M. H. PIPER.

SHEET FEEDING MECHANISM.

APPLICATION FILED JUNE 28, 1909.

994,193.

Patented June 6, 1911.

4 SHEETS—SHEET 1.

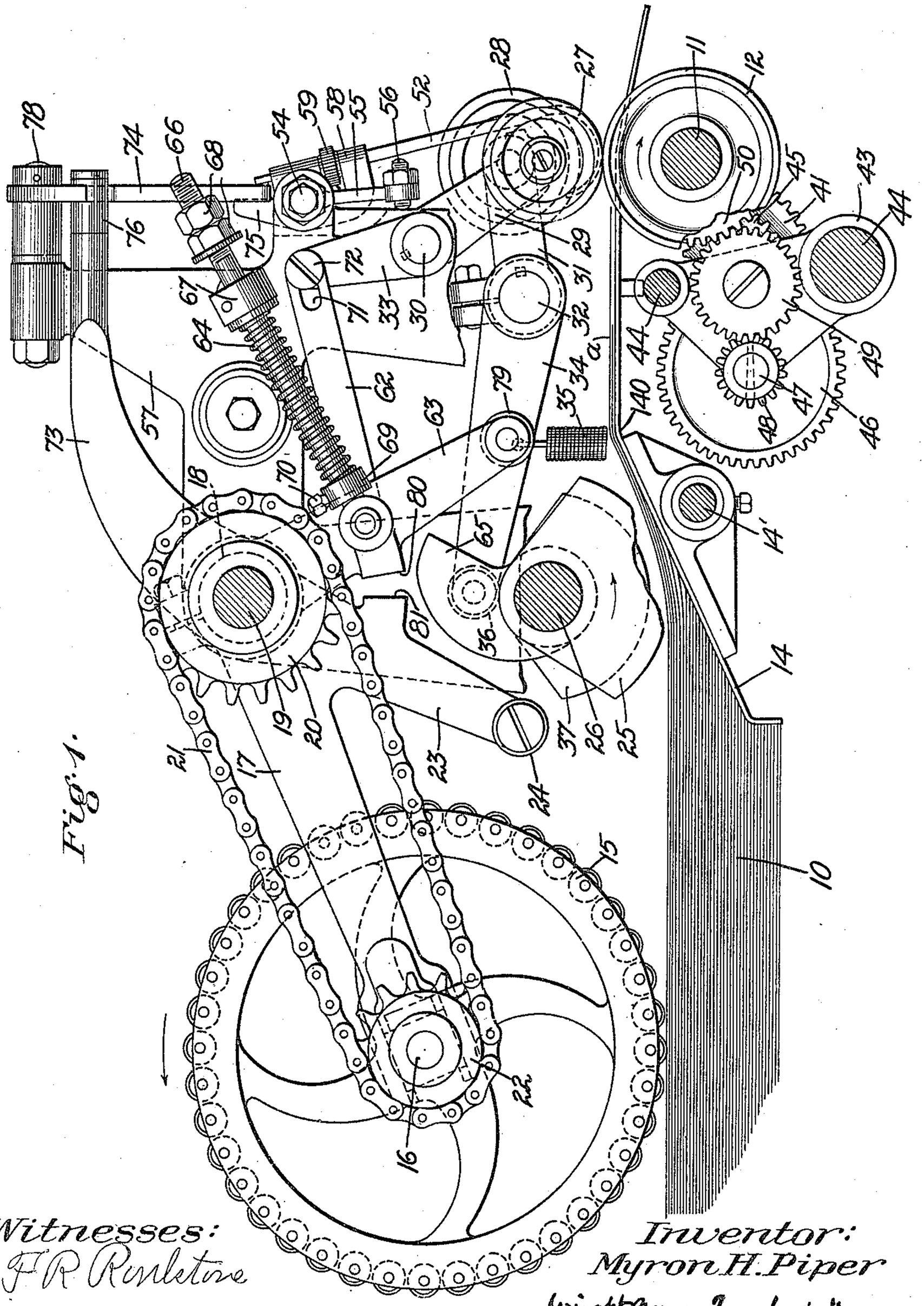

Fig. 1.

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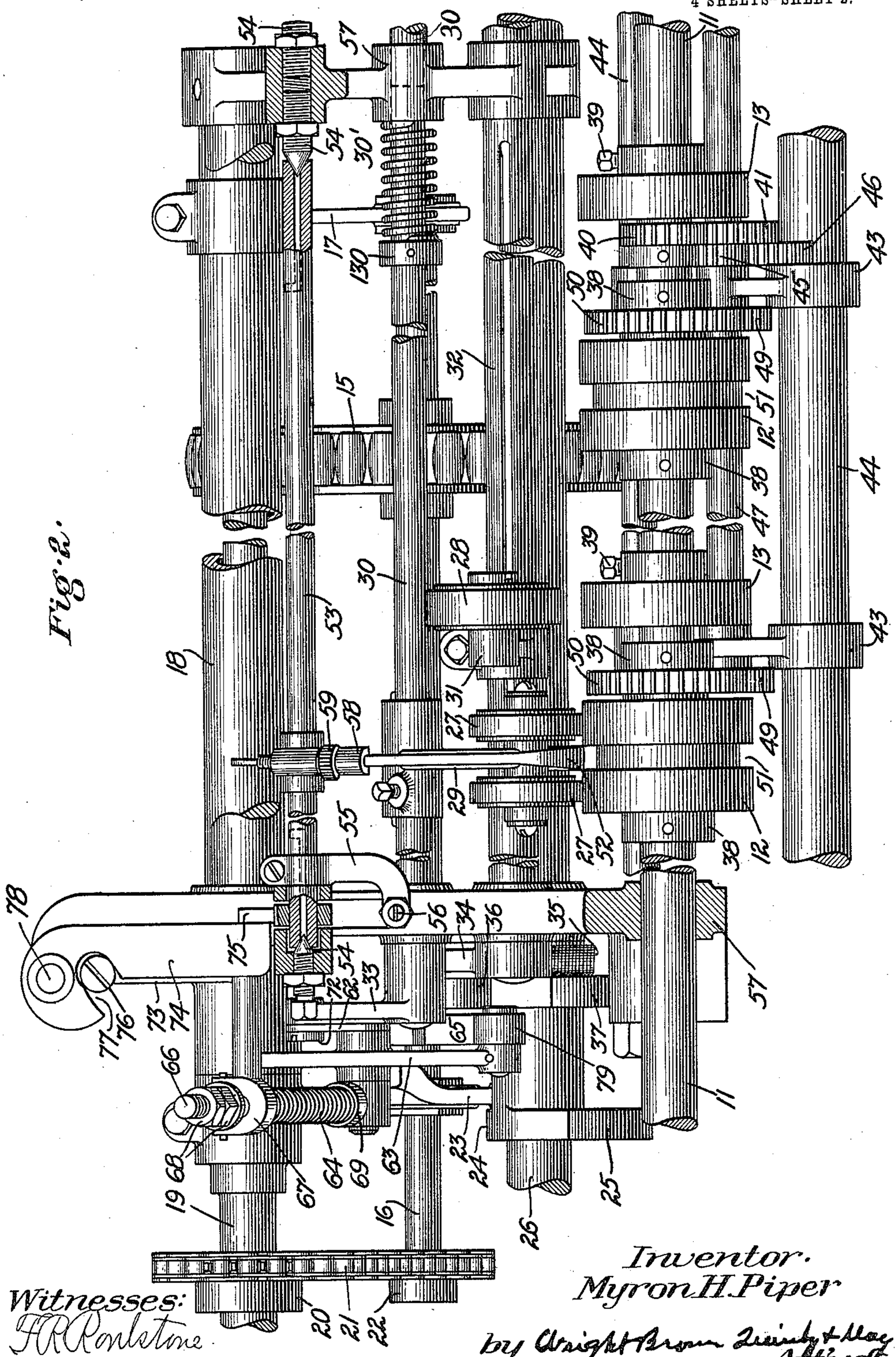
4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

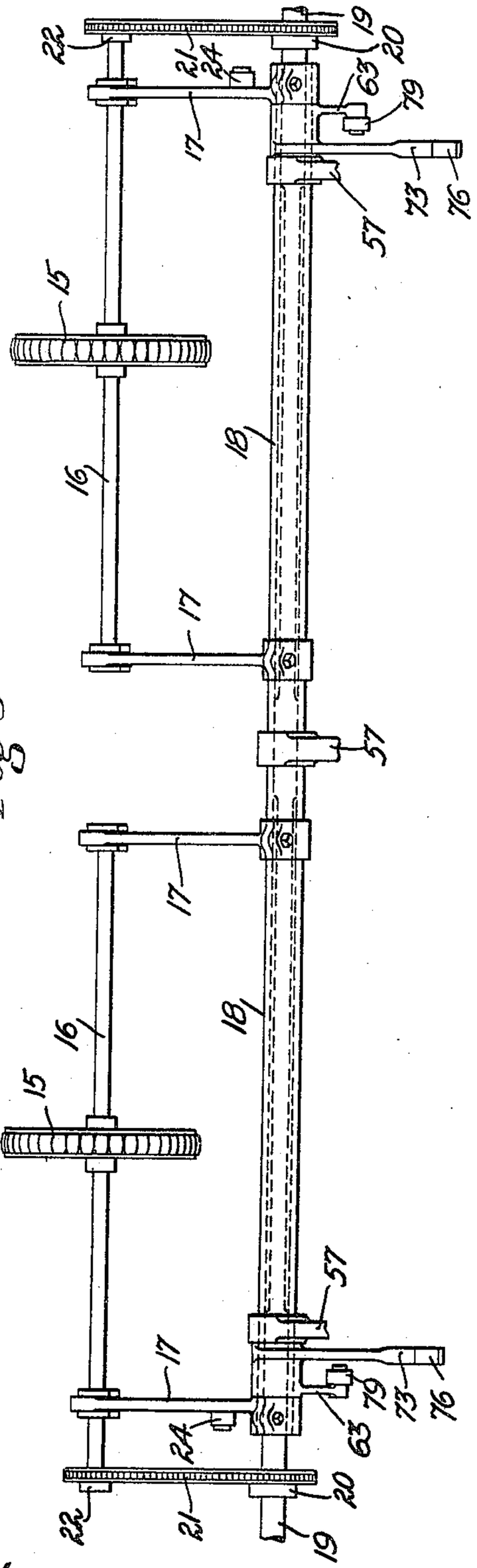

Fig. 3.

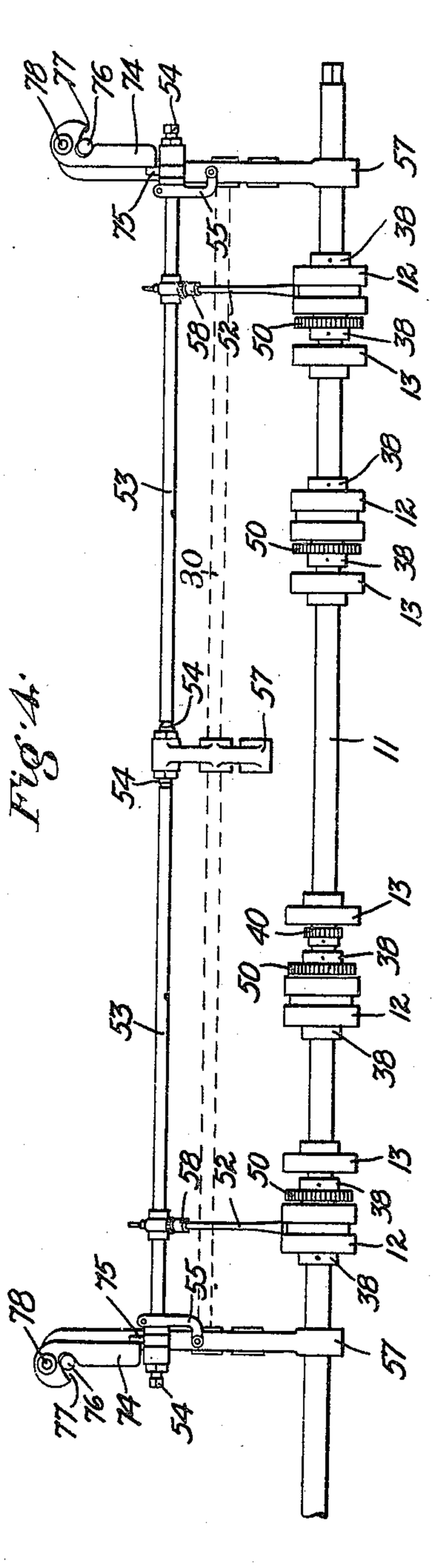

Fig. 4.

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4 SHEETS—SHEET 4.

Fig. 5.

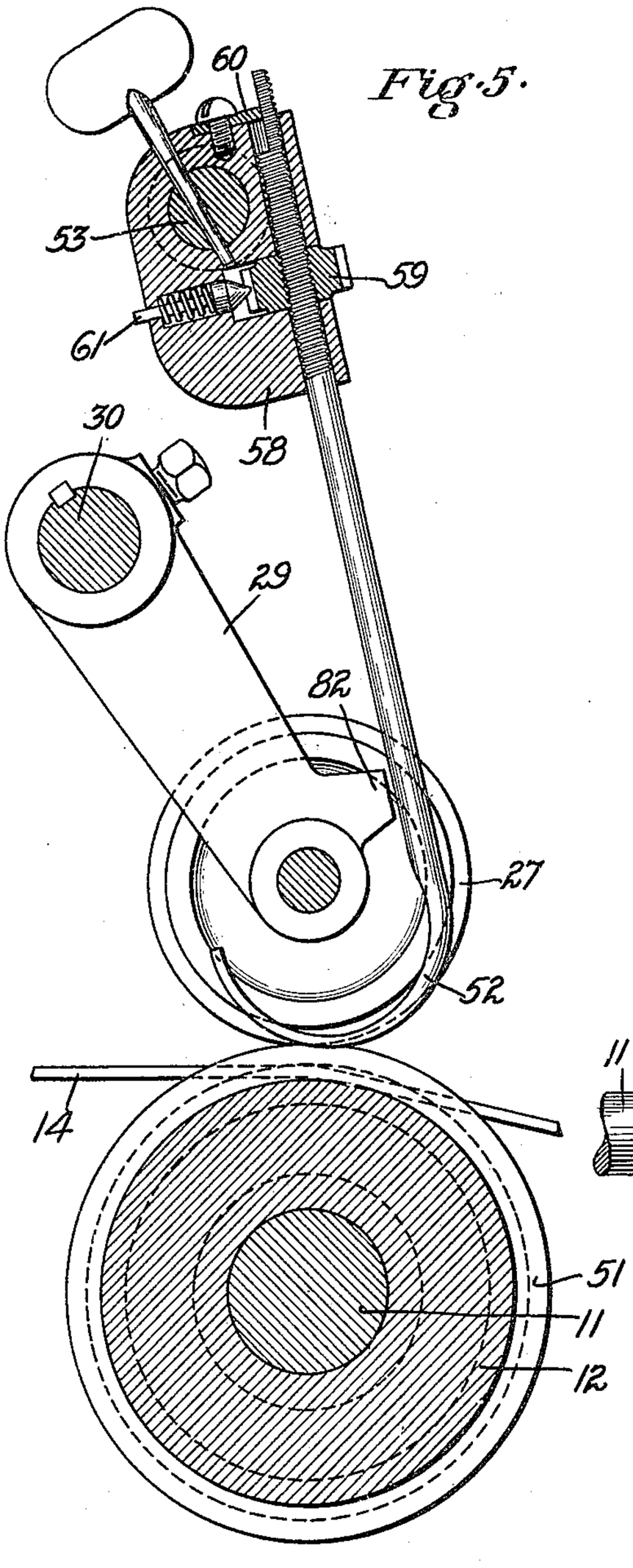


Fig. 6.

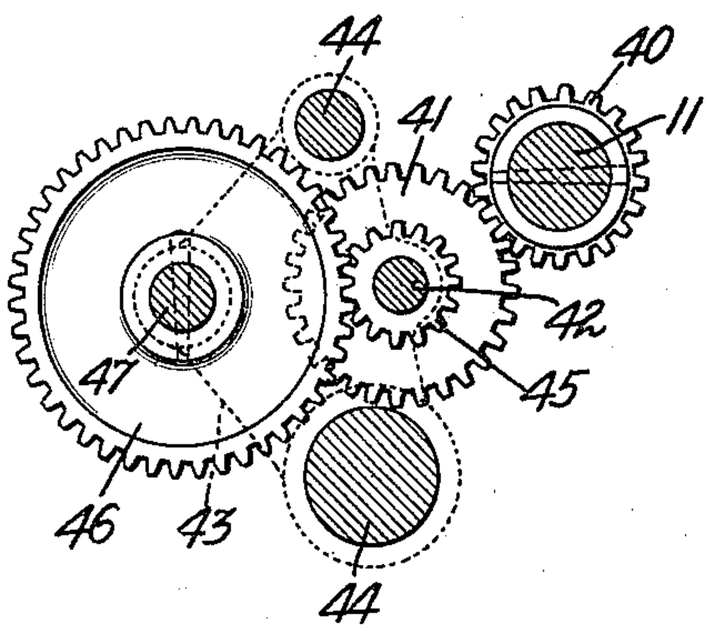
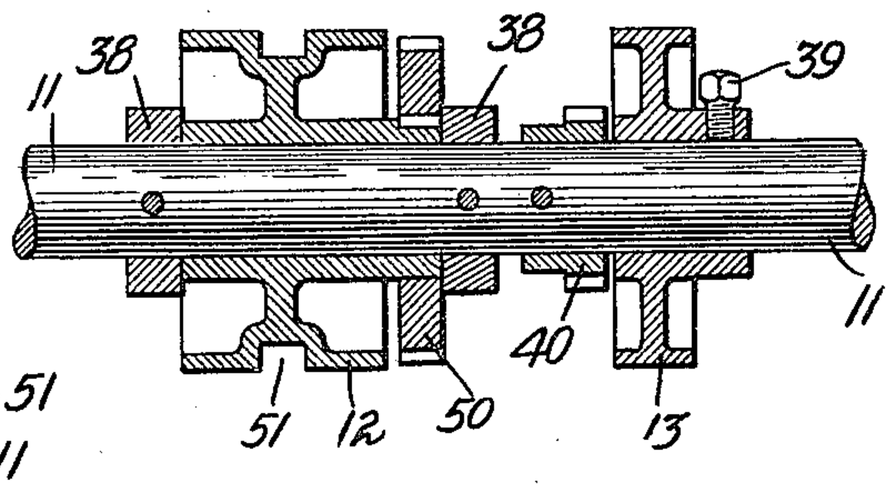


Fig. 7.



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UNITED STATES PATENT OFFICE.

MYRON H. PIPER, OF WALPOLE, MASSACHUSETTS, ASSIGNOR TO UNITED PRINTING MACHINERY COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MAINE.

SHEET-FEEDING MECHANISM.

994,193. Specification of Letters Patent. Patented June 6, 1911.

Application filed June 28, 1909. Serial No. 504,637.

To all whom it may concern:

Be it known that I, MYRON H. PIPER, a resident of Walpole, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Sheet-Feeding Mechanisms, of which the following is a specification.

This invention relates to that class of sheet-feeding machines in which individual sheets are separated from a bank or pile of sheets so that they may be removed and presented one by one to a machine for further utilizing them, such as a printing machine. A common form of mechanism for so delivering sheets to a printing press or other machine includes what are termed combing wheels and feeding rolls interposed between the combing wheels and the subsequent machine for taking the sheets one by one as they are advanced by the combing wheels and delivering them at stated intervals to the succeeding machine. The action, arrangement, and general mechanism of the combing wheels is well known and requires no detailed explanation for the purposes of the present invention. In mechanism of this kind, it has hitherto been customary to provide a shaft having two sets of rolls affixed thereon and two sets of relatively movable rolls adapted to coöperate respectively with the two sets of rolls on the shaft, said shaft being driven at a relatively rapid rate for the purpose of delivering the sheets one by one to the succeeding machine without undue delay. One set of rolls on the said shaft is utilized for the purpose of drawing in the sheets as they are advanced by the combing wheels and the other set of rolls is utilized for the purpose of delivering the sheets so drawn in. The two sets of rolls thus mounted on one and the same shaft are by necessity of equal diameter and consequently their peripheral speed is equal. The only difference between the actions of the two sets of rolls thus mounted on the same shaft is that the drawing-in rolls engage the foremost edge of the sheet while the delivering rolls, which are initially inoperative, engage the sheet within its margin after the foremost edge has been advanced beyond the nip of the rolls. A serious objection to this uniform arrangement of the drawing-in rolls and delivering rolls is that, when the shaft is driven at a speed required by a press, the drawing-in rolls frequently tear fragments from the foremost edge of a sheet because of their relatively insufficient initial hold thereon. The sheets are, as well known to those skilled in the art, advanced very slowly by the combing wheels and are suddenly caught up by the relatively rapid drawing-in rolls with the result stated. This serious objection is overcome as hereinafter explained.

Another serious objection resulting from drawing in a slow moving sheet by means of rapidly moving rolls is the liability of disarranging the sheet so as to cause it to become twisted. Sheet-feeding mechanisms of this character are usually provided with automatic means for causing the two sets of relatively movable rolls to move to and from operative relation with their respective drawing-in and delivering rolls. When the initially operative and rapidly moving drawing-in rolls engage a slow moving sheet, they invariably give the sheet a yank and then release the sheet in consequence of sheet-actuated tripping means, which causes the retraction of the movable drawing-in rolls and the positioning of the movable delivering rolls. The change of rolls takes place immediately following the yank imparted to the sheet, and, when the sheet is subsequently engaged by the movable delivery rolls otherwise known as "drop rolls", it has a crook which is eliminated by a kicking out of the edge of the sheet. In this way, the sheets become disarranged to various extents with the result that no two sheets may be delivered in the same relative position. This objection, together with the objection first stated in regard to the tearing of the sheets, is overcome by providing relatively slow drawing-in rolls which are arranged upon the same shaft as the relatively rapid delivering rolls. The delivering rolls may be driven at any desired speed without injury to the sheet, because the point of the sheet at which they take hold is sufficiently distant from the edge to provide the full strength of the sheet as distinguished from the edge. The drawing-in rolls are driven by suitable mechanism which imparts to them a peripheral speed approximately equal to the speed of the sheet being combed up to them. By reason of so driving the drawing-in rolls, no severe strain is imposed upon the edge of the sheet, the sheet is not yanked so as to disarrange it, and no perceptible amount of time is lost by reason of the relatively slow

drawing-in rolls, because they are rendered inoperative almost immediately after taking hold upon the edge of the sheet.

Of the accompanying drawings, which illustrate one form in which the invention may be embodied,—Figure 1 represents an end elevation partly in section, showing the essential elements of a sheet feeder comprising combing wheel mechanism, drawing-in rolls, delivery rolls, and tripping mechanism for controlling the action of the rolls. Fig. 2 represents a front elevation thereof. Fig. 3 represents a plan view of the combing mechanism detached. Fig. 4 represents a front elevation of a sheet-actuated tripping mechanism for controlling the combing wheels and delivery rolls. Fig. 5 represents a perpendicular section of a portion of the tripping mechanism, together with the drawing-in rolls. Fig. 6 represents a perpendicular section of gearing for driving the drawing-in rolls. Fig. 7 represents a transverse section of a drawing-in roll, a delivery roll, and the gears associated therewith.

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

Referring first to Fig. 1, 10 represents a pile or bank of paper sheets *a* arranged in the usual manner upon a table (not shown). 11 represents a driven shaft on which are loosely mounted a plurality of drawing-in rolls 12 and on which are affixed a plurality of delivery rolls 13. The sheets *a* are conducted from the pile 10 to the drawing-in rolls upon a series of plates 14 arranged upon a transverse supporting rod 14′, as shown by Fig. 1. The plates are bent so as to form a ridge at 140 whose function is to separate the foremost sheet from the sheet below it in order to eliminate the tendency of the sheets to adhere to each other by reason of suction. The plates preferably extend between and beyond the drawing-in rolls for the purpose of preventing the sheets from adhering to the rolls and being wound thereon as is sometimes the case, especially when the sheets *a* are made of extremely thin paper. 15 15 represent a pair of combing wheels for combing the sheets from the pile 10 over the ridge 140 to the drawing-in rolls. The combing wheels, when in operative position, rest by reason of force of gravity upon the top of the pile 10 and are elevated by means hereinafter described whenever a sheet *a* is drawn in so as to actuate the tripping mechanism. The pile 10 of sheets is preferably elevated step by step by means of its supporting table in any one of a variety of methods commonly employed, such feeding of the pile being well known and requiring no further explanation for the purpose of this invention. Each of the combing wheels 15, as shown by Fig. 3, is mounted upon an individual shaft 16, each of said shafts being mounted in a pair of arms 17. Each pair of arms 17, as shown by Fig. 3, is clamped or otherwise secured upon a sleeve 18, two of such sleeves being loosely mounted upon a driven shaft 19. The shaft is provided with sprockets 20 and chains 21 which pass over sprockets 22 mounted one on each of the shafts 16. In this way, the combing wheels are adapted to be driven continuously, and, while rotating, they may be elevated and dropped by reason of rocking the sleeves 18 which carry the supporting arms 17. One of each pair of arms 17 is formed with an additional arm 23 carrying a trundle roll 24 adapted to be engaged by a cam 25 affixed upon a continuously moving shaft 26. The cams 25 are adapted to actuate the arms 23 at stated intervals, and such actuation is imparted to elevate the shafts 16 so as to retract the combing wheels from the pile of sheets. The cams 25 are adapted to elevate the combing wheels in unison, but the combing wheels may be otherwise elevated independently of each other by means hereinafter described under the control of sheet-actuated tripping means.

The drawing-in rolls 12 and the delivery rolls 13 may be mounted upon the shaft 11, as shown by Figs. 4 and 7. Fig. 4 shows two pairs of drawing-in rolls and two pairs of delivery rolls. The outermost rolls are employed for advancing a relatively wide sheet *a* and the more closely related rolls are employed for a relatively narrow sheet. Said rolls are preferably positioned so as to be held against axial movement on the shaft, and either set may be caused to operatively engage a sheet *a* by reason of the provision of relatively movable rolls adapted to coöperate therewith. The movable rolls for the drawing-in rolls are indicated at 27, and the movable rolls which cooperate with the delivery rolls are indicated at 28. The latter rolls are commonly termed "drop rolls" and are initially in a remote position when a sheet is drawn in and are subsequently caused to drop into engagement with a sheet so as to coöperate with the delivery rolls in passing a sheet on to the succeeding machine. Inasmuch as only a pair of drawing-in rolls and a pair of delivery rolls are employed at one time, one pair only of movable rolls of each kind is provided. The movable drawing-in rolls are mounted upon a pair of arms 29, said arms being splined or otherwise secured upon abutting rock-shafts 30. The arms 29 are adapted to be set at the appropriate positions upon their respective rock-shafts to cause them to coöperate with the desired drawing-in rolls 12. The drop rolls 28 are mounted upon a pair of arms 31 which are likewise splined or otherwise secured upon a rock-shaft 32. The arms 31 may be moved axially upon their rock-shaft 32 and set

at the appropriate positions to cause the drop rolls to coöperate with the desired delivery rolls 13. The shafts 30 are adapted to be rocked independently of each other so as to disengage the drawing-in rolls near one side of the paper without disengaging those near the other side. The rolls are adapted to remain in operative position by reason of their own weight and may be elevated by arms 33, of which there is one affixed to each of the rock-shafts 30. Cooperative pressure of the rolls 27 may, if desired, be reinforced by providing the rock-shafts 30 with springs 30′, as shown by Fig. 2, in which one end of each spring is connected to a part of the supporting frame 57 and the other end is connected to a collar 130 affixed upon the shaft. The rock-shaft 32 is provided with an arm 34 which is engaged by a spring 35 which exerts its tension to raise the drop rolls to inoperative position. The free end of the arm 34 carries a cam roll which coöperates with a cam 37 affixed upon the cam shaft 26, and which is adapted to rock the arm 34 against the tension of the spring for the purpose of moving the drop rolls into engagement with a sheet interposed between them and the delivery rolls 13. The cam 37 actuates the drop rolls at uniform intervals, but the removal of the rolls 27 is controlled by sheet-actuated tripping means hereinafter described.

Referring again to Fig. 7, it will be seen that each drawing-in roll 12 is loosely mounted upon the continuously revolving shaft 11 between a pair of fixed collars 38. The delivery rolls are rigidly secured to the shaft by any appropriate means such as set screws 39. The drawing-in rolls are driven by gears which receive their power from the shaft 11 and which are of such proportions and arrangement as to cause the drawing-in rolls to revolve in the same direction but at a greatly reduced speed. There is a separate series of driving gears for each of the drawing-in rolls and the several series are driven in unison.

40 represents a spur gear affixed upon the shaft 11 and intermeshing with a gear 41 mounted upon a stud 42. The stud is here shown as supported by a stationary hanger 43 mounted upon a pair of transverse supporting rods 44. The gear 41 carries a pinion 45 which intermeshes with a gear 46 mounted upon a shaft 47 supported by the hanger 43. The shaft 47 is provided with pinions 48 from which motion is transmitted through intermediate idle gears 49 to gears 50 affixed upon the hubs of the drawing-in rolls. According to the proportions and arrangement of the gears herein illustrated, the drawing-in rolls, which are of the same diameter as the delivery rolls, are driven at about one-tenth of the speed of the delivery rolls. This relatively slow rim speed of the drawing-in rolls is approximately equal to the speed at which the sheets are combed toward them.

The drawing-in rolls are formed with peripheral grooves which are adapted to receive feelers 52 which form part of sheet-actuated tripping means for controlling the combing wheels 15 and movable rolls 27. Each of the pair of the rolls 27 is adapted to coöperate with a drawing-in roll 12, one on either side of the groove 51. In this way, a sheet is given sufficient tension to cause the portion bridging the groove to actuate the feeler interposed in its path. The feelers, of which there is one near each side of a sheet, are mounted upon individually movable rock-shafts 53 which are mounted upon bearings adapted to render them sensitive to the least force of a sheet. For this reason, the ends of the rock-shafts are formed with cone bearings, as shown by Fig. 2, which are occupied by adjustable pointed bearing screws 54. The ends of the shafts may be drilled out, as illustrated, for the purpose of providing sockets adapted to contain oil wicks for lubricating the cone bearings. The force of gravity tends to maintain the lower ends of the feelers in the grooves 51 and the downward movement of the feelers is limited by stop arms 55, of which there is one on each of the rock-shafts.

56 represents a stop screw in the free end of each of the arms 55, said screws being adapted to engage portions of the supporting frames 57.

The shanks of the feelers 52 are screw-threaded but are loosely arranged in holders 58 pinned or otherwise affixed upon the rock-shafts. The holders are formed with recesses containing adjusting nuts 59 arranged upon the screw-threaded shanks of the feelers and adapted to adjust the feelers toward or from the drawing-in rolls. The upper ends of the shanks may be cut away as indicated by Fig. 5 and may be prevented from turning by affixing key plates 60 to the holders 58. Spring followers 61, arranged in sockets formed in the holders, are adapted to extend into notches formed in the peripheries of the nuts 59 and prevent undue rotation of the nuts.

For the purpose of retracting the movable drawing-in rolls 27, each of the arms 33 is connected by a link 62 to an actuator 63. There is one actuator for each of the arms 33, said actuators being loosely mounted upon the sleeves 18 (see Fig. 3). The actuators are adapted to be moved in one direction by springs 64 and in the opposite direction by cams 65 affixed upon the cam shaft 26.

66 represents a plunger, of which one end is pivotally connected to an actuator 63 and of which the other end extends through a boss 67 on the supporting frame 57. There

are two of such plungers, one for each actuator, and their outer ends are provided with nuts 68 adapted to engage the bosses and limit the movement of the plungers. The springs 64 are coiled about the plungers and compressed between the bosses 67 and collars 69 affixed to the plungers by set screws 70. The links 62, which connect the arms 33 with the actuators 63, are formed with elongated slots 71 which are occupied by pins or screws 72 carried by the arms 33. When the actuators are moved by the springs, they cause retraction of the rolls 27, but, when they are actuated by the cams 65, the springs are compressed and rolls 27 are permitted to drop into coöperative relation with the drawing-in rolls 12.

Suitable tripping mechanism is provided for holding the actuators 63 in retracted position so that the rolls 27 may be enabled to continue in operative relation. Said means comprises arms 73 formed on the actuators 63, latches 74 adapted to hold the arms, and a pair of detents 75 affixed on the rock-shafts 53 which carry the feelers 52. The free ends of the arms 73 are provided with anti-friction rolls 76 which are adapted to enter recesses 77 formed in the latches 74. The latches are pivotally mounted upon studs 78 affixed to the supporting frames 57, and the free ends of the latches are movable transversely of the detents 75. When the actuators 63 are retracted so as to place the rolls 76 in the recesses 77, and when the latches 74 are in operative position, they are held against movement by the detents which overlap them slightly as shown by Figs. 1 and 2. In order that the actuators may be retracted as described to inoperative position, they are provided with trundle rolls 79 adapted to be engaged by the cams 65. When the actuators are retracted by their respective cams, the latches and other elements of the tripping mechanism normally assume locking relation by reason of their own gravity. The actuators 63 are not only adapted to elevate the rolls 27, but are also adapted to elevate the combing wheels 15. For the latter purpose, they are formed with lugs 80 which are adapted to impinge against lugs 81 formed upon the arms 23. A sheet *a*, in being advanced by the combing wheels to the initially operative drawing-in rolls and movable rolls 27, is nipped between said rolls and advanced until the feelers 52 are displaced by the forward edge of the sheet. If it so happens that the edge of the sheet extends squarely across the machine parallel to the shaft 11, the two feelers may be displaced in unison. On the other hand, if the sheet is combed up to the drawing-in rolls in such a way that one side is slightly in advance of the other, the feeler first engaged is displaced before the other. Each feeler, upon being displaced, causes the removal of its respective detent 75 from contact with the adjacent latch 74, thereby permitting said latch to be displaced by the arm 73 of the respective actuator 63, the spring 64 rocking the arm 73, thus moving the latch 74 (see Figs. 1 and 2). The actuators thus released impinge against the arms 23, thus elevating the combing wheels and at the same time they rock the individually movable shafts 30 and raise the rolls 27. The arms 29, which carry the rolls 27, are formed, as shown by Fig. 5, with lugs 82 which engage the feelers and remove them from contact with the sheet. In this way, each side of the sheet, upon arriving at a predetermined point, actuates its own tripping mechanism, thus causing disability of the drawing-in rolls on that side without disabling the drawing-in rolls on the other side, and the drawing-in rolls on the other side are permitted to remain in operative relation until the other side of the sheet is advanced to transverse alinement with the side first arriving at the predetermined point. After a sheet is drawn in beyond the nip of the rolls by the relatively slow moving drawing-in rolls, the cam 37 moves the arm 34 against the tension of the spring 35 and thus places the drop rolls in operative position within the margin of the sheet, whereupon the sheet is taken up and advanced by the relatively rapid delivery rolls.

Having thus explained the nature of my said invention and described a way of constructing and using the same, although without attempting to set forth all of the forms in which it may be made or all of the modes of its use, I declare that what I claim is:—

1. In a sheet-feeder, a combing mechanism combined with a driven shaft and delivery rolls affixed thereon, of a plurality of drawing-in rolls loosely mounted on said shaft, and means for driving said drawing-in rolls at a relatively slow speed in the same direction as said shaft.

2. In a sheet-feeder, a combing mechanism combined with a driven shaft and delivery rolls affixed thereon, of a plurality of drawing-in rolls loosely mounted on said shaft, and means driven by said shaft for driving said drawing-in rolls with less peripheral speed than that of the delivery rolls.

3. In a sheet-feeder, relatively slow drawing-in rolls for engaging the edge of a sheet, retractable rolls for coöperation therewith, means for retracting the same, relatively rapid delivery rolls, initially retracted drop rolls for coöperation therewith, means for moving the drop-rolls into coöperative relation with the delivery rolls, and sheet-actuated means in consequence of which said retractable drawing-in rolls are retracted after having advanced the edge

of a sheet beyond the nip of the delivery rolls.

4. In a sheet-feeder, positively driven delivery rolls, relatively slow drawing-in rolls arranged in axial alinement with the delivery rolls, initially retracted rolls for coöperation with the delivery rolls, means for moving the same into coöperative position, initially operative retractable rolls for coöperation with the drawing-in rolls, means for retracting the same, and sheet actuated means in consequence of which said retractable drawing-in rolls are retracted after having advanced the edge of a sheet beyond the nip of the delivery rolls.

5. In a sheet-feeder, a driven shaft, drawing-in rolls loosely mounted thereon, means driven by the shaft for driving said rolls at a relatively slow speed in the direction of the shaft, retractable combing wheels, retractable rolls for coöperation with said drawing-in rolls, yielding means for retracting the combing wheels and said retractable rolls, controlling means for retaining said yielding means in inactive position, sheet-actuated means for causing the release of said yielding means, delivery rolls affixed upon said shaft, and drop rolls adapted to coöperate with said delivery rolls.

6. In a sheet feeder, combing means combined with means for drawing a sheet therefrom at a relatively slow speed, means adapted to be rendered active by a sheet for rendering the drawing means inoperative, and means for carrying out such sheet at a relatively rapid speed.

7. In a sheet-feeder, coöperative relatively stationary and movable feed-rolls, yielding means for retracting the movable rolls, releasable means for retaining said yielding means, a rock-shaft, adjustable conical end bearings therefor, means affixed on said shaft and adapted to be engaged and moved by a sheet, and means affixed on the shaft for retaining and releasing said releasable means.

8. In a sheet feeder, combing means, delivering means for acting on a sheet after the combing means, intermediate means for moving a sheet to the delivering means, said intermediate means acting less rapidly than said delivering means, and means adapted to be rendered active by a sheet for rendering the intermediate means inactive.

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

MYRON H. PIPER.

Witnesses:
F. R. Roulstone,
P. W. Pezzetti.