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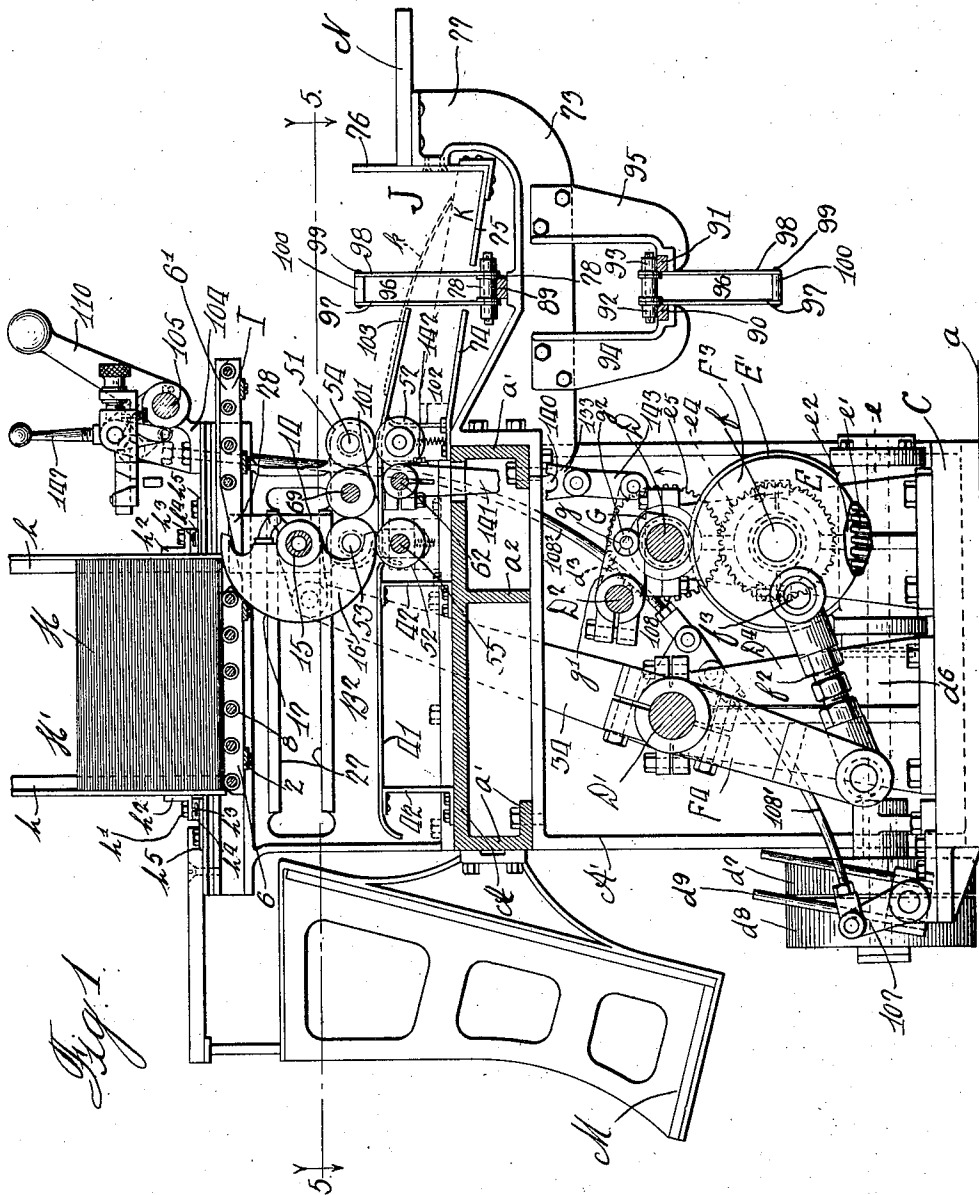
1,520,022

S. C. GRUNLEE

MACHINE FOR SEPARATING AND GATHERING SHEETS OF PAPER

Filed Oct. 9, 1922

8 Sheets-Sheet 1



Witness:

Carl S. Magnusson.

Inventor:
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Dec. 23, 1924.

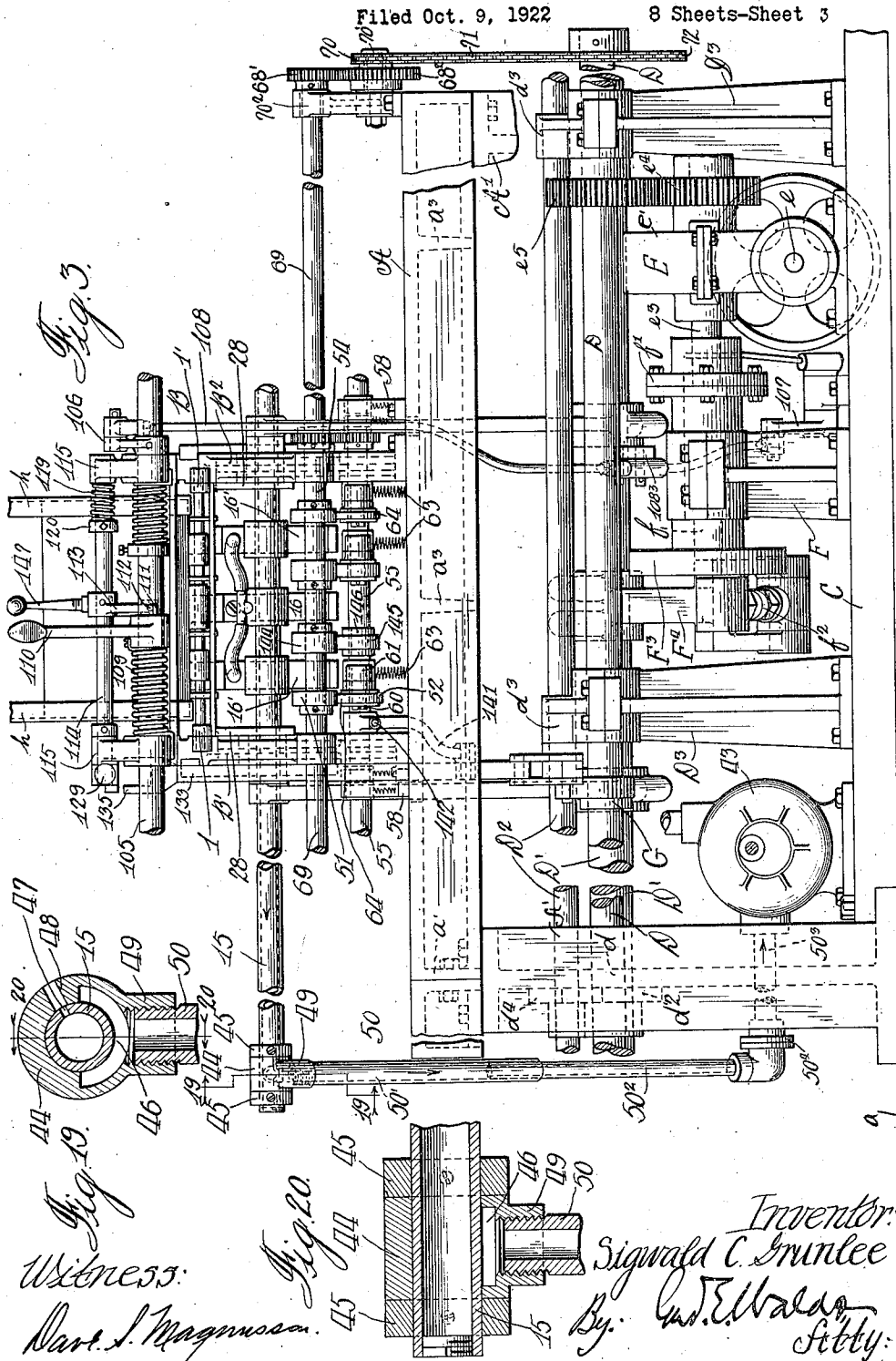
S. C. GRUNLEE

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MACHINE FOR SEPARATING AND GATHERING SHEETS OF PAPER

Filed Oct. 9, 1922

8 Sheets-Sheet 3



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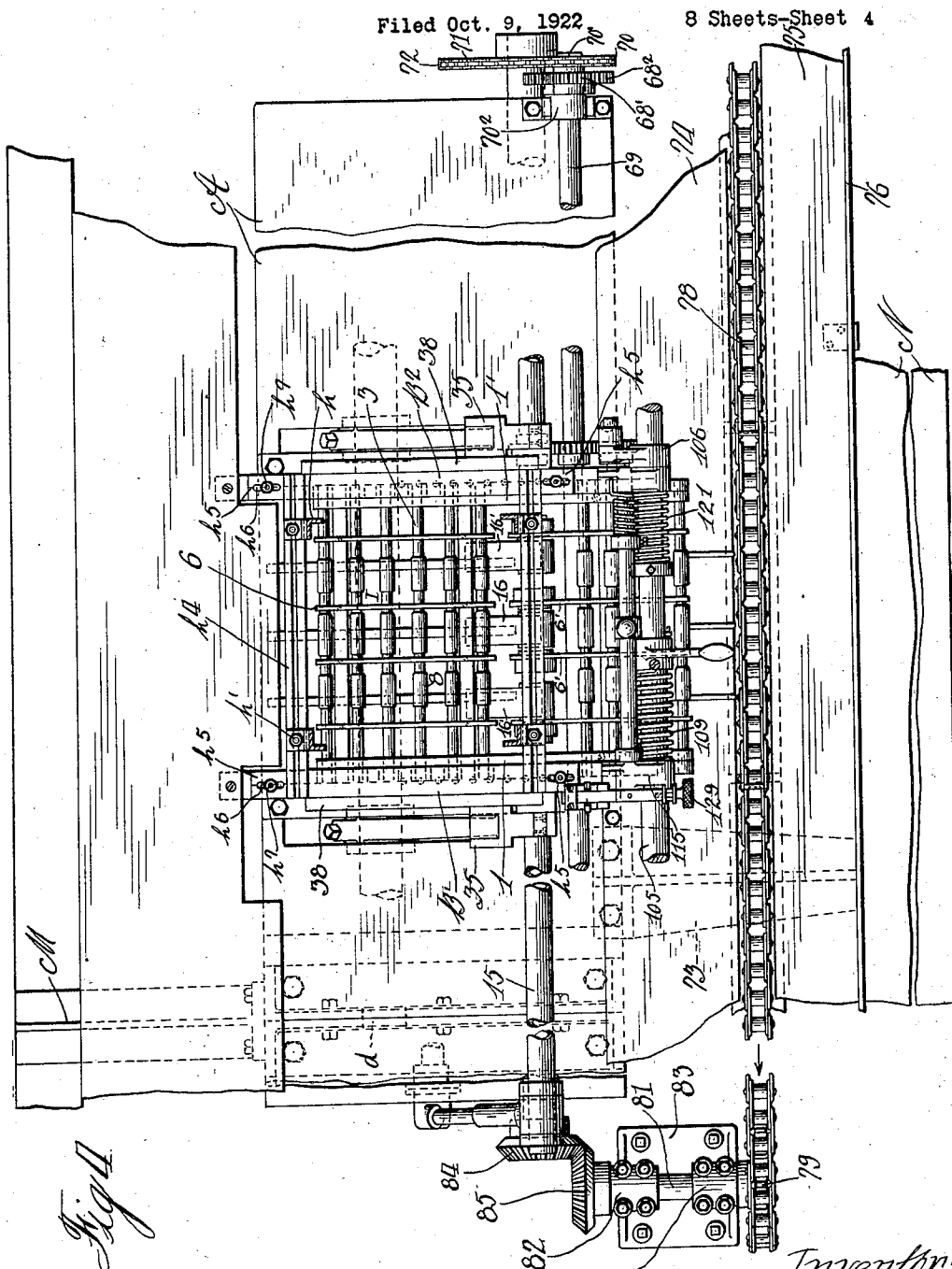
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MACHINE FOR SEPARATING AND GATHERING SHEETS OF PAPER

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8 Sheets-Sheet 4



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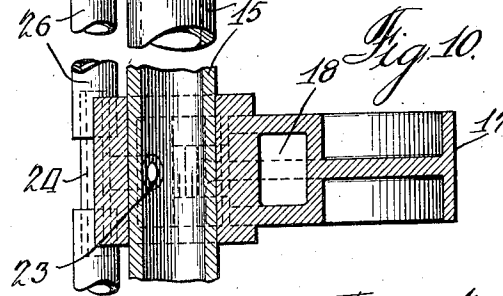
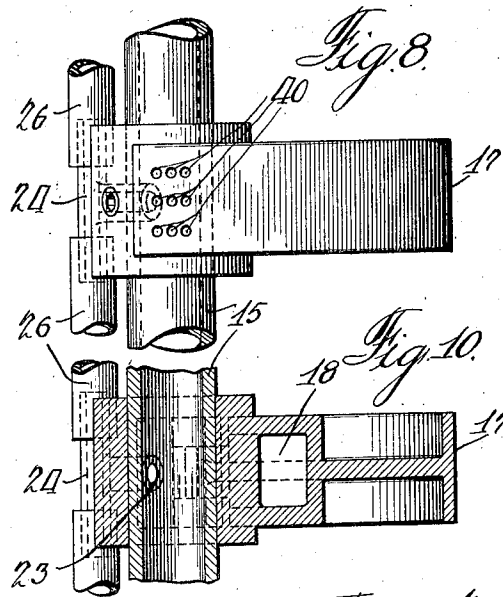
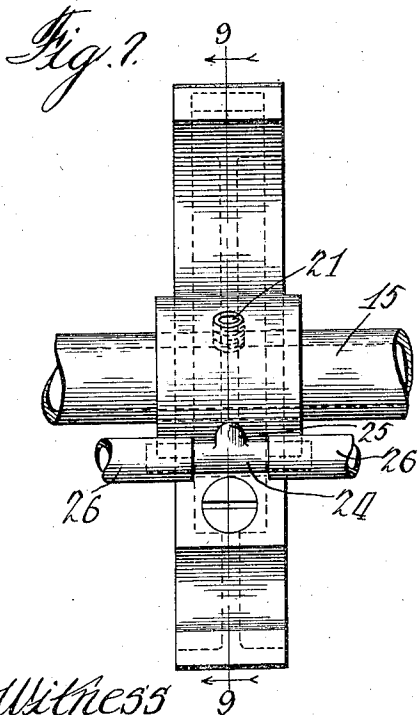
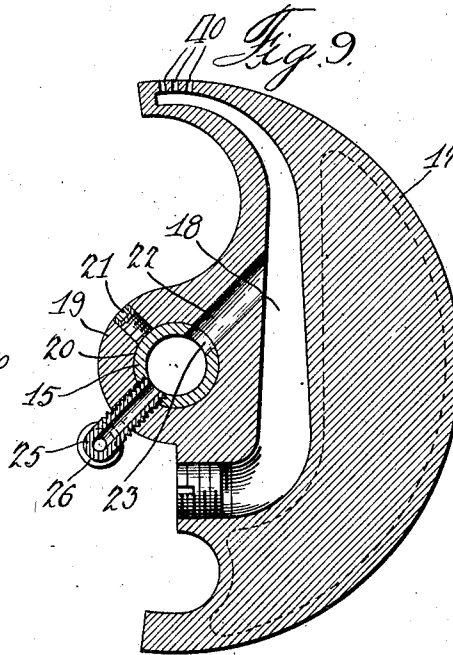
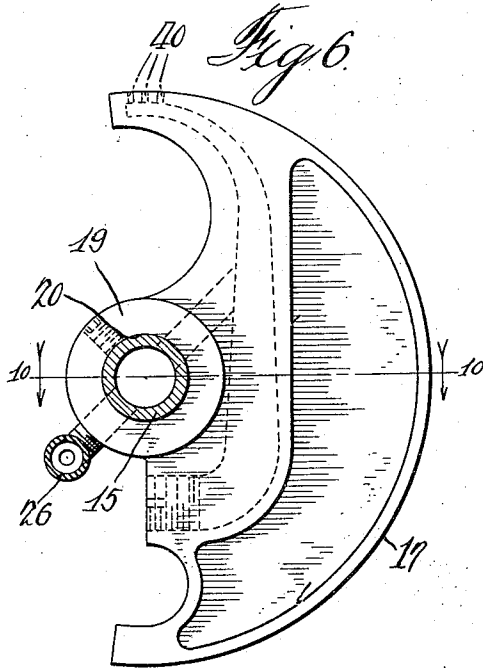
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S. C. GRUNLEE

MACHINE FOR SEPARATING AND GATHERING SHEETS OF PAPER

Filed Oct. 9, 1922

8 Sheets-Sheet 6



Witness
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Inventor:
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Dec. 23, 1924.

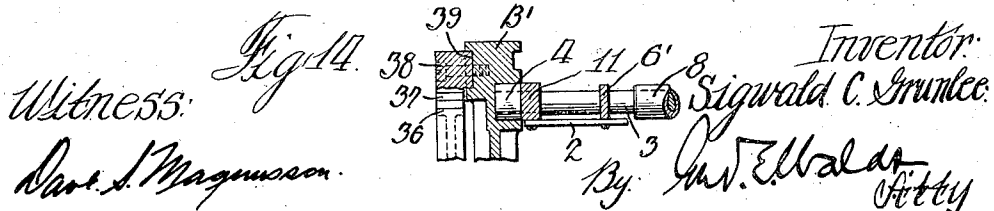
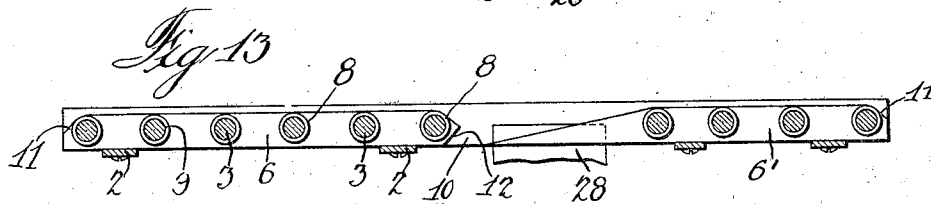
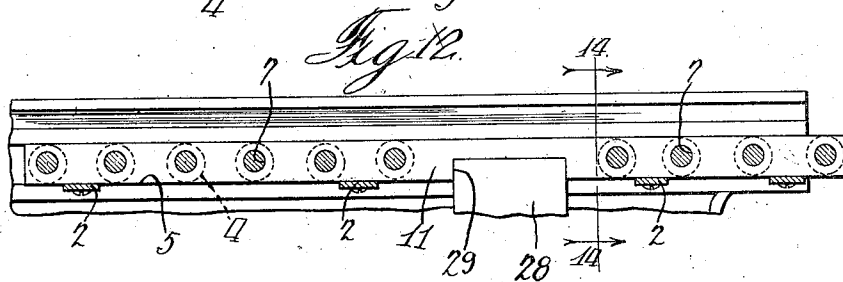
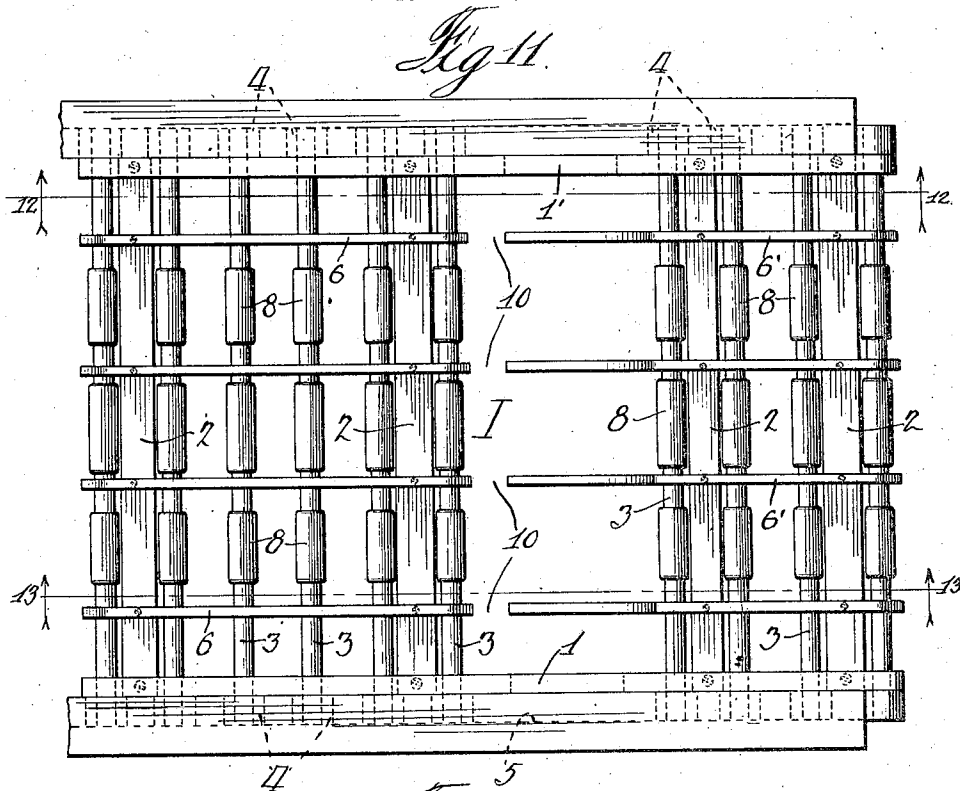
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MACHINE FOR SEPARATING AND GATHERING SHEETS OF PAPER

Filed Oct. 9, 1922

8 Sheets-Sheet 7



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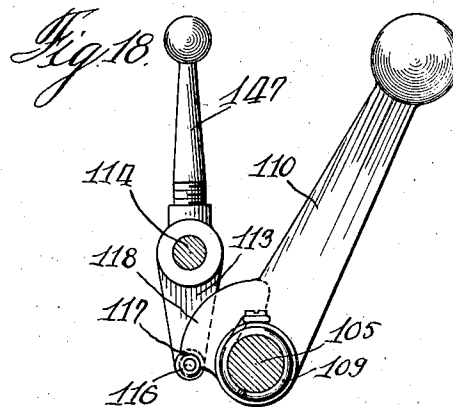
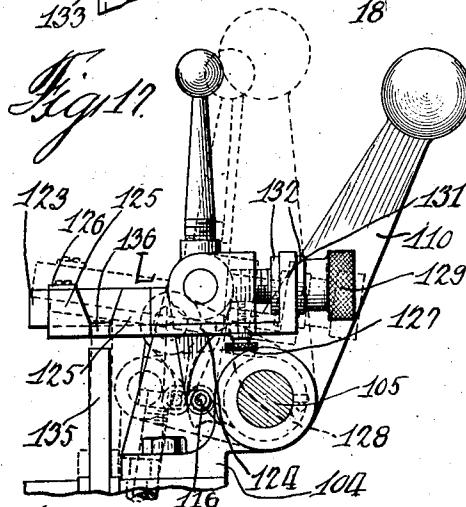
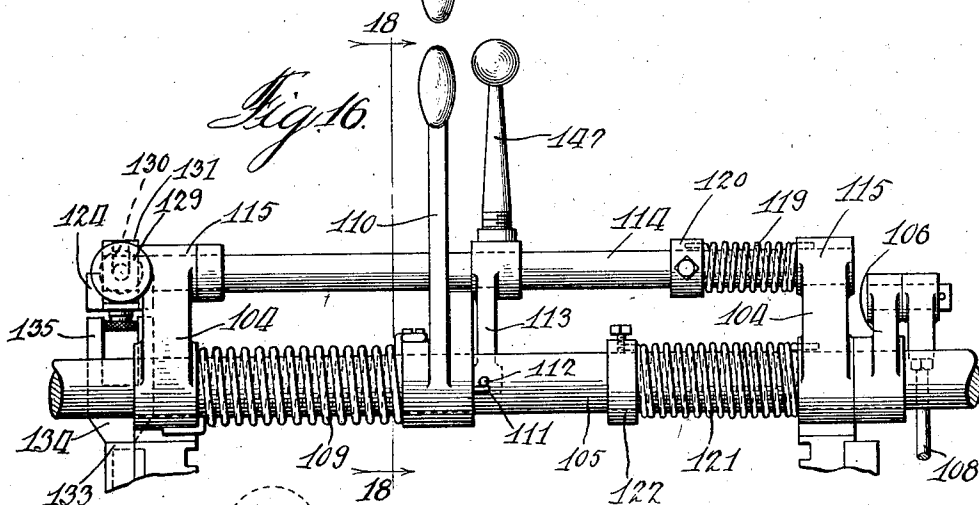
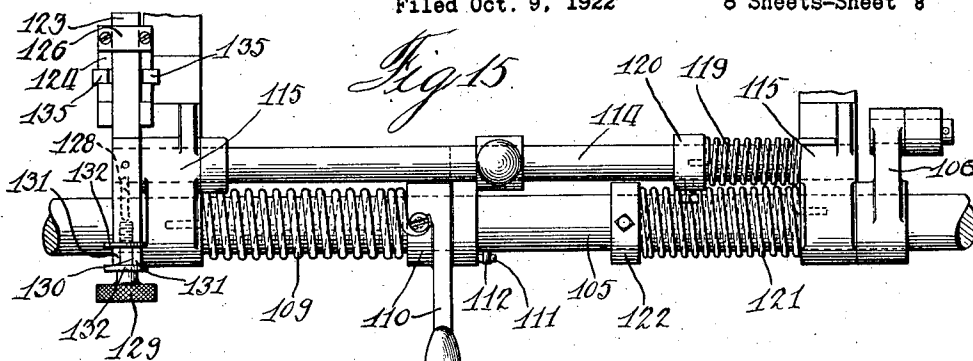
S. C. GRUNLEE

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MACHINE FOR SEPARATING AND GATHERING SHEETS OF PAPER

Filed Oct. 9, 1922

8 Sheets-Sheet 8



Witness:

Carl A. Magnusson.

Inventor:
Sigurd C. Grunlee.
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UNITED STATES PATENT OFFICE.

SIGWALD C. GRUNLEE, OF CHICAGO, ILLINOIS.

MACHINE FOR SEPARATING AND GATHERING SHEETS OF PAPER.

Application filed October 9, 1922. Serial No. 593,332.

To all whom it may concern:

Be it known that I, SIGWALD C. GRUNLEE, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented Improvements in Machines for Separating and Gathering Sheets of Paper, of which the following is a specification.

This invention relates to machines for separating and gathering sheets of paper, either single sheets or a plurality of sheets, and relates particularly to machines for the purpose specified in which the paper is fed from the bottom of a pack contained in a magazine or pack-box.

For purposes of definite and concrete illustrations, I have, in the drawings, shown my invention and improvements as embodied in a machine particularly designed and especially adapted for separating and gathering signatures in book binding. The particular application shown, however, is illustrative merely and in no sense restrictive. Among other contemplated uses to which my improved machine may readily be adapted, is for feeding single sheets of paper to folding machines, wrapping machines, printing presses etc.

As is generally well known to persons familiar with paper separation and feeding, in present machines for the purpose in which the sheets or units are fed from the bottom of a pack—either singly or a number at a time, and either flat or folded—the universal practice so far as I am aware, is to effect separation of the different units by means of pneumatic or suction devices applied to the bottom unit, and feeding is effected by withdrawing the bottom unit by means of suitable gripping and pulling devices, against the frictional resistance of the superposed pack, such resistance varying with the size of the pack, being at maximum when the magazine or pack-box is full and decreasing with the size of the pack.

This construction and method of operation is very objectionable for various reasons, principal among which is that the resistance to the withdrawal of the paper frequently results in tearing the paper or, if not sufficient to tear the paper, produces imperfect feeding, necessitating stopping of the machines—which are usually equipped with automatic stop mechanisms—interrupt-

ing operation and correspondingly limiting capacity.

At the same time, in order to render operation of the machine continuous, it is desirable to retain the feature of feeding from the bottom of the pack, whereby the magazine or pack-box may be refilled during operation, by depositing additional units into the magazine or pack-box on top of the pack contained therein at a given time.

The principal object of the present invention is, therefore, to provide a machine for the purpose specified, constructed and arranged for feeding the units from the bottom of the pack, but without resistance—frictional or otherwise—due to the weight of the pack contained in the magazine or pack-box, thus effectually preventing tearing of the units, imperfect feeding, and stopping of the machine, with the delays and decreased capacity incident thereto.

A further object of the invention is to improve and simplify certain features of machines for feeding book signatures embodying separating and gathering means of my invention.

To effect the objects which I have in view, a machine embodying my invention and improvements comprises the various features, combination of features and details of construction hereinafter described and claimed.

In the accompanying drawings, in which my invention is fully illustrated

Figure 1 is a sectional elevation of my improved separating and gathering machine, taken between two units, showing the power unit and the near side of the separator unit removed.

Figure 2 is a side elevation of my improved machine showing the separator device at opposite limits of their movement, in full and dotted lines, respectively.

Figure 3 is a rear view of the machine with the gathering mechanism removed.

Figure 4 is a top plan view of the machine.

Figure 5 is a sectional top plan view, the section being taken on the line 5—5 of Fig. 1.

Figure 6 is an enlarged side view of one of the suction heads of the machine.

Figure 7 is a view from the left side of Fig. 6.

Figure 8 is a top plan view thereof.

Figures 9 and 10 are sectional views on the lines 9—9 and 10—10 of Figs. 7 and 6, respectively.

Figure 11 is a top plan view on an enlarged scale, of the rack or grid forming the bottom of the pack box, together with associated supporting parts.

Figure 12 is a sectional side view on the line 12—12 of Fig. 11.

Figure 13 is a sectional side view on the line 13—13 of Fig. 11.

Figure 14 is a sectional view on the line 14—14 of Fig. 12.

Figure 15 is an enlarged top plan view of the automatic starting, stopping and tripping mechanism of the machine.

Figure 16 is a front elevation of the mechanism shown in Fig. 15.

Figure 17 is an end view from the left side of Fig. 16.

Figure 18 is a detached side view of the lock mechanism forming part of the automatic trip device from the position 18—18 of Fig. 16.

Figure 19 is a detached, fragmentary, sectional view on the line 19—19 of Fig. 3.

Figure 20 is a sectional view on the line 20—20 of Fig. 19.

Figure 21 is an enlarged side view of the feed and caliper rolls together with the means for driving the same.

As is well known to persons familiar with the art of book binding, machines for separating and gathering signatures, comprise a plurality of units all of which are duplicates one of another, and are mounted upon a common frame and are actuated from a common shaft which has driving connection with a source of power.

In the drawings, the main frame of the machine upon which the different separating and gathering units are mounted, comprises a bed portion A, which is supported upon upright supports or standards A¹ the bases of which rest upon the floor or other support, the line of which is indicated at a.

As shown, the top of the bed A is flat and said bed is reinforced and strengthened by marginal flanges a¹ comprising sections which extend downwardly and inwardly, respectively, and by intermediate longitudinal and transverse webs a², a³.

Also, the bed A of the machine preferably comprises separate sections, each of suitable length—say five feet—to accommodate several separating and gathering units, designated as a whole B, said sections being bolted or otherwise connected together end to end, thus providing for increasing the length and capacity of the machine at any time, if desired.

The operative parts of each separating and gathering unit B are mounted upon a suitable frame comprising side frame members B¹, B², the bases or bottom edges of

which are bolted or otherwise rigidly secured to the bed plate A of the main frame of the machine in proper position.

The entire machine, including all of the separating and gathering units B—whether one or many—are driven from a common power unit, which for purposes of convenient and definite reference and description, particularly as regards the operation of the machine as a whole and of the different units thereof, will now be described.

Said common power unit is preferably mounted substantially at the longitudinal center of the machine, the different elements thereof being mounted upon a base plate C, preferably made of cast iron, bolted or otherwise secured to the bases of the standards A¹ of the main frame of the machine.

Said power unit comprises shafts D, D¹, D², which are continuous from end to end of the machine, holes d being cored in the webs of the standards A¹ of the frame through which said shafts extend, the shaft D being mounted in bearings formed in standards D³ secured to the base plate C and in brackets d¹ bolted to the webs of the frame standards A¹; the shaft D¹ being mounted in standards D⁴ secured to the base plate C, and to brackets d² bolted to the webs of the main frame standards A¹; and the shaft D² being mounted in bearings formed in brackets d³ formed on the standards D³ and in brackets d⁴ bolted to the webs of the standards A¹.

In operation, the shaft D—which may be designated the main driving shaft of the machine—is rotated continuously in the direction indicated by the arrow, Fig. 1, by suitable driving connection with a source of power, not shown, said driving connection comprising a counter-shaft d⁵, mounted in bearings in brackets on the base plate C, tight and loose pulleys d⁷, d⁸, on said countershaft adapted to be connected with the source of power by a belt applied thereto, not shown, a belt shifter d⁹, a worm transmission, designated as a whole E, comprising a worm shaft e, which forms an extension of the counter-shaft d⁵, a worm e¹ secured to rotate therewith, and a worm gear e² secured to rotate with a shaft e³, said worm transmission E, being enclosed in a suitable housing E¹ provided with bearings for the shafts e, e³; the main driving shaft D being driven directly from the shaft e³ by means of spur gears e⁴, e⁵, secured to the shafts e³ and D, respectively.

Oscillatory movement is adapted to be imparted to the shaft D¹ from the shaft e³ in the following manner:—Rotatably mounted in a suitable bearing in a bearing standard F in alignment with the shaft e³ is a shaft f, said shafts e³ and f being connected by a suitable coupling consisting, as shown, of disks f¹ secured to said shafts, respectively, and which are adapted to be bolted or other-

wise rigidly connected to each other so that said shaft f will form, in effect, an extension of the shaft e^3 . The shaft f is connected to the shaft D^1 by means of a connecting rod f^2 , which connects the crank pin f^3 of a crank disk F^3 secured to said shaft f , with the end of an arm F^4 secured to rotate with the shaft D^1 . Said arm F^4 is preferably clamped to the shaft D^1 so as to be angularly adjustable thereon, and to provide for varying the operative length of the connecting rod f^2 , said connecting rod preferably comprises separate sections connected by means of a turn-buckle, in a familiar manner.

In the preferable construction shown, the shaft e^3 to which the worm gear e^2 is secured, is positioned above the lower end of the arm F^4 secured to the shaft D^1 , and the connecting rod f^2 is made as short as practicable without causing interference between the lower end of said arm and the crank disk F^3 . By this relation a relatively slow movement will be imparted to the suction heads 16, 16', during the process of separating and withdrawing the blanks from the magazine or pack-box H^1 ,—presently described; while said suction heads will be returned to their frontward position with a relatively fast movement. This operation results from the fact that when the arm F^4 is in position corresponding to the extreme rearward position of the suction heads, the connecting rod f^2 will be in the position $x-y$, Fig. 2 whereas, when said suction heads are at the extreme frontward limit of the movement, said connecting rod will be in the position x^1-y^1 , Fig. 2. Or, with the crank disk F^3 rotating in the direction indicated by the arrow, the movement of the suction heads from rearward to frontward position will occupy the time that the crank pin f^3 is passing through the short arc defined by the lines $x-y$, x^1-y^1 or about 150 degrees; while the movement of said suction heads from frontward to rearward positions will occur while the crank pin is traversing the long arc defined by said lines—or about 210 degrees. Obviously, this particular relation admits of variation within considerable limits.

Oscillating or rocking movement is also adapted to be imparted to the shaft D^2 from the main driving shaft D by means of a cam G secured to the shaft D which impinges against a stud g on an arm g^1 secured to the shaft D^2 , an anti-friction roller g^2 being preferably mounted on said stud.

I do not, however, desire to limit myself to the particular drive mechanism shown, as other forms of drive may readily be devised by skilled mechanics, and my invention contemplates the use of any form of drive suitable for the purpose.

As previously stated, the different separating and gathering units B are duplicates

one of another, and a description of one thereof will, therefore, suffice for all. Accordingly, only one separating and gathering unit is shown in the drawings, and the description thereof will be in the singular.

In accordance with usual practice, the pack of signatures designated H , is contained in a magazine, commonly known as a pack-box, designated as a whole H^1 , consisting as shown, of angle bars h secured in upright position to the side frame members B^1 , B^2 of the separating and gathering unit B , in proper relative positions to define a magazine or pack-box of desired shape and size. As shown, said angles h are arranged to form a substantially square or rectangular magazine or pack-box and are secured in position by means of clamping bolts h^1 which extend through holes formed in lugs h^2 on said angles, the heads of said clamping bolts engaging T-slots h^3 formed in bars h^4 , the ends of which rest upon and are rigidly secured to the upper edges of the side frame members B^1 , B^2 , thus providing for adjusting the transverse dimension of the magazine.

Preferably, also, the angle bars h are supported so as to be adjustable from front to back of the unit B , adjustment of the front angle bars being within narrow limits, to provide for engaging the suction heads 16—presently described—with the front edges of the signatures or other blanks contained in the magazine or pack-box H^1 , at slightly greater or less distance from their front edges, while the capacity for adjustment of the rear angle bars is much greater to provide for adjusting the size of the magazine or pack-box H^1 for signatures or blanks of different sizes.

As shown, this is effected in the following manner:—Riveted or otherwise secured to the bars h^4 to which the angle bars h are clamped, are plates h^5 , formed in which are slots h^6 inserted through which are clamping screws h^7 threaded into holes formed in the upper edges of the frame members B^1 , B^2 , the rear clamping screws h^7 being interchangeable in a plurality of holes formed in the upper edges of said frame members, thus providing a relatively large capacity for adjustment of the rear angle bars h , in the manner desired.

With the described construction it is obvious that adjustment of the front angle bars h will be limited by the length of the slots h^6 , while that of the rear angle bars will be equal to the distance between the extreme holes for the clamping screws h^7 plus the length of the slots h^6 .

With the construction described, the slots h^6 provide means for fine adjustments while the series of holes in which the rear clamping screws are interchangeable will provide for coarse adjustment of said angle bars.

The top of the magazine or pack-box formed by the angles h is open and the bottom thereof is closed by means of what may be described as a rack or grid I, which is supported on the side frame members B^1 , B^2 so as to be movable endwise.

As shown, said rack or grid I consists of side bars 1, 1^1 , which are rigidly connected by transverse bars 2 secured to the lower edges thereof by screws or other suitable means. Rotatably mounted in bearings formed in the side frame bars 1, 1^1 , are shafts 3, the ends of which project beyond the outer sides of said side bars and rotatably mounted on the projecting ends of which are rollers 4 which run in grooves 5 formed in the inner sides of the frame members B^1 , B^2 . Said rack or grid also comprises bars 6, 6^1 , supported between the side bars 1, 1^1 , the bars 6 being arranged at the front end of the grid and the bars 6^1 at the rear end thereof. Said bars 6, 6^1 are rigidly connected to the side cross bars 2 in the same manner as the side bars 1, 1^1 , thus rigidly connecting said bars 6, 6^1 to each other and also to the side frame bars 1, 1^1 . Said bars 6, 6^1 , are also provided with holes or openings 7 through which the shafts 3 extend, said holes being of such size that said shafts will turn freely therein.

Rotatably mounted on the shafts 3 between the intermediate bars 6, 6^1 , are rollers 8, the shaft bearings 9 in said rollers being fitted to the shafts 3 so that said rollers will turn freely thereon. Said rollers 8 will preferably be made of vulcanized fibre, hard rubber or similar material, though my invention contemplates making them of any desired material.

The lower ends of the angle bars h which form the magazine or pack-box H^1 , extend into close proximity to the top sides of the rollers 8, the relation being preferably such that, as reciprocating movement is imparted to the rack or grid I in the operation of the machine, as presently described, the rollers 8 will just clear the lower end of said angle bars h .

As shown, the bars 6, 6^1 , are arranged so that bars of each series will be in alignment with each other. The aggregate lengths of the bars 6, 6^1 is less than the overall length of the rack or grid I, and said bars are so positioned that spaces or openings 10 are formed between the adjacent ends of aligned bars, through which the blanks are withdrawn from the magazine H^1 in the operation of the machine, and to prevent said bars from catching in and tearing the blanks—sheets of paper or signatures—contained in the magazine H^1 , the top edges of said bars 6, 6^1 are beveled or rounded at both their front and rear ends, as shown at 11. Also, in order that the surface of the suction

heads, presently described, may run in close proximity to the rear rollers 8 of the section of the grid I formed by the front bars 6, the lower edges of the rear ends of said bars are upwardly and rearwardly beveled, as shown at 12.

With the described construction, it is obvious that the pack H contained in the magazine H^1 , will rest directly upon the rollers 8 of the rack or grid I and that said rack or grid will be supported so as to be freely movable endwise beneath the magazine H^1 , said rack or grid being made of such greater length than said magazine that it will close the bottom of said magazine in all positions.

In operation, reciprocating movement is adapted to be imparted to the rack or grid I in the manner presently described.

In accordance with my invention, the separation of the sheets is effected in the following manner:—Mounted to turn freely in bearings formed in journal blocks 14 is a hollow shaft 15, secured to which, so as to rotate therewith are heads 16, 16^1 , the head 16 being secured in fixed relation centrally beneath the magazine H^1 and the rack or grid I, and the heads 16^1 being positioned one on each side of the central head 16 and being secured to the shaft 15 so as to be adjustable towards and from said central head, so as to adapt the machine to operate on stocks of different width.

Excepting as regards minor details, to be presently described, the heads 16, 16^1 , are duplicates one of another, said heads comprising surfaces 17 which form segments of cylinders and being provided with chambers 18 which are adapted to be connected with the bore of the hollow shaft 15, to which a suction pump is applied in the manner presently described. Said heads also comprise hubs 19, formed in which are holes 20 adapted to receive the shaft 15, said heads being secured to said shaft so as to rotate therewith by suitable means, as set screws 21. As shown, the central head 16 is provided with a hole 22 which communicates directly with a hole 23 formed in said shaft and which communicates with the bore thereof. But to provide for adjustment of the heads 16^1 without cutting off communication of the chambers 18 in said heads with the bore of the shaft 15, the suction chambers of said heads are connected directly with the suction chamber 18 of the head 16. Preferable means for this purpose comprise a T 24 secured in a hole in the head 16 which communicates with the head of the suction chamber 18 thereof, and nipples 25 secured in corresponding holes in the heads 16^1 which communicate with the suction chambers 18 thereof, and rubber or other flexible hose 26 which connect said T and nipples.

The journal boxes 14 are slidably fitted to bearings 27 formed in the side frame members B¹, B² of the unit frame B and formed on said boxes are upward extensions 28, the upper ends of which engage notches 29 formed in the under sides of the side frame bars 1, 1¹ of the rack or grid I.

In the operation of the machine, reciprocating movement is imparted to the shaft 15, the journal boxes 14 therefor, and through the upward extensions 28 of said boxes, to the rack or grid I; means, rendered operative by the reciprocating movement of said shaft, being also provided for simultaneously imparting angular oscillatory movement to said shaft, and to the suction heads 16, 16¹ about the axis of the shaft. As shown, the means for imparting reciprocating movement to said shaft, journal boxes and grid consist of arms 34 secured to the rock shaft D¹ outside of the frame members B¹, B², the upper ends of which are connected directly to the shaft 15 by links 35 pivoted to said arms at one end and to said shaft at the other. Also, as shown, the means for imparting oscillating movement to said shaft 15 and to the heads 16, 16¹ consist of segmental gears 36 secured to the shaft 15, the teeth of which intermesh with racks 37 formed on rack bars 38 secured in grooves 39 formed in the unit frame members B¹, B².

The radius of the cylindrical surfaces 17 of the suction heads 16, 16¹, is such that said surfaces extend flush with the top sides of the pack supporting rollers 8, in which relation the cylindrical surfaces of said suction heads will run in contact with the under side of the bottom signatures or other sheet of the pack H, contained in the magazine or pack-box H¹, through the space or opening 10.

The suction heads 16, 16¹ are secured to the hollow shaft 15 in such relation that, when at the limits of their movement frontwards and backwards, they will be in the positions shown in Fig. 2 of the drawings, their extreme positions frontwards and rearwards being shown in full and dotted lines, respectively.

Adjacent to the ends of the cylindrical surfaces 17 of the suction heads 16, 16¹, which are uppermost when the suction heads are at the frontward limit of their movement, said heads are provided with perforations 40 which communicate with the suction chamber 18 thereof, the relation being such that said perforations will be covered by the bottom signature or other sheet of the pack H when said heads are at the frontward limit of their movement, whereby the suction exerted by said perforations will cause the front edges of said blanks to adhere to the suction heads, and oscillation of said suction heads will operate to withdraw

the bottom blank of the pack H from the magazine H¹ through the space or opening 10, as said heads execute their oscillating movement to their extreme rearward positions. A blank, when being withdrawn from the magazine H will have no engagement with the suction heads 16, 16¹ excepting at the perforations 40, and will merely lie loosely in contact therewith, so that when the suction heads reach the rearward limit of their movement in which position the blank will be fully withdrawn—said blank will fall by gravity onto a table 41 supported on the bed portion A of the main frame of the machine by means of uprights or standards 42 and from which they will be withdrawn by feed rolls and delivered to the gathering mechanism of the machine, as fully hereinafter described.

A partial vacuum, which will produce a suction in the pipe 15 and in the chambers 18 of the suction heads 16, 16¹, sufficient to cause the blanks to adhere to the perforations 40, is adapted to be created and maintained by means of a suitable pump, indicated at 43, mounted on the base plate C, the suction end of which is connected to the bore of the pipe 15. Also, in order to release the blanks from the suction heads 16, 16¹, at the time said blanks are delivered to the feed rolls, means are provided for breaking the suction of said pump and for venting the suction pipe 15 and the chambers 18 of the suction heads 16, 16¹.

As shown, the means for connecting the pipe 15 with the pump 43 and for breaking the suction of said pump and venting said shaft and suction heads, consists of a fitting 44 provided with a bearing fitted to the exterior of the pipe 15 and confined in position thereon between collars 45 secured to said shaft, formed in which is a chamber 46 which is in open communication with the shaft bearing in said fitting and with which a hole or opening 47 formed in the shaft 15 is adapted to communicate during the entire oscillatory movement of said shaft excepting only when the suction heads are in their extreme rearward position, shown in full lines Fig. 1, the relation being such that just before the suction heads reach the rearward limit of their movement, said hole 47 will pass out of communication with the chamber 46 and will be brought into communication with a vent opening 48 formed through the wall of the fitting 44.

Formed on the fitting 44 is a boss 49 provided with a hole which communicates with the chamber 46 in said fitting and secured in said hole is a pipe 50 which extends downwardly and the lower end of which is connected to the suction end of the pump 43. To provide for reciprocating movement of the hollow shaft 15, the shaft 50 preferably

comprises separate sections 50¹, 50², of which the section 50² is fitted to and adapted to telescope with the bore of the section 50¹.

To avoid interference with other parts of the machine, the fitting 44 and pipe 50 are positioned beyond the end of the machine, while the pump 43 is preferably mounted on the base plate C adjacent to the longitudinal center of the main frame of the machine. The lower end of the pipe section 50² is connected with the suction end of the pump by a lateral extension 50³ of said pipe, the pipe sections 50² and 50³ being connected by a swivel connection indicated at 50⁴. Also, if found necessary to provide and maintain sufficient suction in the suction heads, my invention contemplates the use of duplicate suction connections between the pump 43 and the pipe 15 at both ends of the machine.

With the described construction, it is obvious that a partial vacuum will be maintained in the suction heads 16, 16¹ at all times in the operation of the machine, excepting only as said suction heads approach their extreme rearward positions, at which time the hole 47 in the shaft 15 will pass out of communication with the chamber 46 in the fitting 44 and will be brought into communication with the vent opening 48 in said fitting, thus venting the suction heads 16, 16¹ and releasing the blanks from said suction heads and permitting them to be delivered by the feed rolls from the table 34, onto which they are delivered by said suction heads, to the gathering mechanism, as will now be described. Said feed rolls comprise two sets of rolls each consisting of upper rolls 51 and lower rolls 52. The upper feed rolls 51 of each set are secured to shafts 53 and 54 rotatably mounted in suitable bearings in the side frames B¹, B² of the separating unit B. The lower feed rolls comprise a front set which are secured to a shaft 55 rotatably mounted in journal boxes 56 slidably fitted to slots 57 formed in bearing standards 58 secured to the bed plate A of the main frame of the machine. To permit the feed rolls of each unit to accommodate themselves to the thickness of the signatures or other blanks to be fed thereby, which may vary, separate shafts 55 are provided for each unit, said shafts being maintained at the upper limit of their movement corresponding to contact of the feed rolls 52 thereon with the front set of feed rolls 51, by springs 59 inserted between the undersides of the journal boxes 56 and the bottoms of the slots 57 to which said journal boxes are fitted.

The lower feed rolls 52 also comprise a rear set of feed rolls which are rotatably mounted on studs 60 secured in the outer ends of arms 61, formed in the inner ends of which are bearings fitted to turn freely on

a shaft 62 secured in fixed bearings in the side frame members B¹, B², of the gathering unit B.

The rear set of lower feed rolls 52 is held yieldingly in contact with the opposed upper feed rolls by springs 63 inserted between the outer ends of the arms 61 and the bed plate A of the main frame of the machine. Also, to provide necessary traction of the feed rolls with the blanks to be fed, all of the lower feed rolls 52 are provided with rubber treads 64.

Separate shafts 53, 54 and 62 are preferably provided for each separating unit B.

Both sets of upper feed rolls 51 and the front set of lower feed rolls 52 are positively driven from the main driving shaft D of the machine in the following manner:—Secured to the shafts 53, 54 and 55 respectively, so as to rotate therewith are gears 65, 66 and 67, the gears 65 and 67 meshing directly with each other while the gears 65 and 66 mesh with an intermediate gear 68 secured to a shaft 69 mounted in bearings in the frame members B¹, B², and which is continuous from end to end of the machine. The gear 68 is positively driven from the shaft D by means of a gear 68¹ secured to the shaft 69, which meshes with a gear 68² secured to the hub of a sprocket wheel 70 rotatably mounted on a stud 70¹ secured in a standard 70² on the extreme end of the bed plate A of the main frame of the machine. The sprocket wheel 70 is driven from the shaft D by means of a chain belt 71 adjusted to said sprocket wheel 70 and to a sprocket wheel 72 secured to the shaft D. A simple and preferable construction consists in positioning the sprocket wheels 70 and 72 and operating parts directly associated therewith beyond the end of the bed plate A of the main frame of the machine. The use of the gear 68² is necessary to secure rotation of the feed rolls 51 and 52 in the proper direction.

The gearing connecting the driving shaft D with the shaft 69 affords convenient means for speeding up the feed rolls to insure delivery of signatures or other blanks into the gathering chute J within the time limited, so that they will clear the arms 96 of the gathering mechanism and whereby, also, impact of said signatures or other blanks with the outer side wall 76 of the gathering chute J, will "jog" the blanks of each pack K.

The rear set of lower feed rolls 52 are friction driven by contact with the rear set of upper feed rolls 51, or with the blanks as they are fed between said feed rolls.

The gathering mechanism of the machine is supported upon brackets 73 secured to the rear side of the main frame of the machine, and comprises what may be referred to as a chute, designated as a whole J, comprising

ing a bottom portion consisting of sections 74 and 75 and an outer side wall 76. The section 74 of the bottom of the chute is secured to the main frame of the machine, while the bottom section 75 is rigidly connected to the lower edge of the side wall 76 which, in turn, is rigidly secured to upward extensions 77 at the outer ends of the brackets 73. The sections 74 and 75 of the bottom of the chute are separated by a space, running in which is a chain belt 78 which is adjusted to sprocket wheels 79 and 80, of which the sprocket wheel 79 is positively driven by means of suitable driving connection with the main driving shaft D of the machine. As shown, said driving connection comprises a shaft 81 rotatably mounted in bearings formed in arms 82 forming part of a bracket 83 secured to the floor beyond the end of the machine, said sprocket wheels 79 being secured directly to said shaft and said shaft being connected to the driving shaft D by bevel gears 84 and 85 secured to the shafts D and 81, respectively. The sprocket wheel 80 is not positively driven, and is secured to a shaft 86 mounted in bearings formed in arms 87 on a bracket 88 secured to the frame standard A¹ at the extreme end of the machine opposite to standard to which the bracket 87 is secured.

Between the sprocket wheels 79 and 80, the top lap of the chain belt 78 runs upon a track-bar 89 secured to the upper sides of the brackets 73 in proper position. Preferably, also, the lower lap of said chain belt runs upon and is supported by a track comprising spaced track members 90 and 91 supported in proper position beneath the brackets 73, said track members being separated by a space slightly wider than the extreme width of the chain belt 78 and being supported by means of rollers 92 and 93 mounted on the projecting ends of pins connecting links of said chain belt. As shown, the track members 90 and 91 are secured to the lower ends of brackets 94 and 95 secured to and which depend from the under sides of the brackets 73.

The chain belt 78 is positioned below the sections 74 and 75 of the bottom of the gathering chute and secured thereto and projecting upwardly therefrom through the space separating said bottom sections 74 and 75 of the gathering chute are arms 96. As shown, said arms 96 are formed by spaced sheet metal members 97 and 98 secured to registering links on opposite sides of the chain belt 78, being preferably formed integral therewith. The outer ends of the arm members 97 and 98 are rigidly connected, convenient means for this purpose consisting of rivets 99 and interposed spacing members 100.

Adjacent arms 96 will be spaced apart a distance equal to the center to center distance

between adjacent gathering units B, and the chain belt 78 is driven at such a rate of speed that, at each cycle of the machine, movement will be imparted to the arms 96 equal to the distance between adjacent arms or units, and the relation is such that during the time the blanks are being delivered to the gathering chute by the feed rolls, the arms 96 will be traversing the spaces between the feed rolls of adjacent gathering units.

Associated with the feed rolls and the gathering mechanism is a support for the blanks while being fed from the table 41 to the gathering chute J. As shown, said support is a skeleton construction consisting of wires 101 and 102. The wires 101 extend between the feed rolls and form a skeleton extension of the table 41, their rear ends extending beyond the feed rolls into close proximity to the arms 96 on the chain belt 78, as shown at 103. The wires 102 are secured directly to the bottom section 74 of the gathering chute and extend upwardly and their upper ends are bent rearwardly to bring them into the plane defined by the rearward extensions 103 of the wires 101.

The planes defined by the rearward extensions 103 of the wires 101 and 102 of different units B will extend at different angles to the bottom of the gathering chute J, depending upon the thickness of the pack of gathered signatures at each unit, the relation being such that at each unit, the signatures delivered to the gathering chute therefrom will be directed substantially into the angles formed by the top signatures of each pack and the outer side wall 76 of said chute.

In the drawing, K indicates a pack of signatures contained in the gathering chute J and L a blank as it is delivered from a separating unit onto the top of the pack K.

In order to prevent defective signatures from being delivered to the pack K contained in the gathering chute J, and incorporated into the bound book, which would necessarily result in a defective book, my improved machine comprises a stop mechanism constructed and arranged to automatically stop the machine whenever a signature either thicker or thinner than the normal thickness of the signatures on which any gathering unit B is operating at a given time, passes into the feed rolls 51 and 52, which normal thickness can vary only within very narrow limits, represented by the thickness of the thinnest sheet of said signatures.

As shown, the construction and operation of said stop mechanism is as follows:—

Rotatably mounted in bearings in brackets 104 secured to the rear upper edges of the side frame members B¹, B² of the separating unit B, is a shaft 105, which extends from end to end of the machine and is common to all of the separating units B, secured

to which is an arm 106 which is connected with an arm 107 applied to the belt shifter d^o by a rod 108. As shown, said rod 108 comprises sections 108¹, 108², the adjacent ends of which are pivoted to studs secured in a sleeve or collar 108³ rotatably mounted on the shaft D¹.

Applied to the shaft 105 is a spring 109 adapted to maintain said shaft and belt shifter d^o in positions corresponding to engagement of the driving belt with the loose pulley d^s , means being also provided for relieving said shaft 105 from the tension of the spring 109 and for shifting the driving belt from the loose to the tight pulley, when it is desired to operate the machine.

As shown, the means for applying said spring 109 to said shaft 105 and for relieving said shaft from the tension of said spring are as follows:—Pivoted upon the shaft 105 is a lever 110, one end of the spring 109 being secured to the hub of said lever and its opposite end to the adjacent bearing bracket 104, and said lever 110 having operative engagement with the shaft 105 by means of pins 111 and 112 secured in said lever and shaft, respectively, the relation being such that pivoted movement of the lever 110 to retract the pin 111 secured therein from the pin 112 secured in the shaft 105 will relieve said shaft 105 from the tension of the spring 109 and will permit movement of said shaft in a direction to shift the driving belt from the loose pulley d^s to the tight pulley d^t .

In accordance with my invention, also, means are provided for locking the lever 110 in position to relieve the shaft 105 from the tension of the spring 109. As shown, said locking means or mechanism consists of an arm 113 secured to a shaft 114 mounted in brackets 115 forming extensions of the brackets 104, a projection 116 on the free end of which is adapted to engage a shoulder 117 formed on a fin 118 on the lever 110, said projection 116 preferably consisting of a stud secured in the said lever arm and an anti-friction roller mounted on said stud. Said shaft 114 will preferably be maintained yieldingly in position corresponding to engagement of said projection 116 with the shoulder 117 on the lever 110 by a spring 119 applied thereto. As shown, said spring is a coiled spring which surrounds the shaft 114, one end of which is connected to one of the brackets 115 and the other to a collar 120 secured to said shaft, preferably by a set screw so as to provide for adjusting the tension of said spring.

When the shaft 105 is relieved from the tension of the spring 109, movement is adapted to be imparted to the belt shifter to shift the driving belt to the tight pulley by a spring applied thereto, thus starting the machine. As shown, said spring consists of

a coiled spring 121 which surrounds the shaft 105, opposite ends of which are secured respectively, to a collar 122 on said shaft 105 and to the adjacent bearing bracket 104, said collar 122 being preferably secured to the shaft by means of a set screw, thus providing for adjusting the tension of the spring 121.

As previously stated, in the contemplated operation of the machine, the spring 109, when released, is designed to turn the shaft 105 so that, through the arm 106, the rod 108 and the belt shifter d^o , the driving belt will be shifted from the tight pulley d^t to the loose pulley d^s , this stopping the machine. With the construction described, it is obvious that, to render said spring 109 effective for its designed purpose, it will be necessary that said spring shall be sufficiently strong to overcome the tension of the spring 121, to depress the weight of the connecting rod 108 and to overcome the friction of the various operative parts of the belt shifting mechanism.

To start the machine, it is merely necessary to turn the lever 110 into the position shown in Fig. 1 to effect engagement of the projection 116 on the arm 113 with the shoulder 117 on the fin 118 on said lever, thus imparting movement to the belt shifter d^o to shift the belt from the loose pulley d^s to the tight pulley d^t ; and, to stop the machine, it is merely necessary to disengage the projection 116 from the shoulder 117, permitting the spring 109 to turn the lever 110 into the position shown in Fig. 2 and, through the pins 111, 112, turning the shaft 105 in the direction to shift the pulley from the tight pulley to the loose pulley.

My improved machine also comprises an automatic trip mechanism, the construction and operation of which is as follows:

Secured to the shaft 114, so as to turn therewith is a trip lever, designated as a whole L, comprising a fixed arm 123 pinned or otherwise rigidly secured thereto, and a member 124 attached to the under side of said fixed member so as to be adjustable endwise thereof. Formed on the outer end of said adjustable member 124 are flanges 125 which embrace the sides of the fixed member 123, secured to the top edges of which is a strap 126 which extends over the top of said fixed member. The opposite end of said adjustable member 124 is adapted to be secured to the fixed member 123 by a clamping screw 127 which extends through a slot 128 formed therein and has screw threaded engagement with a hole formed in said fixed member 123. Adjustment of the member 124 endwise of the fixed member 123 is adapted to be effected by means of an adjusting screw 129 which has screw threaded engagement with a hole formed in the end of the fixed member 123 and which is

mounted to turn freely in a slot 130 formed in an upwardly extending lug or projection 131 formed on the inner end of said adjustable member 124, said adjusting screw being secured against endwise movement relative to said adjustable member by flanges 132 thereon, which are adapted to embrace opposite sides of said lug or projection 131.

Co-operating with the trip lever L is a push-bar 133, rigidly secured to the upper end of which is a forked plate 134 the forked ends 135 of which are adapted to play through holes 136 formed in the flanges 125 on the adjustable member 124 of the trip lever.

The push-bar 133 is mounted so as to admit of limit endwise movement by means of roller studs 137 and 138 which extend through slots 139 and 140 formed in the lower end of said push-bar.

The stud 137 is secured in the adjacent side frame of the separating unit B and the stud 138 is secured in the outer end of an arm 141 secured to the shaft 62. To provide for adjusting the angular position of the lever arm 141 on the shaft 62, said lever arm is preferably clamped to said shaft by means of a clamping screw 142, the shaft bearing in said lever being preferably slotted as shown at 142' to permit said bearing to be compressed upon the shaft 62.

Reciprocating movement is adapted to be imparted to the push-bar 133 by means of a link 143 pivotally connected to the lower end of said push-bar and to the outer end of the rock-arm g^1 .

With the construction described, it is obvious that at each revolution of the shaft D, the cam G on said shaft, through the roller-stud g on the arm g^1 will operate to impart oscillatory movement to the arm g^1 , which, through the link 143 will impart reciprocating movement to the push-bar 133, in the manner desired.

My improved automatic stop mechanism also comprises caliper rolls 144 and 145, of which the roll 144 is secured to the shaft 54 so as to rotate therewith and the roll 145 is mounted at the outer end of an arm 146 secured to rotate with the shaft 62, preferably in such manner as to be angularly adjustable thereon. As shown, the shaft bearing in said brackets 146 is split and said arm is adapted to be clamped to said shaft by means of a clamping screw, in a familiar manner.

With the described construction, it is obvious that as signatures and other blanks are delivered from the table 41 to the gathering chute J, they will pass between the caliper rolls 144, 145, which will operate, in an obvious manner, to force the lower roll 145 downwardly away from the upper roll and will impart limited rocking movement to the shaft 62—which will vary with the

thickness of the signatures or other blanks—which will, in turn, impart oscillation to the arm 141 secured to said shaft, and through it to the push-bar 133 and to the fork 134 secured to the upper end thereof.

The cam G on the shaft D is so timed with reference to the feeding of the signatures or other blanks, that the upward reciprocation of the push-bar 133 will occur simultaneously with the feeding of the signatures or other blanks from the table 41 to the gathering chute J and their passage between the caliper rolls 144, 145.

Preliminary to starting a run, the stop mechanism is adjusted so that when a signature or other blank of normal thickness is between the caliper rolls 144, 145, the ends 135 of the fork 134 will pass freely through the holes 136 in the trip lever L. Such adjustment is made by first securing the arm 141 to the shaft 62 in position to effect approximate registration of said forked ends with the holes or openings 136 with a signature between the caliper rolls; exact registration being then effected by adjusting the slide member 124 of the trip lever L endwise into proper position by means of the adjusting screw 129. Exact registration having been effected, the member 124 is then secured in fixed adjustment by the clamping screw 127.

Having adjusted the push-bar to effect registration of the forked ends 135 with the holes 136 in the trip-lever L, the lever 110 is turned against the force of the spring 109 applied to the shaft 105 to start the machine, in which position it is secured by engagement of the projection 116 on the lever 113 with the shoulder 117 on the fin 118, operation of the machine continuing without interruption so long as the signatures or other blanks passing through the feed and caliper rolls are of normal thickness. If, however, a signature either thicker or thinner than the normal thickness of the signatures enters the caliper rolls 144, 145, a corresponding error will occur in the angular movement of the push-bar 133 which error will be multiplied several times at the forked ends 135, due to the fact that the distance between the guide studs 137 and 138 is only about one sixth of the distance between the fixed pivot stud 137 and the extreme upper ends of the forks 135. This departure from normal in the operation of the push-bar 113 will bring the fork ends 135 out of register with the holes 136 in the trip-lever L so that, as said push-bar is raised by the action of the cam G on the driving shaft D, causing the fork ends 135 to strike the under side of said trip-lever at one side or the other of said holes 136, as the defective signature is thicker or thinner than normal, thus turning said trip lever and with it the shaft 114 pivotally to dis-

engage the projection 116 from the shoulder 117, thereby releasing the shaft 105 and permitting it to turn under the tension of the spring 109 to shift the driving belt from the tight pulley to the loose pulley and stop the machine in the manner contemplated, before the defective signature is delivered into the gathering chute J, thus permitting it to be removed and replaced by a perfect signature.

In accordance with my invention, also, the stop mechanism is adapted to be tripped manually by means of a hand lever 147 formed on the trip arm 113.

In accordance with usual practice, my improved machine also preferably comprises racks or boxes M secured to the front of the machine, which are adapted to contain a supply of signatures or other blanks such as the unit to which they are secured, respectively, is adapted to handle. Also, my improved machine comprises a shelf N secured to the tops of the upward extension 77 of the brackets 73, said shelf forming a convenient support where defective signatures and other blanks may be deposited when removed from the machine.

While I have herein described my invention and improvement as embodying in a machine having a continuous frame, my invention, in accordance with familiar practice, contemplates equally, constructing the machine in separate sections, the driving shaft of one of which is driven from the driving shaft of the other by means of a cross shaft connected to the sections of the driving shaft by mitre gears. The advantage of the double section construction is that it renders the machine more compact and the different units thereof more readily accessible to the operator. The construction of the machine in separate sections will also necessitate the use of a gathering apparatus comprising a chain belt which turns about a vertical axis instead of about a horizontal axis, as herein shown. The use of gathering belts of this type is old and well known and can readily be provided by mechanics skilled in the art without a description thereof in detail.

I claim:

1. In blank separating mechanism, the combination of a pack-box adapted to contain blanks, a grid supported beneath said pack-box so as to be movable endwise on which the pack of blanks contained in the pack-box is supported, said grid comprising a frame slidably fitted to bearings in the machine frame, and anti-friction rollers rotatably mounted on said frame on which the pack of blanks rests directly, said grid being constructed and said anti-friction rollers arranged to provide an unobstructed space intermediate the ends of said grid for the withdrawal therethrough of the bottom

blank of the pack contained in said pack-box, a suction head mounted beneath said pack-box so as to admit of simultaneous reciprocating and oscillating movement, means for imparting reciprocating and oscillating movement thereto, means for imparting reciprocating movement to said grid co-incidental with that of said suction head, said suction head comprising a cylindrical surface and being so positioned that said cylindrical surface will contact with the bottom blank of the pack contained in said pack-box through the space formed in the grid for the withdrawal of the blanks from the pack-box, said suction head being provided with a chamber and with perforations in its cylindrical surface which communicate with said chamber, and suction means applied to said suction head, the relation being such that the perforations in the cylindrical surfaces of said suction head will engage the bottom blank of the pack contained in the pack-box adjacent to its front edge when said head is at the forward limit of its movement, substantially as described.

2. A blank separating mechanism as specified in claim 1, which comprises means for breaking the suction applied to the suction head at the rearward limit of its movement, substantially as described.

3. A blank separating mechanism as specified in claim 1, in which the supporting means for the suction head comprises a shaft to which said suction head is secured, and journal boxes slidably fitted to slide bearings formed in the machine frame in which said shaft is rotatably mounted.

4. A blank separating mechanism as specified in claim 1, in which the supporting means for the suction head comprises a shaft to which said suction head is secured, and journal boxes slidably fitted to slide bearings formed in the machine frame in which said shaft is rotatably mounted and the blank supporting grid is reciprocated by direct connection with the journal boxes in which the suction head supporting shaft is mounted.

5. A blank separating mechanism as specified in claim 1, in which the supporting means for the suction head comprises a shaft to which said suction head is secured, and journal boxes slidably fitted to slide bearings formed in the machine frame in which said shaft is rotatably mounted and the blank supporting grid is reciprocated by direct connection with the journal boxes in which the suction head supporting shaft is mounted, consisting of extensions of the journal boxes for the suction head supporting shaft which engage notches formed in members of the grid frame.

6. A blank separating mechanism as specified in claim 1, in which the means for oscillating the suction head comprises gears

connected thereto so as to rotate therewith, and rack bars secured to the machine frame with which said gears intermesh.

7. A blank separating mechanism as specified in claim 1, in which the supporting means for the suction head comprises a shaft to which said suction head is secured, and journal boxes slidably fitted to slide bearings formed in the machine frame, and the means for oscillating said suction head comprises gears secured to said shaft and rack bars secured to the machine frame with which said gears intermesh.

8. A blank separating mechanism as specified in claim 1, in which the supporting means for the suction head comprises a shaft to which said suction head is secured, and journal boxes slidably fitted to slide bearings formed in the machine frame, in which said shaft is rotatably mounted, said suction head supporting shaft being hollow, and the suction means comprises an air exhauster, connection between said exhauster and the bore of said suction head supporting shaft constructed and arranged to permit reciprocating and oscillating movement of said shaft, and connection between the bore of said shaft and the chamber of said suction head.

9. A blank separating mechanism as specified in claim 1, in which the supporting means for the suction head comprises a shaft to which said suction head is secured, and journal boxes slidably fitted to slide bearings formed in the machine frame, in which said shaft is rotatably mounted, said suction head supporting shaft being hollow, and the suction means comprises an air exhauster, connection between said exhauster and the bore of said suction head supporting shaft constructed and arranged to permit reciprocating and oscillating movement of said shaft, and connection between the bore of said shaft and the chamber of said suction head, the connection between the air exhauster and the bore of the suction head supporting shaft comprise a fitting mounted to turn on said shaft, said fitting being provided with a chamber which is in open communication with the shaft bearing therein, and with a vent opening and said shaft being provided with a hole adapted to be brought alternately into communication with the chamber and vent opening in said fitting by relative rotation of said shaft and fitting produced by the reciprocating and oscillating movement of said shaft, a pipe which connects said fitting with the suction end of the exhauster, said pipe having flexible connection with said exhauster, and comprising separate sections which have telescoping connection with each other, the relation being such that the hole in said shaft will be in communication with the chamber in said fitting throughout substan-

tially its entire stroke, but will pass out of communication therewith and into communication with the vent opening in said fitting when the suction head is at the rearward limit of its movement.

10. A blank separating mechanism as specified in claim 1, in which the supporting means for the suction head comprises a shaft to which said suction head is secured, and journal boxes slidably fitted to slide bearings formed in the machine frame, in which said shaft is rotatably mounted, said suction head supporting shaft being hollow, and the suction means comprises an air exhauster, connection between said exhauster and the bore of said suction head supporting shaft constructed and arranged to permit reciprocating and oscillating movement of said shaft, and connection between the bore of said shaft and the chamber of said suction head, the connection between the air exhauster and the bore of the suction head supporting shaft comprise a fitting mounted to turn on said shaft, said fitting being provided with a chamber which is in open communication with the shaft bearing therein, and with a vent opening and said shaft being provided with a hole adapted to be brought alternately into communication with the chamber and vent opening in said fitting by relative rotation of said shaft and fitting produced by the reciprocating and oscillating movement of said shaft, a pipe which connects said fitting with the suction end of the exhauster, said pipe having flexible connection with said exhauster, and comprising separate sections which have telescoping connection with each other, the relation being such that the hole in said shaft will be in communication with the chamber in said fitting throughout substantially its entire stroke, but will pass out of communication therewith and into communication with the vent opening in said fitting when the suction head is at the rearward limit of its movement, the suction connections to the hollow suction head supporting shaft being positioned beyond the end of the frame of the machine.

11. A blank separating mechanism as specified in claim 1, which comprises a plurality of suction heads, and the means for supporting said suction heads comprises a hollow shaft to which said suction heads are secured and journal boxes slidably fitted to slide bearings formed in the machine frame in which said shaft is rotatably mounted, one of said suction heads being secured to said shaft in fixed position, said fixed head and shaft being provided with registering holes which connect the bore of said shaft with the suction chamber of said head, said suction heads also comprising a head which is adjustable towards and from said fixed head, and flexible pipe connections between

the suction chambers of said adjustable head and the suction chamber of said fixed head, and in which also the suction means are connected directly to the bore of the suction head supporting shaft.

12. A blank separating mechanism as specified in claim 1, in which the pack supporting grid comprises side frame members and transverse members which rigidly connect said side members, transverse shafts fitted to holes formed in the side members of the grid frame, the ends of which project through and beyond said side frame members, anti-friction rollers mounted on the projecting ends of said shafts adapted to run in bearing grooves formed in the machine frame, and rollers rotatably mounted on said transverse shafts between the side frame members of said grid on which the pack of blanks contained in the pack-box of the apparatus rest directly.

13. A blank separating mechanism as specified in claim 1, in which the pack supporting grid comprises side frame members and transverse members which rigidly connect said side members, transverse shafts fitted to holes formed in the side members of the grid frame, the ends of which project through and beyond said side frame members, anti-friction rollers mounted on the projecting ends of said shafts adapted to run in bearing grooves formed in the machine frame, and rollers rotatably mounted on said transverse shafts between the side frame members of said grid on which the pack of blanks contained in the pack-box of the apparatus rest directly, said anti-friction rollers comprising a plurality of rollers on each transverse shaft, corresponding rollers on each shaft being arranged in series lengthwise of the grid, and the frame of the machine comprises stripper bars which extend parallel with the side members of the grid frame and are arranged between different series of anti-friction rollers, said stripper bars being rigidly secured to the transverse members which connect the side frame members of the grid and being provided with holes through which the transverse shafts of said grid extend, said intermediate bars comprising front and rear bars proportioned and positioned so that their adjacent ends will terminate short of each other, the relation being such that the space between their adjacent ends will be coincident with the space in said grid through which the blanks are withdrawn from the pack-box in the operation of the machine.

14. A blank separating mechanism as specified in claim 1, in which the pack-box consists of four angle bars supported in upright position on the machine frame.

15. A blank separating mechanism as specified in claim 1, in which the pack-box

consists of four angle bars adjustably supported in upright position to provide for varying the size of said pack-box.

16. A blank separating mechanism as specified in claim 1, in which the pack-box consists of four angle bars adjustably supported in upright position to provide for varying the size of said pack-box, and to cause the suction head to engage the blanks contained in said pack-box at a different distance from their front edges.

17. A blank separating mechanism as specified in claim 1, in which the pack-box consists of four angle bars supported in upright position on the machine frame, the means for supporting said angle bars comprising lugs thereon, bars secured to the machine frame provided with T-slots and clamping screws the heads of which engage said T-slots and which extend through holes formed in the lugs on said angle bars.

18. A blank separating mechanism as specified in claim 1, in which the pack-box consists of four angle bars supported in upright position on the machine frame, the means for supporting said angle bars comprising lugs thereon, bars secured to the machine frame provided with T-slots and clamping screws the heads of which engage said T-slots and which extend through holes formed in the lugs on said angle bars, and the bars in which said T-slots are formed are secured to plates adapted to be clamped to the machine frame by screws inserted through slots formed in said plates and which have screw threaded engagement with holes formed in the machine frame.

19. A blank separating mechanism as specified in claim 1, in which the pack-box consists of four angle bars supported in upright position on the machine frame, the means for supporting said angle bars comprising lugs thereon, bars secured to the machine frame provided with T-slots and clamping screws the heads of which engage said T-slots and which extend through holes formed in the lugs on said angle bars, and the bars in which said T-slots are formed are secured to plates adapted to be clamped to the machine frame by screws inserted through slots formed in said plates and which have screw threaded engagement with holes formed in the machine frame, the clamping screws which secure the rear angle bars of the pack-box in position being interchangeable in a plurality of holes in the machine frame positioned at different distances from the front side of the back-box.

20. A blank separating mechanism as specified in claim 1, in which the means for imparting reciprocating movement to the suction head is constructed and arranged to retard and accelerate their rate of movement from frontward to rearward positions

and from rearward to frontward positions, respectively.

21. A blank separating mechanism as specified in claim 1, in which the means for imparting reciprocating movement to the suction head comprises a rock-shaft, lever arms secured thereto, connection between said lever arm and said suction head, and means for imparting oscillating movement to said rock-shaft.

22. A blank separating mechanism as specified in claim 1, in which the means for imparting reciprocating movement to the suction head comprises a rock-shaft, a lever arm secured thereto, connection between said lever arm and said suction head, and means for imparting oscillating movement to said rock-shaft, comprising an arm secured thereto, a crank shaft, a crank secured thereto, and a connecting rod connecting the crank pin of said crank with the lever arm on said rock-shaft.

23. A blank separating mechanism as specified in claim 1, in which the means for imparting reciprocating movement to the suction head comprises a rock-shaft, a lever arm secured thereto, connection between said lever arm and said suction head, and means for imparting oscillating movement to said rock-shaft, comprising an arm secured thereto, a crank shaft, a crank secured thereto, and a connecting rod connecting the crank pin of said crank with the lever arm on said rock-shaft, the crank shaft being positioned above the end of the arm secured to said rock-shaft and in close proximity thereto, the relation being such that the movement of the suction head from rearward to frontward position will be effected by rotation of the crank shaft through an arc of less than 180 degrees, and the movement of said suction head from frontward to rearward position will be effected by rotation of said crank shaft through more than 180 degrees.

24. A blank separating mechanism as specified in claim 1, in which the means for imparting reciprocating movement to the suction head comprises a rock-shaft, lever arms secured thereto, connection between said lever arm and said suction head, and means for imparting oscillating movement to said rock-shaft, comprising an arm secured thereto, a crank shaft, a crank secured thereto, and a connecting rod connecting the crank pin of said crank with the lever arm on said rock-shaft, the crank shaft being positioned above the end of the arm secured to said rock-shaft and in close proximity thereto, the relation being such that the movement of the suction head from rearward to frontward position will be effected by rotation of the crank shaft through an arc of substantially 150 degrees and the movement of said suction head from front-

ward to rearward position will be effected by rotation of said crank shaft through an arc substantially 210 degrees.

25. A blank separating mechanism as specified in claim 1, in which the means for imparting reciprocating movement to the suction head comprises a rock-shaft, lever arms secured thereto, connection between said lever arm and said suction head, and means for imparting oscillating movement to said rock-shaft, comprising an arm secured thereto, a crank shaft, a crank secured thereto, and a connecting rod connecting the crank pin of said crank with the lever arm on said rock-shaft, the crank-shaft being driven by a worm gear.

26. The combination of blank separating mechanism as specified in claim 1, a support upon which the blanks are adapted to be deposited when fully withdrawn from the pack-box of the separating mechanism, and feed rolls to which said separating mechanism is adapted to deliver blanks withdrawn from said pack-box.

27. In blank separating mechanism, the combination of a pack-box adapted to contain blanks, a grid supported beneath said pack-box so as to be movable endwise on which the pack of blanks contained in the pack-box is supported, said grid comprising a frame slidably fitted to bearings in the machine frame, and anti-friction rollers rotatably mounted on said frame on which the pack of blanks rests directly, said grid being constructed and said anti-friction rollers arranged to provide an unobstructed space intermediate the ends of said grid for the withdrawal therethrough of the bottom blank of the pack contained in said pack-box, a head mounted beneath said pack-box so as to admit of simultaneous reciprocating and oscillating movement, means for imparting reciprocating and oscillating movement thereto, means for imparting reciprocating movement to said grid co-incident with that of said head, and means on said head for engaging the bottom blank of the pack contained in the pack-box adjacent to its front edge when said head is at the forward limit of its movement.

28. In blank separating mechanism, the combination of a pack-box adapted to contain blanks, a grid supported beneath said pack-box so as to be movable endwise on which the pack of blanks contained in the pack-box is supported, said grid comprising a frame slidably fitted to bearings in the machine frame, and anti-friction rollers rotatably mounted on said frame on which the pack of blanks rests directly, said grid being constructed and said anti-friction rollers arranged to provide an unobstructed space intermediate the ends of said grid for the withdrawal therethrough of the bottom

blank of the pack contained in said pack-box, a head mounted beneath said pack-box so as to admit of simultaneous reciprocating and oscillating movement, means for imparting reciprocating and oscillating movement thereto, means for imparting reciprocating movement to said grid co-incident with that of said head, and suction means

for engaging said head with the bottom blank of the pack contained in the pack-box adjacent to its front edge when said head is at the forward limit of its movement. 10

In witness that I claim the foregoing as my invention, I affix my signature this 6th day of October, A. D. 1922.

SIGWALD C. GRUNLEE.