V. GARNER.

PAPER FEEDING MACHINE.

APPLICATION FILED NOV. 16, 1911.

1,108,569.

Patented Aug. 25, 1914.

15 SHEETS—SHEET 1.

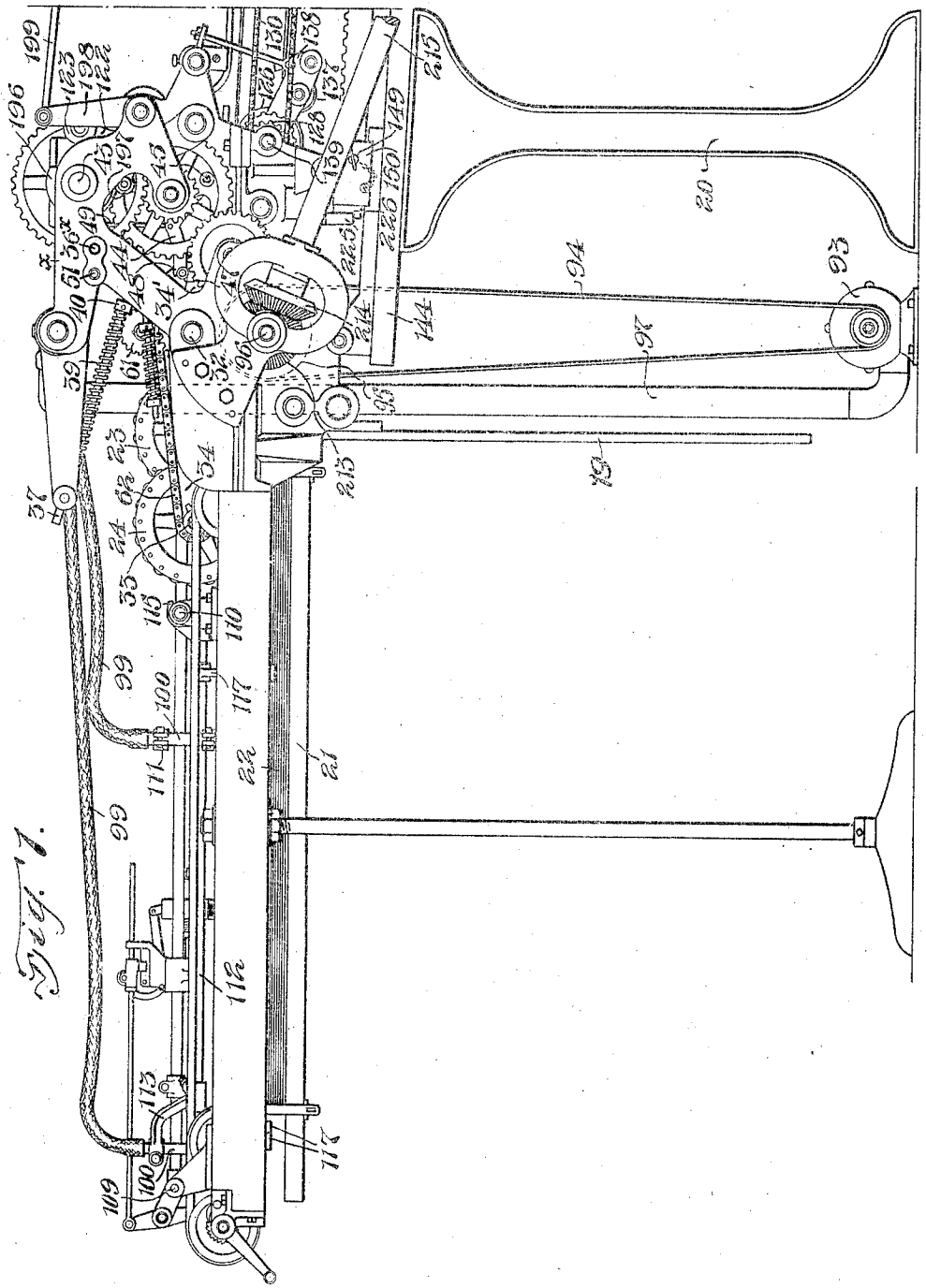


Fig. 1.

Witnesses:
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Alp. Scott

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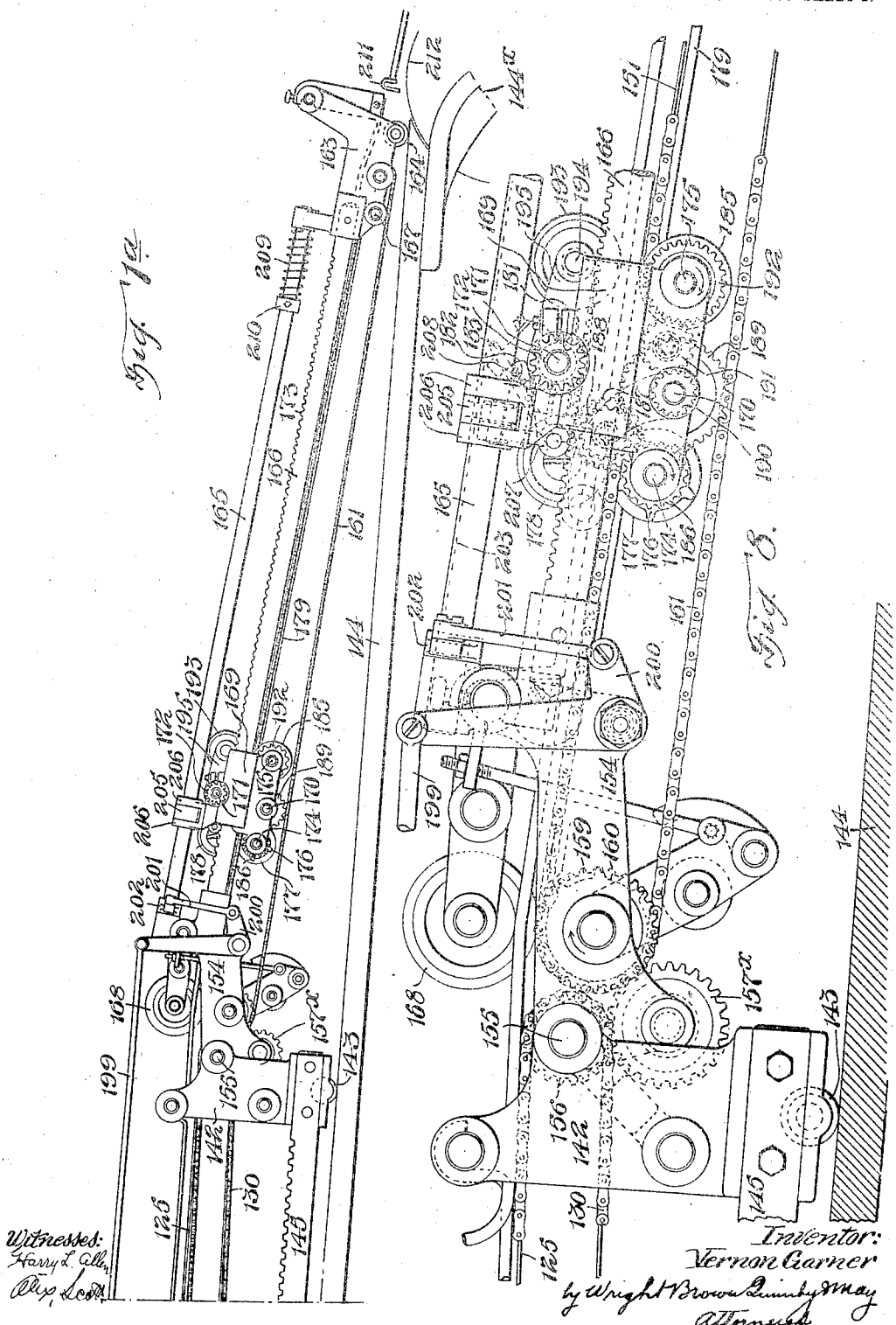
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15 SHEETS—SHEET 2.



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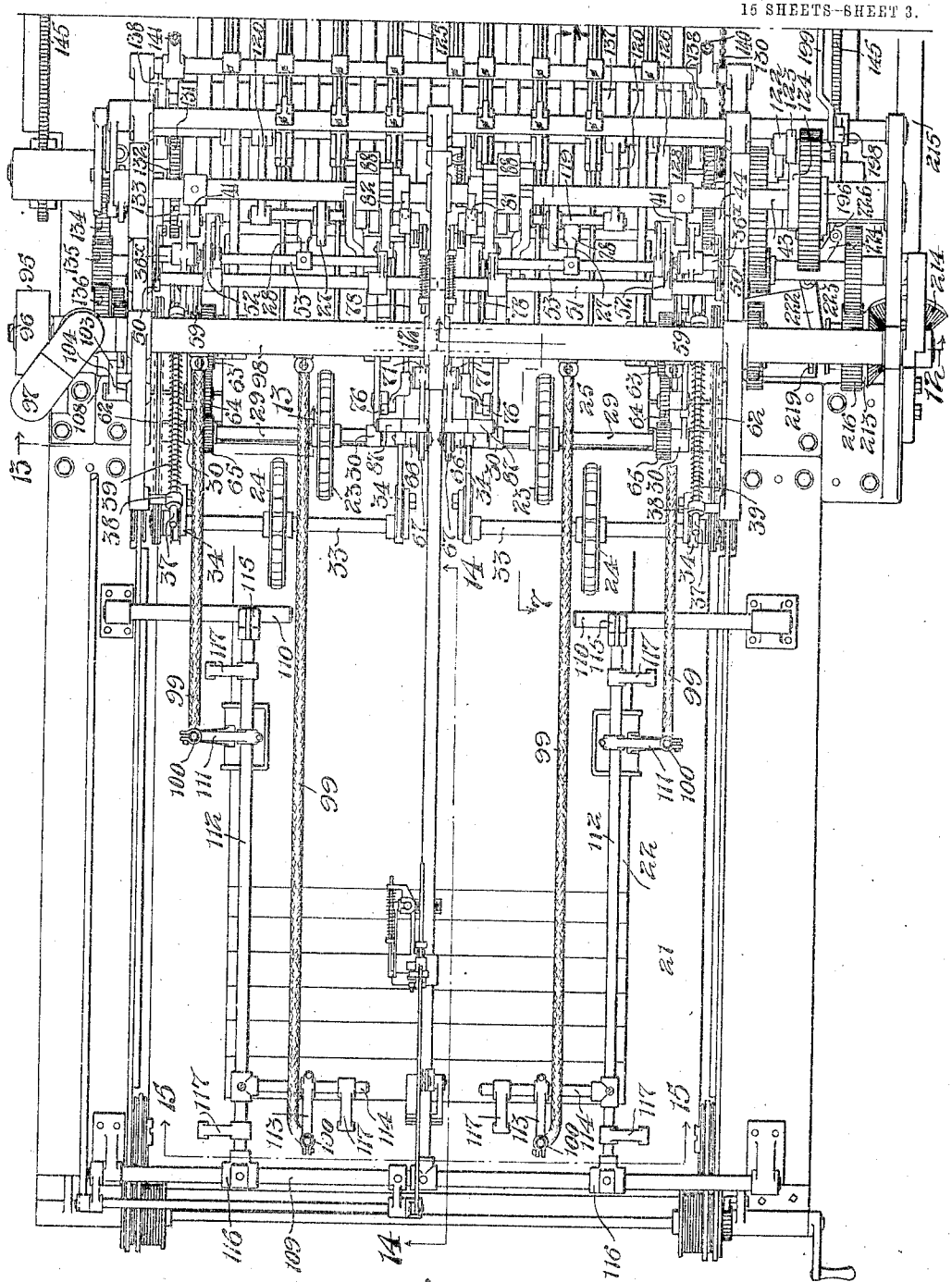
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15 SHEETS—SHEET 3.



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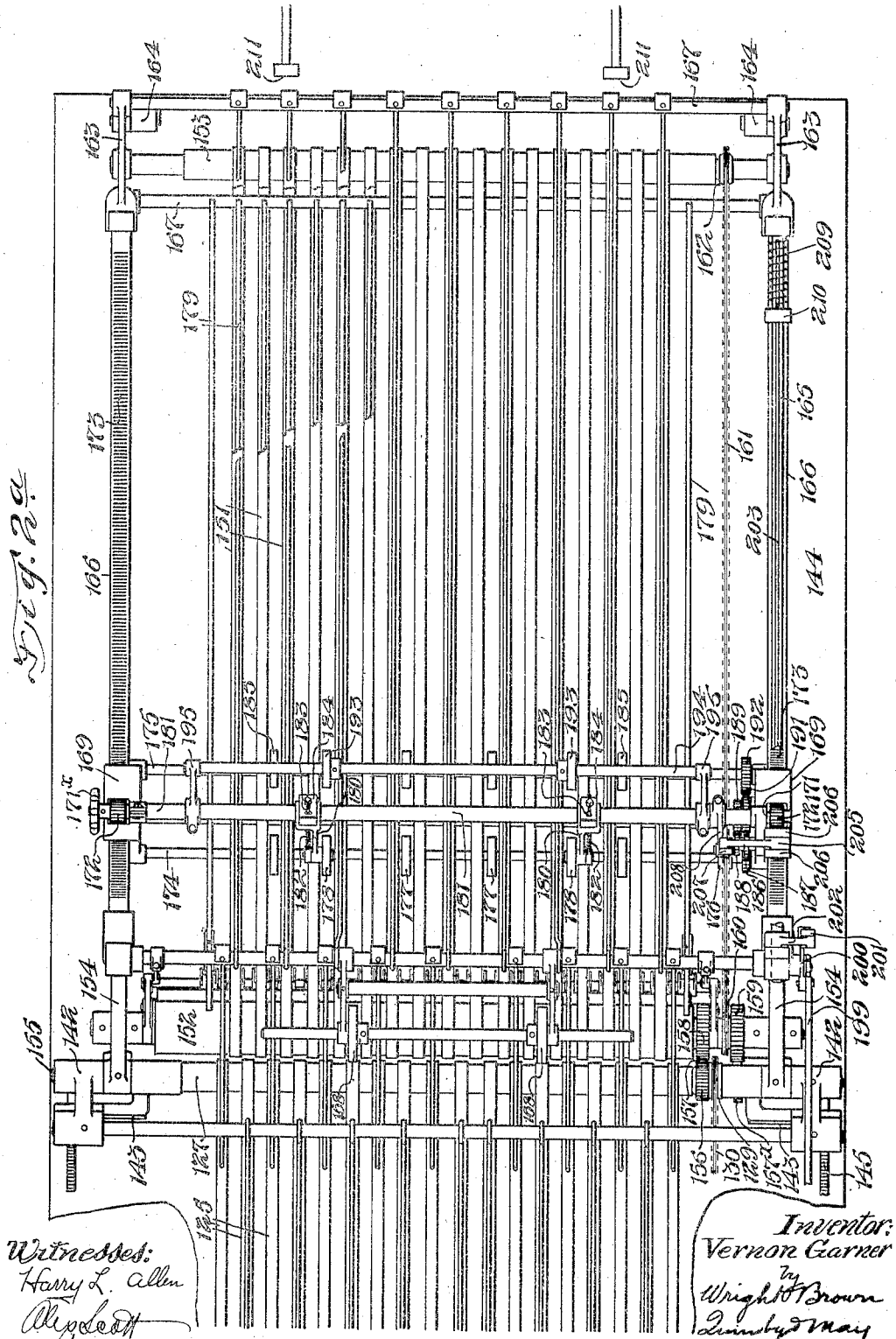


Fig. 12.

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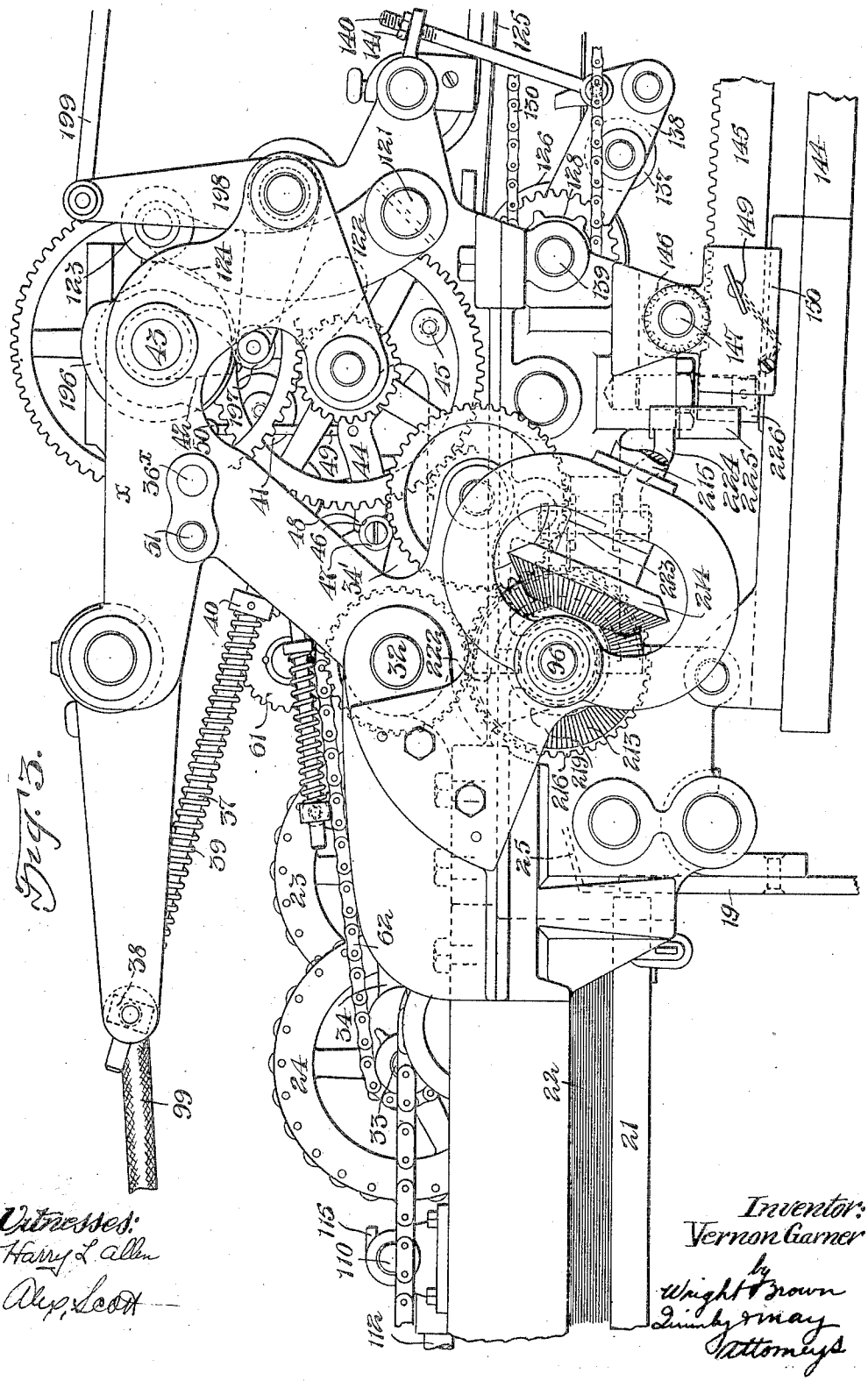
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15 SHEETS—SHEET 5.



Witnesses:
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15 SHEETS—SHEET 6.

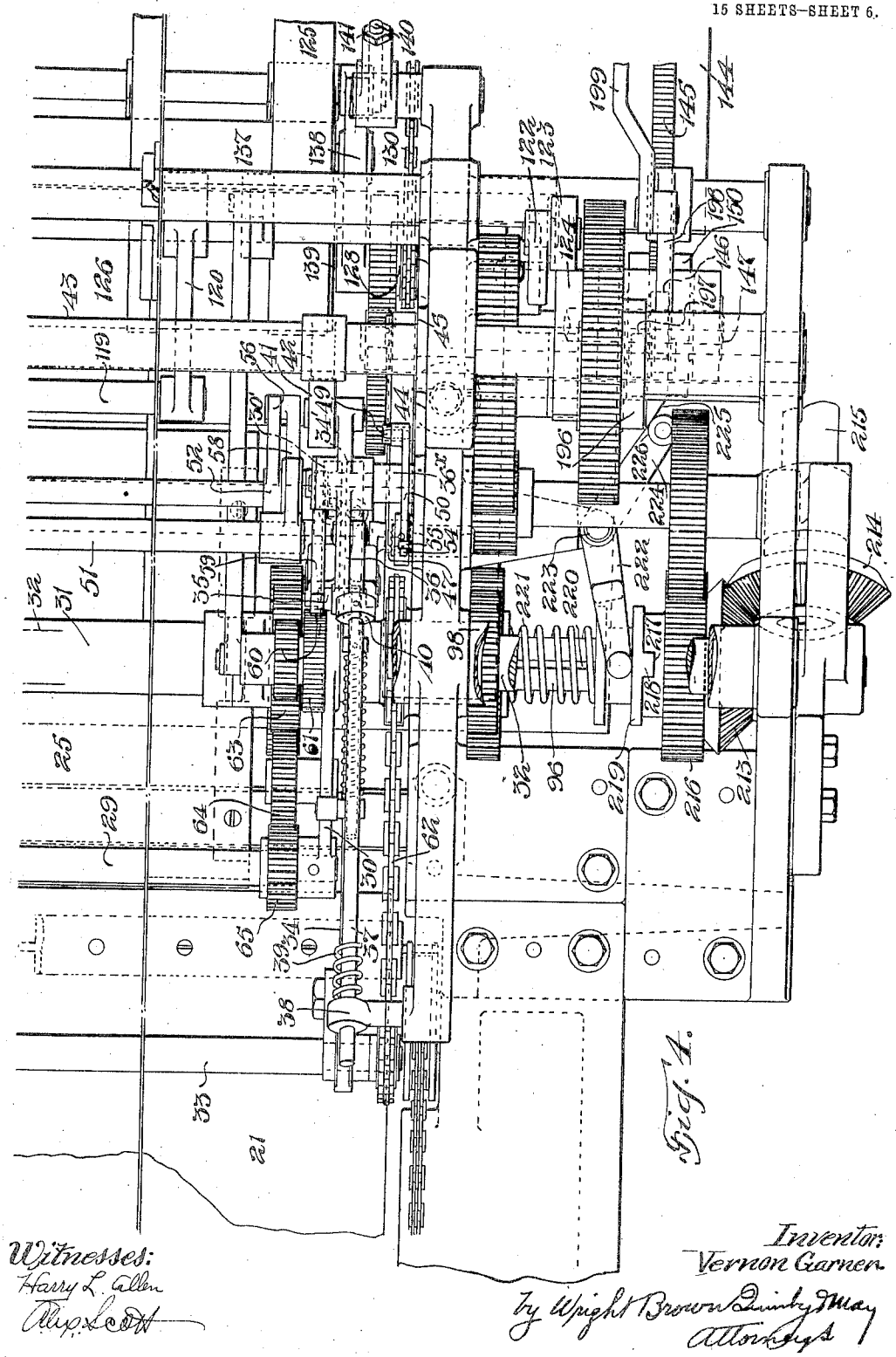


Fig. 4.

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15 SHEETS—SHEET 7.

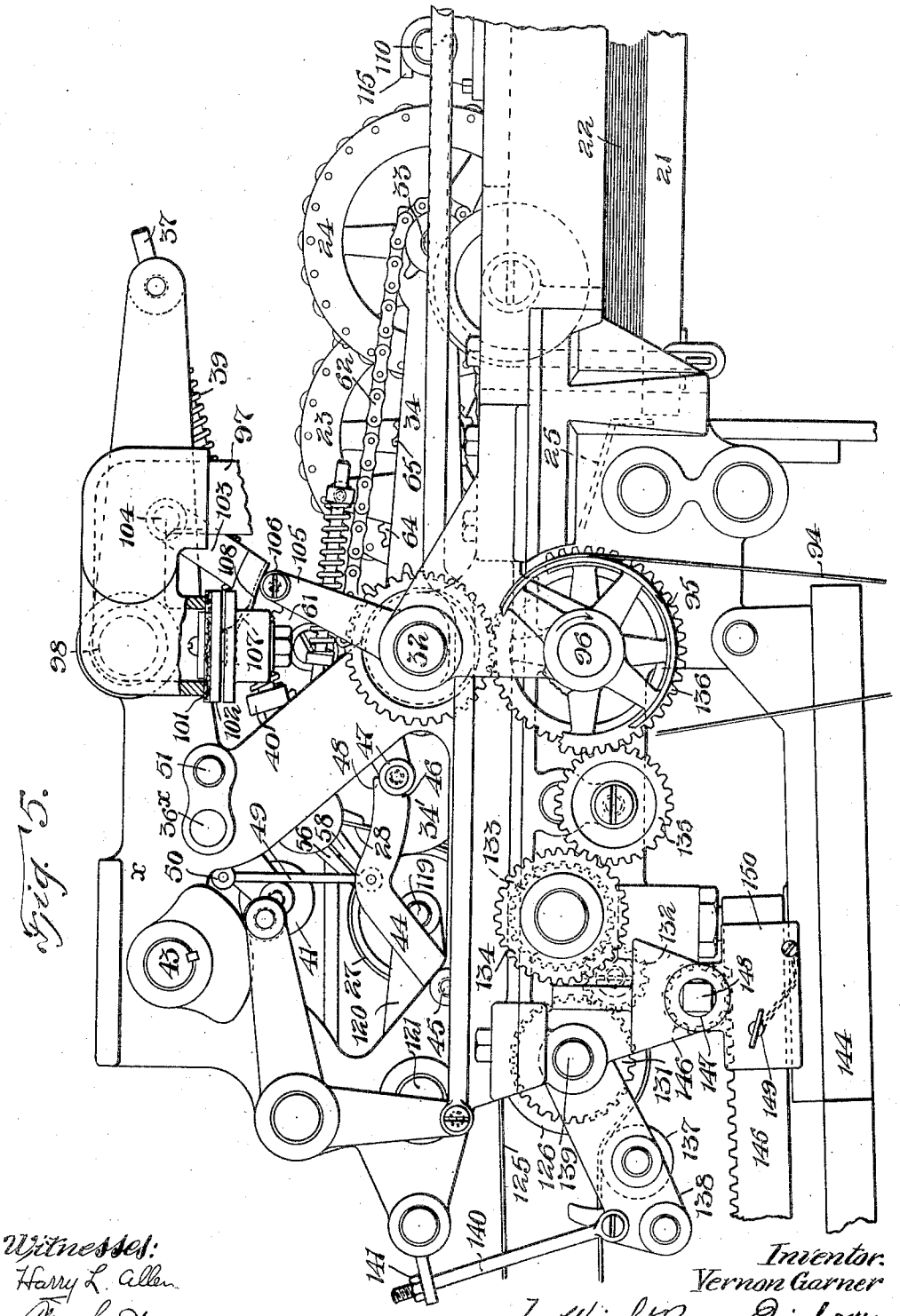


Fig. 7.

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15 SHEETS—SHEET 8.

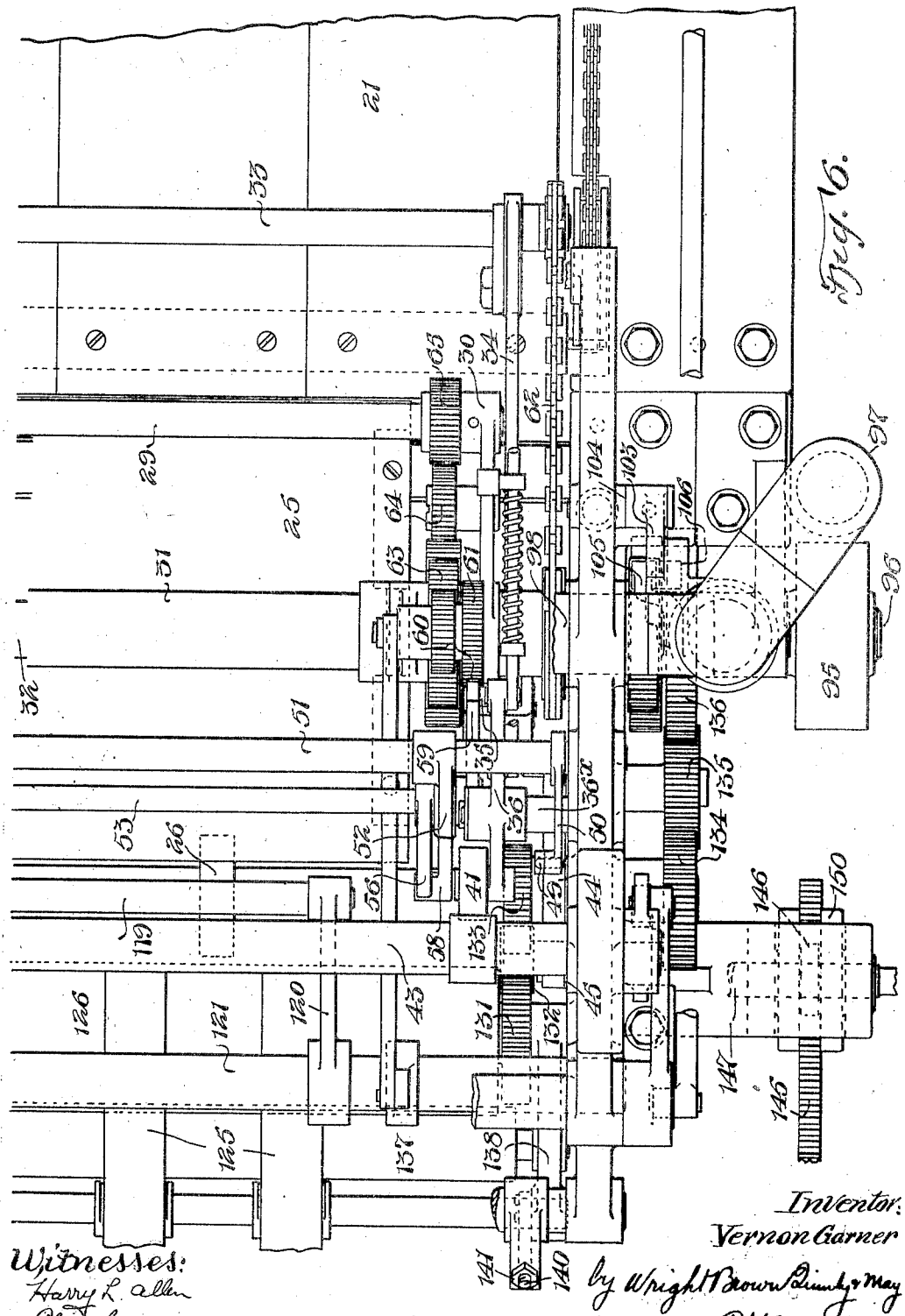


Fig. 6.

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PAPER FEEDING MACHINE.

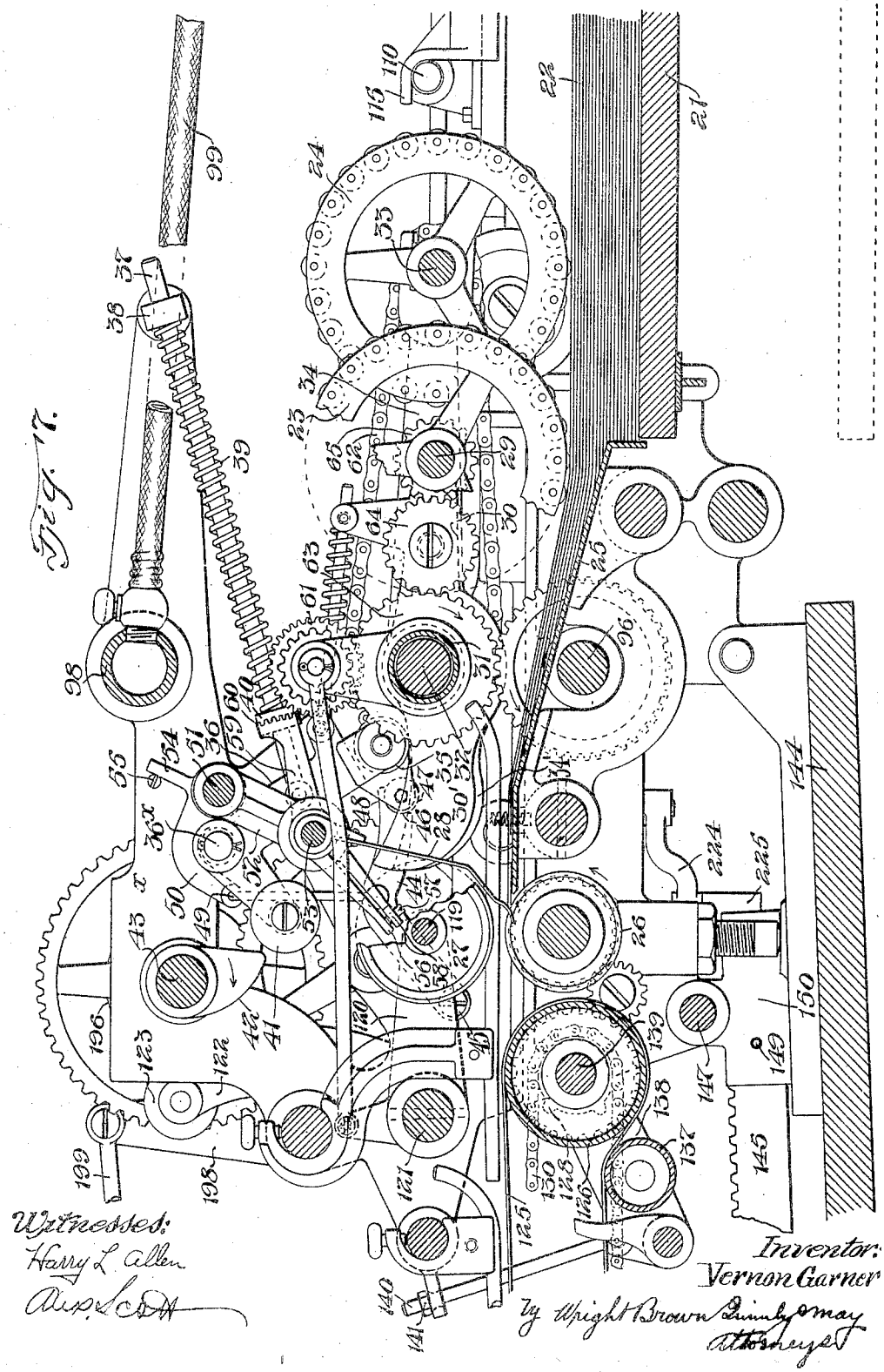
APPLICATION FILED NOV. 16, 1911.

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Patented Aug. 25, 1914.

15 SHEETS—SHEET 9.

Fig. 17.



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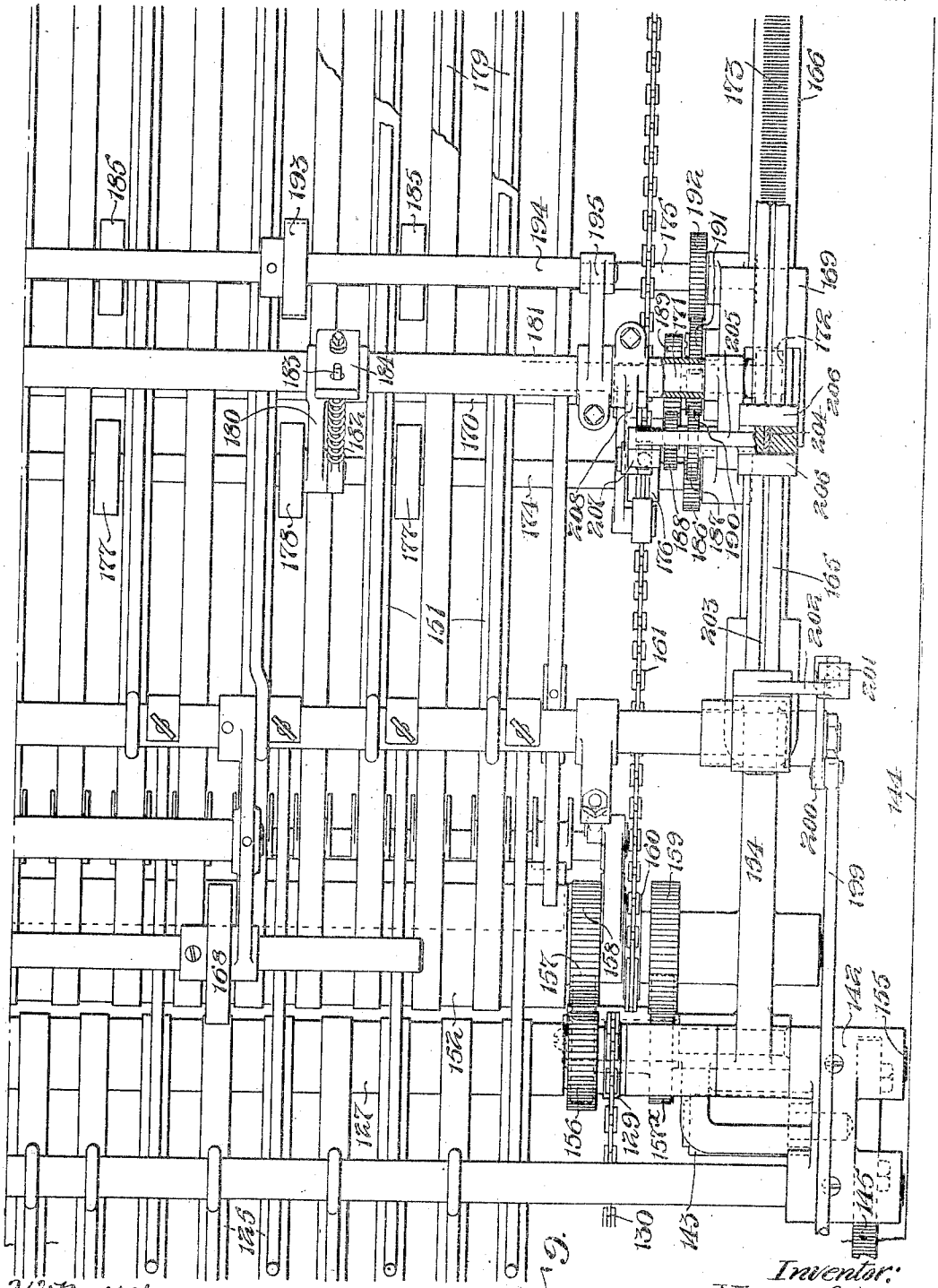
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1,108,569.

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15 SHEETS—SHEET 10.



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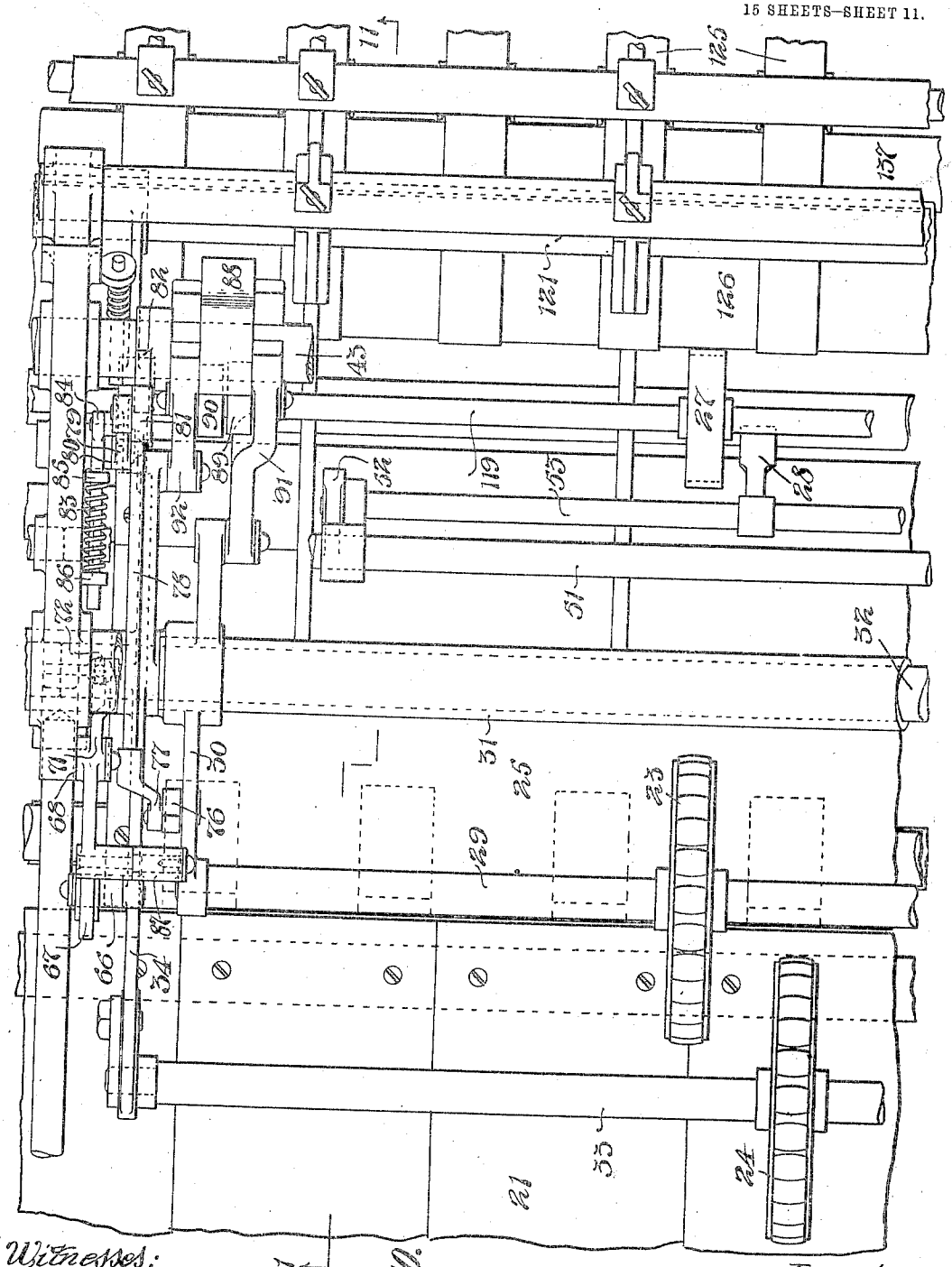
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1,108,569.

Patented Aug. 25, 1914.

15 SHEETS—SHEET 11.



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Fig. 10.

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APPLICATION FILED NOV. 16, 1911.

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Patented Aug. 25, 1914.

15 SHEETS—SHEET 12.

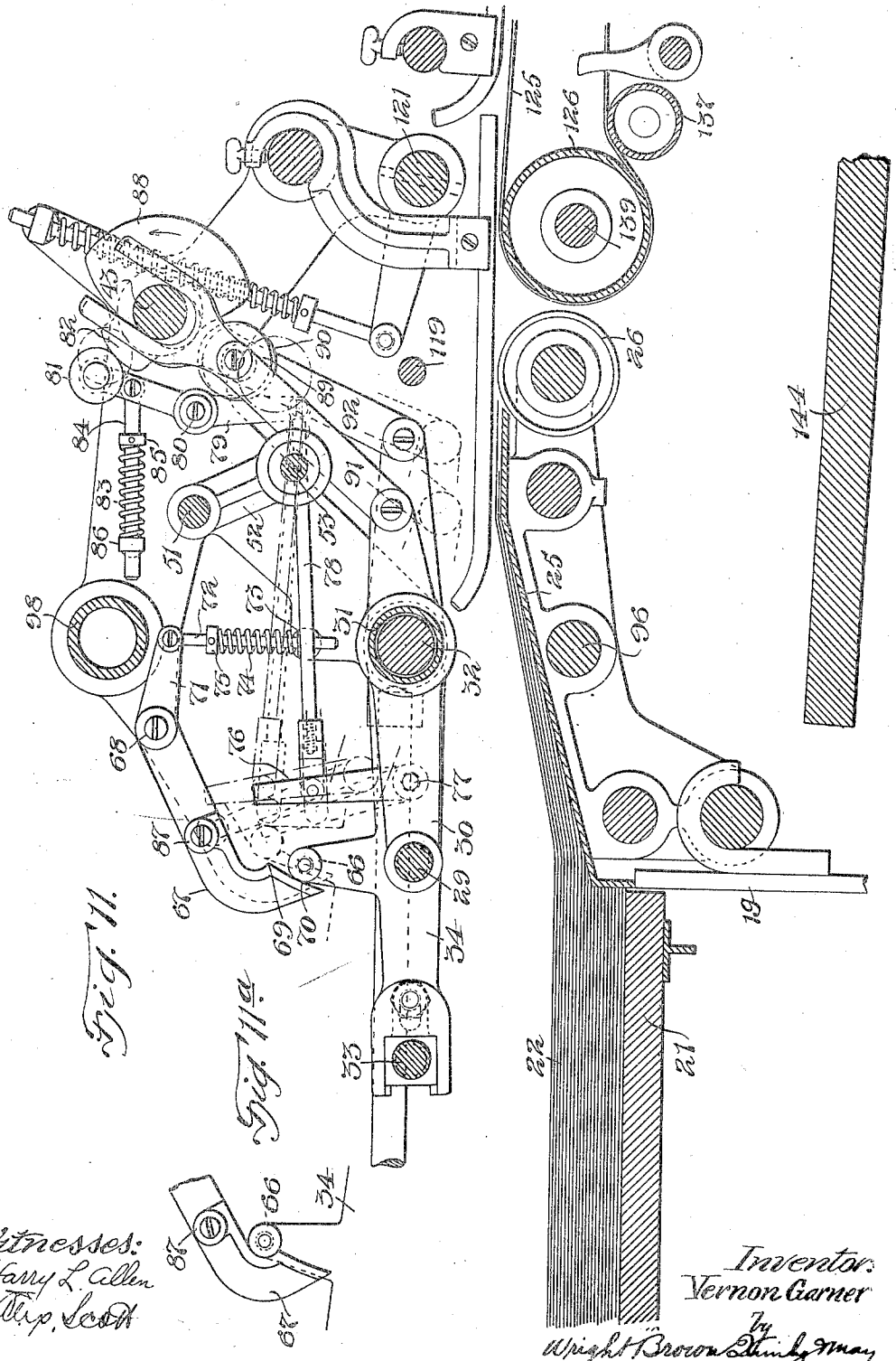


Fig. 11.

Fig. 11a.

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15 SHEETS—SHEET 13.

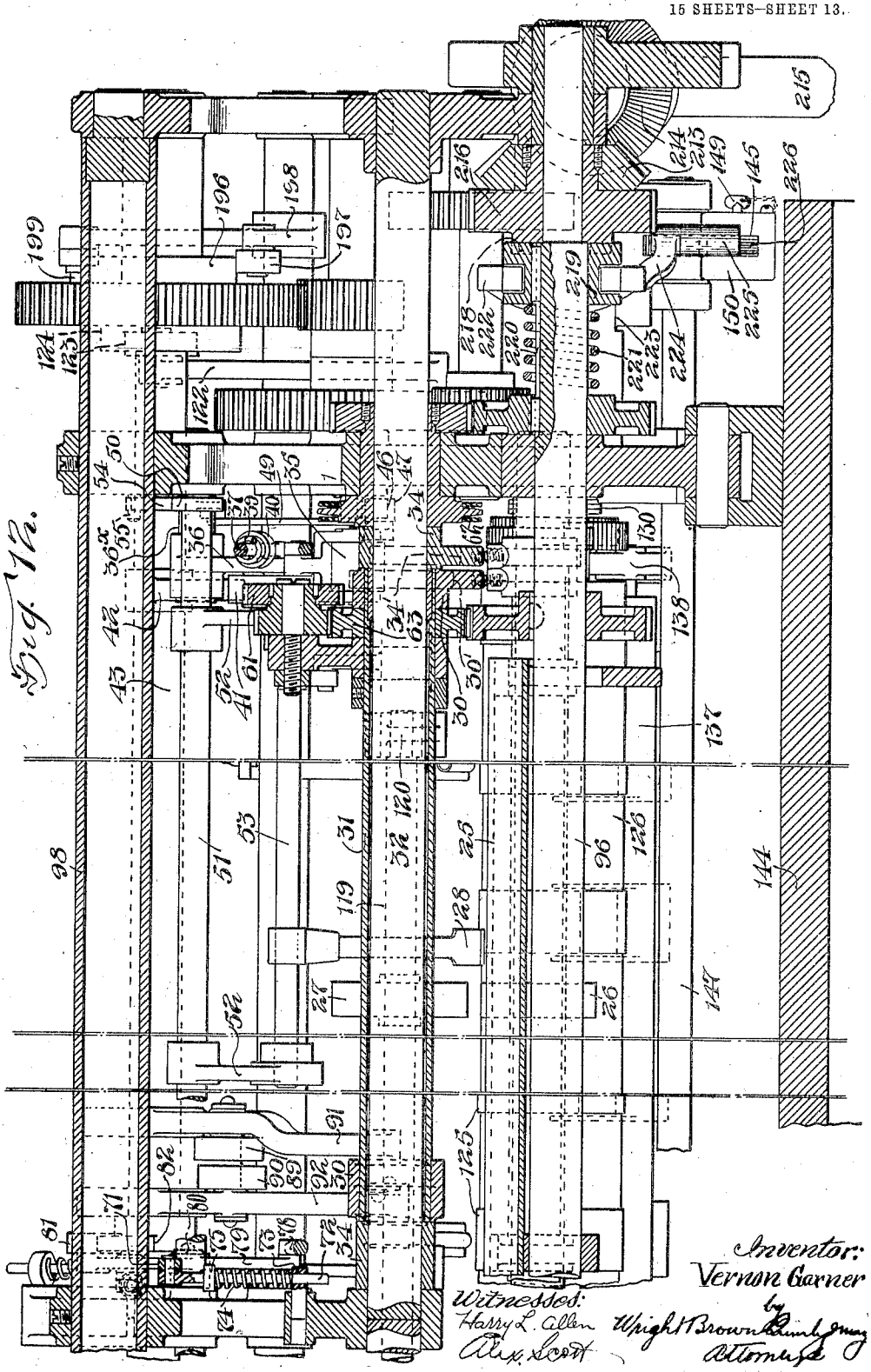


Fig. 112.

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PAPER FEEDING MACHINE.

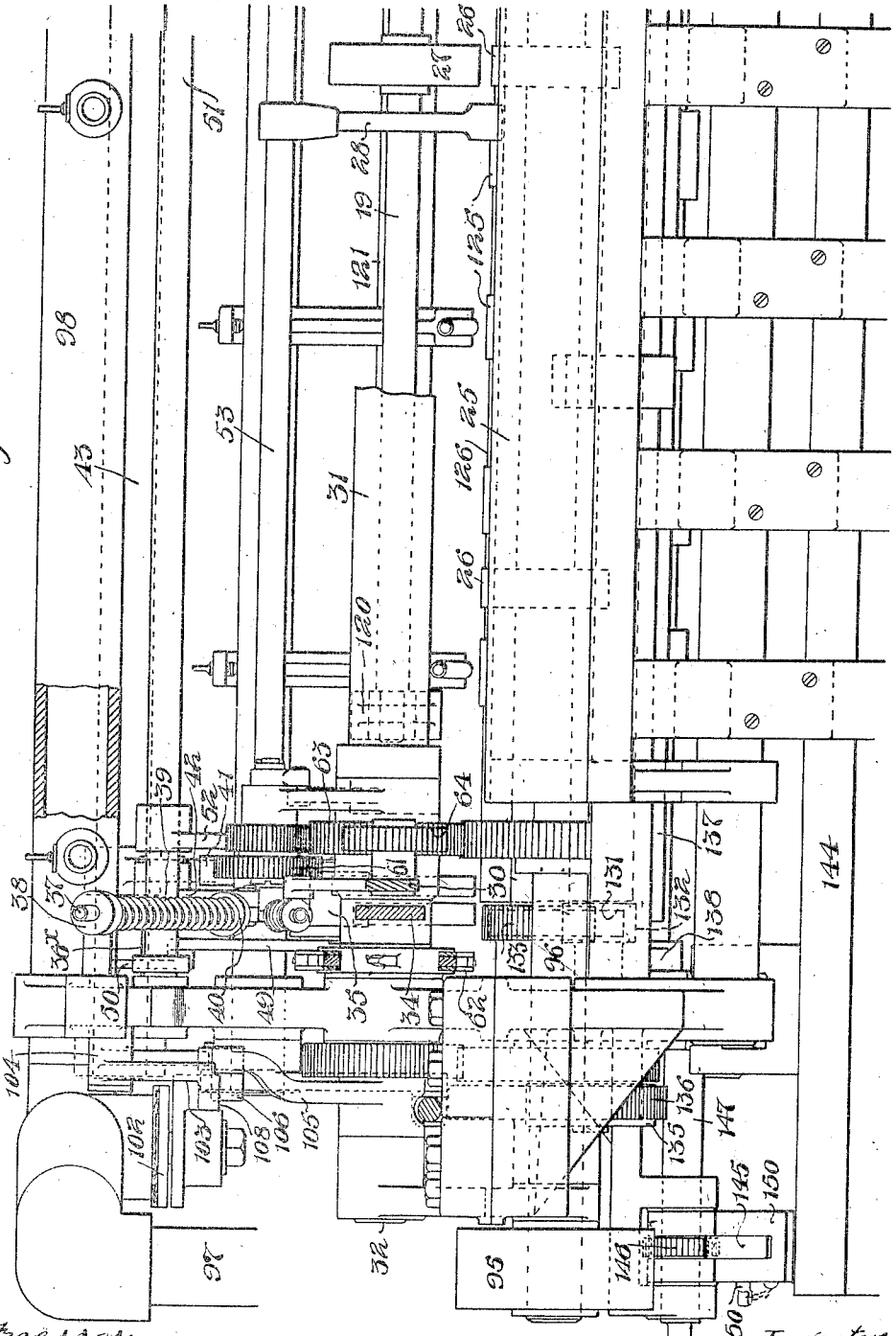
APPLICATION FILED NOV. 16, 1911.

1,108,569.

Patented Aug. 25, 1914.

15 SHEETS—SHEET 14.

Fig. 13.



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15 SHEETS—SHEET 15.

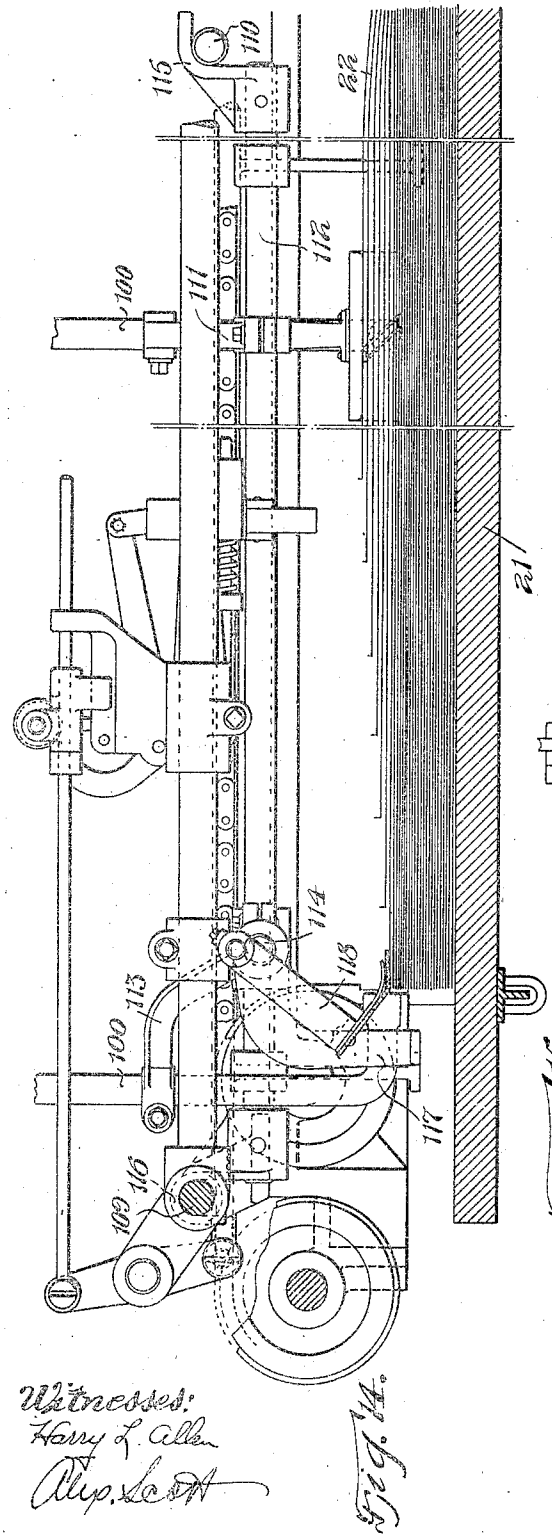


Fig. 14.

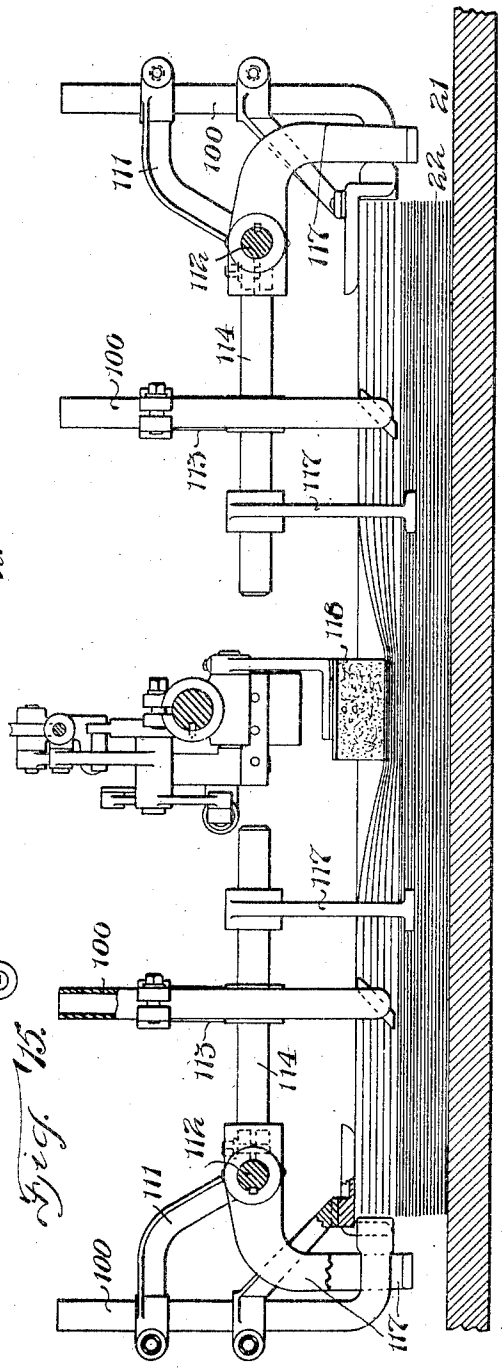


Fig. 15.

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UNITED STATES PATENT OFFICE.

VERNON GARNER, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO UNITED PRINTING MACHINERY COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MAINE.

PAPER-FEEDING MACHINE.

1,108,569. Specification of Letters Patent. Patented Aug. 25, 1914.

Application filed November 16, 1911. Serial No. 660,668.

To all whom it may concern:

Be it known that I, VERNON GARNER, a citizen of the United States, and resident of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Paper-Feeding Machines, of which the following is a specification.

This invention relates to machines for feeding paper sheets one by one to other machines in which the sheets are printed, folded, or otherwise treated.

One of the features of the invention is means for combing the sheets from a pile to other means which convey the sheets one at a time and advance them. In accordance with the common practice, the machine is provided with trip mechanism adapted to be operated by the foremost feathered sheet to control the operation of the combing mechanism and also to control the means by which the sheet is conveyed away.

The combing mechanism comprises primary combing devices and auxiliary combing devices which are controlled by the trip mechanism to operate in the following manner: The primary combing devices are arranged to act upon a relatively small number of feathered sheets resting on a support between the pile and the conveyer mechanism. The auxiliary combing devices are arranged to act upon the pile. The primary combing devices operate during each cycle of movements, and are controlled directly by the trip mechanism. The auxiliary combing devices which act upon the pile are controlled by the primary combing devices so as to be thrown into operation when the combing of the sheets as effected by the primary combing devices is slower than the speed of the machine requires. The auxiliary combing devices are further controlled so as to be held inoperative when their operation is not required.

In connection with the combing mechanism, the machine is provided with air conduits adapted to direct currents of air laterally between the sheets to loosen the sheets from each other by the operation which is known as winding the sheets. The winding devices are controlled by the action of the primary combing devices so as to effect the winding of the sheets only when the primary combing devices are unable to comb the sheets at the required speed. It follows, therefore, that the winding of the sheets occurs only when the auxiliary combing devices are put in operation, but the winding means may be employed and controlled in the same manner without the auxiliary combing means, if desired.

The delivery mechanism for conveying the sheets from the combing mechanism to the ultimate machine is necessarily driven so as to convey the sheet at a relatively rapid rate in order to get each sheet out of the way of the succeeding sheet. Another important feature of this invention relates to the conveyer mechanism, irrespective of the combing mechanism or any other mechanism by which the sheet is placed in the conveyer mechanism. The feature above mentioned is means for reducing the speed of the sheet in the conveyer mechanism at a point near the customary stops, so that the sheet will not strike the stops when moving at a rapid rate of speed, thus avoiding injury to the front edge of the sheet and rebounding of the sheet due to buckling and recoil. The slow-down mechanism comprises continuously driven rolls adapted to engage one side of the sheet, and idle rolls adapted to coöperate therewith and engage the other side of the sheet. The slow-down rolls are mounted in advance of the stops for the sheet at a distance slightly greater than the length of the sheet, and they are controlled to remain open while the forward part of the sheet is passing between them and to close an instant before the rear edge of the sheet reaches them, thus grasping the rear portion of the sheet to retard the speed and thereafter to advance the sheet at a relatively slow speed until the rear edge of the sheet passes beyond them. The slow-down rolls are so mounted as to be adjustable toward and from the stops for the purpose of adapting them to sheets of different size.

Other features of the invention are illustrated upon the accompanying drawings and hereinafter described and claimed.

Of the accompanying drawings which illustrate the invention: Figure 1 represents a side elevation of sheet-feeding mechanism including an elevator for a pile of sheets, combing mechanism, and a portion of the conveyer mechanism. Fig. 1ª represents a side elevation of the delivery end of the conveyer mechanism and includes the slow-down device. Fig. 2 represents a top plan view

of the mechanism included in Fig. 1. Fig. 2ª represents a top plan view of the mechanism included in Fig. 1ª. Fig. 3 represents a side elevation, on a larger scale, of the combing mechanism included in Fig. 1. Fig. 4 represents a partial plan view of the mechanism shown by Fig. 3. Fig. 5 represents an elevation of the opposite side of the combing mechanism. Fig. 6 represents a partial plan view of the mechanism included in Fig. 5. Fig. 7 represents a longitudinal vertical section through the combing mechanism as indicated by line 7—7 of Fig. 2. Fig. 8 represents a side elevation of the slow-down device included in Fig. 1ª, Fig. 8 being on a larger scale than Fig. 1ª. Fig. 9 represents a partial top plan view of the mechanism included in Fig. 8. Fig. 10 represents a partial top plan view of the combing mechanism, similar to that included in Fig. 2 but on a larger scale. Fig. 11 represents a longitudinal vertical section through the trip mechanism which controls the primary and auxiliary combing devices. The plane of the section is indicated by line 11—11 in Fig. 10. Fig. 11ª represents, in side elevation, a detail included in Fig. 11 and showing the parts in different relative positions. Fig. 12 represents a transverse vertical section on line 12—12 of Fig. 2. The scale is the same as Figs. 3 and 4. Fig. 13 represents a transverse vertical section indicated in Fig. 2 by line 13—13. The scale is the same as Figs. 5 and 6. Fig. 14 represents a longitudinal vertical section indicated in Fig. 2 by line 14—14. The scale is larger than Fig. 2. Fig. 15 represents a transverse vertical section through the pile elevator and includes the devices for winding the sheets in the pile, and a device for clamping the pile below the top sheet. (See line 15—15 of Fig. 2.)

The same reference characters indicate the same parts wherever they occur.

Referring first to Figs. 1 and 1ª, these figures may be read in conjunction with each other by placing Fig. 1ª at the right of Fig. 1, the structure shown by Fig. 1ª being a continuation of the mechanism shown by Fig. 1. The combing mechanism and controlling mechanism therefor, and other mechanisms hereinafter described, are supported by suitable framework comprising standards such as that indicated at 20 in Fig. 1, one of these standards being provided at each side of the machine. A vertically movable support for a pile of unfeathered sheets is indicated at 21, the function of this support being to raise a pile 22 of sheets in the usual manner to present the sheets to the combing mechanism. The front edges of the sheets in the pile are kept from advancing by vertical guides or abutments 19 until the sheets rise above the abutments. Any suitable means may be provided for raising the support 21. The drawings do not illustrate any means for raising the support, because such means does not form any part of the present invention.

The combing devices are indicated at 23 and 24. As shown by Fig. 2, there are two combing devices 23 and two combing devices 24. The combing devices 23 are hereinafter termed the primary combing devices, because they are controlled to act during each cycle of the machine. The combing devices 24 are hereinafter termed the auxiliary combing devices, because they are controlled to act only when the action of the primary combing devices is insufficient to advance the sheets at the required speed. As shown by Figs. 1 and 1ª, the feeding movement of the sheets is from left to right. Referring now to Fig. 7, which illustrates in section a different view of the combing mechanism, the sheets are fed from right to left. As the sheets rise above the abutments 19 and are feathered by the combing devices they pass over a support 25 usually termed a ridge. The ridge conducts the sheets to coöperative delivery rolls which are adapted to take each sheet and deliver it at a relatively high speed. The delivery rolls comprise continuously driven rolls 26 and drop rolls 27, all arranged to operate in the well known manner.

As shown by Fig. 7, the primary combing devices 23 are arranged to coöperate with the support or ridge 25, and the combing devices 24 are arranged over the support 21 so as to act upon the sheets in the pile before the sheets are advanced to the ridge. The vertically movable support 21 is illustrated at or near its extreme upper position, but it will be understood that when a relatively deep pile 22 is placed upon the support the support will stand initially at a much lower position than that illustrated. Its obvious, therefore, that the auxiliary combing devices act for the most part upon a relatively deep pile of sheets, which pile, however, is reduced in depth as the top sheets are removed. On the other hand, the primary combing devices act upon a relatively small number of sheets which are advanced from the pile upon the ridge. The conditions under which the primary combing devices act remain substantially unchanged, because the aggregate thickness of the sheets upon which they act does not vary. The action of the primary combing devices is controlled by mechanism including sheet-actuated members 28, one at either side of the machine. The lower ends of said members are arranged to normally intersect the path of the sheet at a point slightly in advance of the nip of the delivery rolls 26, 27.

The combing devices 23 are affixed to separate shafts indicated at 29. Each of the shafts is mounted in two arms indicated

at 30. The arms 30 are affixed to two sleeves 31 which surround two rock shafts 32. The sleeves and rock shafts are arranged in end to end relation in alinement with each other, the two sleeves being adapted to rock independently of each other, and the two shafts being adapted to rock independently of each other, while the shafts and sleeves are adapted to rock independently of each other. By virtue of this construction, the two combing devices 23 are adapted to be raised and lowered independently of each other and are controlled as hereinafter explained so that whenever one side of the sheet reaches the delivery rolls in advance of the other the combing device acting upon the advance side of the sheet will be thrown out of operation before that acting upon the other side of the sheet. This method of controlling the combing devices is well known and is provided for the purpose of positioning the sheet squarely with relation to the delivery rolls.

The auxiliary combing devices 24 are affixed to shafts 33, and these shafts are mounted in arms 34 in the same manner as the shafts which carry the primary combing devices. Each pair of arms 34 is affixed to one of the two rock shafts 32. This construction and arrangement adapts the auxiliary combing devices to be rendered operative or inoperative independently of each other.

The construction and arrangement of the combing devices 23 and 24 on both sides of the machine are identical, and a description of those on one side will be sufficient for both sets. The two outer arms 30 and 34 on one side of the machine, and the two similar arms on the other side of the machine are provided with extensions, indicated at 30′ and 34′ respectively in Fig. 7. The upper faces of these extensions constitute cam surfaces whereby the arms may be rocked to raise the combing devices. The two extensions on one side of the machine lie side by side in close proximity to each other and are both adapted to be engaged by a roll 35 carried by a lever 36. The lever is mounted upon a fulcrum stud 36× projecting from a frame-piece x fixed with relation to the standards 20. The lever 36 is pivotally connected to a rod 37 one end of which is adapted to slide in a stationary block or ear 38. A helical spring 39 surrounds the rod and is compressed between the member 38 and a collar 40 affixed to the rod. Mechanism is provided for setting the lever 36 in the position shown in Fig. 7 to compress the spring 39, and when the lever is released the action of the spring causes the roll 35 to engage the extensions 30′ and 34′, with the result of rising the combing devices out of contact with the sheets. The lever 36 is provided with a second roll 41 which is adapted to be engaged by a cam 42 affixed to a continuously driven shaft 43. The function of the cam 42 is to set the lever in the position shown by Fig. 7, thereby compressing the spring 39. The lever is held in its restrained position by a latch 44 which is mounted upon a pivot 45. The latch is formed with a shoulder 46 which is adapted to engage a third roll 47 carried by the lever 36. The latch is further provided with a finger 48 which is adapted to rest upon the roll 47 to support the free end of the latch in operative relation. The latch 44 is connected by a link 49 with one arm 50 of a lever affixed to a rock shaft 51. The lever comprises a second arm, indicated at 52, which affords a bearing for one end of the rock shaft 53. The other end of the rock shaft is mounted in an arm similar to the arm 52 and likewise affixed to the rock shaft 51. One of the sheet-actuated members 28 is affixed to the rock shaft 53, the other member 28 being affixed to a similar rock shaft 53 mounted in the same manner at the other side of the machine. The lever comprising the arms 50 and 52 is provided with a finger 54. The normal position of the lever, due to the weights carried by it, keeps the finger 54 against a stop 55. The sheet-actuated member 28 is fixed with relation to a finger 56 which is adapted to engage an adjustable stop 57 mounted in an extension 58 of the arm 52. The function of the stop 57 is to adjust the lower end of the member 28 to the desired position in the path of the sheet.

An arm 59 affixed to the rock shaft 53 is provided with gear teeth 60 forming a segment. This gear segment is adapted to cooperate with a continuously driven gear 61, but is normally held out of engagement by the weight of the members affixed to the rock shaft. The arc of the teeth 60 is not concentric with relation to the rock shaft 53 but is sufficiently eccentric to effect a lateral movement of the rock shaft away from the gear 61 when the teeth 60 move downwardly into the gear 61.

When the forward edge of a sheet strikes the member 28, the combing device 23 is retracted to inoperative position in the following manner: The rocking movement of the member 28 carries the first tooth 60 into the path of the teeth of the gear 61. When the sheet has effected this movement it is thereafter relieved of further duty in causing the retraction of the combing devices. The teeth of the gear 61 thereafter swing the arm 59 downwardly and at the same time effect the aforesaid lateral movement of the rock shaft 53. This lateral movement is transmitted through the rock shaft 51, arm 50 and link 49, to the latch 44 which is raised to release the roll 47 on the lever 36. When the lower edge of the shoulder 46

moves above the line which intersects the centers of roll 47 and pivot 45, the latch 44 is further raised by the tension of the roll, thereby causing a reactionary movement which is transmitted through link 49, arm 50, rock shaft 51, arm 52, shaft 53, and arm 59, which moves the teeth 60 forward out of engagement with the gear 61. The spring 39 thereupon actuates the lever 36, and the roll 35 acting upon the extension 30′ raises the arms which support the shaft 29 on which the combing device 23 is mounted. The forward movement which the roll 47 receives from the spring 39 carries it under the latch 44, causing the roll to hold the latch in its elevated position, thereby keeping the teeth 60 free from the gear 61. When the sheet is carried out it releases the member 28 which, together with members 56 and 59, is so weighted as to resume its initial position, ready for the next operation. If the combing devices 24 are in operation at the time, each will be raised in the same manner by the coöperation of the roll 35 with the extension 34′. When the combing devices are elevated they are held by mechanism hereinafter described until the top sheet is carried out by the delivery rolls, after which the primary combing devices and, under some conditions, the primary and auxiliary combing devices, are released so that they may drop upon the next top sheet.

As shown by Fig. 7, the combing devices 24 are driven by chains 62, and the combing devices 23 are driven by gears 63, 64 and 65. The arms which support the primary combing devices also support the intermediate gears 64 by which rotation is transmitted from the gears 63 to the gears 65. These gears and the chains are, of course, continuously driven.

The next description relates to the controlling means for the auxiliary combing devices whereby the said combing devices are held inoperative so long as the primary combing devices advance the sheets at the required speed, and whereby the auxiliary combing devices are rendered operative when the sheets are not advanced at the required speed by the primary combing devices alone. The controlling mechanism for this purpose is illustrated by Fig. 11. This figure includes the arms 30 and 34 which support the inner ends of the combing devices on one side of the machine. The arm 34 carries a roll or projection 66 which is adapted to coöperate with a lever 67. The lever is mounted upon a stationary fulcrum 68 projecting from the frame-piece 38, and is provided with a shoulder 69 adapted to underlie the member 66 to hold said member in its upper position. The free end of the lever has a face 70 which is adapted to lie against the member 66 as shown by Fig. 11. The lever is provided with an arm 71 to which is connected a rod 72. The rod extends through a block or ear 73 on the frame and is surrounded by a helical spring 74. The spring is compressed between the member 73 and a collar 75 affixed to the rod. The spring normally tends to force the free end of the lever 67 against the member 66. When the arm 34 is raised sufficiently to carry the member 66 beyond the shoulder 69, the spring moves the shoulder in under the member 66, thereby locking the arm in its upper position.

The arm 30 which carries the primary combing device also carries a finger 76 which is mounted upon a pivot stud 77. The finger is connected by a link 78 with one arm of a lever 79 pivoted at 80 to the frame. The lever 79 carries a roll 81 which is adapted to coöperate with a cam 82 affixed to the continuously driven cam shaft 43 hereinbefore mentioned. The roll is held against the cam by a spring 83 which is coiled about a rod 84 and compressed between a collar 85 on the rod and an ear 86 on the frame. One end of the rod is arranged to slide in the ear 86, and the other end is pivotally connected to the lever 79. The arc of the projecting portion of the cam extends through a number of degrees in the cycle of operations in which the primary combing devices should complete the combing of the top sheet at the desired speed. This portion of the cam is so arranged as to coöperate with the roll 81 during the combing operation of the primary combing devices.

The position of the upper end of the finger 76 is varied by the action of the cam 82 so as to move the said upper end of the finger to and from engagement with a projection 87 on the lever 67. Assuming that both the primary and auxiliary combing devices are placed in operative position when starting the machine, they will both be raised at the end of the first cycle by the springs 39 hereinbefore described. When the auxiliary combing devices are raised, the projections 66 engage the levers 67 as shown by Fig. 11ª, and the auxiliary combing devices are held in their inoperative positions by the levers. The primary combing devices thereafter descend, leaving the auxiliary combing devices in inoperative position. During the next cycle of operations, in which the primary combing devices alone act upon the sheets, the projecting portion of the cam 82 engages the roll 81 during the combing operation. If the forward movement of the sheet is so slow that the projecting portion of the cam 82 leaves the rolls 81 before the retracting mechanism is released, the spring 83 will move the upper end of the finger 76 to the left so that the said finger will engage the projection 87 when the primary combing device is positively raised, as hereinafter ex-

plained. The finger 76 in moving up lifts the lever 67 so as to release the projection 66, whereupon the auxiliary combing device is released, so far as the lever 67 is concerned. The auxiliary combing device is otherwise held, as hereinafter explained, until the primary combing device descends, so that both primary and auxiliary devices may descend at the same time.

This machine, like the majority of paper-combing machines, is provided with means for positively lifting the combing devices in case they are not lifted sufficiently early by the spring-tension lifting means. The mechanism for supplementing the spring-tension lifting means comprises cams 88 affixed to the continuously driven shaft 43. There are two cams 88, one at either side of the machine, each of said cams being adapted to lift one of the primary combing devices and one of the auxiliary combing devices. Each cam 88 is adapted to engage two cam rolls, which are indicated in Fig. 11 at 89 and 90, the two cam rolls being arranged close to each other and the face of the cam 88 being broad enough to overlap both rolls. The roll 89 is carried by a link 91, one end of which is pivotally connected to an arm 30 which carries the primary combing device. The roll 90 is carried by a link 92, one end of which is pivotally connected by an arm 34 which carries the auxiliary combing device. Each of the links 91 and 92 is forked at the other end and is arranged to straddle the cam shaft 43. The cam 88 is so timed as to raise the combing devices after the time when it is desired to have the combing devices raised by the spring-tension means hereinbefore described. In case the sheet is not combed at the required speed, the spring-tension means is not released and the combing devices become raised by the cams 88. The cams 88 also serve to hold the primary combing devices in their raised position until a predetermined point of time after the spring-tension retracting means has been restrained by the cams 42. The cams 88 have the further function of supporting the auxiliary combing devices after the said devices have been released by the hooked lever 67, and until the time desired for releasing the primary combing devices. In other words, the cams 88 are adapted to hold all the combing devices retracted for a brief period and to release them all simultaneously.

The means hereinbefore mentioned for winding the sheets is controlled in much the same manner as the auxiliary combing devices. That is to say, it is controlled so as to be inoperative when the sheets are combed at the required speed by the primary combing devices alone, and to be rendered operative when the action of the primary combing devices alone is not sufficient to comb the sheets at the required speed. From this it follows that the winding operation is controlled to occur only when the auxiliary combing devices are set in operation, and to be discontinued when the auxiliary combing devices are no longer needed.

A blower is indicated at 93 in Fig. 1. This blower is continuously driven by a belt 94 which passes over a pulley 95 on the main driving shaft 96 of the machine. This driving shaft is continuously driven. The blower delivers air through a supply pipe 97 which runs upwardly and is connected to a transverse pipe 98. (See Figs. 1, 5, 6, 7 and 13). As shown by Fig. 2, a plurality of flexible tubes are connected to the pipe 98 to distribute air to the desired points. These flexible tubes are indicated at 99. Each flexible tube is connected to a delivery nozzle 100, the drawings illustrating four of said nozzles. As shown by Figs. 2, 14 and 15, two of the delivery nozzles are arranged to direct jets of air laterally at the sides of the pile, while the other two are arranged at the rear of the pile to direct the jets in the direction of feed.

Referring now to Fig. 5, the air-supply conduit is provided with a relief opening 101, which is controlled by a valve 102. The valve 102 is carried by an arm 103 pivotally mounted at 104. An arm 105 provided with a roll 106 adapted to coöperate with the arm 103 is affixed to the shaft 32 which supports the arms 34 of the auxiliary combing devices. The arm 103 is formed with a cam face 107 and with a face 108 which is concentric with relation to the shaft 32 when the valve 102 is closed. Whenever the auxiliary combing devices are in operation, as shown by Fig. 5, the relief valve 102 is closed and the roll 106 engages the concentric surface 108. The length of the surface 108 is sufficient to provide for the necessary rise and fall of the auxiliary combing devices due to varying level of the top of the pile. Whenever the auxiliary combing devices are retracted, the arm 105 is moved to the left, as seen in Fig. 5, thus releasing the valve 102 so that it may open. The current of air generated by the blower may therefore escape through the relief opening 101 instead of being conducted to the winding devices. Upon subsequently lowering the auxiliary combing devices, the arm 105 is moved to the right; and the roll 106, acting upon the cam surface 107, closes the relief valve so that the current of air can escape only through the winding devices.

Means is provided for raising the delivery nozzles 100 at the vertically movable support 21 for the pile approaches its extreme upper position, thus avoiding the possibility of injuring the delivery nozzles. As shown by Fig. 2, the frame of the machine

is provided with fixed supporting rods 109 and 110 which extend transversely. The side delivery nozzles are carried by brackets 111 which in turn are supported by rods 112 extending longitudinally. The ends of the rods 112 are supported respectively by the transverse rods 109 and 110. The connections between the rods 112 and the transverse supporting rods are slidable so as to render the rods 112 movable toward and from each other for the purpose of locating the delivery nozzles for sheets of different width. The brackets 111 are adapted to be moved along the rods 112 and set at any desired position. The nozzles at the rear of the pile are mounted in brackets 113 supported by rods 114 extending laterally from the rods 112. The connections between the rods 114 and 112 are slidable, so that the nozzles 113 may be moved forward or back for sheets of different length. The brackets 113 are adapted to slide longitudinally of the rods 114 so that the nozzles may be set at any desired distance apart.

The connections at the ends of the rods 112 are adapted to be lifted from the supporting rods 109 and 110. As shown by Fig. 14, the connections 115 which engage the rods 110 rest upon the top and engage one side of said rods. The connections at the other end of the rods 112 are hooked, as indicated at 116. The rods 112 are provided with depending abutments 117, and the rods 114 are provided with similar abutments 117. The lower ends of these abutments are in the same horizontal plane, slightly below the mouths of the delivery nozzles, and are adapted to be engaged by the support 21 with the result of lifting the rods 112 and 114. When the rods are lifted, the connections 115 and 116 are moved upwardly with relation to their supports 109 and 110 and are adapted to resume their positions shown when the support 21 is thereafter moved downwardly. Figs. 14 and 15 include a presser-foot or clamp 118 which is provided for engaging the second sheet from the top for clamping all the sheets except the top sheet. This device, however, does not form any part of the present invention, but it may be disposed of by stating that it is actuated to move to and from operative position at appropriate times to clamp and release the sheets.

As shown by Fig. 7, the drop rolls 27 are mounted upon a shaft 119 whose ends are mounted in arms 120. The arms 120 are affixed to a rock shaft 121. Referring to Fig. 3, the rock shaft is provided with a fixed arm 122 which carries a roll 123 adapted to be engaged by a cam 124 on the continuously driven cam shaft 42.

The conveyer mechanism by which the sheets are conveyed from the rolls 26, 27 to the ultimate machine comprises two sections arranged in tandem. The two sections are driven at different speeds for the purpose of removing the sheets from the combing mechanism at a relatively rapid rate of speed and for thereafter reducing the speed before the sheet reaches the ultimate machine. The two sections of the conveyer mechanism are similar in construction, each section comprising continuously driven tapes which support and carry the sheets. The high-speed tapes over which the sheet first passes are indicated at 125 in Figs. 1, 1^a, 2, 2^a, 3, 5, 7, 9 and 11. These tapes pass over a driving roll 126 near the combing mechanism, and a roll 127 at a distance from the combing mechanism. A sprocket wheel 128, fixed with relation to the roll 126, drives a sprocket wheel 129 through the medium of a chain 130. The sprocket wheel 129 is arranged at one end of the roll 127, but is loose with relation to said roll and is employed, as hereinafter explained, for the purpose of transmitting motion to the slow-speed section of the conveying mechanism. Referring to Fig. 5, the roll 126 is driven by a train of gears indicated at 131, 132, 133, 134, 135 and 136. The gear 136 is affixed to the main driving shaft 96, which is driven continuously.

Figs. 3 and 5 illustrate a device whereby all the tapes 125 may be tightened simultaneously from either side of the machine. This device includes an idle roll 137 adapted to engage the lower stretch of the tapes. The ends of the roll are supported by arms 138 which are affixed to a rock shaft 139. The rock shaft extends through the driving roll 126,—the driving roll and gear 131 being loosely mounted thereon. To each arm 138 is pivotally connected a rod 140. The two rods extend through portions of the machine frame and are threaded to receive adjusting nuts 141. Whenever either of the nuts is turned to draw one of the arms 138 upwardly, movement is transmitted through the rock shaft 139 to the other arm 138, with the result of raising both ends of the rolls 137 equally.

Referring now to Figs. 1^a, 8 and 9, the roll 127 at the delivery end of the high-speed tapes is mounted in a pair of movable trucks 142, one at either side of the machine. The trucks are provided with rollers 143 which rest upon a support 144. One end of the support is connected to the machine frame, near the combing mechanism, and the other end (see Fig. 1^a) is connected to a fixture 144^x. The trucks are movable toward and from the combing mechanism for the purpose of retracting the conveyer mechanism from the ultimate machine. Each truck is affixed to a rack member 145. The rack members extend backward toward the comb-

ing mechanism, and their teeth engage pinions 146 affixed to a manually operative shaft 147. (See Figs. 3 and 5). As shown by Fig. 5, one end of the shaft is provided with an angular head 148 adapted to receive a wrench or crank whereby it may be turned to advance or retract the rack members. Locking pins 149 are provided for locking the rack members with relation to guide blocks 150 in which they slide. The guide blocks 150 are mounted upon the shaft 147.

The other section of the conveying mechanism is shown by Figs. 1ª, 2ª, 8 and 9, and comprises endless tapes 151 which pass over rolls 152 and 153. The roll 152 is mounted in a pair of brackets 154 which are arranged upon a shaft 155 which supports the roll 127 of the section first described. A gear 156, fixed with relation to the sprocket 129 but loose with relation to the roll 127, transmits rotation through an intermediate gear 157 to a gear 158 which is fixed with relation to the tape roll 152. A gear 157ˣ, fixed with relation to the gear 157, drives a gear 159 which is loose with relation to the gear 158. A sprocket wheel 160, fixed with relation to the gear 159, drives a chain 161 which passes over a sprocket wheel 162 mounted on the shaft of the roll 153 at the delivery end of the slow-speed conveyer. The sprocket wheel 162 is loose with relation to the roll 153, and the chain 130 performs a function independent of driving the slow-speed conveyer, as hereinafter explained. The relative sizes of the gears 156, 159, and of the respective rolls 127 and 152, is such that the speed of the tapes 151 is relatively slow as compared to the speed of the tapes 125.

The roll 153 is mounted in a pair of trucks 163 which are provided with rollers 164 bearing upon the support 144. The trucks 163 are rigidly connected with the brackets 154 by the rods or bars 166 and by a rock shaft 165 hereinafter mentioned. The trucks 163 are rigidly connected with each other by transverse rods 167. The brackets 154, trucks 163 and connecting members 165, 166 and 167, constitute a swinging frame for the slower section of the conveying mechanism, the frame as a whole being adapted to swing about the shaft 155 from the position shown to a position in which the delivery end is brought close to the combing mechanism.

The sheets, in passing from the high speed tapes to the low-speed tapes, pass under pressure rolls 168 which coöperate with the roll 152. As shown by Fig. 2ª, there are two rolls 168, but this number may be increased if desired. The function of the rolls 168 is to clamp the sheet with relation to the slow-speed conveying mechanism so that the speed of the sheet will be reduced as soon as the forward edge of the sheet reaches the slow speed tapes. The sheet is thereafter conveyed at reduced speed, which speed is further reduced before the sheet leaves the slow-speed tapes.

The final reduction of speed is effected by a slow-down device illustrated by Figs. 1ª, 2ª, 8 and 9. This slow-down device is driven by the chain 161. Referring to Figs. 1ª and 2ª, the rods 166 support sliding blocks 169 which are movable forward and back between the ends of the slow-speed tapes. These blocks are connected by a tie rod 170, the ends of which are fixed in the blocks. The blocks are further connected by a shaft 171 which is provided with pinions 172 which engage rack teeth 173 formed on the supporting rods 166 for positioning the blocks longitudinally. The shaft 171 is provided with a hand wheel 171ˣ whereby it may be turned to effect the desired position. Two rotatable shafts 174 and 175 are mounted in bearings in the blocks 169. A sprocket wheel 176, affixed to the shaft 174, engages the chain 161 to be driven thereby. This shaft is provided with rolls 177 whose upper portions are in the plane of the tapes 151 and whose rim speed is the same as the speed of the tapes. Pressure rolls 178 are arranged above the tapes to coöperate with the driven rolls 177 to feed the sheet at the speed of the tapes, either in conjunction with the tapes or independently if the tapes are removed. In event of removing the tapes, the sheet is supported by a series of longitudinal bars 179. The pressure rolls 178 are carried by arms 180 loosely mounted upon a sleeve 181 which in turn is loosely mounted upon the adjusting shaft 171. (See Fig. 9). Tension is applied to the rolls 178 by springs 182 surrounding rods 183. The rods are pivotally connected to the arms 180 and extend through members 184 affixed to the sleeve. The springs 182 are compressed between the members 184 and the heads at the opposite ends of the rods 183.

The shaft 175 carries a series of rolls 185 which are arranged between the rolls 177 and the delivery end of the tapes 151. The upper portions of the rolls 185 lie in the plane of the tapes and they are driven so that their rim speed is considerably less than the speed of the tapes and the rolls 177. The rolls 185 are fixed to the shaft 175, and the shaft is driven by gearing which receives its motion from the sprocket wheel 176. A gear 186, fixed with relation to the sprocket wheel, drives through gears 187, 188, 189, 190, 191 and 192, the gear 192 being affixed to the shaft 175. The ratio of speed as between the rolls 177 and 185 is, of course, optional; but the gearing illustrated is adapted to cause the rolls 185 to rotate at a speed approximately one-fifth as great as that of the rolls 177. Pressure rolls 193 are ar-

ranged above the rolls 185 to coöperate therewith. The rolls 193 are mounted upon and affixed to a shaft 194 whose ends are mounted in arms 195. The arms are affixed to the sleeve 181 which is rocked by mechanism hereinafter explained to move the rolls 193 toward and from the rolls 185.

The mechanism for operating the rolls 193 receives its motion from the continuously driven cam shaft 43 near the combing devices. Referring to Figs. 3 and 4, the operating cam is indicated at 196. This cam coöperates with a roll 197 carried by a bell crank 198. The bell crank is connected to one end of a rod 199, the other end of which, as shown by Figs. 8 and 9, is connected to a bell crank 200. The bell crank is connected by a link 201 with an arm 202 affixed to the rock shaft 165 hereinbefore mentioned. The rock shaft 165 is provided with a longitudinal groove 203 to receive a spline 204 (see Fig. 9) for connecting a sliding arm 205 with the rock shaft. The hub of the arm is confined between ears 206 formed upon one of the sliding blocks 169. The free end of the arm 205 is connected by a link 207 with the free end of an arm 208 affixed to the sleeve 181.

The rock shaft 165 is subject to the tension of a spring 209 (see Fig. 1a), one end of which is attached to a collar 210 affixed to the rock shaft, and the other end of which is attached to the truck 163 in which the shaft has a bearing. The function of the spring is to depress the rolls to coöperate with the driving rolls 185. The function of the cam 196 is to lift the rolls 193 against the tension of the spring. The cam is so timed as to hold the rolls elevated while the forward part of the sheet is passing between the rolls, and to release the rolls so that they may drop upon the rear portion of the sheet at any desired distance from the rear edge of the sheet. When the rolls 193 are dropped, the speed of the sheet is very greatly decreased and the sheet is thereafter fed at the rim speed of the rolls 185, notwithstanding the greater rate of speed of the tapes 151.

Figs. 1a and 2a illustrate movable stops or front gages 211, and Fig. 1a includes a curved line 212 intended to represent conventionally a paper-handling machine for which the paper-feeding mechanism is provided. It may be assumed that the stops 211 are operated in the usual manner to place them in the path of the sheet and to retract them according to the operation of the paper-handling machine represented at 212. In practice, the adjustable slow-down mechanism will be adjusted toward or from the stops 211 at a position where the nip of the rolls 185 and 193 will be slightly greater than the length of the sheet. After the rear edge of the sheet has passed beyond the nip of the rolls, the momentum of the sheet may be sufficient to carry the front edge into engagement with the stops 211; but, in any event, when the tapes 151 are employed they will serve to carry the sheet a short distance to the stops without materially increasing the speed of the sheet.

Reviewing the operation of the mechanism for conveying the sheets from the combing means to the stops 211, it is clear that the sheets are initially conveyed at a relatively high speed over the first section of the conveying mechanism; that the speed of the sheet is reduced when the forward edge passes between the rolls 168 and tapes 151; and that the speed is still further decreased by the retarding action of the rolls 185 and 193. This combination of conveying devices removes the sheet from the combing mechanism at a speed which enables the combing mechanism to operate rapidly and ultimately reduces the speed of the sheet so that when the sheet reaches the stop 211 it will be moved so slowly that there will be no appreciable buckling nor rebounding of the sheet.

The main driving shaft 96, located near the combing mechanism, is provided with a disconnectible clutch and with automatic means for disconnecting the clutch when the conveying mechanism is retracted from the paper-handling machine 212. This clutch mechanism is provided because it is sometimes necessary to operate the paper-handling machine 212 independently of the combing and conveying mechanism. In an instance of this kind it is not desirable to operate the combing and conveying mechanism, and, in fact, it is necessary to retract the conveying mechanism in order to manually feed the sheets into the machine 212. This clutch mechanism is shown by Figs. 2, 3 and 4. A bevel gear 213, loosely mounted upon the shaft 96, is driven by a bevel gear 214 affixed to a shaft 215. This gearing may be driven directly from the machine 212 or otherwise driven at the required speed. A spur gear 216, fixed with relation to the bevel gear 213, is provided with one or more notches 217 in its hub adapted to receive clutch teeth 218 formed upon a clutch sleeve 219. The clutch sleeve is adapted to slide longitudinally on the shaft 96, but is connected with the shaft by a spline (not shown) movable in a keyway 220 formed in the shaft. A spring 221, acting against the clutch sleeve, tends to hold the sleeve in driving connection with the hub of the gear 216. The sleeve 219 is grooved for the reception of portions of a shipping lever 222 pivotally mounted at 223. The lever has an arm 224 which carries a roll 225. This roll is adapted to be engaged and moved by an inclined face 226 formed upon the rack bar 145 on one side of the machine. When the

framework of the conveying mechanism is retracted from the machine 212, it immediately actuates the shipping lever 222, with the result of disconnecting the clutch sleeve 219 from the hub of the gear 216. The disconnection of the clutch is therefore a condition coincident with retraction of the conveying mechanism. When the conveying mechanism is restored to its operative condition, the clutch is automatically connected by the spring 221.

I claim:

1. In a sheet feeder, two supports one of which is higher than the other, said supports being so related that a plurality of the upper sheets of a pile of sheets of sufficient depth resting on the lower support may slide to and upon the upper support, sheet-feathering means disposed to coöperate with the upper support, means disposed to cooperate with the lower support to feed sheets from the pile to the upper support, means for holding said feeding means above and out of contact with the top sheet of the pile, and means controlled by said feathering means for actuating said holding means to release said feeding means.

2. In a sheet feeder, two supports one of which is higher than the other, said supports being so related that a plurality of the upper sheets of a pile of sheets of sufficient depth resting on the lower support may slide to and upon the upper support, sheet-feathering means disposed to coöperate with the upper support, sheet-feathering means disposed to coöperate with the lower support to feather sheets from the pile to the upper support, means for holding above and out of contact with the top sheet of the pile the feathering means which coöperates with the lower support, and means controlled by the other feathering means for actuating said holding means to release the feathering means so held.

3. In a sheet feeder, two supports one of which is higher than the other, said supports being so related that a plurality of the upper sheets of a pile of sheets of sufficient depth resting on the lower support may slide to and upon the upper support, sheet-feathering means disposed to coöperate with the upper support, sheet-feathering means disposed to coöperate with the lower support to feather sheets from the pile to the upper support, means for holding one of said feathering means above and out of contact with the top sheet, and means controlled by the other feathering means for actuating said holding means to release the feathering means so held.

4. In a sheet feeder, two supports one of which is higher than the other, said supports being so related that a plurality of the upper sheets of a pile of sheets of sufficient depth resting on the lower support may slide to and upon the upper support, sheet-feathering means disposed to coöperate with the upper support, sheet-feathering means disposed to coöperate with the lower support to feather sheets from the pile to the upper support, both said feathering means being operative at one time, means for lifting both feathering means out of contact with the work, means for catching and holding one of said feathering means in elevated position, the other feathering means being adapted to operate upon the sheets while said one of said feathering means is held elevated, and means controlled by said other feathering means for actuating said holding means to release said one of said feathering means.

5. In a paper-feeding machine, a support for a pile of sheets, primary combing means adapted to act upon the sheets during each cycle of the machine, means controlled by the foremost combed sheet for rendering the primary combing means inoperative, auxiliary combing means, means for holding said auxiliary combing means out of contact with the sheets, and means controlled by the primary combing means for causing the auxiliary combing means to operatively engage the sheets.

6. In a paper-feeding machine, a support for a pile of sheets, primary combing means, auxiliary combing means, means for holding the auxiliary combing means out of contact with the sheets, and means controlled by the primary combing means for actuating said holding means to render the auxiliary means operative.

7. In a paper-feeding machine, a support for a pile of sheets, primary combing means, auxiliary combing means adapted to be raised out of contact with the sheets, restraining means for holding said auxiliary combing means out of contact, and means controlled by the primary combing means for acting upon said restraining means to release the auxiliary combing means.

8. In a paper-feeding machine, a support for a pile of sheets, primary combing means, auxiliary combing means, means controlled by a sheet for lifting the primary and auxiliary combing means from contact with the sheet, means for supporting the auxiliary combing means out of contact, and means controlled by the primary combing means for acting upon said supporting means to release said auxiliary combing means.

9. In a paper-feeding machine, a support for a pile of sheets, means adjacent the top of the pile for supporting the sheets combed from the pile, primary combing means, auxiliary combing means, one of said combing means being arranged over the pile to act thereon, and the other combing means being arranged to coöperate with said supporting means adjacent the pile, each of

said combing means being retractable from the sheets, means for causing the primary combing means to act during each cycle of the machine, means controlled by a sheet for lifting both combing means out of contact with the sheet, restraining means for holding the auxiliary combing means in retracted position, and means controlled by the primary combing means for acting on said restraining means to render the auxiliary combing means operative.

10. In a paper-feeding machine, combing means, spring-tension means for rendering the same inoperative, a detent for said spring-tension means, a sheet-actuated member for causing the release of said spring-tension means, a continuously driven toothed member, and a pivotally-mounted toothed member connected to said sheet-actuated member so as to be moved thereby into coöperative engagement with said continuously driven member, said pivotally-mounted member being laterally movable and connected to said detent to release said spring-tension means when moved laterally, the teeth of said pivotally-mounted member being adapted to cause lateral movement of said member when engaged by said continuously driven member.

11. In a paper-feeding machine, combing means, means controlled by a sheet for rendering said combing means inoperative, and means controlled by said combing means for winding the sheets.

12. In a paper-feeding machine, an upwardly movable support for a pile of sheets, means adjacent the top of the pile for supporting the sheets combed from the pile, combing means arranged to coöperate with said means, means controlled by a sheet for rendering said combing means inoperative, and means controlled by said combing means for winding the sheets at the top of the pile.

13. In a paper-feeding machine, primary combing means, means controlled by a sheet for rendering said combing means inoperative, auxiliary combing means adapted to be rendered inoperative by said sheet-controlled means, means controlled by said primary combing means for rendering said auxiliary combing means operative, and means controlled by said primary combing means for winding the sheets at the top of the pile.

14. In a paper-feeding machine, combing means, means controlled by a sheet for rendering said combing means inoperative, means for winding the sheets, and means controlled by said combing means for rendering said winding means operative when more than a predetermined period is required to comb a sheet to said sheet-controlled means, and for rendering said winding means inoperative at all other times.

15. In a paper-feeding machine, an upwardly movable support for a pile of sheets, means in the path of said support for directing wind between the sheets of said pile, a fixed support for said wind-directing means, said means being arranged to rest upon said fixed support and being free to be lifted therefrom, and abutments depending from said means and adapted to be engaged by said movable support for lifting said means from said fixed support.

16. In a paper-feeding machine, the combination with stop gages for the front edge of a sheet, and means for conveying a sheet thereto, of driven rolls whose peripheral speed is less than the speed of said conveying means, said rolls being arranged to engage one side of a sheet on said means, idle rolls adapted to coöperate with said driven rolls to retard a sheet, a shaft connecting said idle rolls and affixed thereto, movable means for supporting said shaft so that it is free to turn, said driven rolls and idle rolls being adjustable toward and from said stop gages, and means for actuating said shaft-supporting means to separate said rolls to admit a sheet between them, said actuating means being adapted to cause said idle rolls to coöperate with the driven rolls while the sheet is between them, and feed the sheet at the speed of the driven rolls until the rear edge of the sheet passes from them.

17. The combination with a machine for operating upon paper sheets, of paper-feeding mechanism comprising means for conveying the sheets from a feathered bank, said means being driven to convey at relatively high speed, means for engaging the under side of the sheets to deliver the sheets to said machine, said delivering means being driven to feed a sheet at a very much reduced speed, intermediate conveying means for carrying the sheets from said high-speed conveying means to said delivering means, said intermediate means being driven to convey at an intermediate speed, idle rolls mounted to rest upon said intermediate means to press the sheets against the same, drop rolls adapted to rest upon said delivering means, said drop rolls and said delivering means being arranged relatively near said idle rolls so that the forward edge of a sheet will pass between said delivering means and drop rolls before the rear edge leaves said idle rolls, and means for holding the drop rolls away from said delivering means while a sheet is entering between them, said holding means being adapted to permit the drop rolls to drop after the forward edge of the sheet has passed, and to remain thereon until the rear edge of the sheet passes beyond the same.

18. The combination with a machine for operating upon paper sheets, of paper-feeding mechanism comprising means for separating the sheets from a feathered bank, said means being adapted to feed out the

sheets at a relatively fast speed, and speed-reducing feeding means between said separating means and said machine, said speed-reducing means comprising driven rolls, idle rolls for coöperating therewith, supports for said rolls adjustable longitudinally of the path of the sheets, a longitudinally extending rock shaft, means for operating said shaft, and means having sliding tongue-and-groove connection with said rock shaft for opening and closing said rolls.

19. The combination with a machine for operating upon paper sheets, of means for separating the sheets from a feathered bank, stationary supporting means therefor, means for conveying the sheets from said separating means to said machine, said conveying means being adapted to be retracted from said machine, disconnectible clutch members for driving said separating means, and means for disconnecting said clutch members, said means being adapted to be operated by retractory movement of said conveying means.

20. In a sheet feeder, a fixed sheet-support, a movable sheet-support for moving the sheets toward said fixed support, sheet-feathering means arranged to coöperate with said fixed support, sheet-feathering means arranged to coöperate with said movable support, said two feathering means being arranged to act on the top sheet at the same time, and means controlled by one of said feathering means for controlling the operation of the other feathering means.

21. In a paper-feeding machine, means for raising a pile of sheets, feed rolls, means intermediate said pile-raising means and said rolls for combing a plurality of sheets toward said rolls, auxiliary combing means for combing a plurality of sheets from said pile to said intermediate means, means for holding said auxiliary means out of contact with the sheets, and means controlled by said intermediate means for causing said auxiliary means to operatively engage the sheets.

22. In a paper-feeding machine, feed rolls, mechanism for combing a plurality of sheets toward said rolls, combing mechanism intermediate of said rolls and the first-mentioned combing mechanism, means for holding one of said combing mechanisms out of contact with the sheets, and means controlled by the other combing mechanism for causing the restrained combing mechanism to operatively engage the sheets.

23. In a paper-feeding machine, means for raising a pile of sheets, feed rolls, means intermediate of said pile-raising means and said rolls for combing a plurality of sheets toward the rolls, means over the pile-raising means for combing a plurality of sheets toward said intermediate combing means, means for holding one of said combing means out of engagement with the sheets, and means controlled by the other combing means for causing the restrained combing means to operatively engage the sheets.

24. In a paper-feeding machine, means for raising a pile of sheets, feed rolls, means intermediate of said pile-raising means and said rolls for supporting the sheets, means over said pile raising means for combing a plurality of sheets toward said intermediate supporting means, means disposed between said first-mentioned combing means and said rolls for combing a plurality of sheets, said intermediate combing means being disposed to coöperate with said intermediate supporting means, means for holding said first-mentioned combing means out of contact with the sheets, and means controlled by said intermediate combing means for causing said restrained combing means to operatively engage the sheets.

25. In a paper-feeding machine, combing means, means controlled by a sheet for rendering the same inoperative, continuously driven combing means, means for holding the same out of engagement with the sheets, and means controlled by the first-mentioned combing means for causing the continuously driven combing means to operatively engage the sheets.

26. In a paper-feeding machine, continuously driven combing means, means controlled by a sheet for retracting the same from working position, auxiliary combing means, means for holding the same out of contact with the sheets, and means controlled by said continuously driven combing means for causing said auxiliary combing means to operatively engage the sheets.

27. In a paper-feeding machine, continuously driven combing means, means controlled by a sheet for retracting the same from working position, continuously driven auxiliary combing means, means for holding the same out of contact with the sheets, and means controlled by the combing means first-mentioned for causing the auxiliary combing means to operatively engage the sheets.

28. In a paper-feeding machine, combing means, means controlled by a sheet for retracting said combing means from operative position, auxiliary combing means, means for holding the same out of contact with the paper, a member movable by said combing means first mentioned for actuating said holding means, the retractory movement of the first-mentioned combing means being adapted to release the auxiliary combing means through the agency of said member, and means for moving said member periodically so that it may not actuate said holding means when moved by the first-mentioned combing means.

29. In a paper-feeding machine, combing means, means controlled by a sheet for re-

tracting said combing means from operative position, auxiliary combing means, means for holding the same out of contact with the paper, a movable member for actuating said holding means to release said auxiliary combing means, the retractory movement of the first-mentioned combing means being adapted to cause the releasing movement of said member, and means for otherwise moving said member at uniform intervals whereby it is periodically rendered inoperative for releasing said auxiliary combing means.

30. In a paper-feeding machine, combing means, auxiliary combing means, means controlled by a sheet for retracting both of said combing means from the work, means for automatically locking said auxiliary combing means out of contact with the work when the same is retracted, and means controlled by the first of said combing means for actuating said locking means to release said auxiliary combing means.

31. In a paper-feeding machine, combing means, auxiliary combing means, means controlled by a sheet for retracting both of said combing means from the work, means for automatically locking said auxiliary combing means out of contact with the work when the same is retracted, means actuated by the first of said combing means for moving said locking means to release said auxiliary combing means, and continuously driven means for periodically rendering said releasing means incapable of operating said locking means.

32. In a paper-feeding machine, combing means, auxiliary combing means, means controlled by a sheet for retracting both of said combing means from the work, means for automatically locking said auxiliary combing means out of contact with the work when the same is retracted, means actuated by the first of said combing means for moving said locking means to release said auxiliary combing means, and continuously driven means for periodically rendering said releasing means capable and incapable of operating said locking means.

33. In a paper-feeding machine, combing means, auxiliary combing means, means controlled by a sheet for retracting both of said combing means from the work, means for automatically locking said auxiliary combing means out of contact with the work when the same is retracted, means actuated by the first of said combing means for moving said locking means to release said auxiliary combing means, a continuously driven cam, and means actuated by said cam for rendering said releasing means alternately capable and incapable of operating said locking means.

34. In a paper-feeding machine, combing means, auxiliary combing means, means for retracting both of said means from the work, means for automatically locking said auxiliary means in retracted position, means operable by the first of said combing means for acting upon said locking means to restrain locking action thereof, and continuously driven means for rendering said restraining means alternately operative and inoperative.

35. In a paper-feeding machine, combing means, spring-actuated means for retracting the same from the paper, means for restraining said spring-actuated means, a laterally movable rockshaft, a sheet-engaging member affixed to said rockshaft for transmitting movement from a sheet to turn the shaft, a continuously rotating member, a rocking member affixed to said rockshaft and adapted to be moved into engagement with said rotating member in consequence of movement imparted to said sheet-engaging member by a sheet, said rocking member being adapted to be further rocked by said rotating member and to move said shaft laterally in consequence thereof, and means adapted to be moved by lateral movement of said shaft for actuating said restraining means to release said spring-actuated means.

36. In a paper-feeding machine, combing means, spring-actuated means for retracting the same from the paper, means for restraining said spring-actuated means, a continuously rotating member, a member for releasing said combing means, said releasing member being movable to and from engagement with said rotating member, said rotating member having a series of faces each adapted to strike said releasing member and move the same, means connecting said releasing member and said restraining means whereby the latter is caused to release said combing means, and a sheet-actuated member connected to said releasing member for moving it into the path of said faces of the rotating member.

37. In a paper-feeding machine, combing means, spring-actuated means for retracting the same from the paper, means for restraining said spring-actuated means, a continuously rotating member, a member adapted to be actuated by said rotating member for actuating said restraining means to release said combing means, and a sheet-actuated member for moving said releasing member into operative engagement with said rotating member, said restraining means being adapted to be actuated by said spring-actuated means to retract said releasing member from contact with said rotating member.

38. In a paper-feeding machine, combing means, spring-actuated means for retracting the same from the paper, means for restraining said spring-actuated means, two coöperative toothed members, one of which is adapted to be actuated for causing said re-

straining means to release said spring-actuated means, and the other of which is continuously driven and adapted to operate the one first specified, one of said toothed members being movable to and from engagement with the other, and a sheet-actuated member for moving one of said toothed members into engagement with the other.

39. In a sheet-feeder, a fixed sheet-support, a movable sheet-support for moving sheets toward said fixed support, sheet-feathering means arranged to coöperate with said fixed support, sheet-feathering means arranged to coöperate with said movable support, and means controlled by the first-mentioned feathering means for controlling the operation of the last-mentioned feathering means.

40. In a sheet-feeder, a plurality of separate sheet-feathering means each movable to and from contact with the top sheet, and means arranged to hold one of said feathering means out of contact with the work so long as the successive top sheets are advanced to a predetermined position within a predetermined interval of time, said holding means being controlled by the other feathering means to release said one of said feathering means in consequence of the failure of a top sheet to reach said predetermined position within said predetermined interval of time.

41. In a sheet feeder, a plurality of separate sheet-feathering means arranged one in advance of another, and movable to and from contact with the top sheet, and means controlled by the foremost one of said feathering means arranged to hold other feathering means out of contact with the work so long as the successive top sheets are advanced to a predetermined position within a predetermined interval of time, said holding means being controlled by said foremost feathering means to release said other feathering means in consequence of the failure of a top sheet to reach said predetermined position within said predetermined interval of time.

42. In a sheet-feeder, a plurality of separate combing means movable to and from contact with the top sheet, means for holding one of said combing means out of contact with the work, and means controlled by the length of time during which another one of said combing means remains in contact with the top sheet, for causing said holding means to release the first specified one of said combing means.

In testimony whereof I have affixed my signature, in presence of two witnesses.

VERNON GARNER.

Witnesses:

MARGARET M. KELAHER,

KATHRYN M. HALLORAN.