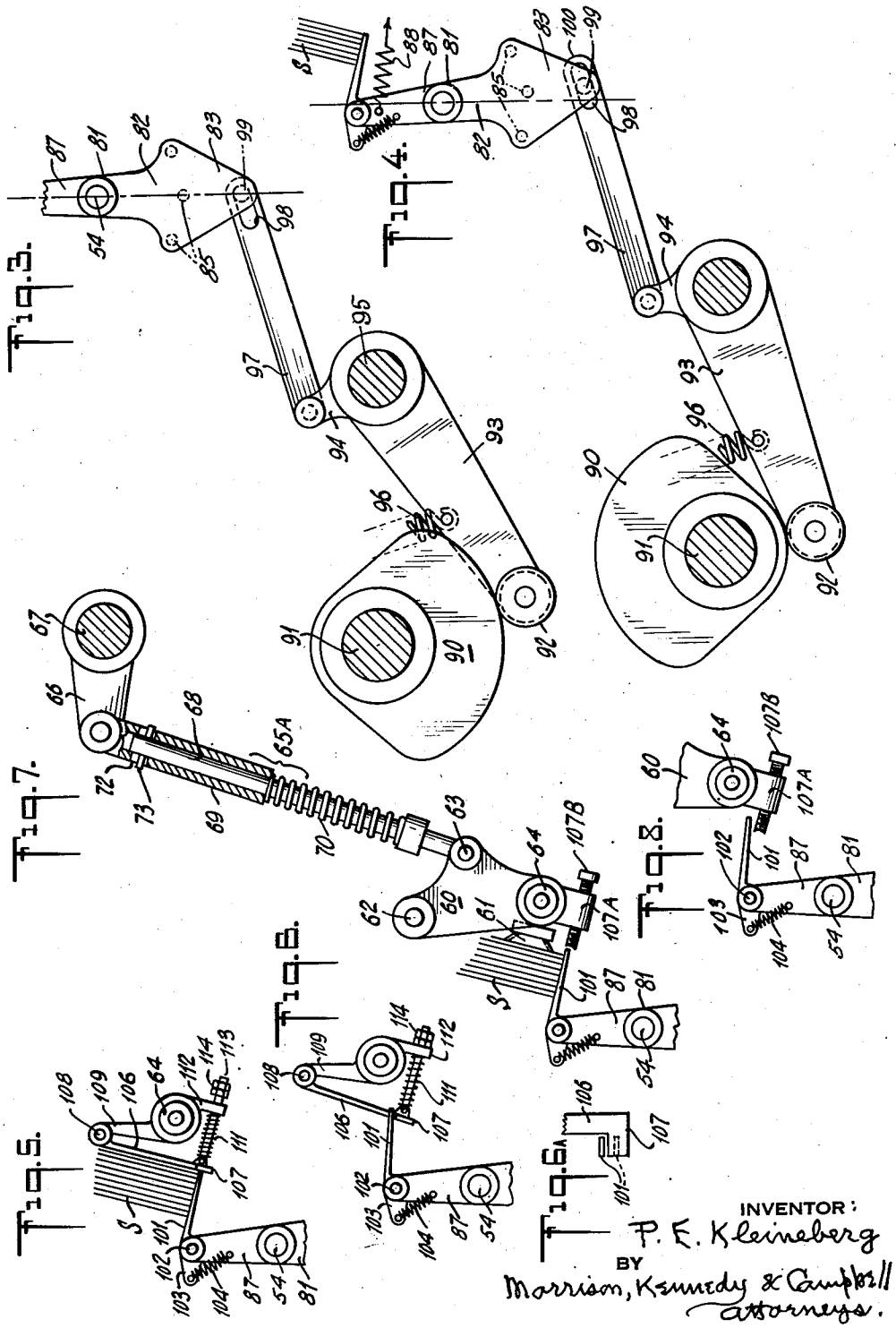
Fig. 2.

INVENTOR:
P. E. Kleineberg
BY
Morrison, Kennedy & Campbell
Attorneys.

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Filed July 31, 1946 3 Sheets-Sheet 3



INVENTOR:
P. E. Kleineberg
BY
Morrison, Kennedy & Campbell
Attorneys.

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UNITED STATES PATENT OFFICE

2,532,626

SIGNATURE HOPPER MECHANISM

Paul E. Kleineberg, Easton, Pa., assignor to T. W. & C. B. Sheridan Company, New York, N. Y., a corporation of New York

Application July 31, 1946, Serial No. 687,498

13 Claims. (Cl. 271—31)

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This invention is a novel signature hopper mechanism, and refers particularly to signature stack supporting and feeding means of the known kind wherein the signatures are stacked edgewise, resting upon a support or hopper bottom which includes a frontwardly traveling web upon which the signatures stand edgewise, and also includes side walls or stack guides between which the stack may be loaded or resupplied from the rear, to be advanced progressively frontwardly, and a front abutment against which the stack may bear in suitable position for the successive extractions therefrom of front signatures with substantially vertical or upright extracting motion, upwardly or downwardly.

A typical instance of the practical utility of a signature stack holder or hopper of the kind referred to is in signature gathering machines; and an illustration of such a machine embodying a hopper mechanism of the kind referred to is that shown in the prior patent of Kleineberg, Schweizer and Wilks No. 2,163,732, issued June 27, 1939, reissued June 25, 1940, No. 21,489. The hopper and stack feeding means of the present invention may be employed in various signature handling machines including different types of gathering machine, such as the insert gatherer for producing saddle stitched pamphlets, illustrated in said prior patent, or the flat gathering machine for producing side-stitched pamphlets; wherein in either case the signatures are stacked edgewise or substantially upright in the hopper in a manner adapting each frontmost signature to be gripped by its upper or lower edge, extracted from the hopper by suitable extracting means, as a rotary drum, carried away from the extracting position and transferred to a suitable receiving point such as the conventional traveling conveyor of an insert gathering or a flat gathering machine. Said prior patent illustrates upward extraction, preceded by a slight downward retraction of each signature, while herein is illustrated the well known plan of direct lower edge gripping and downward extraction of each signature, either plan being usable with the hopper mechanism of the present invention; while the hopper bottom or stack supporting web is preferably, as shown in the prior patent and herein, slightly inclined downwardly toward the front, so that gravity aids in keeping the loaded supplies in place, the signatures leaning lightly frontward.

The general object of the present invention is to afford a signature hopper mechanism of improved operation, efficiency and durability, especially with respect to the bodily feeding of the

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stack of edgewise signatures by the frontward travel of a supporting bottom or web. A further object is to afford improved reliability of action and ability to operate at the increasing speeds prevailing in the gathering of signatures and production of pamphlets therefrom. A particular object is to afford a fine control of the stack feeding action in a manner to keep pace correctly with the rate of gradual depletion of the stack at its front end while resupplies are added at the rear end of the stack or hopper. Another object is to afford a practical means for fine adjustment in accordance with varying thicknesses of signature. Other and further objects and advantages of the invention will be explained in or appear from the hereinbelow description of one or more illustrative embodiments of the invention.

In the accompanying drawings:

Fig. 1 is a general left elevational view of sufficient portions of a signature feeding and gathering machine to illustrate the novel elements and combination constituting or embodying the present invention; certain longitudinal parts and shafts being shown in transverse vertical section, and certain detacher parts shown in dotted lines in a different position; the front of the machine being considered to be at the righthand side of Fig. 1.

Fig. 2 is a left elevation similar to Fig. 1 but showing a second form involving a modified construction of certain of the elements of the invention.

Fig. 3 is a detached left elevation of certain of the operative elements shown in Figs. 1 and 2, but with the parts in a different position or stage of action; and Fig. 4 is a view similar to Fig. 3 but with the parts in a still different position.

Fig. 5 in a left elevation is a detached view of certain elements of the first form shown in Fig. 1; while Fig. 6 is a view similar to Fig. 5 but showing the same parts in a different position, and Fig. 6A is a front view of part of Fig. 6.

Fig. 7 is a left elevation of a portion of the mechanism of the second form as shown in the Fig. 2 modification, with the parts in a different stage or position; while Fig. 8 shows certain of the parts of Fig. 7 but in a still different position.

Referring first to certain parts of the gathering machine, which may be of design and operation generally as in said prior patent, the lower frame of the machine is omitted, but the upper frame 13 is seen, and this provides bearings for the main shaft, not shown, and various other shafts, as well as longitudinal frame parts and rods extending between the several upper frame

transverse walls 13. Such terms as front and back, right and left, are employed in a relative sense, and not intended as limitations upon the invention. At the upper rear of the frame transverse walls 13 are provided extending brackets 14 to give support, in each section of the gathering machine, to a signaturer loading shelf 15. At the upper front are a number of high front brackets 16 giving support to various elements in each section. The main shaft may be arranged below the extracting drum 75 as in said prior patent, not being herein illustrated, but being the source from which motion is derived by various countershafts and other elements. Other known general parts, such as the extracting means will be described hereinafter.

Referring next to the hopper mechanism, located generally between the loading shelf 15 at the rear and the extracting drum at the front, the hopper in each section of the gatherer is provided with a bottom or plate 30, preferably consisting of two opposite such plates, upon which the edgewise stacked signaturer lower corners may rest. At each side, right and left, of each hopper mechanism is arranged certain stack confining means, shown as including a low wall or side plate 31 at each side and thereabove an opposite pair of side guides or walls 32. The bottom plates or ledges 30 of the hopper may be formed as flanges at the lower edges of the low side walls 31. The high walls or guides 32, and preferably also the low walls 31, are arranged slightly closer together than the length of the signatures, this being for the purpose of compelling the loaded batches of signatures to take a bowed or arched form, with the concave side thereof toward the rear, in the manner more fully shown and explained in said prior patent. This bowing has the effect of stiffening the infed signatures against collapse or slumping in the hopper, while allowing the desired progressive frontward bodily travel or feed of the stack. As in said prior patent the rearwardly concave bowing of the signatures may be confined especially to the lower portion thereof, this being sufficient, and permitting the upper portions of the signatures to stand flatly against the front abutment to be described. As another preference, the hopper side walls are shown terminated somewhat short of the front of the hopper, also as illustrated in said prior patent, this having the advantageous effect of releasing a relatively small group of front signatures, which thereby flatten out against the front abutment, bringing the whole width of such group of signatures frontwardly in optimum position for the detaching and extracting operations to be described.

The upper and lower side walls 32 and 31 at each side of each hopper are supported upon upstanding brackets 33, which may be adjustable widthwise for different lengths of signature. These brackets, constituting carriages for the side walls, are shown supported upon a longitudinal rod 34, that is, transverse to the frontward direction of stack feed, near the rear of the hopper, and may have an extension 33A engaging also a similar front rod 35. The adjustment of the carriages 33 for signature lengths may be effected by providing the rods 34 as threaded shafts, with opposite threads for the respective two carriages in each hopper so that by adjustment they may be set closer together or further apart, as in said prior patent further described.

At the front of each hopper is an abutment 38, constituting a stop plate, preferably of the full width of the hopper, and being inclined slightly frontwardly to correspond with the downward incline of the hopper, so that contained signatures may rest firmly and securely against the abutment plate, and gravity thereby aiding in the frontward feed of the stacked signatures. The abutment 38 is shown mounted upon a cross bar 39 which takes its support from the upper front frame brackets 16, and may run the full length of the gatherer.

For the progressive frontward feed of the stacked signatures in each hopper there is shown a traveling support or bottom web 45, in the nature of a feed belt; this being located centrally between the opposite bottom plates 30 and approximately at the level thereof, said web taking the major part of the weight of the supported signature stack. Preferably the traveling bottom web 45 is an endless belt, with upper and lower stretches, and its upper stretch may travel slidingly along an underneath rigid support, shown as afforded by the upper side of a carriage 47. Said carriage may be positioned by and supported upon the rods or adjusting shafts 34 and 35, and it may be bodily removable therefrom for purposes of access, interchange or repair. The endless traveling web 45 may pass around pulleys 49 at the front and 50 at the rear of the carriage 47.

The progressive frontward travel of the supporting web 45 of each hopper may be effected by the methodical rotation of the front supporting pulley 49, the shaft 54 of which pulley takes it bearings in the bottom supporting carriage 47. The travel being naturally very slow and gradual, special means is necessary to effect the regulated rotation of the driving pulley 49 of the endless feeding belt 45. The rate of feed must be varied in accordance with the thickness of the individual signatures to be fed, and it has been found that intermittent rotation and travel are highly advantageous for the purpose, such action being that described in said prior patent. To carry out this plan there is shown mounted to turn with the drive pulley 49 a ratchet wheel 55, preferably secured near one end of the pulley shaft 54 and formed with fine teeth cooperable with pawl means to deliver clockwise rotation to the pulley, and forward travel of the web, as viewed in Figs. 1 and 2.

To this point the described elements correspond closely with those bearing the same reference numbers in said prior patent; but from this point of description onward the elements, combinations and operations differ materially, calling for the use of independent reference numbers on the parts.

The signatures will first be referred to. The stack S contains the many edgewise-standing individual signatures *s*, and these may be either of the lap type, each having an extension of part of its openable edge to assist opening for saddle gathering, or of the regular type as preferred for flat gathering, as explained in the prior patent. Herein the signatures are shown stacked for downward extraction, each signature having its closed back edge *s'*, whereat the final fold is formed, at the bottom, and its openable edge s^5 at the top; and an extracted signature is seen traveling with its closed edge *s'* leading upon the periphery of the extracting drum.

The successive feeding of frontmost signatures from the stack involves, in the form herein

shown, as in said prior patent, the operation of detaching an edge of the signature from the remainder of the stack, by swinging said edge frontwardly from the stack, followed by gripping of the detached edge and pulling the signature bodily from the stack and hopper, by the use of an extractor means or drum which carries grippers and rotates in the desired direction, in this case counterclockwise for downward extraction and frontward transfer, on the drum periphery, towards a point of gathering or other disposition. Thus in both forms of the invention, seen in Figs. 1 and 2 and others, there is shown a detaching means 60 of the advantageous suction type, the body of which constitutes a carriage, or opposite pair of carriages, shiftable or swingable rearwardly toward the lower edge of the signature stack and frontwardly therefrom to deflect and swing outwardly the signature lower edge. The actual engagement with the signature face is by means of two or more suction cups 61 which partake of the timed swinging movements of the detacher. The carriages 60, at the opposite sides of each carrier section, are mounted to swing about high fulcrums 62, for the lower ends to swing rearwardly and frontwardly. On a frontwardly offset portion of one or both of the carriages 60 is a pivot 63 by which the timed actuation is effected. At the lower portion of the swinging system is a transverse member or hollow suction bar 64, extending substantially the full width of the section and giving direct support to, and pneumatic connection with, the two or more suckers or cups 61.

The operations of each suction detacher 60 in each section of the gatherer and in each extracting cycle are substantially conventional, the suckers being shifted or swung rearwardly at the proper moment in each cycle so as to come in contact with the front signature, the suction effect being then applied through the sucker bar 64 and suction cups by passages, controlling valves etc., not shown, the detaching system being thereupon swung frontwardly to detach and deflect outwardly the lower edge of the frontmost signature, for gripping and extraction, and the release of the suction condition occurring at the same time that the extracting gripper engages the signature edge. The mechanical actuation of the signature detacher may be through any suitable connection thereto from an appropriate cam or timing device providing one operation per cycle. For illustration there is shown an actuating link 65 extending from the detacher pivot 63 upwardly to a pivot at the free end of a rearwardly extending rockarm 66 mounted on a rockshaft or axle 67 supported by the frame bracket 18. By the actuation of the rockshaft or rockarm the required swinging movements of the detaching suckers are produced. Fig. 1 shows in dotted lines the frontswung position of these parts.

The suction detaching means thus described upon Fig. 1 is in general duplicated in Fig. 2, with modifications; and one such modification is the providing, instead of the simple actuating link 65 of Fig. 1 a cushioned or yielding link 65A seen in Fig. 2 and in Fig. 7. This yielding element could be provided at any point in the train of connections for working the suction cups, so long as a limit to the yielding motion is provided, but preferably the yielding means is embodied in the link 65A of the second form of the invention, the purpose and operation of which will be hereinafter fully described. As shown in Figs. 2 and 7 the yieldable link is shown as composed of a pair of telescoping members under spring control, for example, a rod 68 pivoted to the detacher at 63 and a sleeve 69 pivoted to the rockarm 66, the rod being slidable telescopically within the sleeve. The depending sleeve is of short length, and there is arranged a compression spring 70 between the bottom end of the sleeve, and a collar 71 near the low end of the rod, so that the normal effect of the spring is to lengthen or expand the yieldable link, this action however being limited by an expansion stop means shown as a pair of opposite slots 72 formed in the walls of the sleeve member 69 and engaged by a pair of opposite stop pins 73 projecting outwardly from the rod member of the link. The normal length of the link is its full length when the yielding spring 70 has forced the pins 73 to move to the bottom of the slots 72; while the potential yield is such as to permit a slight shortening of the link length thereby to permit an abnormal frontward relative motion or swing of the suction detacher 60.

At this point may conveniently be briefly described the illustrative extracting means shown in the drawings. The main element is the rotary extractor or drum 75, one such drum being provided for each hopper, and the drums being preferably of the skeleton type as in said prior patent. As illustrated, the drum is mounted upon a continuously rotating shaft 76, which may be an elongated shaft serving all sections of the machine, and turning counterclockwise in the present embodiment. On the drum are carried signature grippers 77 shown in the form of jaws each swingable about a rockshaft 78 on the drum and each cooperating with a relatively fixed gripper seat 79. Each illustrated gripper represents a set or pair of grippers, spaced apart longitudinally on each drum so as to be able to grip each detached lower signature edge at two spaced apart points, insuring accurate extraction and transfer of signatures. While one conventional arrangement involves a single gripper set upon each drum, for extraction of a single signature in one complete rotation of the drum, there is shown the other conventional arrangement of a plurality of gripper sets, in this case two opposite gripper sets, involving the extraction of two successive signatures in each rotation of the drum; the drum therefore being rotated at half speed, that is, one half turn of the drum per cycle. Each of Figs. 1 and 2 shows a first gripper set in the act of transferring away a signature just extracted, for handling in a manner forming no part of the present invention; and diametrically opposite thereto a second gripper set which stands open but the jaw 77 of which is ready to be swung rapidly around to bear upon the seat 79 thereby gripping, on the run, the outswung lower edge of the frontmost signature in the hopper.

Having referred to the ratchet or feed wheel 55 by which the stack feeding web 45 is advanced progressively toward the front, the means for causing the controlled clockwise rotation of the ratchet wheel will now be referred to. An oscillating lever 81 is shown in Figs. 1 and 2, also in Figs. 3 and 4, which is mounted coaxially adjacent to the ratchet wheel and carries the pawl means for operating the ratchet. The pawl lever 81 may swing loosely upon the shaft 54 which carries the ratchet wheel and the pulley 49; and the lever comprises a first arm 82, in this case the lower arm, this being provided with

or formed into a head or pawl carrier 83. Instead of using a single pawl operating upon very fine ratchet teeth, as in said prior patent, the preferred arrangement is the use of the multiple pawls, and for this purpose the carrier 83 is shown as giving support to three lightly spring-pressed or gravity-operated pawls 84, all bearing constantly upon the ratchet periphery. The head or carrier 83 is therefore provided with three pawl pivots or pins 85; and these and their pawls are differentially spaced, in the known manner of differential pawls, so that the pawl pitch may be considered as subdivided into three equal fractions, with the three pawls in correspondingly spaced relations. By this arrangement is provided the equivalent of much finer ratchet teeth worked by a single pawl, while retaining teeth of ample size and strength. As the pawl carrier is oscillated, the amount of advancing drive communicated to the ratchet and the hopper web may be to the extent of one-third of the pitch of a single tooth, or of selective multiples thereof. The pawl lever 81 is formed also with a second or upper arm 87, utilized to cooperate in the control of the feeding action of the pawl and ratchet system. A pull spring 88 is shown urging frontwardly the upper end of the pawl lever arm 87, with a very light pull, tending to bring a pawl to a ratchet tooth and hold it there until a feed stroke of the lever 81 takes place; said spring 88 serving also to hold a trip finger 101 on the lever in contact with a feeler member 106 during an idle stroke as will be described.

As a means to oscillate the pawl lever 81 is shown a driven actuator or rotary cam 90 mounted upon a longitudinal drive shaft 91, which may extend the full length of the machine. Said shaft may be geared from the main or drum shaft 76, with 2 to 1 ratio, for example by a sprocket chain 89. The cam should be cyclic, making one action or revolution per cycle, for example, having an outer dwell and an inner dwell separated by two cam slants and adapted to put the pawl lever through its clockwise or feed movement in each cycle. The cam or timing means is preferably an open cam with its periphery acting directly upon a follower or roll 92 carried on a rocking cam arm 93, which constitutes part of a cam lever the second arm 94 of which may extend at an angle to the first.

The cam lever 93, 94 is mounted to rock about a longitudinal axle 95, and in order to hold the follower 92 always in contact upon the cam periphery there is suitably provided resilient means such as a stout coil spring 96 pulling for example upon the first cam rockarm 93. From the second arm 94 extends a connection to the pawl lever, being illustrated as a link 97, arranged for example at about a right angle to the arm 94, so that the lever oscillations produced by the pawl-actuating cam 90 are applied to cause a swinging of the carrier 83 and the pawl or pawls carried thereby. Instead of rigid connections between the cam and the pawl carrier, depriving this system of variable control of stack feeding, a lost motion device is introduced at a suitable point. This for example may consist of a pin and slot device, the slot 98 being shown provided at the front extremity of the link 97, and the pin 99 projecting from the lower tip of the pawl carrier into said slot. Said device is such, acting like a hook, that the cam can only swing clockwise the lever, for its feed stroke as will be hereinafter more fully explained, the link slot end 100 being the hook.

The web-advancing wheel 55, while shown as a ratchet with teeth, may be of the toothless kind if a so-called silent pawl is used, gripping the wheel periphery on each feed stroke. Said feed wheel and the train of connections leading to it, namely, the variable-throw reciprocating carrier or pawl lever 81 and the pawl means thereon, and the cam-driven rocklever 93, 94, with link 97 and pin-and-slot lost-motion device or loose connections 98, 99 extending to the carrier lever from the rocklever, may be considered as constituting a variable speed intermittent drive for the feed web; the variation of the carrier throw being the means of regulating the rate of wheel rotation and of web and stack travel. In combination with these combined elements, in their broad and specific aspects, the present invention provides a novel control means to cause the stack feed to keep pace substantially with the rate of extraction of signatures, and with the resulting depletion at the stack front, being greater with thicker signatures and vice versa.

Said control means of this invention takes its action from the stack itself, and comprises a shiftable feeler member or presser 106 bearing on a free or exposed part of the stack front, preferably resiliently, and taking therefore a variable position responsive to the degree of looseness or tightness of the stacked signatures near the front. This feeler has connections, extending operatively at certain points of time to the regulating means, specifically shown as loose or lost motion connections to the pawl lever or carrier, arranged and operating to increase the stack travel speed with greater looseness of signatures and vice versa; so that excess looseness is promptly corrected by the faster feed, while excess fullness or tightness causes the feed to reduce to a minimum, or even to zero for suspension, until mean conditions are again established. Besides the general advantage of controlling the mean rate of stack feed to accord with the depletion produced by extraction of signatures, the described arrangement has the advantage that the exposed or free areas of the stack front are continuously maintained at a uniform and optimum frontward position, thereby cooperating efficiently and reliably with the suction detacher means including the sucker cups 61 which in each cycle are moved rearwardly to a definite signature engaging position.

More specifically, the invention may be said to consist in a signature hopper mechanism of the kind handling edgewise stacked signatures, having at its bottom the aforesaid traveling feed web for feeding frontwardly the stack, with lateral means for guiding the advancing stack, and the front abutment against which the stack may bear in position for each of the front signatures in cyclical succession and by automatic means to be detached at its edge, gripped and extracted; and characterized by means for advancing the feed web at a rate corresponding substantially with stack depletion, comprising the following elements. A feed wheel 55 having connections operative to advance the feed web, a reciprocable carrier 81, 82 with pawl means 84 to engage and intermittently advance the feed wheel and web to a variable extent determined by the throw of the carrier, and a driven actuator, the cam 90, having connections to said carrier to impart successive feed strokes to bring the carrier to a constant final position in each action but with lost

motion 98, 99 in said actuator connections permitting variable return strokes and consequent variable feed strokes of the carrier. With these elements cooperates the control means for determining in each cycle the variable extent of feed wheel and web advance derived from said actuator cam through said lost-motion connections and carrier, comprising a shiftable feeler 106 resiliently yieldable frontwardly and spring-pressed rearwardly in each cycle to bear upon and compress a free portion of the stack front thereby responsively to take a variable rear position determined by the condition of looseness or tightness of the stack front. The pawl carrier and the feeler are so interconnected at least during the idle part of the cycle that they shift in unison, and the feeler by its variable rear position determined by the stack condition, and its corresponding consequent relative frontward yield during each idle period, effects a variable abridgement of the full operative throw of the pawl carrier, as permitted by the lost motion in said actuator connections. By such mechanism, when the stack is tight full the actuator operations are substantially taken up within said lost-motion, and the pawl carrier throw and stack feed rate are minimum or zero; whereas with increasing stack looseness the feeler and thruster and consequently the connected carrier take progressively rearwardly displaced positions to being about progressively increasing throws of carrier and pawl means, with increasing rate of stack feed, until excess looseness of stack is taken up, and vice versa.

While in principle the interconnection between the feeler and carrier might in some cases be a link pivoted to both of them to cause shift in unison, or even a simple mounting of the feeler upon the carrier, a mere lost-motion connection with contacting cooperation is preferred, in order to permit the feeler to be conveniently mounted on the detacher and shifted away frontwardly with it for one period of each cycle, and also to permit the tripping of the connection into inactivity when the stack is empty, thus obviating wear upon the pawl, ratchet and other parts, as will be more particularly described. Thus the pawl lever is preferably subjected to two one-way actions by loose or lost motion connections operating like mere contacts or hooks; (1) during the feed period the feed cam operating through the link or hook connection 97, 98 to swing the lever clockwise, pulling leftward its lower end to cause feed; while (2) during the non-feed period the feeler-pusher operates through contact connection to swing the lever counterclockwise, pushing its upper end leftward to a variable extent which determines the subsequent extent of feed in the next period. Neither operating train is continuously operative but they act alternately, the feeler-controlled train causing the pawl carrier idle stroke at one stage, to a variable degree according to the needs, the feed-cam train causing the carrier feed stroke to the extent determined by the preceding idle stroke.

The mechanism for carrying out the feed control operations and results of this invention comprises combinations of elements such as shown in Figs. 1, 5 and 6 or as in Figs. 2, 7 and 8, or equivalents thereof, the function thereof being to change the extent or angle of swing of the pawl lever 81 in each direction to a variable movement determined by the condition of the stack at its front end, whether it is tight full or substantially loose and compressible; thereby to

vary accordingly the throw of the pawl carrier and thus accelerate or decelerate the mean or average rate of frontward stack feed in accordance with the needs.

Referring to both forms, one of the preferred elements of the control mechanism, and a contacting part of the interconnections between feeler and carrier, consists of a contact piece preferably in the form of a trip member or finger 101 located upon, and preferably pivoted at 102 atop, the pawl lever 81 or the upstanding arm 87 thereof, being thus an extension of the carrier. This contact member extends frontwardly from said pivot beneath the frontmost group of stacked signatures, and reaches, at its extremity, approximately to the frontmost signature, which is about to be detached and extracted, as seen in Figs. 1, 2, 5 and 7. The trip finger or contact piece 101 therefore is swingable upwardly and downwardly on its pivot 102, and it is shown as being spring-positioned by means of a rearwardly extending tail 103 that is pulled downwardly by a light spring 104 tending slightly to lift the trip finger from its normal or operative position shown in Figs. 5 and 7 to an upwardly swung idle position as shown in Figs. 6 and 8, and in the detached front view Fig. 6A.

This upswinging tripping movement of finger 101 is an abnormal one, occurring only when the stack is empty and serving merely to shift somewhat the trip finger away from the operative position in which it coacts with the feed control elements 106, 107 to be described; the spring 104 having only sufficient tension and play to effect the described slight upward tripping displacement of the contact finger. When the hopper is resupplied with signatures they act to depress again the finger 101 to normal operative position.

This tripping action of the finger 101 is advantageous in rendering the control and feed action inoperative for any given hopper or hoppers which are not being used, thus saving needless wear. In gathering thin pamphlets only a few hoppers may be in use, and the finger tripping action in the others renders them idle.

Cooperating with the tripping contact finger 101, which is carried bodily frontward and rearward with the oscillation of the upper arm 87 of the pawl carrier lever, is what is designated a feeler member or presser 106 arranged to press against the stack, and which feeler takes distinctly different mechanical forms in the two embodiments of the invention, but in each case detecting the degree of looseness of the front group of signatures and thereby undergoing and transmitting to the contact piece or finger 101 and the pawl lever arm 87 a variable idle rearward shift.

The feeler arrangement shown in Figs. 1, 5 and 6 will be first described. The feeler member 106 is provided with an extension piece or foot 107 which during the non-feeding period is located directly frontward of the regular position of the contact finger 101. Therefore the low foot or offset 107 is in thrusting line with and adapted to contact the front end of the contact finger, and may be considered a pusher or thrust piece therefor. The feeler member or presser is arranged with its body part or strip 106 adapted to bear rearwardly against the lower front margin of the stack, where in each cycle it takes a variable position according to the condition of the stack; while at its lower end, where it projects slightly below the lower edge of the front signature, its offset foot or horizontal extension 107

when in feeling position stands directly in front of and is adapted to thrust upon the contact finger or piece 101. Thereby the stack-determined position taken by the feeler extension or thrust piece 107 in each cycle determines the extent to which the contact finger is thrust rearwardly and the pawl lever is swung counterclockwise for its idle stroke. This variable and usually abridged motion or swing, being the idle or return stroke of the pawl lever and carrier, the next subsequent clockwise or feed stroke is of course varied or abridged correspondingly, as the parts pass from the Fig. 4 to the Fig. 3 position during which stroke the action of the cam 90 causes the so-varied active feed stroke of the carrier and pawls, acting through the lost-motion pin-and-slot device 98—99, which permits the described variation of actual throw and feed, the cam action always bringing the carrier to the constant limit or zero position of Fig. 3.

By the principles of the invention the feeler and its offset foot or thrust member 107 are thus adapted in each cycle to shift rearwardly to different operative positions in accordance with the tightness or looseness of the signatures at the front end of the stack, the greater the looseness and need of accelerated feed the greater the rear shift. For these purposes the feeler 106 is arranged and fitted to thrust rearwardly, with sufficient pressure to compact the frontmost signatures when they are in slack condition, taking up the slack and to the degree thereof shifting rearwardly. The feeler 106 may take different mechanical forms, being shown in Figs. 1, 5 and 6 as a depending plate or strip, for example pivoted at 108 at its upper end and extending downwardly therefrom for contact with the front signature, at least during the non-feed period, and with its low extremity extended or offset as the aforesaid thrust extension or contact foot 107, being the part which is shifted by the feeler and directly coacts, by thrust-connection, with the contact finger 101 atop the pawl lever. A convenient way is illustrated for mounting shiftably the plate or feeler 106, its pivot 108 being at the top end of a small bracket 109 shown as extending upwardly from the suction bar 64 or other part of the swinging suction detacher 60. With this arrangement the feeler and mountings are swung bodily away frontwardly from the stack during the signature detaching operation, clearing the path for signature extraction, and then back into feeling position. The stack feed stroke caused by the feed cam preferably occurs during the frontward separation of the feeler from the stack; while the following return of the feeler to the stack and its compression thereof provide the variable idle stroke of the carrier and pawls.

As a means of resiliently pressing the feeler 106 against the front lower margin of the signature stack when the detacher is in its rear swung position, a spring 111 is shown, this being of ample strength to overcome the light pull spring 88, and being under compression between the lower end of the feeler and a convenient front abutment such as a drop lug 112 depending from the sucker bar 64 well in front of the feeler. The spring 111 may be of the helical type and may surround a long pin 113 the rear end of which is pivoted to an ear near the lower end of the feeler and the front end of which is slidable through a perforation in the drop lug 112, a pair of locking stop nuts 114 being mounted upon the front end of the slide pin to determine or limit the extreme rearward position of the feeler 106, as shown in Fig. 6, while permitting frontward yielding, as to the position shown in Fig. 5, which may be caused by the frontward feeding of the stack or in some cases by the cyclic frontward throw of the upper arm 87 of the pawl lever acting through the contact piece 101 to push frontwardly the feeler during each feed action. The feeler mounting elements 108, 109 and 112 are preferably carried as shown by the sucker bar 64, thereby partaking of the swinging movements of the suction detacher 60, by which the suction cups 61 in each cycle are swung frontwardly for detaching the lower margin of each front signature, and thereafter rearwardly again, following the extraction of such signature, into normal contact with the next succeeding signature, for repeat of action; the spring 111 when the detacher is in normal position maintaining the feeler bearing firmly against the stack.

At any time when the extraction of signatures has proceeded to an excess extent, to render loose or slack the frontmost group of signatures, these become compressible so that in each cycle the feeler 106 becomes swung further and further toward the rear, whereby it takes a variable rearward position to determine variably for each cycle the idle position of the pawl lever 81, for example, as shown in Fig. 4. On its next or active stroke the lever is swung clockwise through a variable increased distance, being the same as that of the idle throw. Thus the extent of feed is controlled, being greater with increase of signature looseness and vice versa. The number of ratchet teeth, or tooth fractions, over which the pawls can play becomes thus increased, thereby adjusting the rate of stack feed to accelerate it, until the accelerated advancement of the stack takes up its looseness and may eventually produce tighter packing of the signatures, which action in turn, upon any excess of feed and packing, varies reversely the action of the feeler to reduce again its rearward thrust and therefore reduce the effective rate of stack travel. By these actions the travel of the stack, on the average, is caused to keep pace quite closely with the depletion caused by the removal of signatures at the front end of the stack; and, due to the subdivision of pawl and ratchet action by the differentially spaced pawls, this plan works well with all usual signatures including the thickest and thinnest, maintaining a substantially steady feed, with small variations, and a substantially uniform condition of signature packing.

In the described action it will be understood that the timing cam 90 acts the same as a positive or closed cam, the strong spring 96 holding the follower always to the cam; so that the transmitting link 97 reciprocates always through its full distance, between the limits shown in Figs. 3 and 4. Moreover at the end of each active or feed stroke the pawl lever is brought always to its constant extreme clockwise or Fig. 3 position, the pin-and-slot lost motion being fully taken up. At the end of each idle or return stroke however the lever is seldom if ever brought to its extreme counterclockwise position, sufficient stack looseness therefor being rare, and the lost motion 98, 99 functioning to allow the feeler 106 and thrust piece 107 to bring the connector or trip finger 101 and pawl lever to a variable intermediate position, such as is shown in Fig. 4; in which sense the thrust piece 107 acts as a limiting member or abutment to the lever idle stroke. The stack front in its average condition is fairly tight but slightly loose, so that usually there will occur

some degree of idle swing of the lever, and its corresponding active swing which, as soon as of sufficient extent, will start the pawl means upon its action of feeding the feed wheel and web.

As the feed stroke of the pawl carrier is preferably timed to occur when the feeler is separated away frontwardly from the stack, see the dotted line position in Fig. 1, which affords ample timing latitude, the feed cam action does not cause the compression of the feeler spring 111, although with different timing it might do so, in causing each abridged feed stroke of the pawl lever. Said spring in each cycle yields relatively frontwardly, as in Fig. 5, due to the stack abridging the rearward shift of the feeler. Whenever the stack may become tight full the feeler takes, and is stopped at, its extreme frontward feeling position, permitting the trip finger to remain in its extreme frontward position, for example held there by the light pawl lever spring 88, whereby accordingly the pawl lever remains in its extreme clockwise position, corresponding with the position shown in Fig. 3 at the close of the feed stroke. Consequently, in that condition, the feed stroke is without result, the feed being zero, and the pin-and-slot device 98—99 merely playing idly under the cam-reciprocated motion of the transmitting link 97; until extraction of signatures may again overcome the tightness, and the repositioning of the feeler and connected parts restarts the feed action. In all cases it is the rearward return motion of the feeler, variably limited as stopped by the stack, that determines the variable idle position of the pawl lever and thereby the extent of the next following feed stroke.

The pawl carrier never lacks control; its idle throw is by the counterclockwise thrust imposed by the feeler; its feed throw by the clockwise pull imposed by the cam through the hooking or pulling end 100 of its link slot 98; and between these actions the light lever spring 88 holds a pawl upon the feed wheel or ratchet tooth, the pawl springs also being very light. The friction of the parts 45, 49, 54 etc. prevent false or accidental feed or other motions that might interfere with the controlled feed of the stack.

The stack feeding action of the hopper bottom web 47 being step-by-step its mean travel speed is what is to be coordinated with the depletion caused by extractions of signatures. As an example, with signatures 1/20 inch thick extracted at the rate of 30 per minute the mean speed of the web should average 1.5 inches per minute. While a given mean speed can not be attained exactly by pawl-and-ratchet it can be alternately over and under attained; and the present invention in this way controls the action through the stack feeler operating through the carrier to cause alternating overfeed and underfeed according to the looseness or tightness at the front of the stack. When the stack becomes "low," and its looseness increases to the point whereat the feeler and thruster 106—107 begins to cause sufficient idle swing of the pawl lever for a pawl to pass on to a new tooth, the feed commences, increasing with increase of looseness, until the phase is reversed and the stack feed causes tightening until the opposite action occurs. With thicker signatures a single pawl might give fine enough feed regulation, but the multiple pawl device serves well even for the thinnest. These considerations obviate having to change the ratchets for different pitches with changes of signatures. The ratchets are selected with teeth coarse enough for the thickest signatures, while the subdivision provided by the multiple pawls takes care of the thinnest signatures. More than three pawls can be used for still finer action. In practice the described control of stack feed is quite quickly responsive, and the mechanism tends to assume a fairly steady action, with web travel approximating the needs. And even with thin signatures the front face of the stack never departs so far from its optimum position as to impair cooperation with the detaching suckers.

Referring further to the modification of Figs. 2, 7 and 8 this is upon the same principles as that of Figs. 1, 5 and 6 but with certain changes of structure and operation.

The following elements in Fig. 2, differing from Fig. 1, have already been referred to, namely, the cushioned link 65A by which the opposite suction detacher carriages 60 are oscillated, and the telescoping rod 68 and sleeve 69 comprised in said link, and the compression spring 70 confined between the sleeve 69 and the collar 71 serving to maintain the link yieldingly in its most extended condition, and the sleeve slots 72 engaged by rod pins 73 limiting the elongating movements of the link while providing ample play and resilient yield for the purposes to be described.

As already further explained, each detacher 60, carrying suckers 61, is cyclically shifted rearwardly against the stack and frontwardly to detach the frontmost signature edge, and this motion of the detacher is herein taken advantage of, particularly its rearward swing with pressure of sucker against the stack, to serve as a feeler or detector responsive to the looseness of the stacked signatures. These detacher parts therefore, the body 60 and cup 61, serve not merely for the detaching function, but also to afford the responsive function of the feeler 106 of Fig. 1. The detacher-feeler 60, 61 bears with pressure upon the signature stack for about one twelfth of each cycle, affording a sufficient period of time for responsive action for the purposes of controlling the rate of travel of the feed web 45 and the feed of the signature stack. By reason of the resilient character of the link, and the ability of the feeler 60—61 to yield relatively frontward while in its feeling position, this detacher-feeler, during the non-feed period of each cycle, is caused to assume a variable rearward position in accordance with the extent of depletion at the front of the stack, in a manner analogous to the described action of the feeler of Fig. 1.

Referring to mechanical details, each detacher-feeler 60—61 swings about the high pivot 62 comparable with the pivot 108 of the Fig. 1 feeler 106. Whereas each Fig. 1 feeler has a plate-like body and a downward extension in the form of an offset foot 107 to cooperate with the contact finger 101, the Fig. 2 feeler mechanism has cups to press upon the stack and provides a downward extension in the form of a lug 107A having as a part of it an adjusting screw or thrust piece 107B extending rearwardly, with its rear extension in the line of shifting movement of the finger or contact piece 101 when the feeler is in feeling position pressing upon the stack. Whereas in Fig. 1 the detacher movements are positive and the horizontal spring 111 presses the feeler toward the stack, in Fig. 2 the upright compression spring 70 of the detacher-swinging link 65A serves the same function, and likewise permits relative frontward yield of the detacher-feeler during the feeler imposed variable idle

stroke or counterclockwise throw of the carrier lever.

With this second or alternative form of the invention, as with the first form, the cam 90 should be cyclic, making one turn or cam action per extraction, and the feed stroke caused by the cam should likewise be coordinated with the feeler swinging movements. The thrust piece 107B and contact piece 101 being shown connected only by their mutual lost-motion contact in the period when the feeler comes to stack pressing position, the frontward detaching swing of the detacher-feeler can impart no clockwise or feeding shift or stroke to the carrier lever; such feed action being left to the drive cam under the control afforded by the varying rearward swing of the feeler with pressure on the stack. The relative timing of the cam and the feeler should preferably be such that the cam-produced or clockwise feed stroke of the carrier will commence about when the feeler reaches its most frontward position in each cycle, with an amplitude of stroke and extent of feed of stack predetermined by the preceding rearward shift of the feeler, to its stack-controlled position, thereby ensuring the required abridgement of feed stroke to accord with the stack condition.

There has thus been described a signature hopper mechanism embodying the principles and attaining the objects of the present invention; but since many matters of operation, combination, construction, arrangement and detail may be variously modified without departing from the principles of the invention it is not intended to limit the same except to the extent set forth in the appended claims.

What is claimed is:

1. In a signature hopper mechanism of the kind described having a traveling web on which the signatures are stacked edgewise and fed frontward for front extraction, with rear loading, a variable feed drive for the feed web, said drive comprising a feed wheel connected to drive the web and a variable-stroke oscillating carrier carrying pawl means cooperating with said wheel, means for controlling such drive comprising a shiftable feeler bearing resiliently rearward on the stack front and thereby taking a variable position responsive to the degree of looseness of the signatures, and connections from the feeler to the carrier operating to cause increase of carrier return and advance stroke with increasing looseness of stack due to depletion of signatures, and vice versa, thereby to cause the stack feed to keep pace substantially with the rate of extraction of signatures; the connections from the feeler to carrier comprising extensions in the form of separate pieces in mutual thrusting relation, the feeler piece having a strong rearwardly-pressing spring and the carrier piece a weak frontwardly-pressing whereby the former controls the carrier return stroke.

2. In a signature hopper mechanism of the kind described having a traveling web on which the signatures are stacked edgewise and fed frontward for front extraction, with rear loading, a controlled variable feed drive for the feed web, said drive comprising a feed wheel connected to drive the web and a variable-stroke oscillating carrier carrying pawl means cooperating with said wheel; means for controlling such drive comprising a shiftable feeler bearing resiliently rearward on the stack front and thereby taking a variable position responsive to the degree of looseness of the signatures, and connections from the feeler to the carrier operating to cause increase of carrier return and advance stroke with increasing looseness of stack due to depletion of signatures, and vice versa, thereby to cause the stack feed to keep pace substantially with the rate of extraction of signatures; and in combination with such recited elements the feed drive means comprising lost-motion connections to the oscillating carrier and adapted to shift the carrier for each pawl feed stroke to a constant advanced position; the feeler by its variable position being adapted to operate through its connections to the carrier to limit the return of the carrier to a variably curtailed idle return stroke, thereby correspondingly limiting the extent of the succeeding feed stroke whereby the feed rate of the web and stack is controlled; and the connections from the feeler to the carrier comprising extensions of these in mutual thrusting contact, the feeler having a strong spring pressing it rearward against the stack and the carrier having a weak spring pressing the carrier extension frontward into contact with the feeler extension, whereby the variable feeler position determines the extent of carrier idle return stroke, and thereby the extent of variable feed of the stack to keep pace with the depletion of signatures.

3. A signature hopper mechanism of the kind handling edgewise stacked signatures, having at its bottom a traveling feed web for supporting and feeding frontwardly the stack, lateral means for guiding the advancing stack, and a front abutment against which the stack may bear in position for each of the front signatures, in cyclical succession and by automatic means, to be detached at its edge, gripped and extracted; and in combination therewith means for advancing the feed web at a rate corresponding substantially with stack depletion, the same comprising a feed wheel having connections operative to advance the feed web; a to-and-fro movable carrier having pawl means to engage and intermittently advance the feed wheel and web to a variable extent determined by the throw of the carrier; and a driven actuator having connections to said carrier to impart successive feed strokes arranged to bring the carrier to a constant final position in each action but with lost motion in said actuator connections permitting variable idle return strokes and consequent variable feed strokes of the carrier; and control means for determining in each cycle the variable extent of feed wheel and web advance derived from said actuator through said lost-motion connections and carrier, comprising a first piece constituting an extension of the carrier and movable to-and-fro with the variable throw thereof, a shiftable feeler resiliently yieldable frontwardly and spring-pressed rearwardly to bear upon and compress a free portion of the stack front thereby responsively to take a variable rear position determined by the condition of looseness or tightness of the stack front, and a second piece constituting an extension of the feeler and partaking of the shifting thereof to and from a variable rear position; said first piece and second piece having such cooperative relation and action that the second piece by its variable rear position determined by the stack condition, and its corresponding consequent frontward yield during each feed stroke, effects a variable abridgment of the full operative throw of the first piece and pawl carrier, as permitted by the

lost motion in said actuator connections; whereby with tight full stack the actuator operations are substantially taken up within said lost-motion, and the pawl carrier throw and stack feed rate are minimum or zero, whereas with increasing stack looseness the feeler and first piece take progressively rearward positions to bring about progressively increasing throws of carrier and pawl means, with resulting increasing rate of stack feed, until excess looseness of stack is taken up, and vice versa; and the interconnections between the stack feeler and the pawl carrier comprising a contact extension on the feeler and a trip finger pivoted on an upward extension of the carrier in a position to press upwardly against the stack front end and to press frontwardly against the feeler extension, with a spring tending to swing the carrier to cause the finger to press frontwardly, and a spring tending to press upwardly the finger; whereby the advancing feed stroke of the carrier may thrust frontwardly through said finger against the feeler extension, and whereby when the stack is exhausted the trip finger may rise out of line with said extension, and render inoperative said interconnections.

4. A signature gathering machine hopper mechanism of the kind handling edgewise stacked signatures, having at its bottom a traveling feed web for supporting and feeding frontwardly the stack, permitting rear loading without cessation of operation, lateral means for guiding the advancing stack, and an upright front abutment against which the stack may bear in position for each of the front signatures in cyclical succession and by automatic means to be detached at its edge, gripped and extracted; and characterized, in combination therewith, by means for advancing the feed web at a rate corresponding substantially with stack depletion, the same comprising a feed wheel having connections operative to advance the feed web, a reciprocable carrier with pawl means to engage and intermittently advance the feed wheel and web to a variable extent determined by the throw of the carrier, and a driven actuator having connections to said carrier to impart successive feed strokes to bring the carrier positively to a constant final position in each action but with lost motion in said actuator connections permitting abridgement of return strokes and consequent variable extent of feed strokes of the carrier; and control means for determining in each cycle the variable extent of feed wheel and web advance derived from said actuator through said lost-motion connections and carrier, comprising a shiftable feeler resiliently yieldable frontwardly and spring-pressed rearwardly to bear upon and compress a free portion of the stack front thereby responsively to take a variable rear position determined by the condition of looseness or tightness of the stack front, said carrier and feeler being mechanically interconnected, namely, by an up-extension of the carrier and an alined down-extension of the feeler the former having a front pressing spring weaker than the feeler spring, to shift in unison during return stroke whereby the feeler by its variable rear position determined by the stack condition, and its corresponding consequent frontward yield during each feed stroke, effects a variable abridgement of the full operative throw of the pawl carrier, as permitted by the lost motion in said actuator connections; whereby with tight full stack the actuator operations are substantially taken up within said lost-motion and the pawl carrier throw and stack feed rate are minimum or zero, whereas with increasing stack looseness the feeler and connected carrier take progressively further displaced positions to bring about progressively increasing throws of carrier and pawl means, with increasing rate of stack feed, until excess looseness of stack is taken up, and vice versa.

5. A signature hopper mechanism of the kind handling edgewise stacked signatures, having at its bottom a traveling feed web for supporting and feeding frontwardly the stack, lateral means for guiding the advancing stack, and a front abutment against which the stack may bear in position for each of the front signatures in cyclical succession and by automatic means to be detached at its edge, gripped and extracted; and characterized, in combination therewith, by means for advancing the feed web at a rate corresponding substantially with stack depletion, the same comprising a feed wheel having connections operative to advance the feed web, a to-and-fro movable carrier with pawl means to engage and intermittently advance the feed wheel and web to a variable extent determined by the throw of the carrier, and a driven actuator having connections to said carrier to impart successive feed strokes to bring the carrier to a constant final position in each action but with lost motion means comprising a pin and slot device in said actuator connections permitting variable return strokes and consequent variable feed strokes of the carrier; and control means for determining in each cycle the variable extent of feed wheel and web advance derived from said actuator through said lost-motion connections and carrier, comprising a first piece constituting an extension of the carrier and movable to-and-fro therewith with variable throw, a shiftable feeler resiliently yieldable frontwardly and spring-pressed rearwardly to bear upon and compress a free portion of the stack front thereby responsively to take a variable rear position determined by the condition of looseness or tightness of the stack front, and a second piece constituting an extension of the feeler and partaking of the shifting thereof to and from a variable rear position; said first piece and second piece having such cooperative action in unison that the second piece by its variable rear position determined by the stack condition, and its corresponding consequent frontward yield during each feed stroke, effects a variable abridgement of the full operative throw of the first piece and pawl carrier, as permitted by the lost motion in said actuator connections; whereby with tight full stack the actuator operations are substantially taken up within said lost-motion and the pawl carrier throw and stack feed rate are minimum or zero, whereas with increasing stack looseness the feeler and first piece take progressively rearward positions to bring about progressively increasing throws of carrier and pawl means, with increasing rate of stack feed, until excess looseness of stack is taken up, and vice versa.

6. A signature hopper mechanism of the kind handling edgewise stacked signatures to be gathered, having at its bottom a traveling feed web for feeding frontwardly the stack, and adapted to receive at the rear new supplies of signatures without interrupting operation, and an upright front abutment against which the

stack may bear in position for each of the front signatures to be detached, gripped and extracted; together with means for advancing the feed web at a rate corresponding substantially with stack depletion, comprising a feed wheel having connections operative to advance the feed web, a reciprocable carrier with pawl means to engage and intermittently advance the feed wheel and web to a variable extent determined by the throw of the carrier, and a cam having connections to impart successive feed strokes to bring the carrier to a constant final position in each cycle but with lost motion permitting variable return strokes and consequent variable feed strokes of the carrier; and control means for determining in each cycle the variable extent of feed wheel and web advance derived from said cam through said lost-motion connections and carrier, comprising a carrier extension piece, a shiftable feeler resiliently yieldable frontwardly and spring-pressed rearwardly to bear upon and compress a portion of the stack front thereby responsively to take a variable rear position determined by the condition of looseness or tightness of the stack front, and a feeler extension piece, said two pieces having such cooperative action that the feeler piece by the variable rear position of the feeler determined by the stack condition effects a variable abridgement of the full operative throw of the carrier piece and carrier, as permitted by the lost motion in said cam connections; and said interconnections between feeler and carrier comprising an extension piece of the carrier movable regularly therewith, and an extension piece of the feeler shiftable therewith, these being separate pieces arranged in mutual alinement for loose-play coaction during operation, with spring means pressing the carrier piece toward the feeler piece with less force than the pressure of the feeler upon the stack, whereby the stack condition determines the extent of idle stroke of the carrier.

7. A signature hopper mechanism of the kind handling edgewise stacked signatures to be gathered, having at its bottom a traveling feed web for feeding frontwardly the stack, and adapted to receive new supplies at the rear, and an upright front abutment against which the stack may bear in position for each front signature to be gripped and extracted; together with means for advancing the feed web at a rate corresponding with stack depletion, comprising a feed wheel operative to advance the feed web, a reciprocable carrier with pawl means to engage and intermittently advance the feed wheel and web to a variable extent determined by the throw of the carrier, and an actuator cam having connections to impart successive feed strokes to bring the carrier to a constant final position in each cycle but with lost motion permitting variable return strokes and consequent variable feed strokes of the carrier; and control means for determining in each cycle the variable extent of feed wheel advance derived from said cam through said lost-motion connections and carrier; said control means comprising a shiftable feeler resiliently yieldable frontwardly and spring-pressed rearwardly to bear upon and compress a portion of the stack front thereby responsively to take a variable rear position determined by the condition of looseness or tightness of the stack front, an extension piece of the carrier movable regularly therewith, and an extension piece of the feeler shiftable therewith, said two pieces being separate pieces arranged in mutual alinement along their path of action thereby to undergo operative thrusting contact between them during operation; whereby the feeler piece by the variable rear position of the feeler determined by the stack condition effects a variable abridgement of the full operative throw of the carrier piece and carrier, as permitted by the lost motion in said cam connections; thereby to coordinate the feed of the web and stack with the signature depletion rate.

8. A signature hopper mechanism of the kind stated in claim 7 and wherein is spring means operative to press the carrier piece frontwardly toward the feeler piece with spring thrust less strong than that of the spring means pressing rearwardly the feeler against the stack, whereby the stack condition determines the positions of the two pieces and the extent of the idle stroke of the carrier.

9. A signature hopper mechanism of the kind handling edgewise stacked signatures to be gathered, having at its bottom a traveling feed web for feeding frontwardly the stack, and an upright front abutment against which the stack may bear in position for each front signature to be extracted; together with means for advancing the feed web at a rate corresponding substantially with stack depletion, comprising a feed wheel operative to advance the feed web, a to-and-fro movable carrier with pawl means to engage and intermittently advance the feed wheel and web to a variable extent determined by the throw of the carrier, and an actuator or cam having connections to impart successive feed strokes to bring the carrier to a constant final position in each cycle but with lost motion permitting variable return strokes and consequent variable feed strokes of the carrier; and control means for determining in each cycle the variable extent of feed wheel advance derived from said actuator cam through said lost-motion connections and carrier, comprising a shiftable feeler resiliently yieldable frontwardly and spring-pressed rearwardly to bear upon and compress a portion of the stack front thereby responsively to take a variable rear position determined by the condition of looseness or tightness of the stack front; an extension piece movable with the carrier, an extension piece shiftable with the feeler, said two pieces being separate pieces arranged in alinement along their paths of action thereby to have abutting contact during each cycle; whereby the feeler piece by the variable rear position of the feeler determined by the stack condition effects a variable abridgement of the full operative throw of the carrier piece and carrier, as permitted by the lost motion in said cam connections; and one of said pieces being a trip finger, mounted on one of said members, the carrier or feeler, to shift or tilt out of alinement with the other piece on the other member to render inoperative the pawl feed of the wheel and web, and a means or spring for so shifting said trip finger when the stack is exhausted.

10. A mechanism as in claim 9 and wherein the carrier extension piece or trip finger pivoted to tilt upwardly from operative position thereby to trip the interconnections between feeler and carrier, is provided with a light spring tending to trip and tilt upwardly and trip the finger; the trip finger being so arranged beneath the front part of the signature stack that the stacked signatures present at the hopper front end normally hold down the trip finger in po-

sition to allow cooperation with the feeler extension piece, whereas when the stack is exhausted the finger becomes released to rise into inoperative position, and so prevent web feeding actions.

11. A signature gathering machine hopper mechanism for edgewise stacked signatures comprising a frontwardly advancing web supporting the stack and adapted to be loaded at will at the rear, and means to advance the web and stack at an average rate corresponding with stack depletion, comprising a web feed wheel, and an oscillating carrier having feed and return strokes, with pawl means thereon to advance the wheel and web, said wheel and carrier being mounted directly beneath the front end of the stack of edgewise standing signatures, and the carrier having above its pivot an upwardly extending arm which swings frontwardly when the pawl means on the carrier swings backwardly for each feed stroke, cyclical means to advance the carrier and pawl means, to a constant back position in each web feeding stroke with lost motion therein to permit variation of stroke; and control means to vary the carrier stroke in accordance with the degree of stack looseness, comprising a stack feeler pressed resiliently against the stack front during each carrier return stroke, and connections from the feeler to the upstanding arm of the carrier adapted, by reason of the variable rear position of the feeler, to cause variable abridgement of carrier return stroke and therefore a slower average stack feed with increasing looseness of stack and vice versa.

12. A signature hopper mechanism having a frontwardly traveling feed web for edgewise stacked signatures, and means for advancing the feed web at a rate in pace with stack depletion, comprising a feed wheel, an oscillating carrier with pawl means to advance intermittently the feed wheel and web to a variable extent determined by the throw of the carrier, and an actuator with connections to impart successive feed strokes to bring the carrier to a constant advanced position in each cycle but with lost motion permitting variable return strokes and consequent variable feed strokes of the carrier; and control means for determining in each cycle the variable extent of feed wheel advance derived from said actuator through said lost-motion connections and carrier, comprising a carrier extension piece oscillating with the carrier, a shiftable feeler spring-pressed rearwardly to bear upon and compress a portion of the stack front thereby responsively to take a variable rear position determined by the condition of looseness or tightness of the stack front, said feeler having an extension piece, said two pieces being separate but in mutual alinement whereby to have cooperative action, the feeler piece by its variable rear position determined by the stack condition effecting a variable abridgement of the full operative throw of the carrier piece and carrier, as permitted by the aforesaid lost motion, the carrier extension having spring means pressing it frontward less strongly than the feeler pressure.

13. Mechanism as in claim 12 and wherein the carrier extension piece is a trip finger mounted to tilt upwardly from operative position below the stack and thereby trip the connections between feeler and carrier, with a light spring tending to trip the finger; whereby when the hopper is empty of signatures the carrier extension rises out of line with the feeler extension.

PAUL E. KLEINEBERG.

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