No. 618,916. Patented Feb. 7, 1899.

E. J. STEWART.

BALE REDUCING AND PAD FORMING MACHINE.

(Application filed Sept. 18, 1897.)

(No Model.) 7 Sheets—Sheet 1.

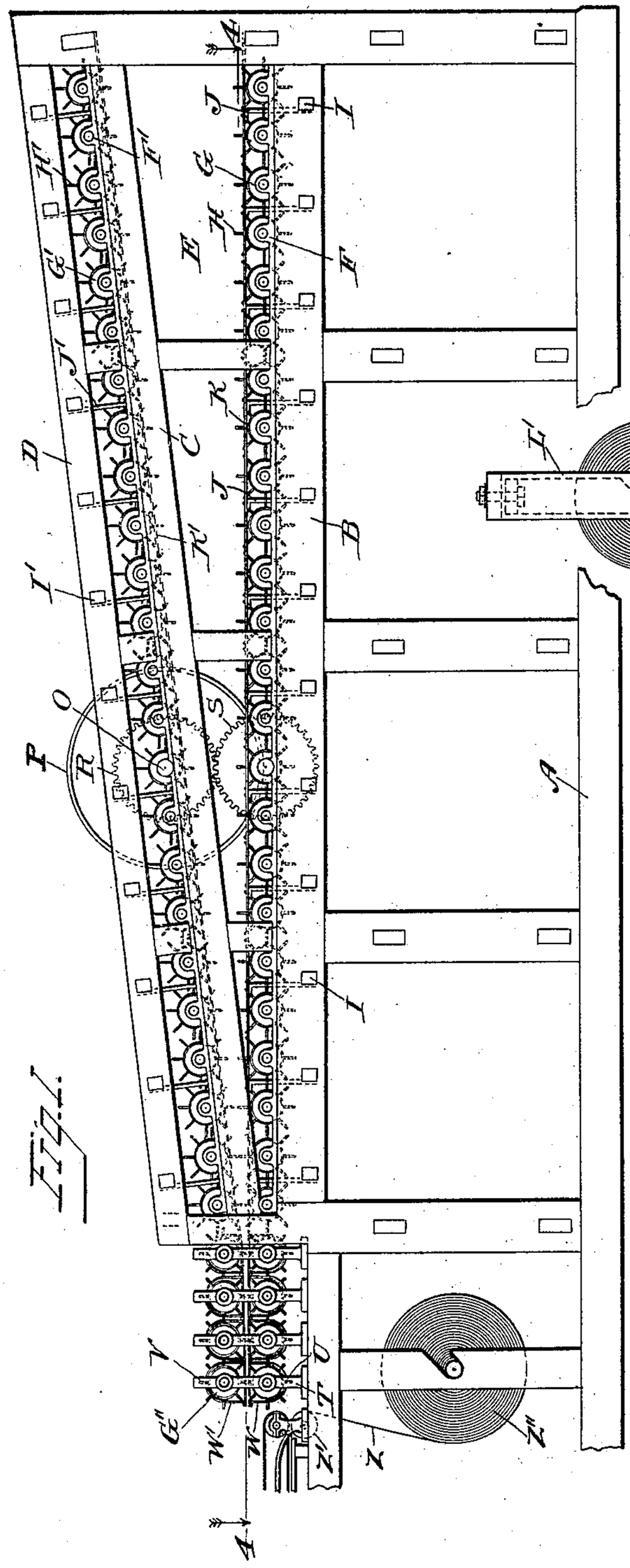

FIG. 1.

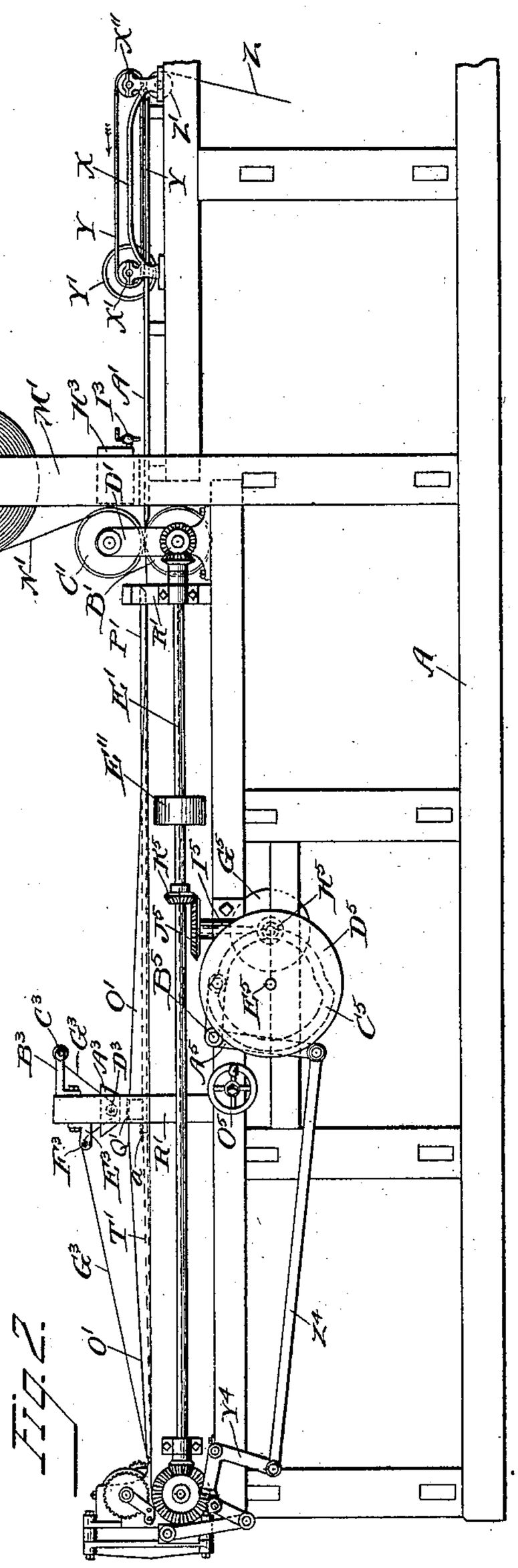

FIG. 2.

Witnesses
Martin A. Olsen.
Leonora Wiseman.

Inventor
Edgar J. Stewart
by Edmund Reston
his atty

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E. J. STEWART.

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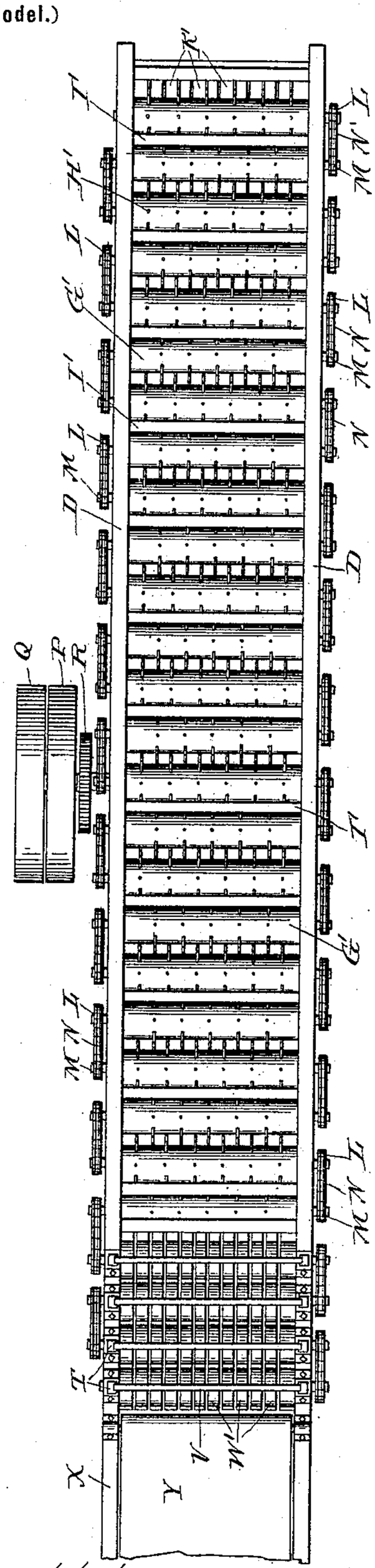

Fig. 2.

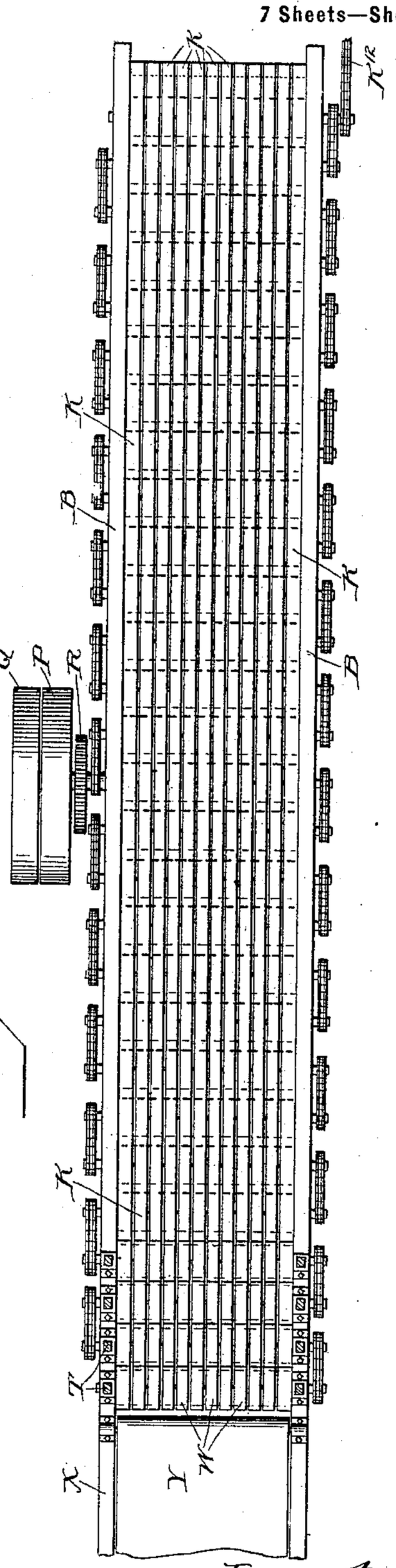

Fig. 1.

Witnesses
Martin N. Olsen.
Leonora Wiseman.

Inventor
Edgar J. Stewart
by Ernest Reeton
his attys

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E. J. STEWART.

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FIG. 5.

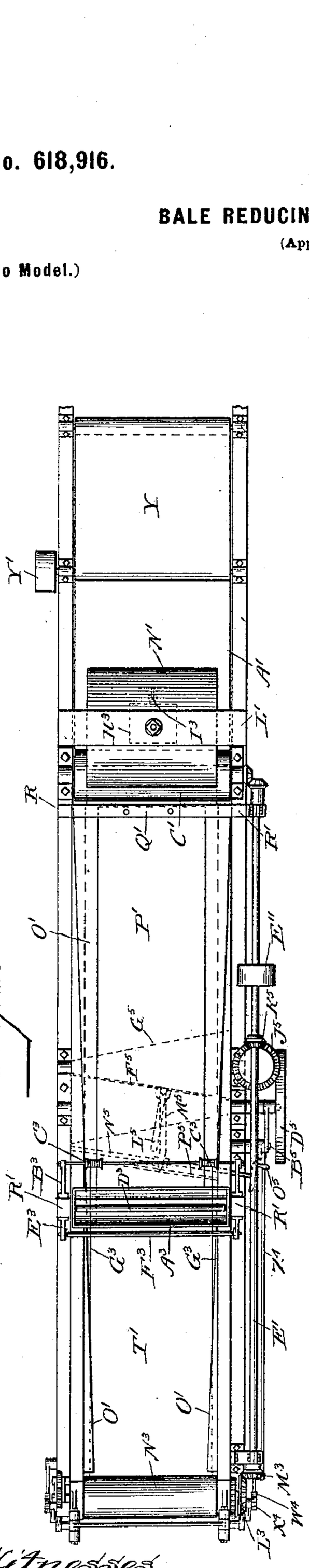
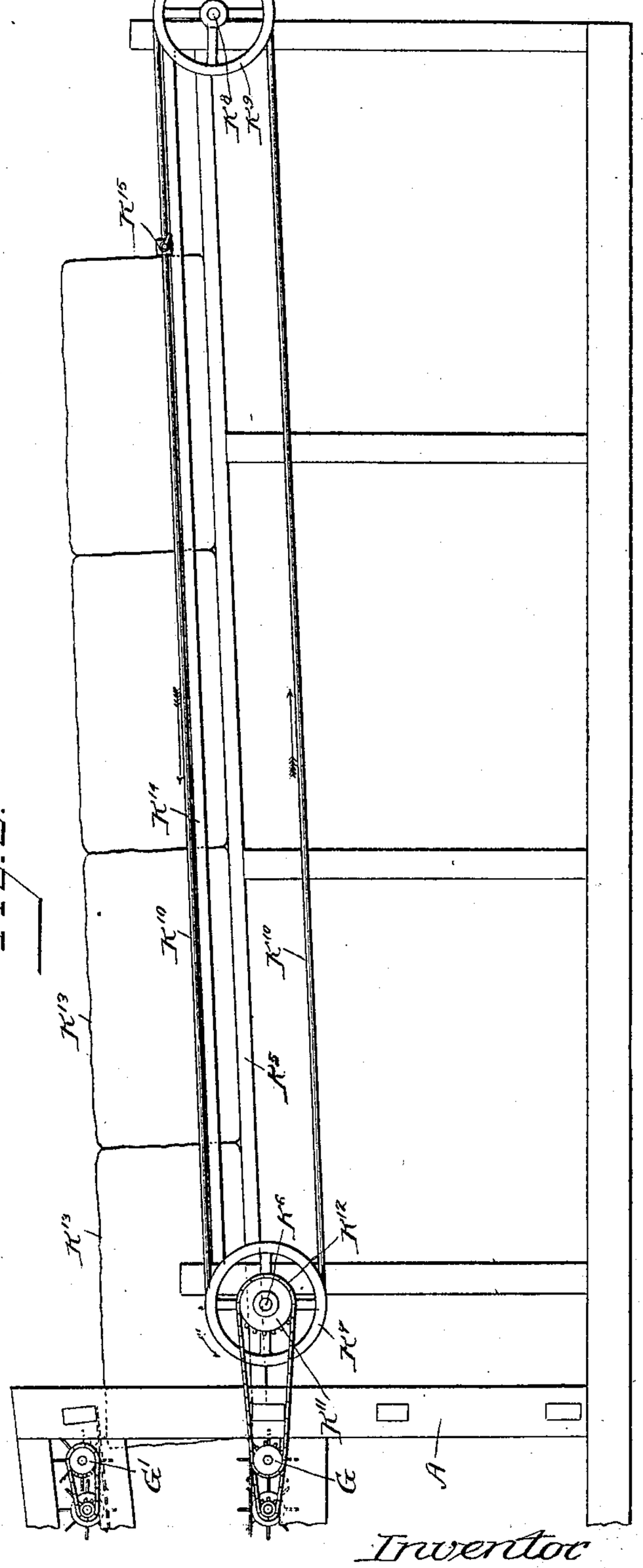


FIG. 6.



Witnesses
Martin H. Olsen.
Leonora Wiseman.

Inventor
Edgar J. Stewart
by Edmund Reeder
his atty

No. 618,916. Patented Feb. 7, 1899.

E. J. STEWART.

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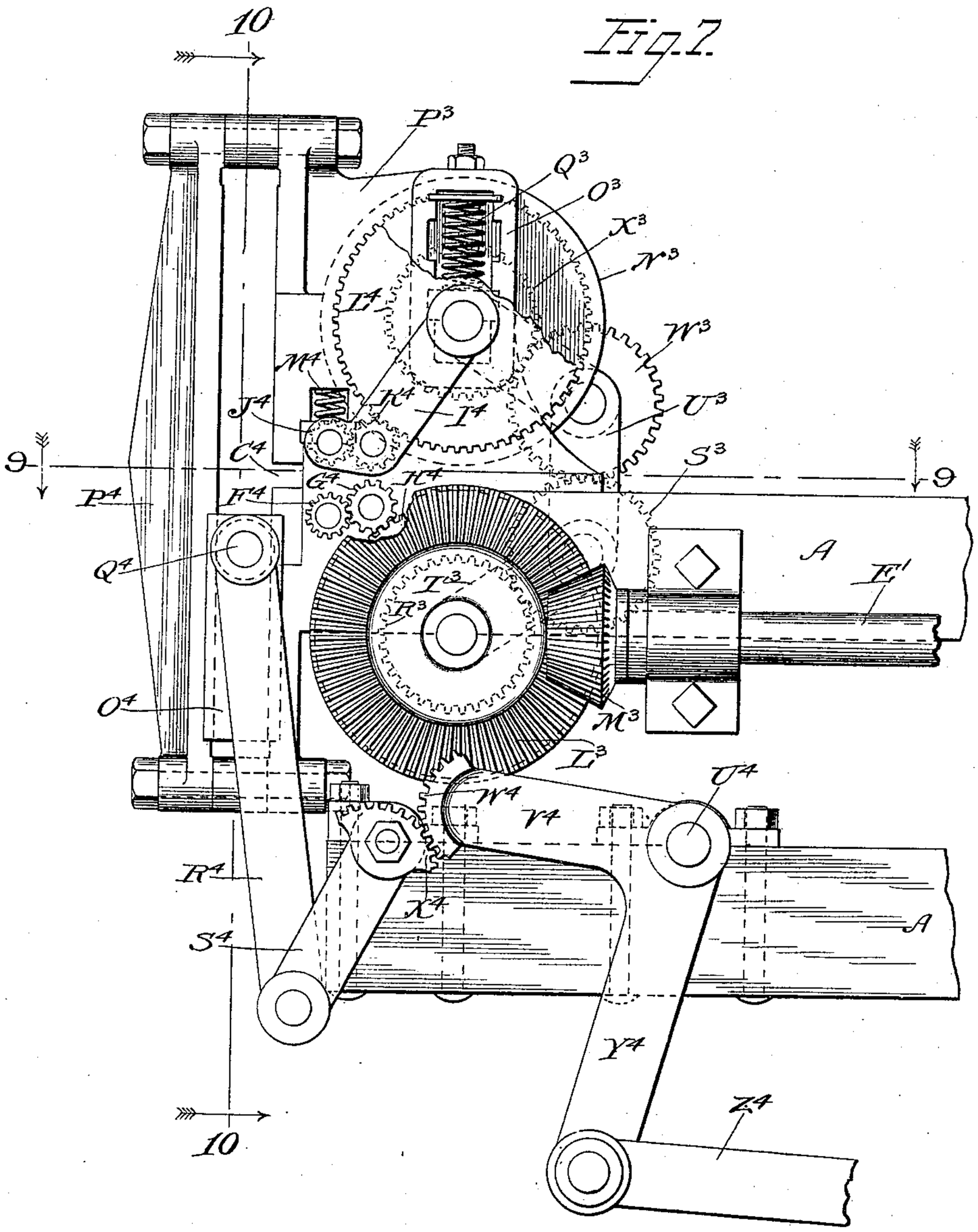
(No Model.) 7 Sheets—Sheet 4.

Fig. 7.



Witnesses
Martin A. Olsen.
Leonora Wiseman.

Inventor
Edwin J. Stewart
by Evans Rector
his attys

No. 618,916. Patented Feb. 7, 1899.

E. J. STEWART.

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(No Model.) 7 Sheets—Sheet 5.

Fig. 8.

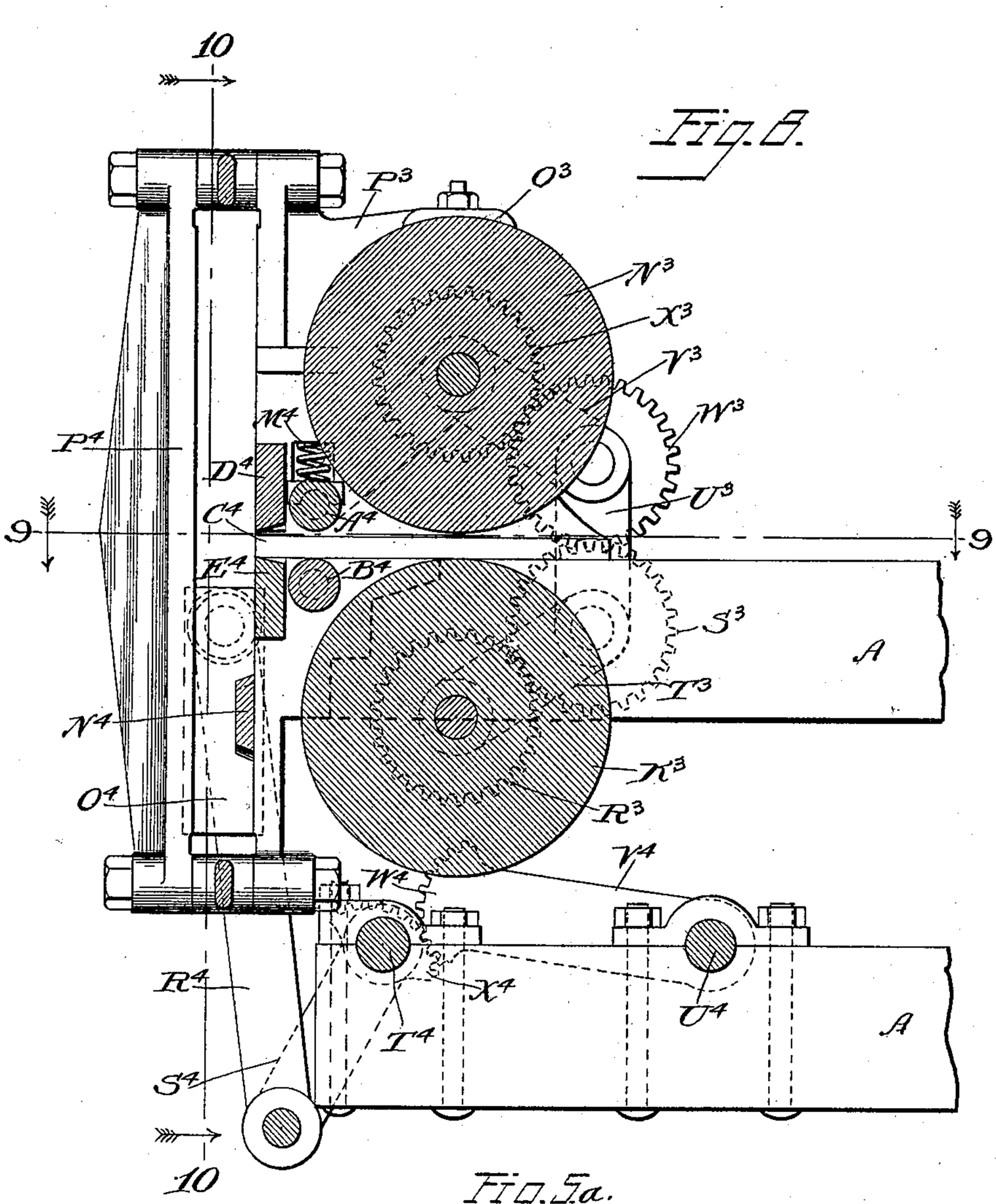

Fig. 5a.

Witnesses
Martin H. Olsen,
Lenora Wiseman.

Inventor
Edgar J. Stewart
by Edmund Rector
his atty

No. 618,916. Patented Feb. 7, 1899.

E. J. STEWART.

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(No Model.) 7 Sheets—Sheet 6.

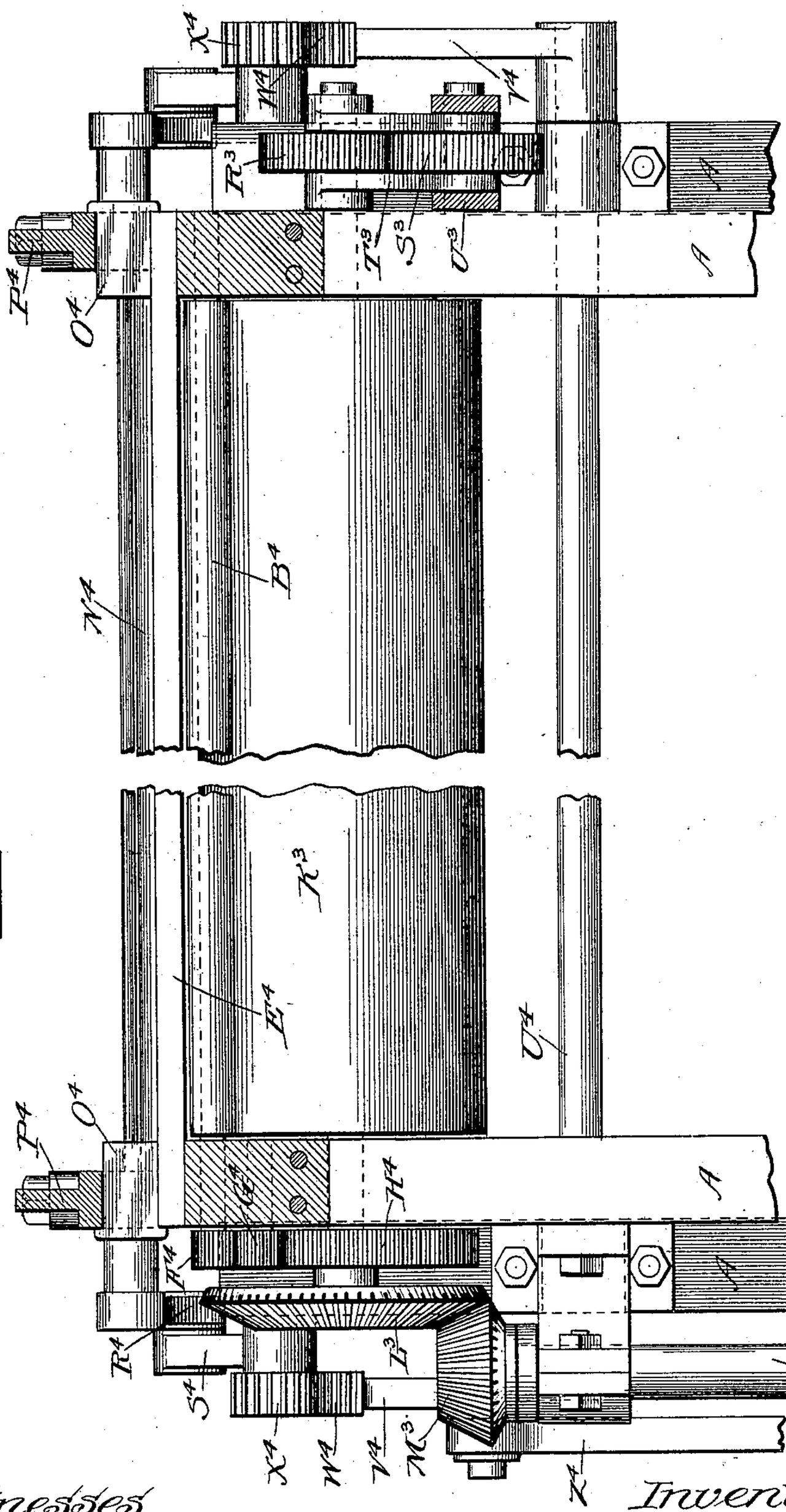


FIG. 17.

Witnesses
Martin N. Olsen.
Leonora Woeman.

Inventor
Edgar J. Stewart
by Edward Rector
his atty

No. 618,916. Patented Feb. 7, 1899.

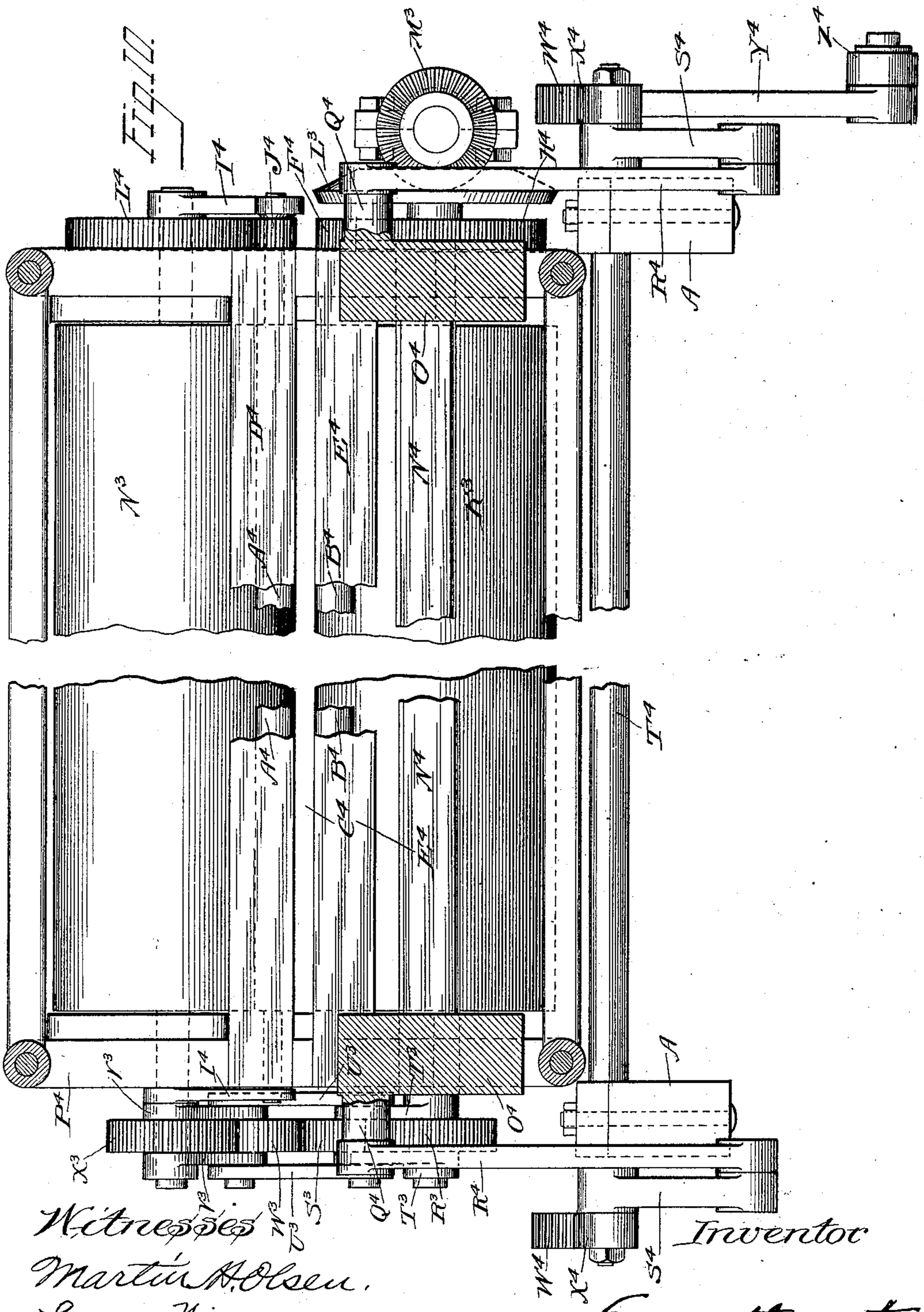
E. J. STEWART.

BALE REDUCING AND PAD FORMING MACHINE.

(Application filed Sept. 18, 1897.)

(No Model.) 7 Sheets—Sheet 7.

FIG. 10.



UNITED STATES PATENT OFFICE.

EDGAR J. STEWART, OF DES PLAINES, ILLINOIS.

BALE-REDUCING AND PAD-FORMING MACHINE.

SPECIFICATION forming part of Letters Patent No. 618,916, dated February 7, 1899.

Application filed September 18, 1897. Serial No. 652,181. (No model.)

To all whom it may concern:

Be it known that I, EDGAR J. STEWART, a citizen of the United States, residing at Des Plaines, in the county of Cook, in the State of Illinois, have invented a certain new and useful Bale-Reducing and Pad-Forming Machine, of which the following is a description, reference being had to the accompanying drawings, forming part of this specification.

The primary object of my invention is the production of a novel and superior machine or apparatus for forming packing pads and wrappers consisting of thin layers of excelsior inclosed between sheets of paper, such pads and wrappers being extensively used in packing glass and other articles to protect them from injury or breakage. To this end my machine or apparatus as a whole consists of two main portions—first, means by which the ordinary compressed bales of excelsior found in commerce may be readily disintegrated and reduced to the form of a thin layer or mat, and, second, means by which such thin layer or mat of excelsior delivered from the bale-reducing apparatus may be inclosed between two continuous strips of paper and the edges of the latter be glued or otherwise secured together to form a continuous mat or pad, which latter may be delivered from the machine in that form and be subsequently cut into the desired lengths for different uses or may be cut into separate pieces as it is delivered from the machine.

The bale-reducing portion of my apparatus is of novel construction *per se* and may be employed as a bale-reducing apparatus independently of the pad-forming portion of my machine and for the disintegration and reduction of compressed bales of other materials than excelsior, while, on the other hand, the pad-forming portion of my apparatus may be employed independently of the bale-reducing portion thereof in connection with any other means for supplying a suitable layer or mat of excelsior to it. The two portions of my apparatus when combined as illustrated in the accompanying drawings and hereinafter described, however, form the most complete and perfect as well as the most economical and expeditious pad-forming machine with which I am familiar, and it is as thus arranged and combined that I will explain them in connection with the accompanying drawings, in which—

Figures 1 and 2 represent an elevation of the left side of the complete apparatus, excepting the bale-feeding devices, it being understood that the machine is broken in two to form the two views, the upper view being the right-hand or rear end of the machine and the lower view the left-hand or forward end; Fig. 3, a top plan view of the portion of the machine shown in Fig. 1; Fig. 4, a top plan view of the lower series of disintegrating rolls or cylinders, being a view substantially on the dotted line 4 4 of Fig. 1; Fig. 5, a top plan view of the portion of the machine shown in Fig. 2; Fig. 5ª, a detail from Fig. 5; Fig. 6, an elevation of the left side of the bale-feeding devices at the rear of the machine; Fig. 7, an enlarged detail view in elevation of the left-hand end of the pad feeding and cutting devices at the extreme forward end of the machine; Fig. 8, a middle vertical section longitudinally of the machine of the parts shown in Fig. 7; Fig. 9, a horizontal section approximately on the lines 9 9 of Figs. 7 and 8 of the parts shown in said views; and Fig. 10, a vertical section approximately on the lines 10 10 of Figs. 7 and 8, looking toward the rear of the machine, being in substance a front elevation of the feed-rollers and cutting mechanism at the extreme forward end of the machine.

The same letters of reference are used to indicate corresponding parts in all the views.

The operative parts of the apparatus are supported upon a suitable framework A, which may be said to consist mainly of two vertical side frames located, in the case of the machine illustrated in the drawings, about twenty inches apart and secured together by suitable cross bars and braces. The entire apparatus from its rear end, at which the bales of excelsior are fed into it, to its forward end, at which the pads are delivered from it, is some twenty-five feet in length, and under the construction shown in the

drawings the main side frames referred to extend the complete length of the apparatus. In the right-hand portion of the framework shown in Fig. 1, which is the bale-reducing end of the apparatus, there are located in each side frame two horizontal longitudinal bars B B, Fig. 4, while arranged above each of the bars B B are two downwardly and forwardly parallel inclined bars C D, there being thus formed between the horizontal plane of the bars B B and the inclined plane of the bars C C above them a passage-way E, Fig. 1, which is of considerable height at its rear inlet end (being in the present instance about twenty-four inches high at that point) and gradually diminishes in height toward its forward delivery end, as shown. Mounted in boxes F, secured upon the upper edges of the bars B B, are the opposite ends of the spindles or journals of a series of transversely-arranged cylinders G, which have secured in and projecting from them a series of rows of radial pins or teeth H. The inclined bars C C above the bars B B support a second series of similar cylinders G', provided with radial pins H' and journaled in boxes F', secured to the upper edges of the bars C C. The lengths of the radial pins or teeth are such relatively to the spaces between the adjacent cylinders in each series that the pins will clear the bodies of the cylinders as the latter revolve, but will overlap and pass each other, to which end the circumferential rows of pins on adjacent cylinders are arranged out of line with each other, the circumferential rows on alternate cylinders being in line with each other, as shown in Figs. 3 and 4. In said views the alternate cylinders, beginning with the one at the right hand end, are shown provided with six circumferential rows of pins, while the intermediate cylinders have five rows. In the actual machine, however, the cylinders are preferably provided with double or treble this number of rows of pins, a less number being shown in the drawings for convenience of illustration and to avoid confusion owing to the comparatively small scale of said drawings.

Secured at their opposite ends in the horizontal bars B B are a series of transverse bars I, to which are secured the lower ends of a series of vertical supports J, consisting of narrow strips or plates having their upper ends bent to horizontal position to form flat supporting-surfaces. Resting upon and secured to the upper ends of these supports J are a series of narrow metal strips K, extending longitudinally of the machine from one end to the other of the series of cylinders G, Fig. 4, and secured at their extreme rear ends to one of the cross-bars of the framework. As seen in Fig. 4, there is one of the longitudinal strips K between each two longitudinal rows of the pins H upon the cylinders G, and also two side strips along the outer rows of pins at the ends of the cylinders. The supports J for the strips K are of substantially the same width as the strips and extend upward between the longitudinal rows of pins upon the cylinders and between the two outer longitudinal rows and the side frames of the machine, and the adjacent longitudinal rows of supports J and the strips K, carried by them, are separated by narrow slits of sufficient width to permit the free passage of the pins as the cylinders revolve, but to otherwise form, as nearly as may be, a closed platform above said cylinders, such platform constituting the bottom of the tapered passage E referred to, Fig. 4. The inclined longitudinal bars D D above the bars C C, which support the upper series of cylinders, have likewise secured in them cross-bars I', which have secured to them the upper ends of inverted supports J', which correspond to the supports J above described, and which have secured to their lower ends longitudinal strips K', corresponding to the strips K and arranged relatively to and coöperating with the cylinders G' and their pins H' in the same manner as the strips K in respect to the cylinders G and their pins H in the lower series. This upper series of strips K' forms the inclined top of the tapered passage E. The open spaces of the framework at the opposite sides of the passage E will be closed by suitable side pieces. (Omitted from the drawings in order to expose the parts within them.)

The cylinders in each series are driven at a gradually-increasing speed from the right-hand or inlet end of the machine to its left-hand or discharging end. The extreme right-hand cylinder in each series is driven at a very low rate of speed, preferably not exceeding ten revolutions per hour, and the succeeding cylinders at the left are driven at a regularly-increasing rate of speed, each cylinder being preferably driven about one-third faster than the adjacent cylinder in rear (to the right) of it, with the result that while the cylinders at the right-hand or inlet end of the machine make only a few revolutions per hour those at the left-hand or discharging end make a considerable number of revolutions per minute, depending upon the number of cylinders employed in the series and the rate of increase in their speed.

The cylinders may be driven in the above-described manner by any suitable driving means and connections. In the machine shown in the drawings the adjacent cylinders are geared to each other by sprocket chains and wheels, each cylinder, as shown in Figs. 3 and 4, having a sprocket-wheel L fast upon one projecting end of its spindle or journal outside the side frame of the machine and a smaller sprocket M fast upon the opposite projecting end of its spindle, and the positions of the large and small sprockets are reversed on adjacent cylinders in each series, so that the large sprockets are upon the spindles of the alternate cylinders and the small sprockets upon the spindles of the intermediate cylinders at each side of the machine.

Short endless sprocket-chains N, passing around the sprocket-wheels of the adjacent cylinders at each end of the latter, gear them together. The sprocket-chains N are shown in Figs. 3 and 4, but omitted from Fig. 1 to prevent confusion. If the driving power were applied at the extreme rear end of the machine to the right-hand cylinders in each series, the large sprockets would constitute the driving-sprockets throughout the series and the small ones the driven sprockets, and the two sets of sprockets are of such size relatively to each other as to produce the desired increase in the rate of speed of the cylinders. I prefer, however, to apply the driving power at a point near the middle of each series of cylinders and to drive both ways from such point, in which event the small sprockets on the cylinders at the right or in rear of the driving-point constitute the driving-sprockets and the large ones the driven sprockets. In the present instance one end of the spindle of the cylinder at O in the upper series, Fig. 1, is shown extended and having mounted upon it a fast pulley P and a loose pulley Q, Fig. 3, over which passes a shifting belt from a counter-shaft. The spindle of this cylinder also has fast upon it a gear R, which meshes with a gear S, fast upon the spindle of the cylinder immediately beneath it in the lower series, and by this means the two series of cylinders are driven in the manner described.

The parts which have been explained constitute the essential portion of the bale-reducing apparatus, whose operation may be briefly described as follows: The ordinary commercial bales of excelsior are forty-eight inches in length by twenty-two inches in width and eighteen inches in height or thickness, and, as before stated, the side frames of the apparatus above described are located about twenty inches apart, while the open right-hand end of the passage E between the two series of cylinders is about twenty-four inches in height. The inlet end of the passage E is therefore of proper size to freely admit one end of a bale of excelsior when the latter is placed upon its edge and pressed into the passage. Immediately at the right of the open end of the passage E is located a table or platform, whose upper surface is flush with and forms a continuation of the lower platform K or bottom of the passage E, upon which table the bale of excelsior rests as it is being fed into the machine, Fig. 6. The bale may be fed into the machine by pressure applied upon it by an attendant; but I prefer to employ automatic means for feeding a series of bales into the machine without the constant employment of an attendant for the purpose, which means will be hereinafter described. As the forward end of the bale is pressed into the open end of the passage E its lower edge will rest upon the bottom K of the passage, while its upper edge will contact with the inclined top K′ thereof, and the teeth H of the end cylinder G in the lower series will act upon its lower forward corner, while the teeth H′ of the end cylinder G′ in the upper series will act upon its upper corner. The revolution of these cylinders, with their teeth acting upon the front end of the bale, will disintegrate the latter at its upper and lower forward corners and permit it to farther advance into the passage, so that the second cylinders in the two series may come into play upon it, and as the action of the four cylinders continues upon it it will be further disintegrated and permitted to farther enter the passage, so that additional cylinders in each series will, pair by pair, come into action upon it, and as the material in the front end of the bale becomes gradually loosened and disconnected from the compressed body of the bale the succeeding cylinders will act upon it more and more rapidly, until it is finally reduced to a thin layer or mat as it is delivered from the forward discharging end of the apparatus, the gradually-increasing speed of the cylinders being such that the ones at the discharging end of the machine will operate to deliver the material from the machine in the form of this thin layer as fast as it is fed into the machine in the form in the compressed bales and disintegrated by the slower-running cylinders toward the rear of the machine.

The automatic means which I have provided for feeding the bales of excelsior to the bale-reducing apparatus is shown in Fig. 6, where it will be seen that supported upon a suitable framework in rear of the main frame of the machine heretofore described is a table or platform K^5, forming a rearward continuation of the platform K, constituting the bottom of the bale-passage E. The upper surface of the platform K^5 at its forward end is flush with the upper surface of the platform K, so as to permit the bales of excelsior placed upon the platform K^5 to be freely slid forward from the same onto the platform K. In rear of this point of junction between the two platforms the platform K^5 may be either horizontal or be slightly inclined upward and rearward, as shown, to facilitate the movement of the bales upon it. Journaled in bearings upon the framework beneath and in rear of the front end of the platform K^5 is a shaft K^6, which has fast upon its opposite ends two grooved wheels K^7. Also journaled in bearings upon the framework at the rear end of the platform K^5 is a second shaft K^8, having fast upon its opposite ends two like-grooved wheels K^9. Passing around each pair of wheels K^7 K^9, at the opposite sides of the machine, is an endless belt, chain, or rope K^{10}. Fast upon one end of the forward shaft K^6 is a sprocket-wheel K^{11}, around which passes a chain K^{12}, which also passes around a smaller sprocket fast upon the outer end of the spindle of the extreme rear cylinder in the lower series G, by means of which connection the shaft K^6 is driven in a forward direction, causing the wheels K^7 K^9 to carry the ropes K^{10} in the direction of the arrow.

The bales of excelsior K[13] are placed upon the platform K[5] in series, one immediately behind the other, and are guided in their forward movement along said platform and held from displacement by side rails K[14], secured to the framework. Detachably connected at its opposite ends to the endless ropes K[10] is a cross-bar K[15], which rests and travels at its opposite ends upon the upper surfaces of the guide-rails K[14] as the ropes K[10] move forward. Under this construction and arrangement of parts the operation of the feeding mechanism may be briefly described as follows: At the beginning of operations the platform K[5] is filled with bales K[13] in series one after another and abutting against each other at their adjacent ends, and the cross-bar K[15] is slipped forward along the ropes K[10] until it abuts against the rear end of the rearmost bale K[13] and in that position is fastened at its opposite ends to the ropes K[10]. Upon now starting the machine the series of bales K[13] will be slowly carried forward along the platform K[5] by the bar K[15] and the front end of the foremost bale forced into the rear end of the bale-passage E into position for the end cylinder of the upper and lower series to act upon it, as heretofore described. The proportions and adjustments of the parts are such that the bales will be carried forward at the proper rate of speed to be disposed of by the toothed cylinders. When the rearmost bale in the series upon the platform K[5] has been advanced until its forward end enters the bale-reducing passage E, the cross-bar K[15] will be detached at its opposite ends from the ropes K[10], either with or without stopping the machine, (the movement of the ropes being exceedingly slow,) and be moved rearward to the rear end of the platform K[5] and the latter be filled with another series of bales and the bar K[15] be then slipped forward against the rear end of the rearmost bale and reconnected to the ropes K[10], whereupon the operation will proceed as before. Any suitable means may be employed for detachably connecting the opposite ends of the bar K[15] to the ropes K[10], and no specific means need be illustrated or described. If desired, a suitable signaling device may be located near the forward end of the platform K[5] in position to be sounded by the bar K[15] as the latter approaches the forward end of the platform K[5] to indicate that the supply of bales upon the platform is about exhausted.

In the present instance there are shown located at the discharging end of the bale-reducing apparatus above described a series of sets or pairs of supplemental toothed cylinders G″, Fig. 1, corresponding to the cylinders G and G′ of the main series. These supplemental cylinders G″ are arranged in separate vertical pairs, the two cylinders of each pair being journaled in vertical posts or standards T, provided at their lower ends with feet, which are bolted to horizontal bars of the side frames of the machine. The two standards supporting each pair of cylinders are connected immediately below the lower cylinder by a cross-bar U and immediately above the upper cylinder by a second cross-bar V, Figs. 1 and 3. The lower one, U, of these two cross-bars serves to support a series of narrow metal strips W, Figs. 1 and 4, which are bent around the cylinders G″ to the shape shown, and whose horizontal upper surfaces form continuations of the longitudinal strips K, constituting the bottom passage between the two series of cylinders G and G′, Fig. 4. The upper cross-bar V serves to support similar metal strips W′, Figs. 1 and 3, whose flat lower sides form continuations of the inclined top strips K′ of the passage E between the cylinders. The layer of excelsior delivered by the cylinders G and G′ at the discharging end of the apparatus therefore passes on between the two supplemental series of cylinders G″, which further act upon it before it is finally delivered to the feed-apron to be carried to the pad-forming portion of the apparatus hereinafter described. The cylinders G″ are driven one from another and the rearmost one from the adjacent end cylinders G or G′ by sprocket chains and wheels, as in the case of the cylinders of the main series, but in this instance at a uniform speed with the two end cylinders G and G′. The pairs of supplemental cylinders G″ are entirely independent of each other, and one or more or all of them may be removed by simply loosening the bolts which fasten them to the framework. The principal purpose of these supplemental pairs of cylinders is to provide means for narrowing the layer of excelsior more or less as it is discharged from the bale-reducing apparatus, to which end said supplemental pairs of cylinders are provided with converging guideways acting upon the opposite edges of the layer of excelsior, which have the effect to narrow the latter to a greater or less degree, according as all or only part of the series of pairs be employed. This feature of the machine, however, relates to the provision of means by which pads of varying width may be formed upon the same machine, and as the novelty of my machine does not depend upon the means employed for this purpose either at this or at other points in the machine and inasmuch as the essential features of my invention may be fully explained without further reference to this feature of the machine no detailed illustration of the supplemental cylinders G″ and the converging guides referred to need be given, and it may be assumed that the layer of excelsior passes between the cylinders G″ in the same condition as when it issues from between the end cylinders of the series G and G″.

Bolted to the upper edge of the side frames of the machine immediately in front (at the left) of the supplemental cylinders G″ is a frame X, Fig. 2, in whose opposite ends are journaled two rollers X′ X″, around which is

passed an endless apron Y, Figs. 3, 4, and 5. Upon the projecting end of the spindle of one of the rollers (in this instance the forward one, X′) is secured a pulley Y′, around which passes a belt leading from a counter-shaft, (not shown,) by means of which the apron Y is driven. The rear end of the apron Y is immediately in front of and beneath the discharge-opening from the cylinders G″, so that the layer of excelsior will be delivered by said cylinders upon said apron, and thence carried on forward by the apron. Also journaled in the frame X immediately beneath the apron-roller X″ is an idle-roller Z′, over which passes a strip or web of paper Z, led from a roll Z″, suitably mounted in the framework, as shown in Fig. 1. From the roller Z′ the paper Z passes forward beneath the lower side of the apron Y and immediately above and upon a horizontal platform A′, mounted upon the framework. The left-hand forward end of the platform A′ terminates immediately in rear of the entrance between a pair of rollers B′ C′, mounted in standards D′ upon the framework, Fig. 2. The two rollers B′ C′ are geared together at their right-hand ends, and the lower roller is driven through the medium of a pair of beveled pinions by a shaft E′, mounted in suitable bearings upon the side of the framework and driven from a counter-shaft by a belt passing around a small pulley E″, fast upon the shaft E′.

In case any of the pairs of supplemental cylinders G″ be removed the frame X, carrying the apron Y and rollers X′, X″, and Z′ will be unbolted from the framework and moved rearward until the rear end of the apron stands immediately in front of the forward pair of cylinders G″ left in the machine, so that such cylinders will properly deliver the layer of excelsior upon the apron. In such adjustment of the frame X the feet at its rear end by which it is bolted to the framework will occupy the positions upon the frame vacated by the feet of the standards T of the rearmost pairs of cylinders which were removed.

The layer of excelsior delivered upon the apron Y by the bale-reducing apparatus is in turn delivered by the apron at its forward end upon the paper strip Z as the latter passes from beneath the apron and forward over the platform A′. The paper Z, with the layer of excelsior upon it, passes on forward between the rollers B′ C′. Suspended in a yoke L′, loosely hung at its upper end in a vertical frame M′, projecting from the main framework, is a second roll of paper N′, which is led downward from the forward side of the roll over the rear side of the roller C′, and thence between the latter and the roller B′, the paper strip N′ thus resting upon the upper surface of the layer of excelsior, which in turn rests upon and is carried forward by the lower strip Z. The rollers B′ C′ do not abut against each other, but are separated a sufficient distance apart to permit the passage between them of the two strips of paper and the intermediate layer of excelsior without any considerable pressure upon them, these two rollers not being relied upon as the main feed-rollers for drawing forward the strips of paper and layer of excelsior, but having more or less feeding action upon them, as may be desirable.

The lower strip of paper Z is wider than the upper strip N′. In the machine illustrated it may be assumed that the lower strip Z is approximately twenty inches in width and that the layer of excelsior delivered upon it is eighteen inches in width. This will leave the lower strip of paper projecting at its opposite edges one inch beyond the layer of excelsior and the upper strip N′, and the next step in the formation of the pad after the two strips of paper and intermediate layer of excelsior emerge from the forward side of the rollers B′ C′ is to turn such projecting edges of the lower strip of paper upward and over upon the edges of the upper strip preparatory to pasting the two together to inclose the layer of excelsior between them. This turning of the edges of the lower strip over upon the edges of the upper strip is effected by what I term the "forming" devices, the first element of which consists of a horizontal sheet-metal plate or platform O′, Figs. 2 and 5, secured to the upper edge of the framework in the same horizontal plane as the platform A′ and the passage between the rollers B′ C′ and having its opposite edges turned upward very gradually from its rear end toward its forward end and bent over inward above the horizontal bottom or body of the plate. The left-hand edge or side of this former-plate O′ is shown projecting above the framework in Fig. 2, while a top plan view of it is shown in Fig. 5. It extends longitudinally of the machine from a point immediately in front of the rollers B′ C′ to a point adjacent the cutting mechanism at the extreme forward end of the machine, and its opposite edges are curved gradually upward and inward all the way from its rear end to its front end, so that the guideways formed by them for bending the edges of the lower strip of paper upward and over upon the upper strip of paper act upon the edges of such lower strip very gradually and serve to direct the edges of the paper as desired without danger of the paper buckling up or becoming mutilated.

In their forward travel over the former-plate O′ the strips of paper and intermediate layer of excelsior pass beneath a longitudinal plate P′, supported at its opposite ends by cross-bars Q′, carried by posts or standards R′, projecting vertically from the framework, Figs. 2 and 5. This plate P′ is supported at such distance above the plate O′ as to leave sufficient space between them for the passage of the paper strips and intermediate layer of excelsior, and the plate P′ serves to hold the paper and excelsior in flat and smooth condition as they travel forward over the plate O′.

Hinged or otherwise loosely connected to the extreme forward end of the plate P′ at *a*, Fig. 2, is the rear end of what may be termed the "inner floating former," which consists of a thin plate T′ of approximately the same width as the layer of excelsior and upper strip of paper and of gradually-reduced thickness from its rear to its forward end. This plate T′ is supported at its rear end only, and at its forward end rests upon the upper strip of paper, and its opposite edges fit beneath the upwardly and inwardly turned edges of the outside former-plate O′ and consequently beneath the upwardly and inwardly turned edges of the lower strip of paper, whose edges fit within and against the inner surface of the edges of the former-plate O′.

The operations above described complete the pad with the exception of pressing the inturned edges of the lower strip of paper firmly down upon the edges of the upper strip of paper and pasting them together. As the strips leave the forward end of the forming devices above described they pass between a pair of feed and pressure rollers, hereinafter described, which serve to firmly press the inturned edges of the lower strip down upon the edges of the upper strip. The two strips of paper may be secured together at their edges in any desired manner—as, for instance, by sewing them together by means of suitable sewing mechanism located in advance of the pair of feed and pressure rollers above referred to; but the usual practice is to paste them together, and I have shown and will describe novel means for that purpose. Heretofore the paste or glue has been applied to the upper surface of the upper strip near its outer edges and beneath the inturned edges of the lower strip by suitably-arranged discharging-spouts from a glue pot or reservoir supported in proper position above the strips. In my new machine, however, I provide means for applying the glue between the strips by directing a glue-carrying thread between the inturned edge of the lower strip and the surface of the upper strip, at each side of the latter. As shown in Fig. 2, there is supported between the forward set of posts R′ upon the framework a glue receptacle or reservoir A^3, which is of sufficient length to extend transversely across the machine, Fig. 5. Mounted upon a spindle supported at its opposite ends in brackets B^3, projecting rearward from the upper ends of the posts R′, are two spools of thread C^3, one spool being located near each end of the spindle upon which they are mounted. Journaled in the glue-reservoir A^3, near the bottom thereof and extending its full length, is a roller D^3, while mounted upon a spindle supported at its opposite ends in brackets E^3, projecting forward from the posts Q′, is a second roller F^3, or instead of one long roller there may be employed two short rollers or grooved wheels adjacent each bracket E^3 at the opposite sides of the machine. The threads G^3 from the spool C^3 pass downward through the glue within the reservoir A^3 and beneath the roller D^3 therein, and thence upward over the roller F^3, and thence forward and downward into the spaces between the inturned edges of the lower strip of paper and the upper surface of the opposite edges of the upper strip. As the strips pass between the pressure-rollers above referred to and the edges of the lower strip are pressed firmly down upon the upper strip, with the glued thread between them, they will be securely pasted together by the glue upon the thread. The operation of the feed and pressure rollers in drawing the strips forward and pressing the edges of the lower strip downward upon the upper strip serves to draw forward the threads G^3 from the spools C^3 and gluing apparatus as the strips themselves are advanced.

The novel means for applying the glue above described is not only simple and efficient, but it overcomes the difficulties which have heretofore been encountered in applying the glue between the edges of the strips by means of curved discharging-spouts from a glue-can. The quantity of glue to be delivered between the edges of the strips is comparatively small, so that the delivery-passages of the spouts must be of corresponding size, owing to which fact and to the shape and length which it is necessary to give them they frequently become clogged unless the glue and spouts are kept very warm.

It is also desirable in wide pads of this character to secure the upper and lower strips of paper and the intermediate layer of excelsior together along their longitudinal middle line, to which end there is shown in Fig. 2 a glue can or reservoir H^3, supported in the frame M′ and provided with a delivery-spout or faucet I^3, from which a stream of glue is delivered upon the upper surface of the layer of excelsior resting upon the lower paper strip Z as they pass over the platform A′. Part of this stream of glue will pass through the excelsior to the lower strip and part will remain upon the upper surface of the excelsior and come in contact with the upper strip of paper N′ as the strips pass between the rollers B′ C′, and when the three are passed between the feed and pressure rollers they will be firmly secured together along their middle line.

The combined pressure and feed rollers heretofore referred to by which the continuous pad is drawn forward through the machine and the edges of the lower strip pressed down upon the upper strip are best shown in Figs. 7, 8, 9, and 10. The lower roller K^3, Fig. 8, has fast upon the left-hand end of its spindle, Figs. 7 and 9, a beveled gear L^3, with which meshes a beveled pinion M^3, fast upon the front end of the driving-shaft E′, heretofore described, Fig. 2. The upper roller N^3 of the pair, Figs. 7 and 8, has its journals mounted in vertically-movable boxes fitting in frames O^3, Figs. 7 and 8, forming part of castings P^3, mounted upon the side frames of the

machine. Coiled springs Q^3, confined in the frames O^3 and bearing at their lower ends upon the vertically-movable journal-boxes, press the latter downward and yieldingly hold the roller N^3 in its lowermost position, in which position there is sufficient space between the two rollers to permit the passage between them of the pad formed of the two strips of paper and intermediate layer of excelsior. The above-described mounting of the roller N^3 is provided for the purpose of enabling the roller to yield not only to accommodate any inequalities in the pad, but also to accommodate pads of different thicknesses, it being intended by the employment of means which need not be described to use the same machine for forming pads of different thicknesses.

The two rollers K^3 N^3 are geared together by the following train of gears, reference being had to Figs. 7 and 8: There is fast upon the right-hand end of the spindle of the roller K^3 a gear R^3, dotted lines, Figs. 7 and 8, which meshes with a gear S^3, journaled upon the end of an arm T^3, hung upon the spindle of the roller K^3, the outer end of which arm T^3 is connected by a link U^3 to the outer end of a similar arm V^3, hung upon the spindle of the upper roller N^3, which arm V^3 carries a gear W^3, which meshes with a gear X^3, fast upon the spindle of the roller N^3. Under this construction and arrangement of parts the rollers K^3 and N^3 remain in gear with each other notwithstanding the vertical movements of the roller N^3.

Located immediately in front of the rollers K^3 N^3 and upon opposite sides of the passage between said rollers are two small rollers A^4 B^4, Figs. 8 and 10, which receive the pad as it is delivered by the rollers K^3 N^3 and support it immediately adjacent the horizontal discharge-opening C^4, between the transverse front plates D^4 E^4, and direct it into said opening. The lower roller B^4 is journaled in fixed bearings and has fast upon the left-hand end of its spindle a pinion F^4, Figs. 7 and 9, which meshes with a pinion G^4, mounted upon a stud projecting from the framework and in turn meshing with a gear H^4, fast upon the spindle of the lower roller K^3 at the right of the beveled gear L^3, Fig. 9, by which means the lower roller B^4 is driven. The upper roller A^4 has the ends of its spindle journaled in the lower forward ends of two arms I^4, hung upon the opposite ends of the spindle of the upper roller N^3, Figs. 7 and 10. At its left-hand end, (right-hand end in Fig. 10,) between the framework and the arm I^4, the spindle of the roller A^4 has fast upon it a pinion J^4, which meshes with a second pinion K^4, mounted upon the arm I^4, Fig. 7, which pinion K^4 meshes with a gear-wheel L^4, fast upon the spindle of the upper roller N^3 and corresponding to the gear H^4 upon the spindle of the lower roller K^3, heretofore described. The roller A^4 is pressed downward toward the roller B^4 by coiled springs M^4, confined above it, Figs. 7 and 8, and bearing at their lower ends upon suitable vertically-movable boxes surrounding the spindle of the roller. In this manner the roller A^4 is driven by the roller N^3 and moves vertically with the latter, while the roller B^4 is driven in fixed position by the lower roller K^3.

The forward side of the upper plate D^4, above the horizontal discharge-opening C^4, Fig. 8, forms the shearing-face for the vertically-reciprocating knife N^4, Figs. 8, 9, and 10, which knife is secured at its opposite ends to slides O^4 O^4, mounted in vertical ways in a frame P^4, in which latter the transverse plates or bars D^4 E^4 are secured, Fig. 10.

The means for operating the knife N^4 and regulating its operation to cut the continuous pad delivered by the machine into pads of the different lengths desired may be next described. Each of the slides has projecting outwardly from it a trunnion Q^4, Fig. 10, to which trunnions are connected the upper ends of links R^4, whose lower ends are connected to the lower forward ends of levers S^4, which levers are rigidly secured at their upper ends to the opposite ends of a rock-shaft T^4, extending transversely beneath the rollers above described and journaled at its opposite ends in boxes secured upon the framework of the machine. Mounted in rear of the rock-shaft T^4 is a second rock-shaft U^4, which has fast upon its opposite ends forwardly-extending arms or levers V^4, Figs. 7 and 8, which have formed upon their extreme front ends gear-toothed sectors W^4, which mesh with corresponding sectors X^4, fast upon the extreme outer ends of the forward rock-shaft T^4, Figs. 7, 8, 9, and 10. Fast upon the rock-shaft U^4 at its left-hand end, and in this instance formed integral with the left-hand lever V^4, is a depending arm or lever Y^4, Figs. 2 and 7, to whose lower end is connected the forward end of a link Z^4, whose rear end is connected to the lower end of the vertical arm of a bell-crank lever A^5, which is fulcrumed upon the framework of the machine at B^5, and whose horizontal arm carries at its rear end a roller fitting in a cam-groove C^5 formed in the inner face of a disk D^5, fast upon a spindle E^5, extending transversely across the machine and journaled at its opposite ends in the side frames thereof, Figs. 2, 5, and 5^a. The rotation of the cam-disk D^5 will serve to rock the bell-crank lever A^5 and through the connection of the latter with the knife N^4 serve to reciprocate said knife vertically across the discharge-opening C^4 between the plates D^4 and E^4 and shear off the pad against the lower edge of the plate D^4. The spindle E^5, which carries the cam-disk D^5, has fast upon it between the side frames of the machine a cone F^5, Fig. 5^a, and located by the side of this cone in reverse position is a second cone G^5, fast upon a spindle journaled in the side frames of the machine and having fast upon its extreme left-hand end a beveled pinion H^5, which meshes with a corresponding beveled

pinion fast upon the lower end of a vertical spindle journaled in a box I^5 upon the framework and having fast upon its upper end a beveled gear J^5, meshing with a beveled pinion K^5, fast upon the driving-shaft E', heretofore described, Figs. 2 and 5. The driving connection between the cones F^5 and G^5 consists of an endless leather belt L^5, surrounding the cone F^5 and adjustable longitudinally of the latter by a shifter M^5, operated by a screw-shaft N^5, journaled in the opposite side frames of the machine parallel with the opening between the cones F^5 and G^5 and operated by a hand-wheel O^5 upon its left-hand end. The shifter M^5 is provided at its forward end with a pointer coöperating with a scale upon a rod P^5, secured in the framework parallel with and adjacent to the screw-shaft N^5.

The foregoing construction and arrangement of parts constitute a well-known form of variable driving mechanism by which the speed of the driven cone F^5 and parts operated by it may be regulated as desired by shifting the belt L^5 in one direction or the other, the shifting of it toward the small end of the cone F^5 increasing the speed of the parts driven by such cone and the shifting of it in the opposite direction decreasing their speed. In the present instance the scale upon the rod P^5 will be such as to indicate different lengths of pads, so that by moving the shifter M^5 to position for its pointer to coöperate with any given point upon the scale the driving mechanism will be adjusted to cause the knife N^4 to be so operated as to cut pads of a length corresponding to that indicated by the pointer, as will be readily understood.

Having thus fully described my invention, I claim—

1. A bale-reducing apparatus of the character described, embodying two converging series of toothed cylinders and means for driving the cylinders at an increasing speed from the inlet toward the discharging end of the apparatus.

2. A bale-reducing apparatus of the character described, embodying two converging series of toothed cylinders, each cylinder being provided with a large sprocket-wheel and a small sprocket-wheel, sprocket-chains connecting the large sprocket of each cylinder with the small sprocket of the cylinder in front of it, and a suitable driving connection for the two series of cylinders.

3. A bale-reducing apparatus of the character described, embodying a longitudinal bale-passage having a top and bottom converging toward its forward end and provided with narrow longitudinal slots or open spaces, a series of toothed cylinders mounted beneath and parallel with the bottom of said passage and having their teeth projecting through its longitudinal slots, a second series of toothed cylinders mounted above and parallel with the top of said passage and having their teeth projecting through its longitudinal slots, and means for driving the cylinders in each series at an increasing speed from the inlet toward the discharging end of the apparatus.

4. A bale-reducing apparatus embodying two converging series of toothed cylinders and means for driving the cylinders in each series at an increasing speed from the inlet toward the discharging end of the apparatus, in combination with means for automatically feeding the bales in series to the inlet end of the apparatus.

5. A bale-reducing apparatus embodying two converging series of toothed cylinders and means for driving the cylinders in each series at an increasing speed from the inlet toward the discharging end of the apparatus, in combination with a platform extending rearward from the inlet end of the apparatus, endless ropes mounted upon pairs of wheels at each side of said platform and extending longitudinally thereof, means for driving said endless ropes, and a cross-bar adapted to have its opposite ends secured to said ropes above and at opposite sides of the platform and to cooperate in the manner described with the series of bales placed upon said platform.

6. A bale-reducing apparatus embodying a longitudinal bale-passage having a top and bottom converging toward its forward end and provided with narrow longitudinal slots or open spaces, a series of toothed cylinders mounted beneath and parallel with the bottom of said passage and having their teeth projecting through its longitudinal slots, a second series of toothed cylinders mounted above and parallel with the top of said passage and having their teeth projecting through its longitudinal slots, means for driving the cylinders in each series at an increasing rate of speed from the inlet toward the discharging end of the apparatus, in combination with a platform extending rearward from the inlet end of said apparatus and forming a continuation of the bottom of said bale-passage, two pairs of wheels mounted on opposite sides of said platform at its front and rear ends, an endless rope passing over each pair of wheels longitudinally of the platform, a pair of side rails or guards along the sides of said platform, a bar extending across the platform and resting at its opposite ends upon said side rails and adapted to be connected to the endless ropes, and means for driving said ropes.

7. A combined bale-reducing and pad-forming machine of the character described, composed of a bale-reducing apparatus receiving the compressed bale at one end and delivering its material in the form of a thin layer at its opposite end, means for supporting and drawing forward two strips of paper—a lower wider one led beneath the discharging end of the bale-reducing apparatus and receiving therefrom the thin layer of material reduced from the bales, and a second narrower strip led over the lower strip and the intermediate layer of material—means for folding the projecting edges of the lower strip upward and

inward upon the edges of the upper strip, means for supplying glue or paste between the edges of the two strips, and a pair of pressure-rollers located in advance of the above-described means and operating to draw forward the two strips of paper and intermediate layer of material and press the inturned edges of the lower strip firmly downward upon the edges of the upper strip.

8. A combined bale-reducing and pad-forming machine of the character described, composed of a bale-reducing apparatus receiving the compressed bale at one end and delivering its material in the form of a thin layer at its opposite end, means for supporting and drawing forward two strips of paper—a lower wider one led beneath the discharging end of the bale-reducing apparatus and receiving therefrom the thin layer of material reduced from the bales, and a second narrower strip led over the lower strip and the intermediate layer of material—means for folding the projecting edges of the lower strip upward and inward upon the edges of the upper strip, means for supplying glue or paste between the edges of the two strips, a pair of pressure-rollers located in advance of the above-described means and operating to draw forward the two strips of paper and intermediate layer of material and press the inturned edges of the lower strip firmly downward upon the edges of the upper strip, and an automatic cutting mechanism located in advance of the pressure-rollers for cutting the continuous pad into separate pieces.

9. In a pad-forming machine, the combination, with the forming devices operating to fold the projecting edges of the lower strip of paper over upon the edges of the upper strip, of a glue-reservoir, means for supporting two spools of thread and leading the threads therefrom through the glue in the glue-reservoir and thence between the inturned edges of the lower strip of paper and the surface of the upper strip, and a pair of pressure-rollers operating to press the inturned edges of the lower strip down upon the upper strip, with the glue-carrying threads between them, and to draw forward the threads with the pad as the latter is formed.

10. In a pad-forming machine, the combination, with the forming devices operating to fold the projecting edges of the lower strip of paper over upon the edges of the upper strip, of a glue-reservoir, a roller journaled therein, means for supporting spools of thread at one side of said reservoir and leading the threads therefrom into said reservoir and beneath the roller therein, another roller or rollers above and in advance of the reservoir and upward and over which the threads are led from the reservoir, and thence forward beneath the inturned edges of the lower strip of paper, and a pair of pressure-rollers operating to press the edges of such strip down upon the upper strip of paper, with the glue-carrying threads between them, and to draw forward the threads with the pad as the latter is formed.

11. In a pad-forming machine, the combination, with means for folding the projecting edges of the lower strip of paper over upon the edges of the upper strip and securing them thereto, and a pair of feed and pressure rollers for drawing forward the continuous pad and between which the pad passes, of a reciprocating knife for cutting the pad into separate pieces as it is delivered from the machine, power-operated driving mechanism for said knife, and adjusting devices in said driving mechanism for regulating the speed of the knife to cut the continuous pad into separate pieces of different lengths.

12. The combination of the frame A containing the longitudinal bars B B and the inclined bars C D located above the bars B B, the series of toothed cylinders G journaled in boxes upon the bars B B and the series of toothed cylinders G′ journaled in boxes upon the bars C C, the cross-bars I connecting the bars B B, vertical supports J carried by the bars I, the longitudinal strips K carried by the supports J and having between them the narrow longitudinal spaces through which project the teeth of the cylinders G, the cross-bars I′ connecting the bars D D, the supports J′ depending from the bars I′, the longitudinal strips K′ secured to the lower ends of the supports J′ and having between them the narrow longitudinal spaces through which project the teeth of the cylinders G′, and means for driving the cylinders G and G′ at an increasing speed from the rear toward the forward end of the series.

13. The combination of the frame A containing the longitudinal bars B B and the inclined bars C D located above the bars B B, the series of toothed cylinders G journaled in boxes upon the bars B B and the series of toothed cylinders G′ journaled in boxes upon the bars C C, the cross-bars I connecting the bars B B, vertical supports J carried by the supports I, the longitudinal strips K carried by the supports J and having between them the narrow longitudinal spaces through which project the teeth of the cylinders G, the cross-bars I′ connecting the bars D D, the supports J′ depending from the bars I′, the longitudinal strips K′ secured to the lower ends of the supports J′ and having between them the narrow longitudinal spaces through which project the teeth of the cylinders G′, the large sprocket-wheel L and the small sprocket-wheel M fast upon each cylinder, the sprocket-chains N connecting the sprocket L of each cylinder with the sprocket M of the cylinder in front of it, and means for applying the driving power to one or more cylinders in each series.

14. The combination, with the bale-reducing apparatus embodying two converging series of toothed cylinders G and G′ and means for driving the same at an increasing speed from their rear toward their forward ends, of the platform K^5 extending rearward from the in-

let end of the passage between said series of cylinders, the wheels K^7 and K^9 mounted at the front and rear ends of said platform, at opposite sides of the same, the sprocket-wheel K^{11} turning with the wheel K^7, the sprocket-chain K^{12} passing over said sprocket-wheel and over a sprocket-wheel fast upon the rear-most cylinder G, the endless ropes K^{10} passing around the wheels K^7 K^9, the guide-rails K^{14} above and at opposite sides of the platform K^5, and the cross-bar K^{15} detachably connected to the ropes K^{10} and resting upon the rails K^{14}.

15. The combination of the former-plate O′ having the upwardly-curved and inturned opposite edges, the glue-reservoir A^3 supported above and across said former-plate in the frame Q′, the roller D^3 journaled in the reservoir A^3, the spools of thread C^3 mounted upon a spindle supported upon the frame Q′, the roller F^3 mounted in supports upon the frame at the opposite side, of the reservoir A^3—the threads G^3 being led from the spools C^3 downward into the reservoir A^3 and beneath the roller D^3, and thence upward over the roller F^3 and thence forward beneath the inturned edges of the lower strip of paper within the former-plate O′—and the pair of feed and pressure rollers K^3 N^3 located at the forward end of the former-plate O′ and operating to draw forward the strips and to press the inturned edges of the lower strip downward upon the upper strip with the glue-threads G^3 between them.

16. The combination, with the rollers K^3 N^3 for drawing forward the continuous pad, the cross-plates D^4 E^4 located in front of said rollers and provided with the discharge-openings C^4, the small rollers A^4 B^4 located between the plates D^4 E^4 and rollers K^3 N^3, for supporting the pad immediately adjacent the plates D^4 E^4, means for driving the rollers K^3 N^3 and the rollers A^4 B^4, the reciprocating knife M^4 carried by the slides O^4 mounted in vertical ways in the frame P^4, and driving mechanism for reciprocating said knife.

17. The combination of the reciprocating knife N^4, and a driving mechanism therefor having interposed in it the driving-cone G^5 and driven cone F^5, the endless belt L^5 intermediate said cones, the shifter M^5 for said belt, the screw-shaft N^5 for operating said shifter, the rod P^5, and the scale on the rod P^5 coöperating with the pointer on said shifter.

18. The combination of the rollers K^3 N^3, the latter journaled in vertically-movable spring-pressed boxes, suitable gearing intermediate said rollers, the plates D^4 E^4 having the passage C^4 between them, the rollers A^4 B^4 located between the plates D^4 E^4 and the rollers K^3 N^3, the roller B^4 being mounted in fixed bearings and geared to the roller K^3, and the roller A^4 being mounted in arms I^4 I^4 hung upon the spindle of the roller N^3 and geared to said roller, springs M^4 bearing upon vertically-movable boxes upon the spindle of the roller A^4, and the reciprocating knife N^4 cooperating with the plates D^4 E^4.

EDGAR J. STEWART.

Witnesses:
EDWARD RECTOR,
LEONORA WISEMAN.