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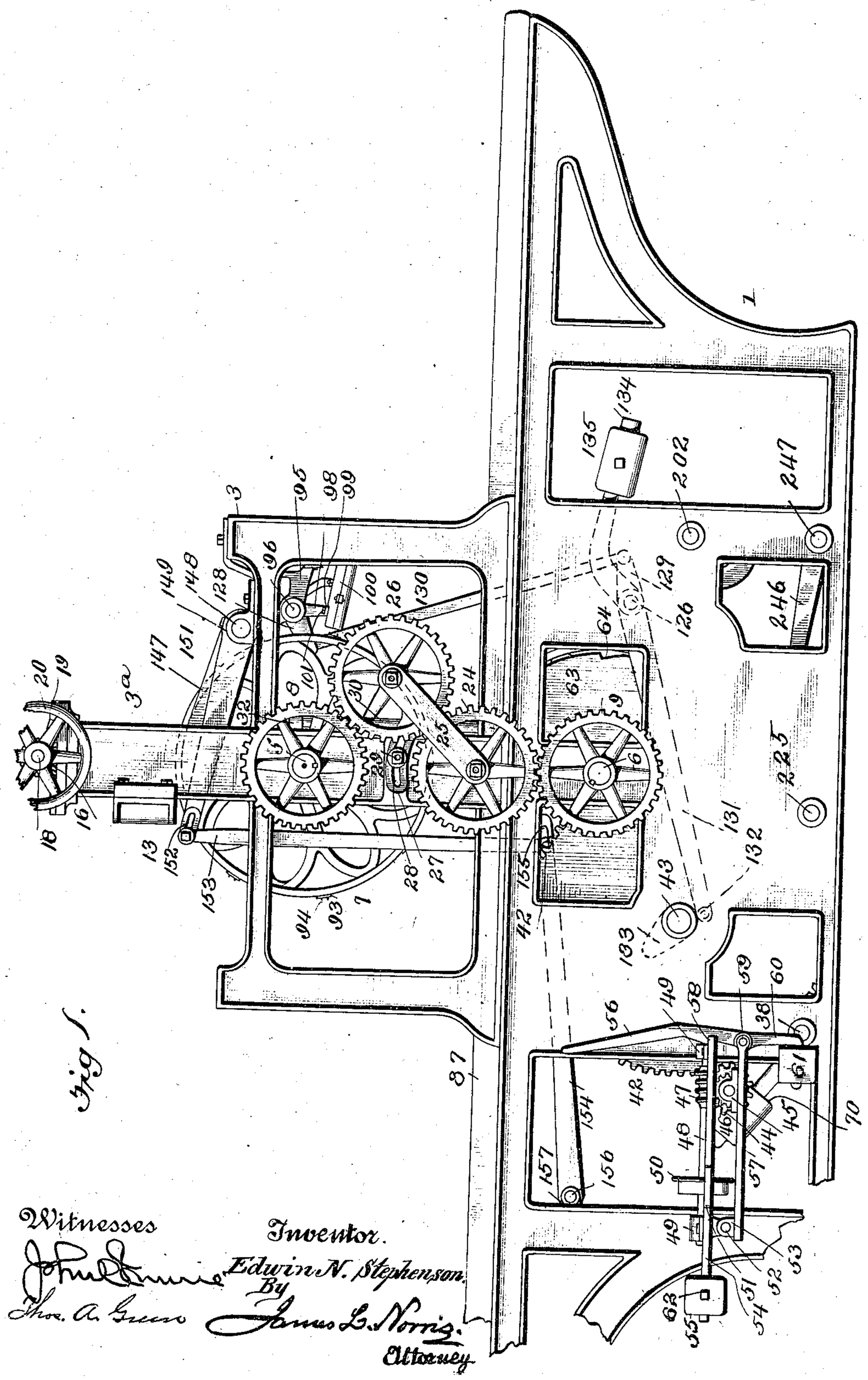
E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.



Witnesses
John L. Norris
Thos. A. Green

Inventor.
Edwin N. Stephenson.
By
James L. Norris.
Attorney

(No Model.) 16 Sheets—Sheet 2.

E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.

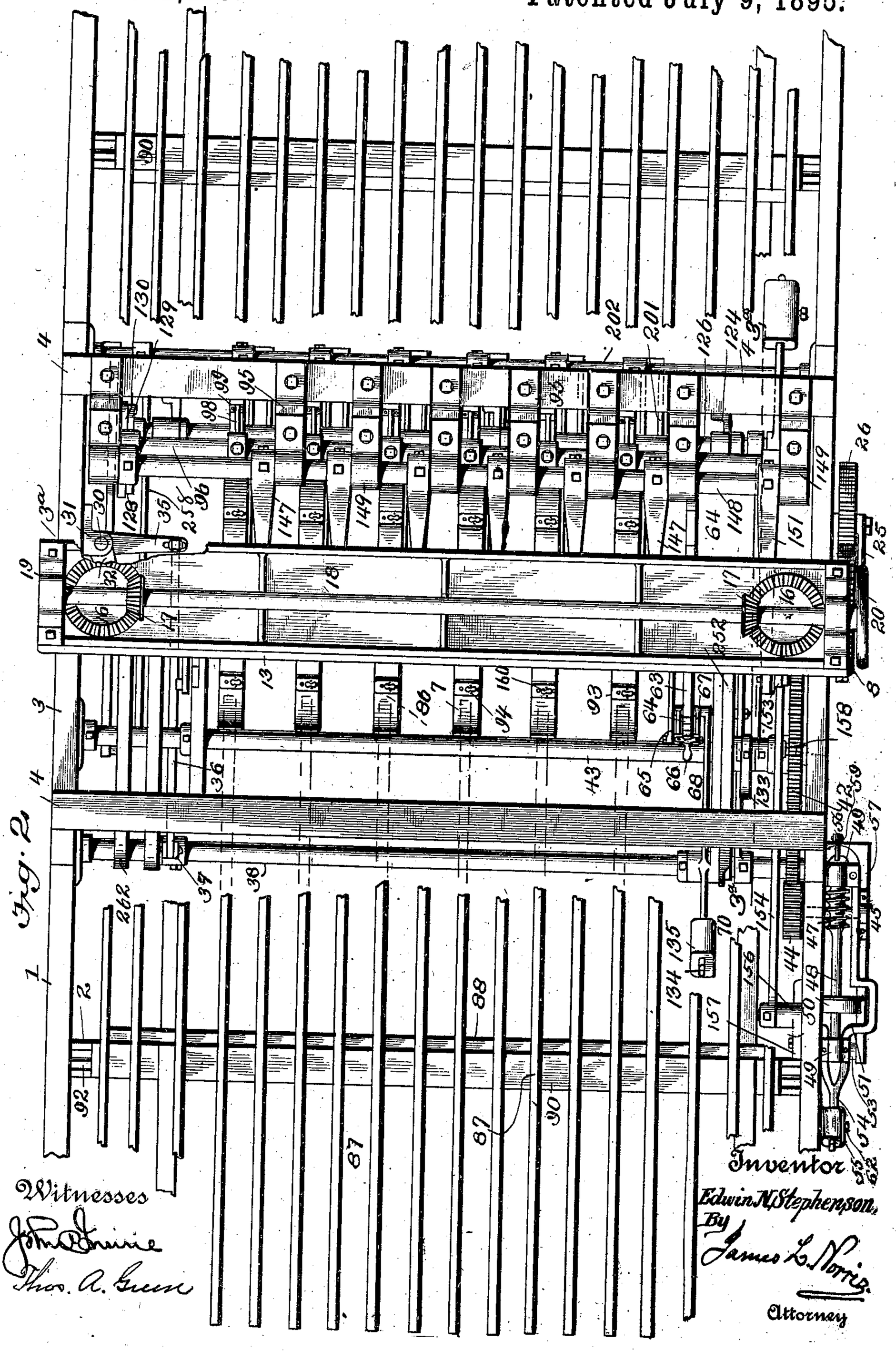


Fig. 2.

Witnesses
John L. Shuie
Thos. A. Green

Inventor
Edwin N. Stephenson,
By James L. Norris
Attorney

(No Model.)

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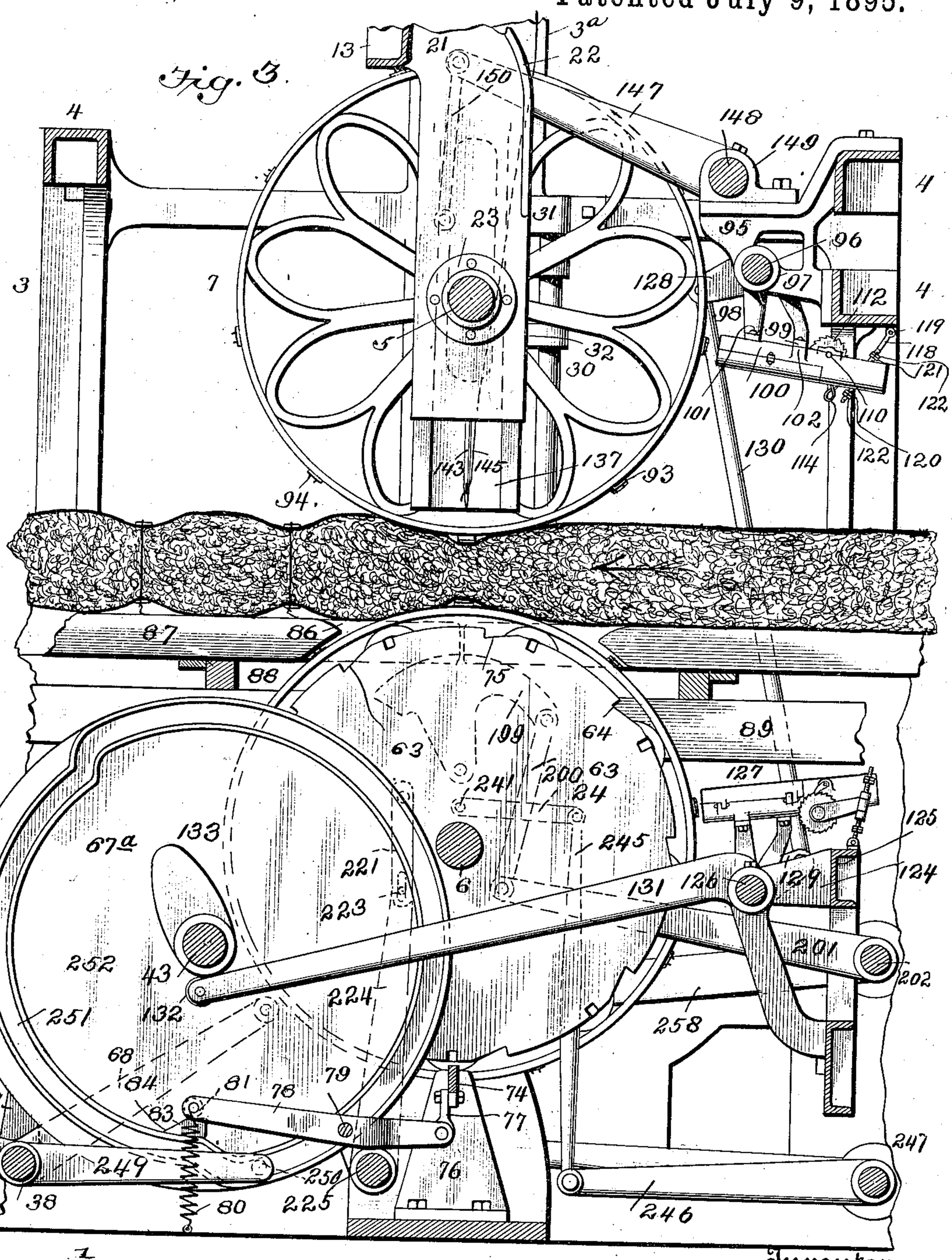
E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.

Fig. 3.



Witnesses
John Dawnie
Thos. A. Green

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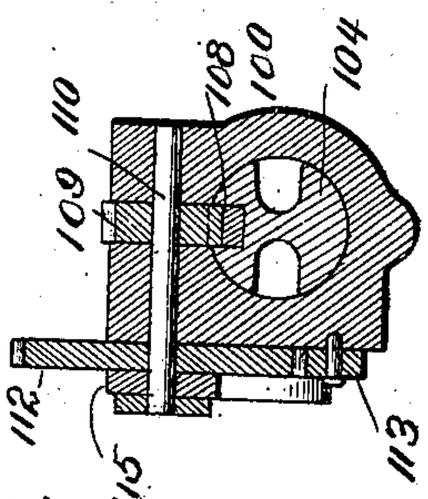
(No Model.) 16 Sheets—Sheet 4.

E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.

Fig. 6.



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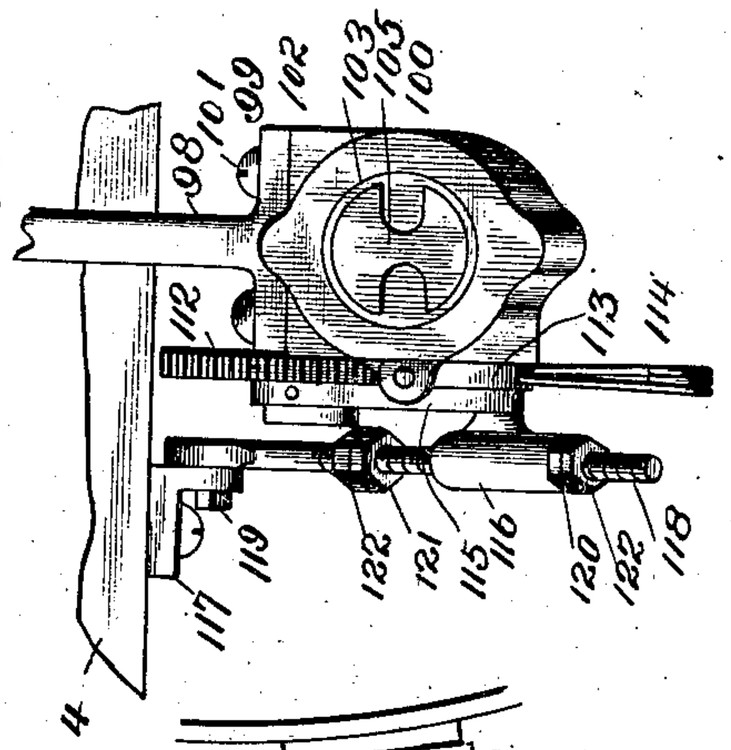

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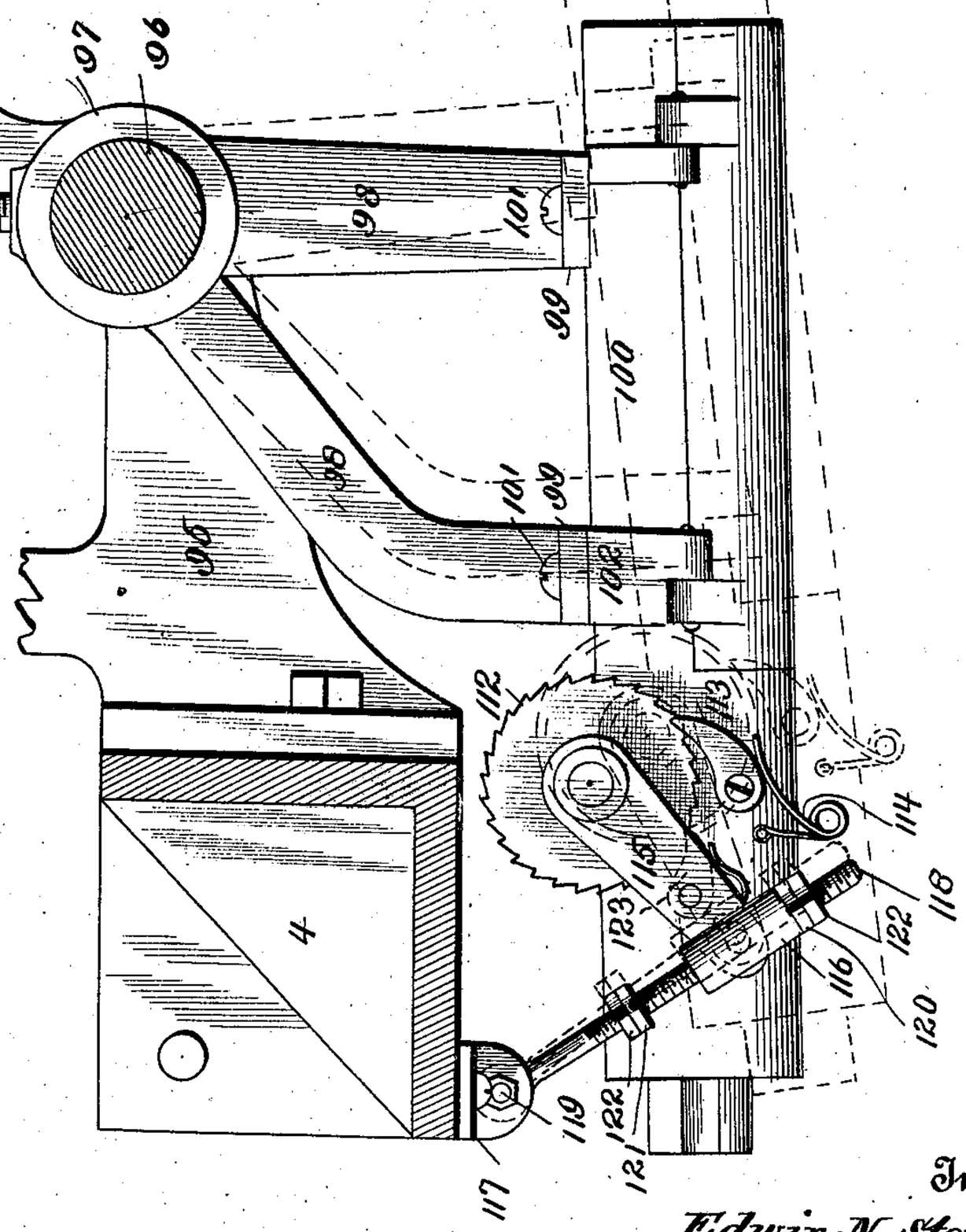

Witnesses
John W. Dennie
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Attorney

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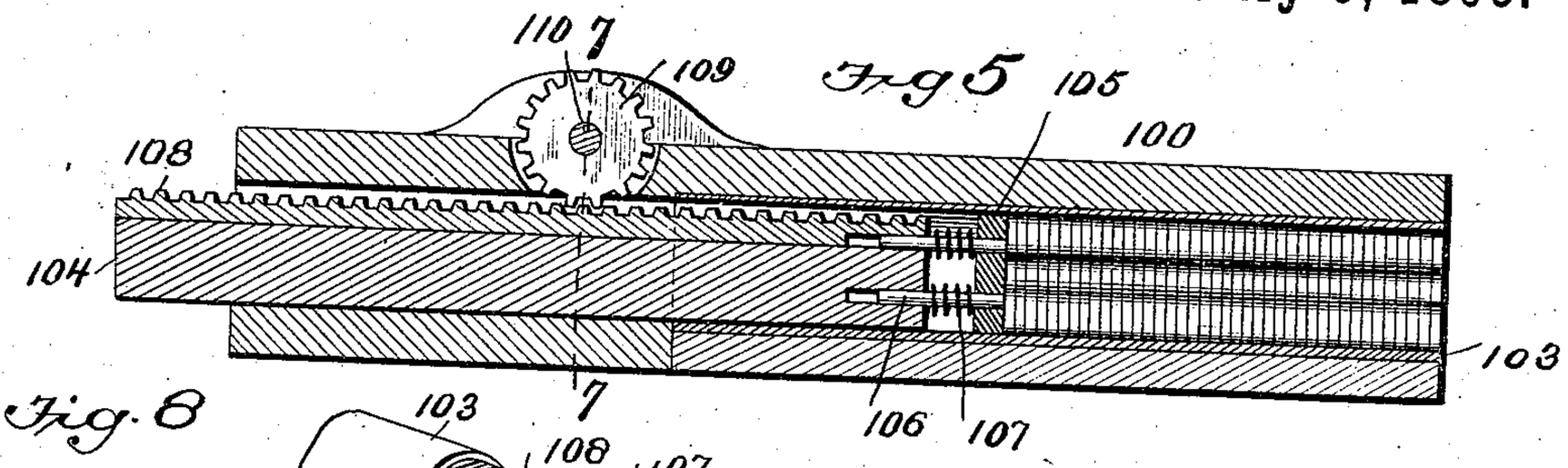
E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.

Fig 5



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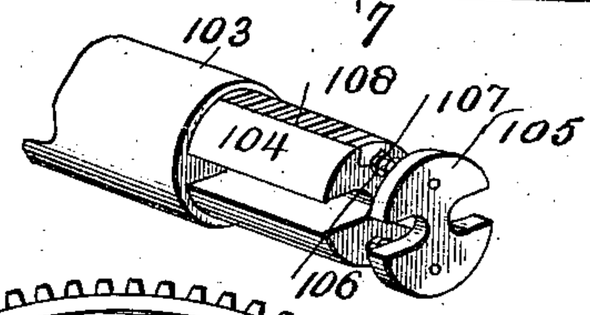

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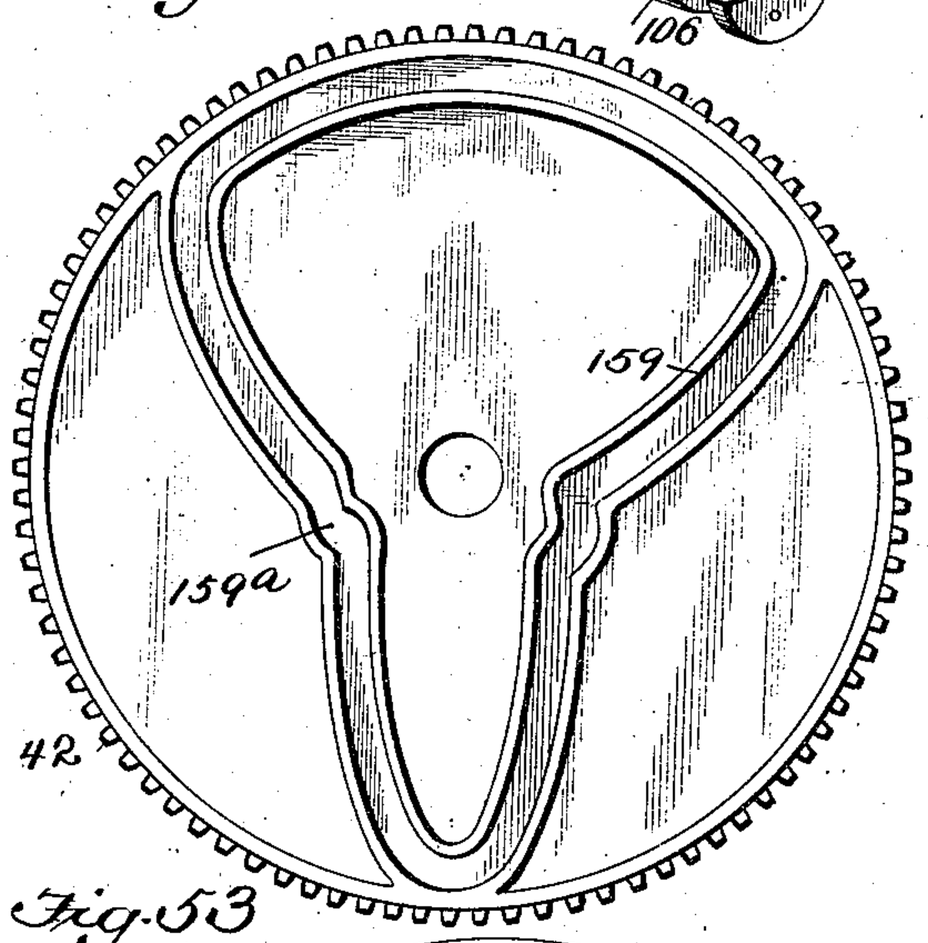

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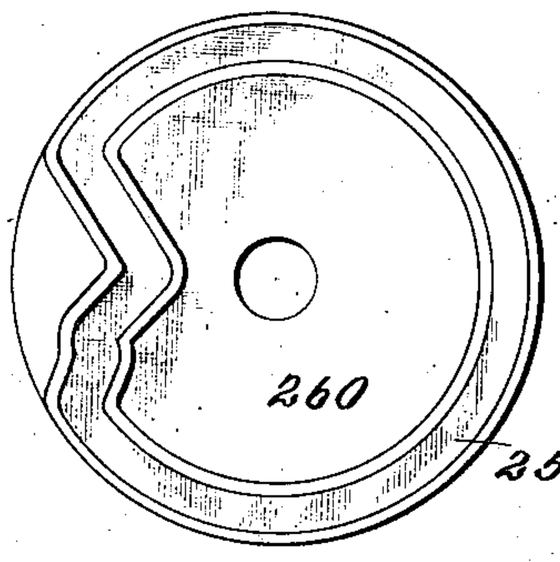

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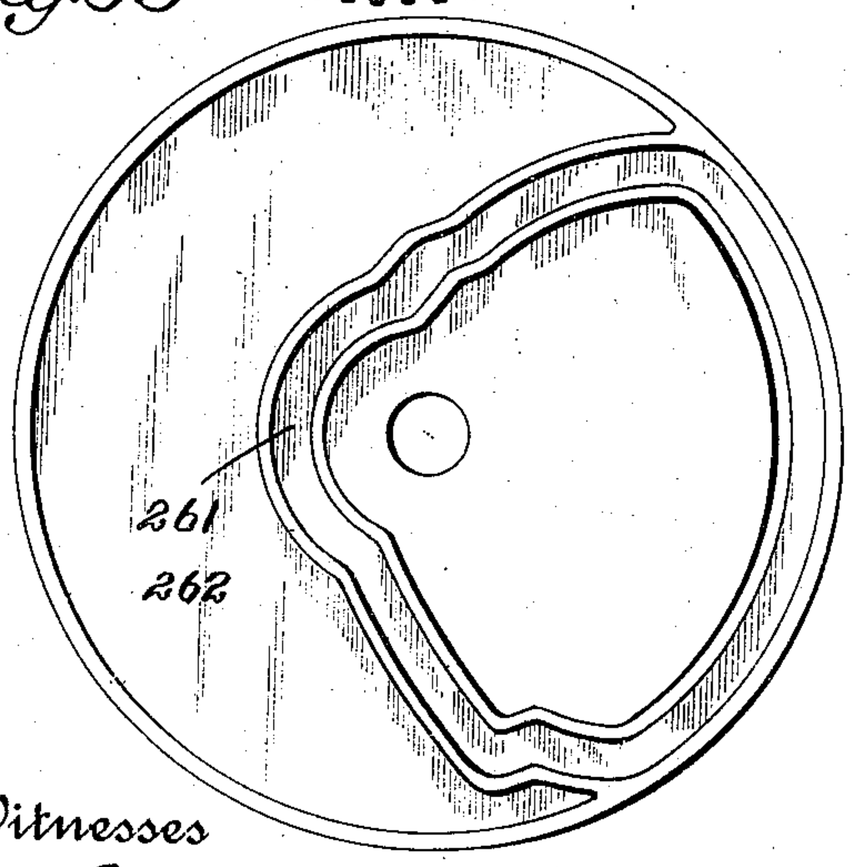

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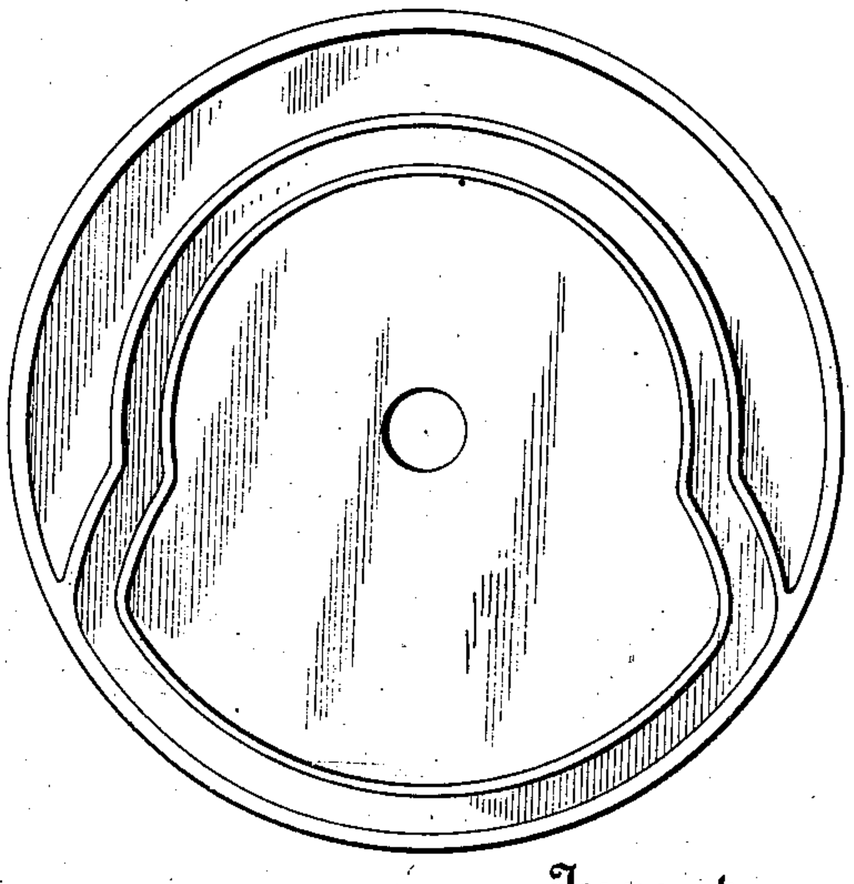

Witnesses

John Stanrie

Thos. A. Green

Inventor

Edwin N. Stephenson.

By James L. Norris.

Attorney

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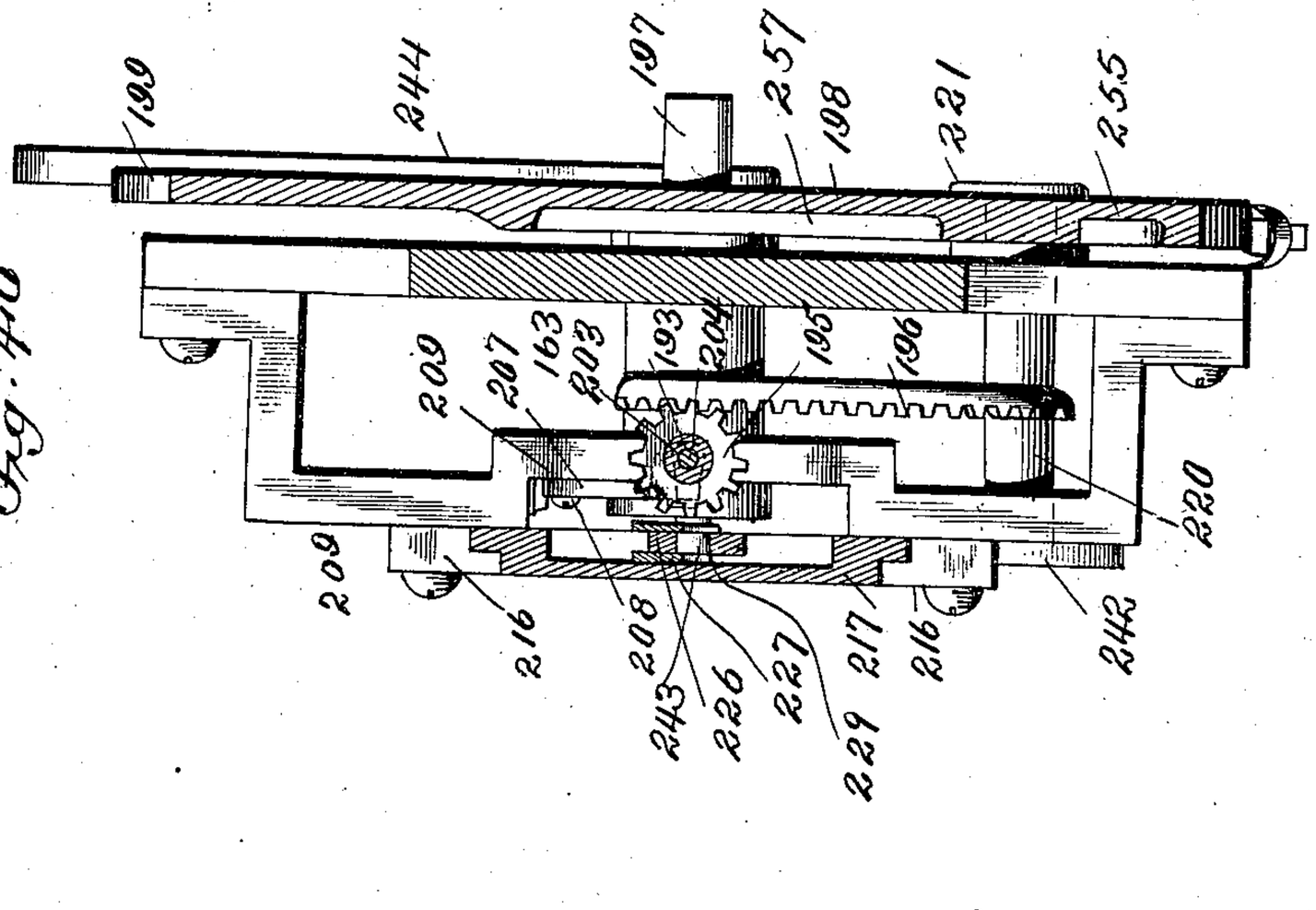
E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.

Fig. 46



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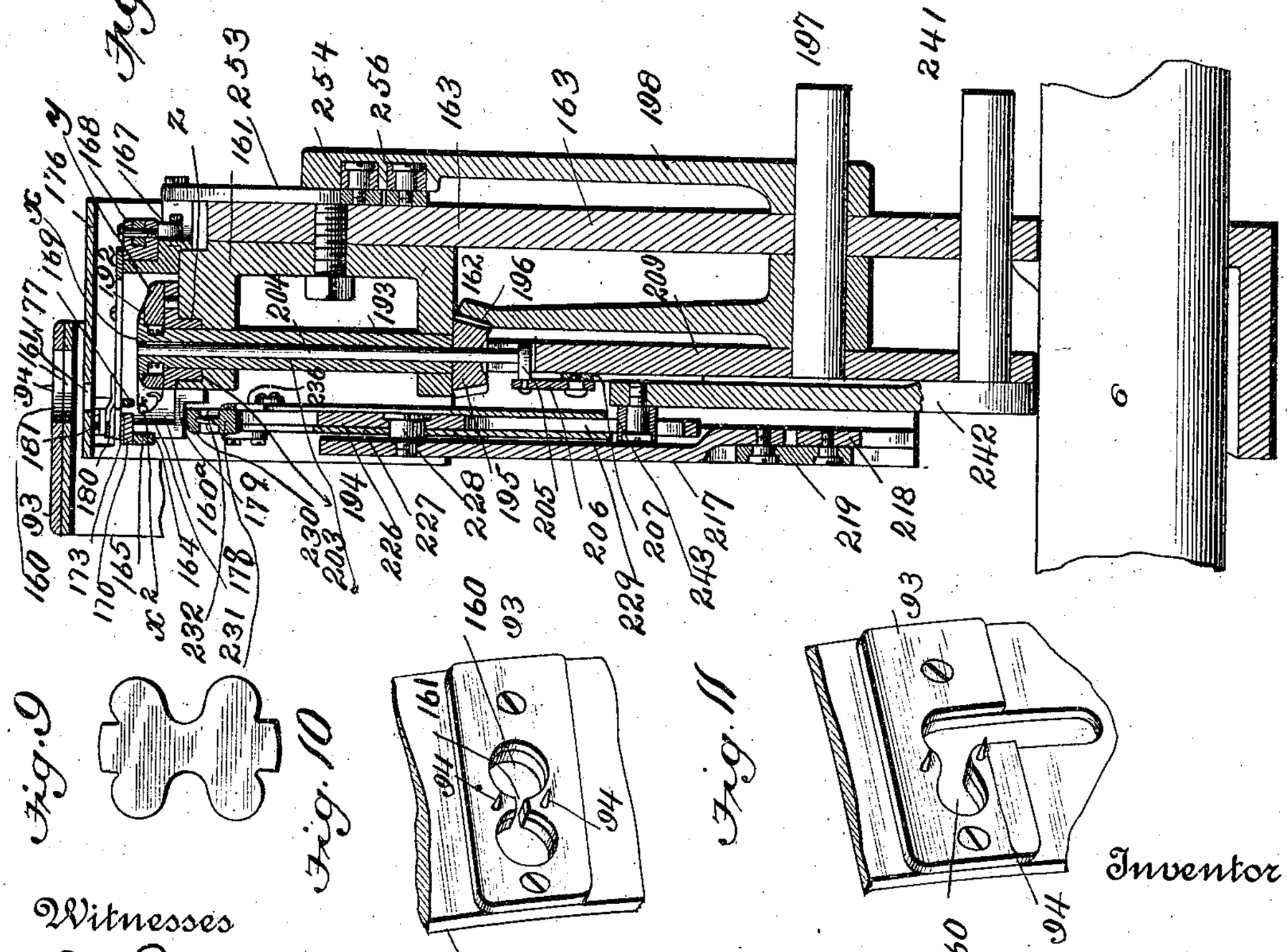

Fig. 9

Fig. 10

Fig. 11

Witnesses
Thos. A. Green

Inventor
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(No Model.)

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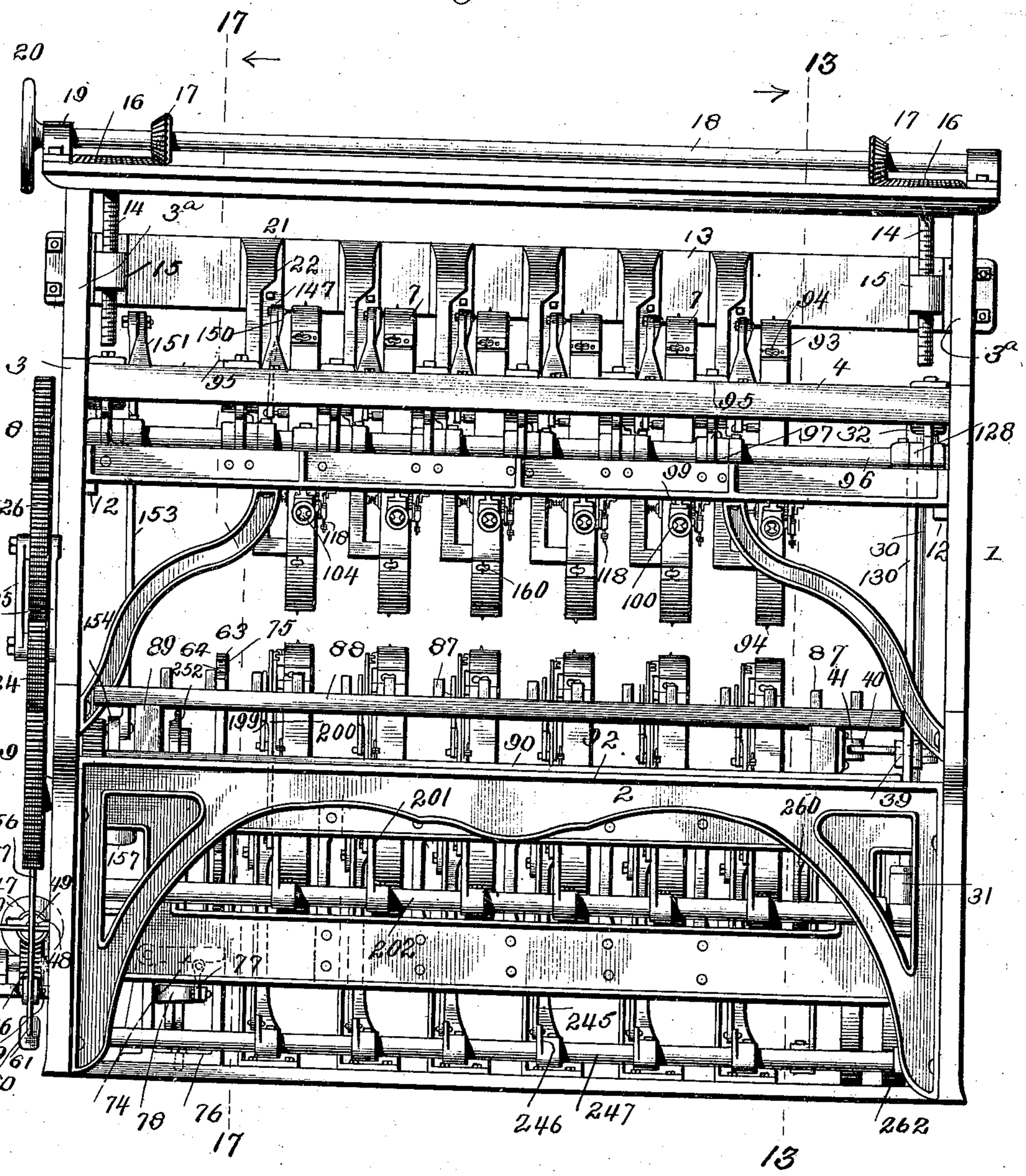
E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.

Fig. 12



Witnesses
John Jamie
Thos. A. Green

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Edwin N. Stephenson.
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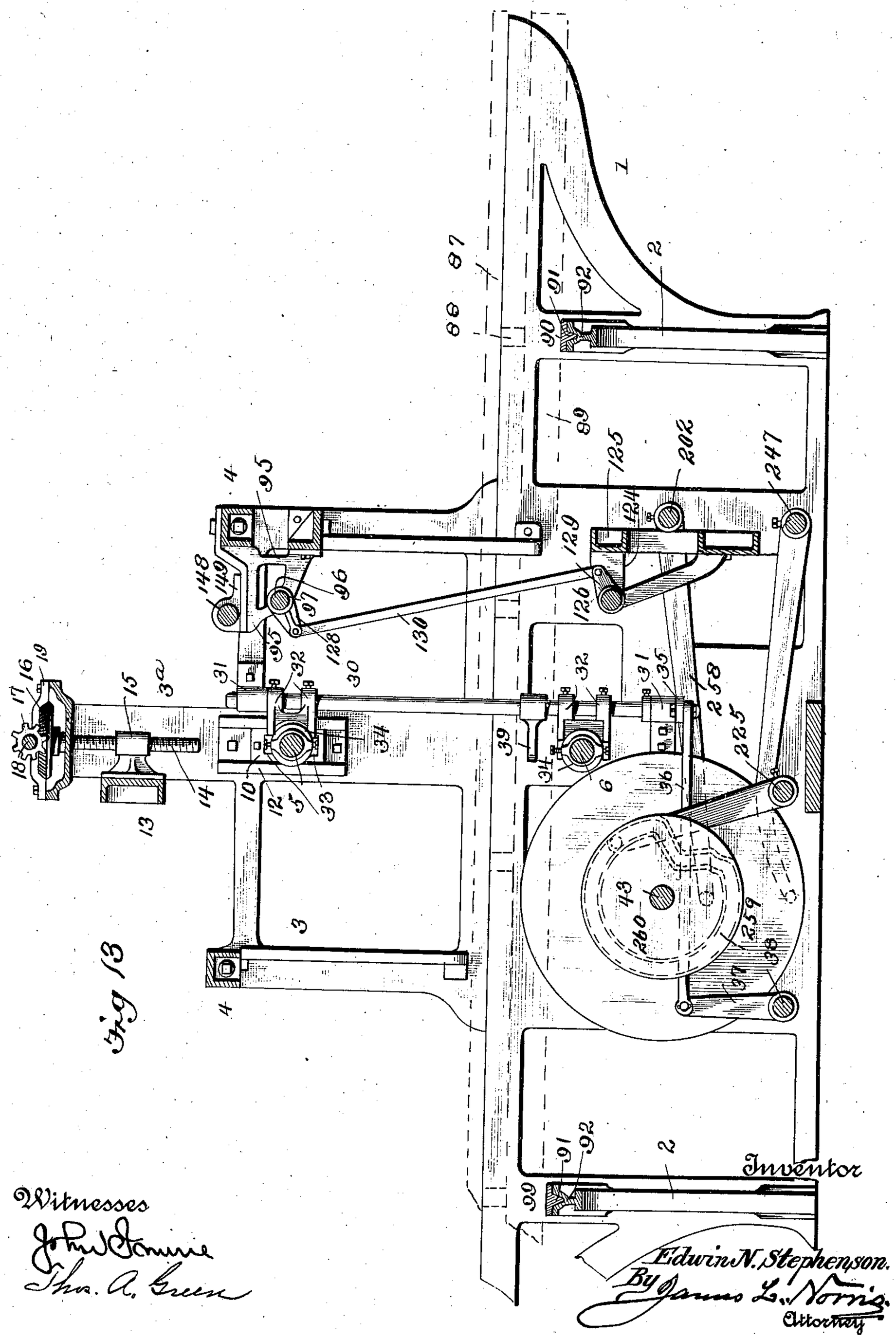
E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.



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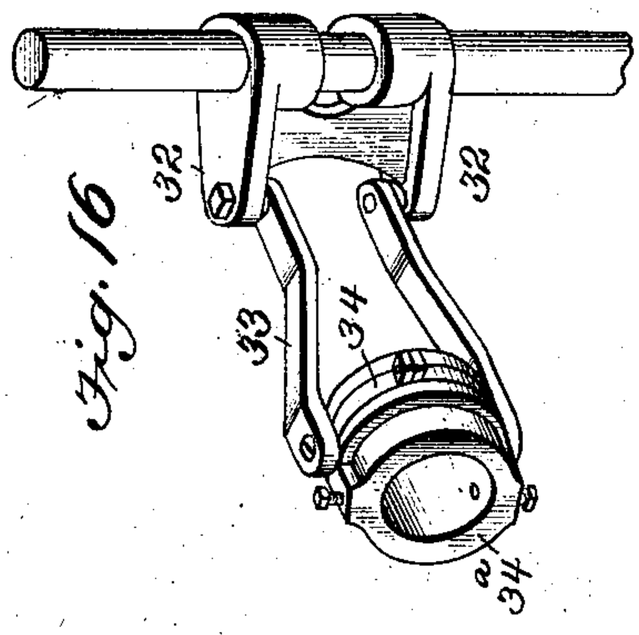
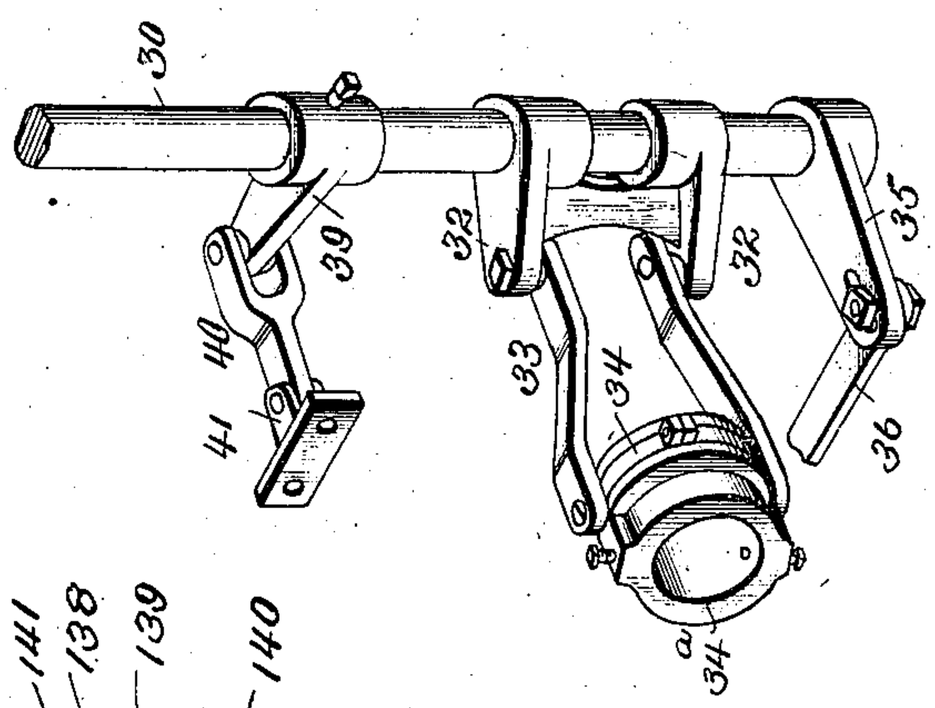
E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.

Fig. 16





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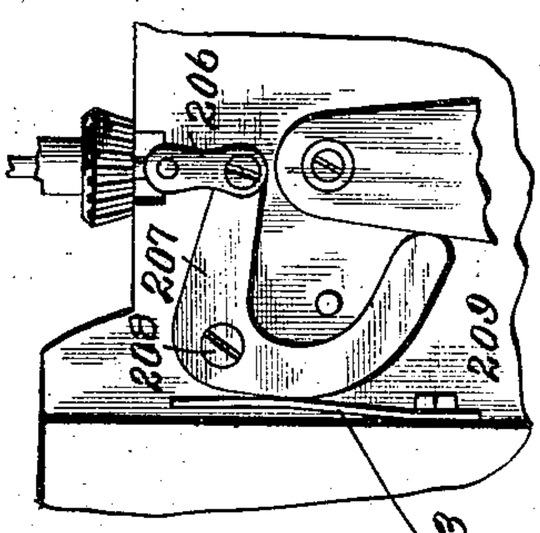

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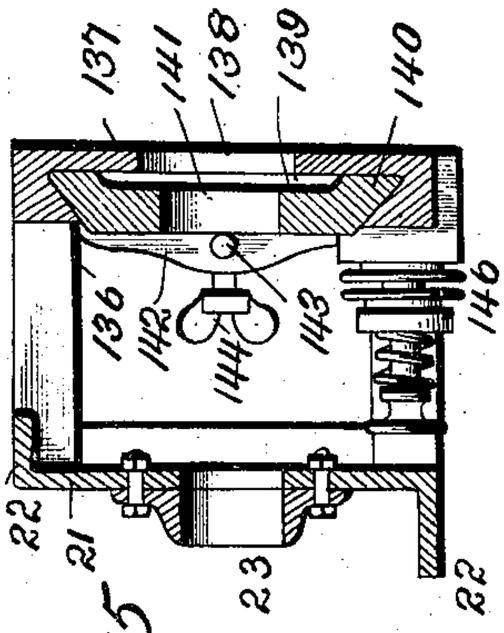

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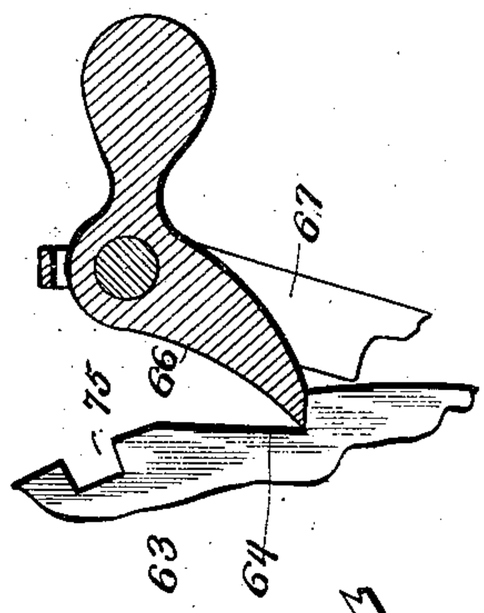

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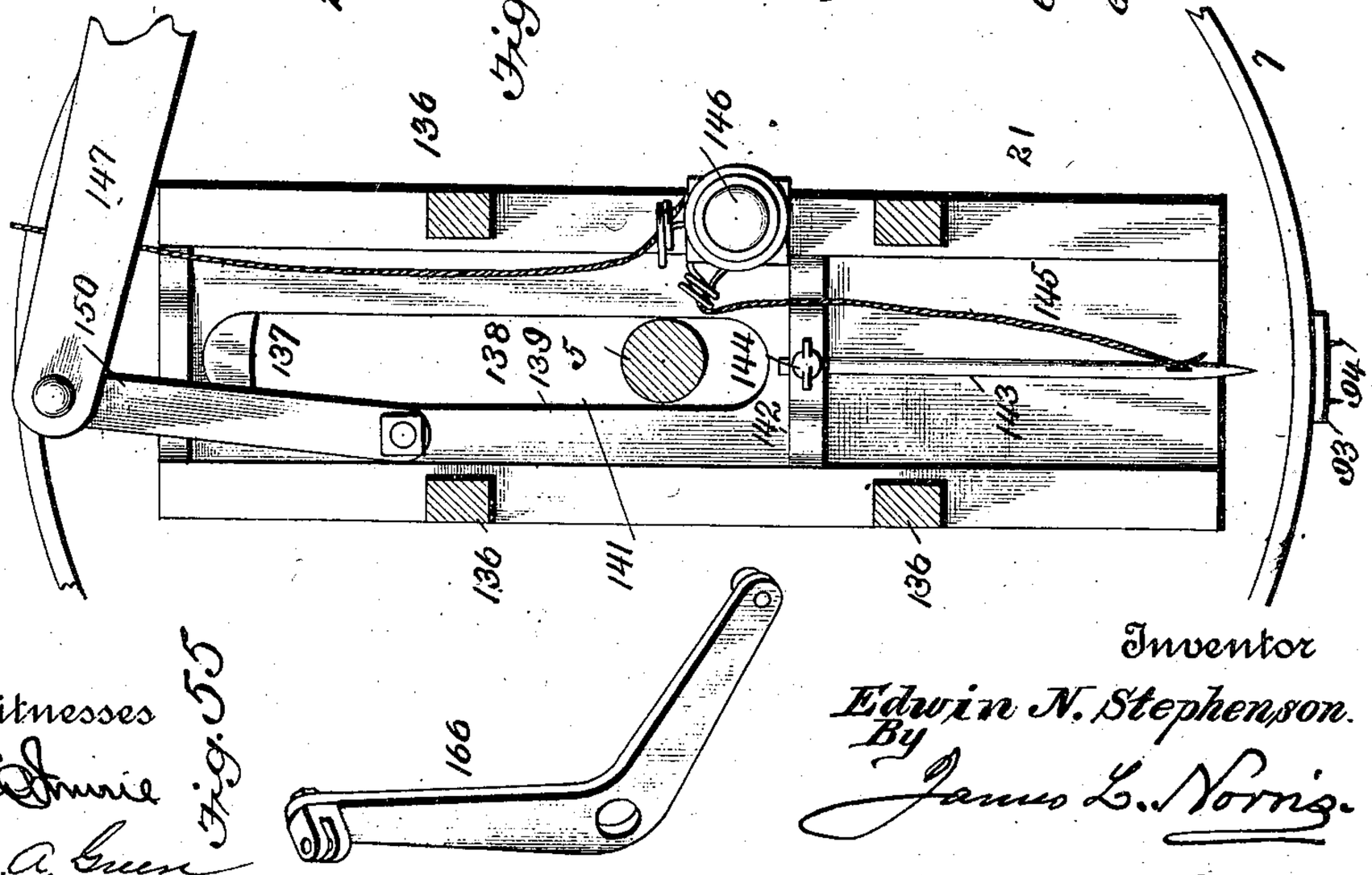

Fig. 55

Witnesses
Fred Smurie
Thos. A. Green

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Edwin N. Stephenson.
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James L. Norris.
Attorney

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16 Sheets—Sheet 10.

E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.

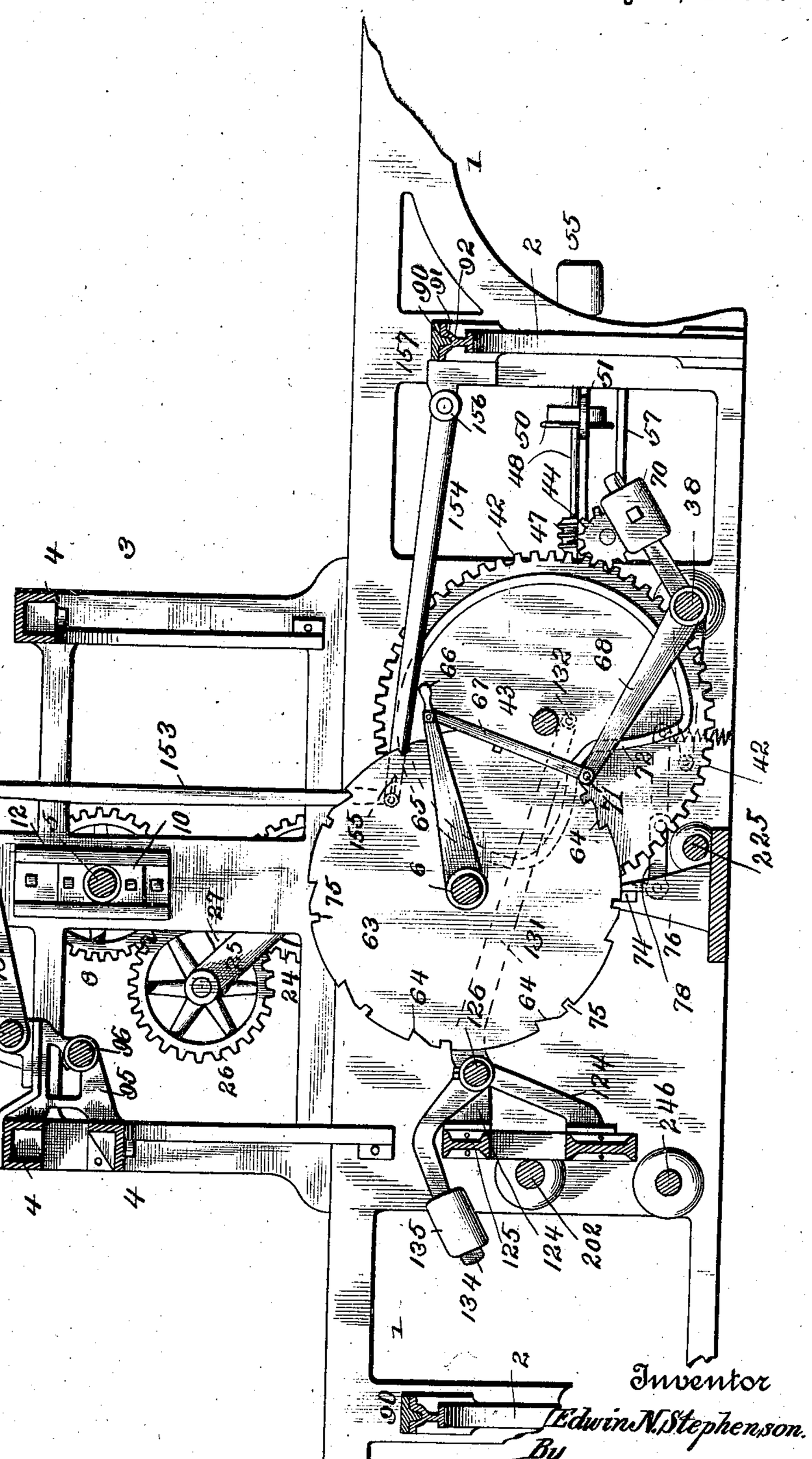

Fig. 17

Witnesses
John Jannin
Thos. A. Green

Inventor
Edwin N. Stephenson.
By
James L. Norris.
Attorney

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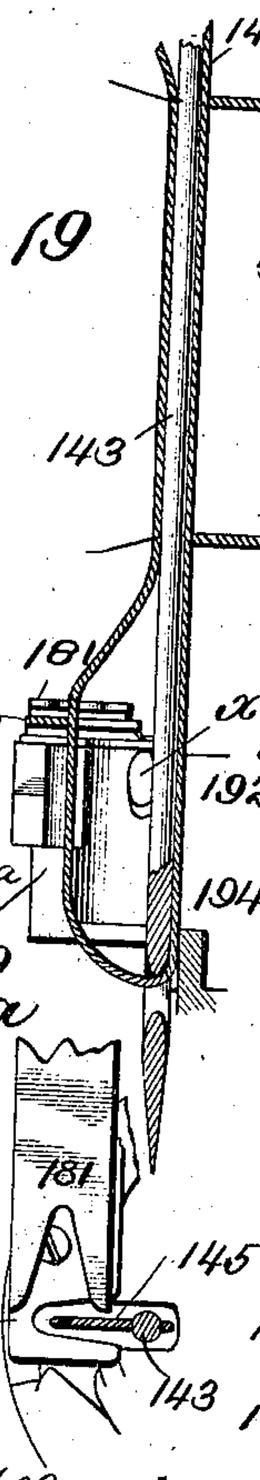
MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.

Fig. 19



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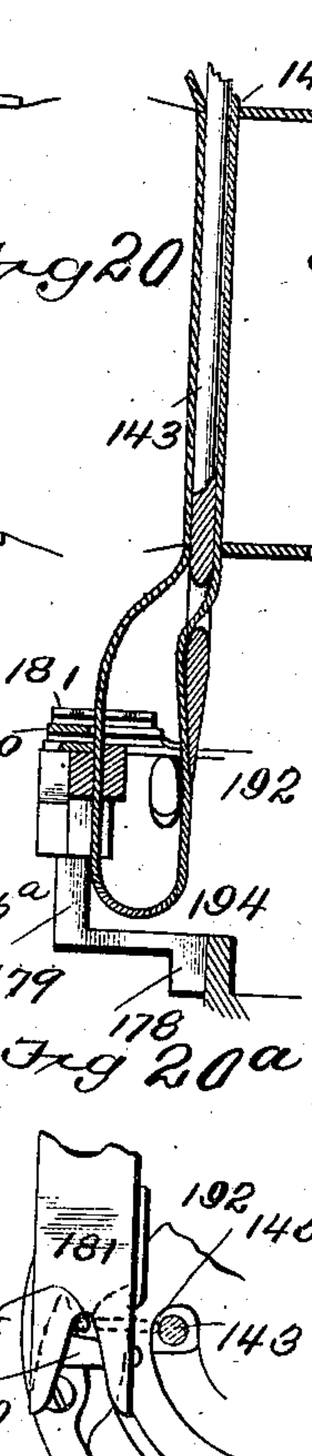

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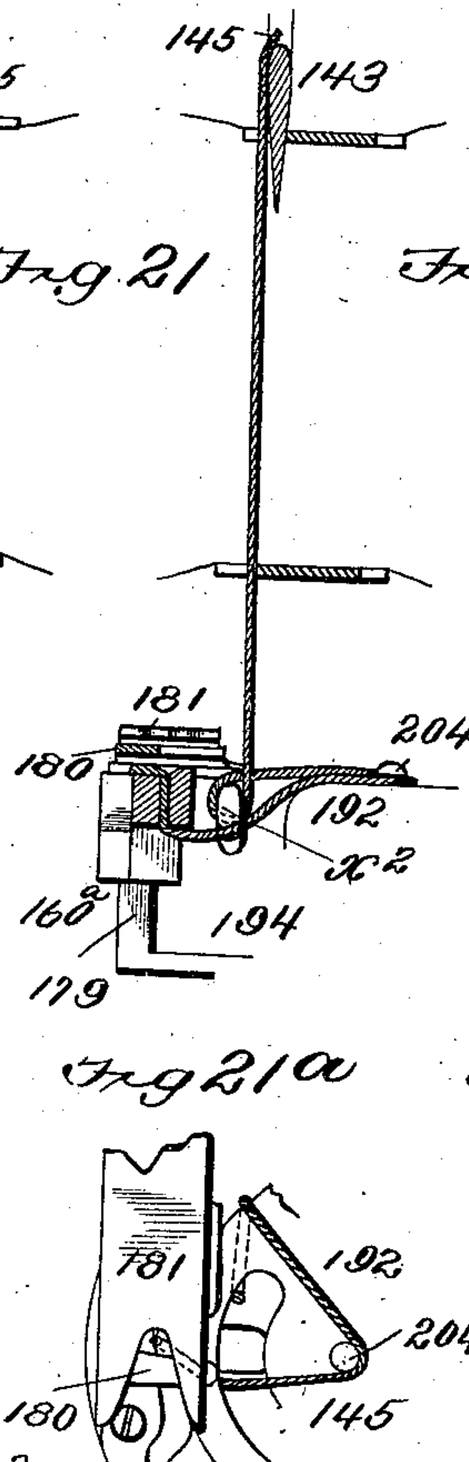

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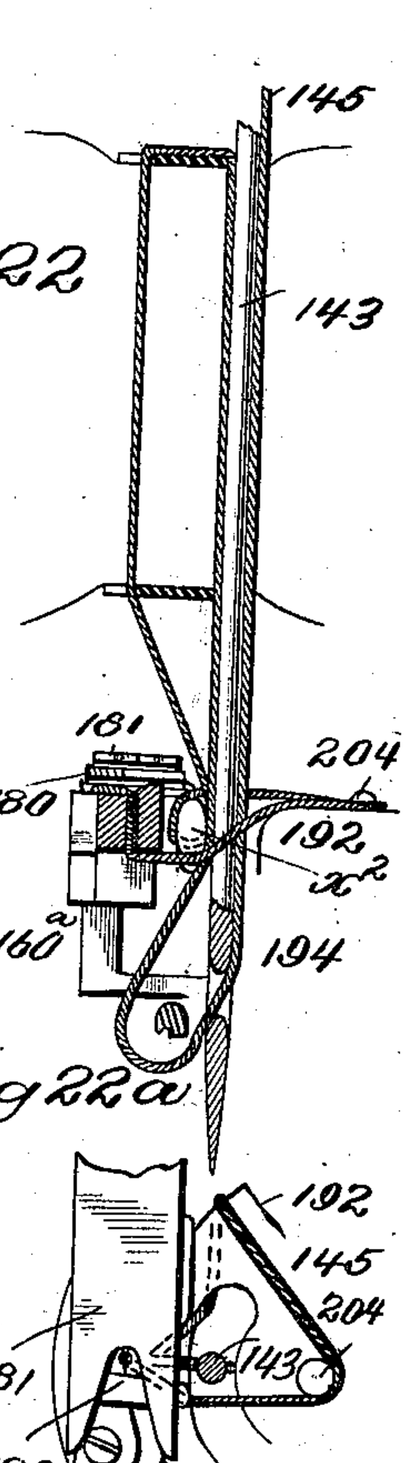


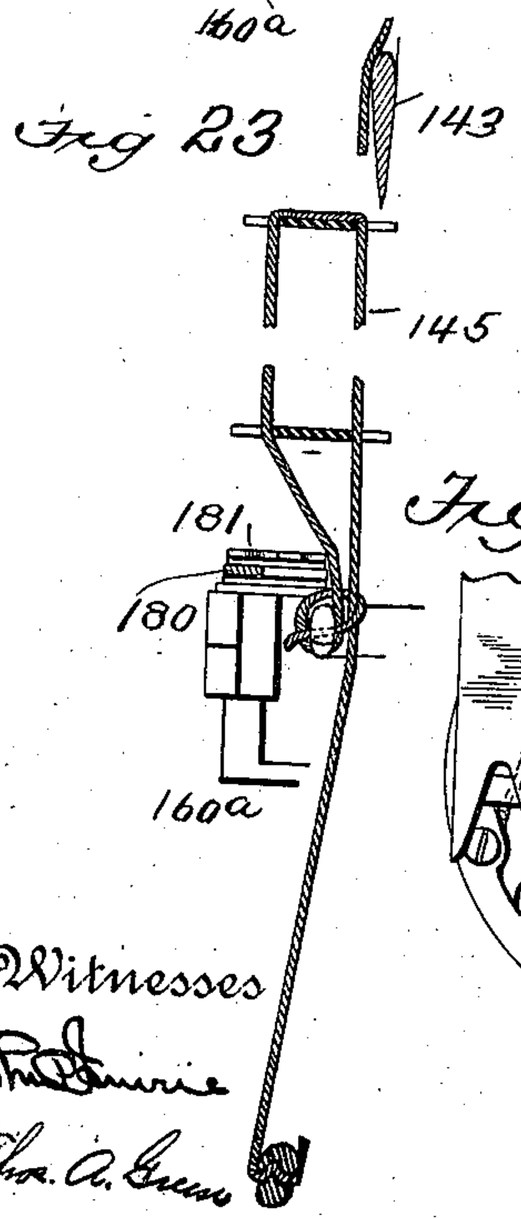
Fig. 19a

Fig. 20a

Fig. 21a

Fig. 22a

Fig. 23



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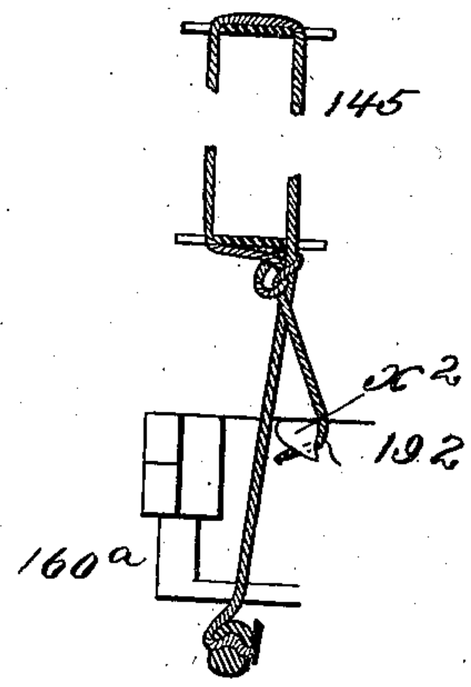

Fig. 23a

Witnesses

John P. Laurie

Thos. A. Grieve

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By James L. Norris.

Attorney

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E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.

Fig. 25

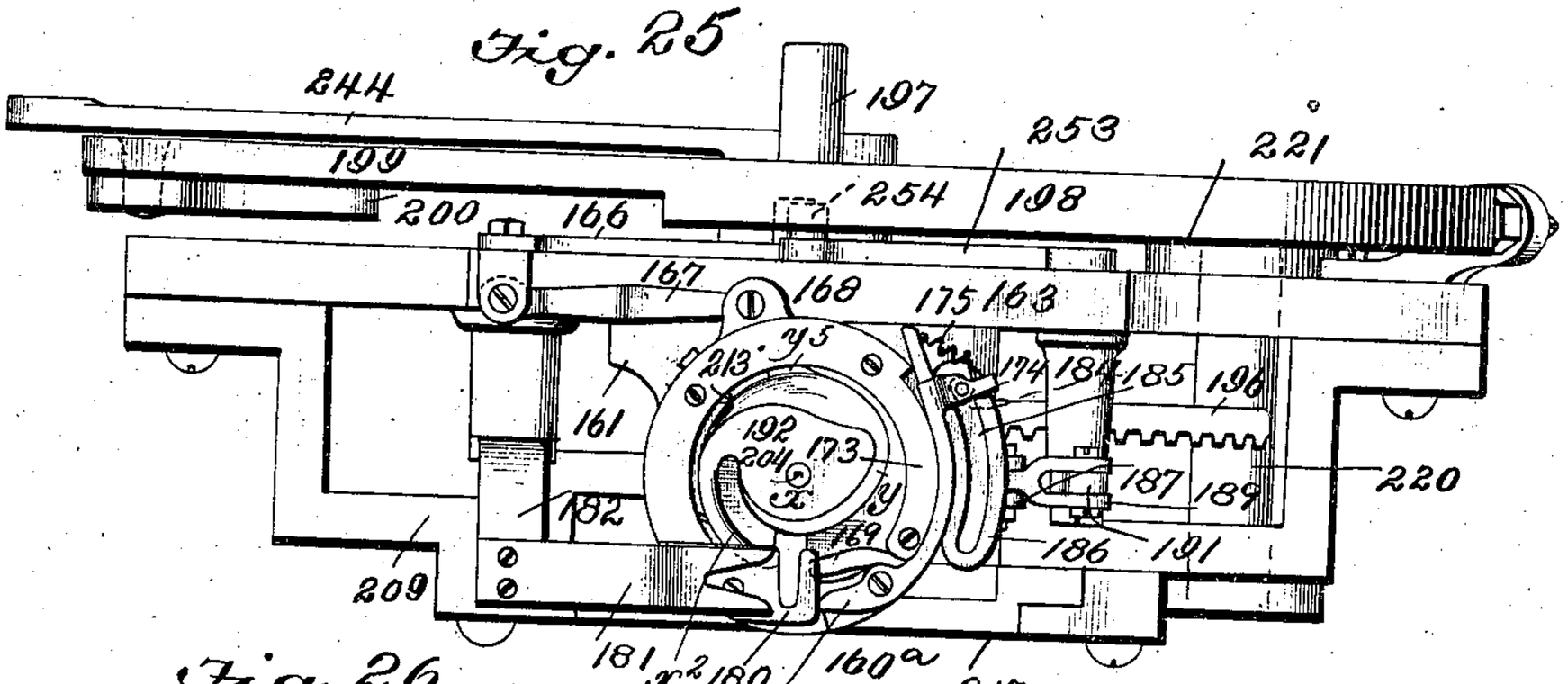
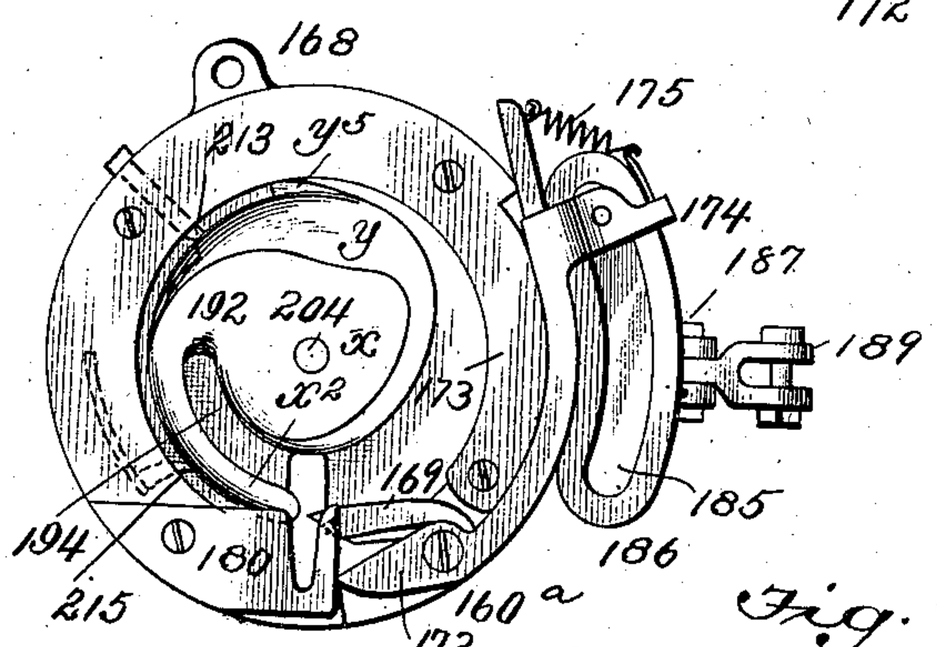


Fig. 26



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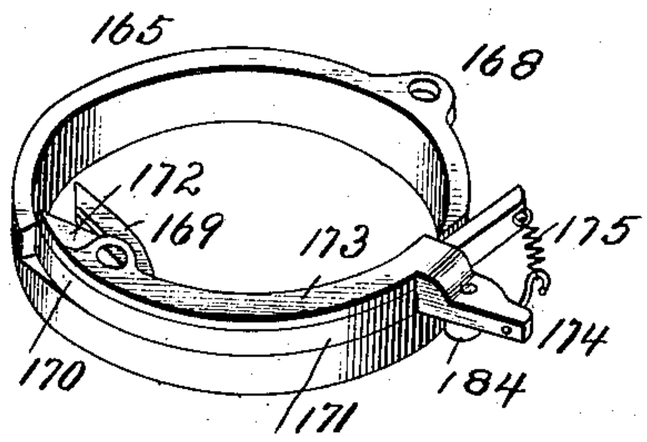

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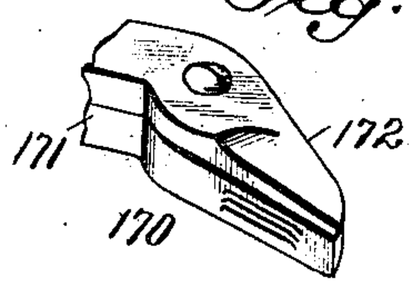

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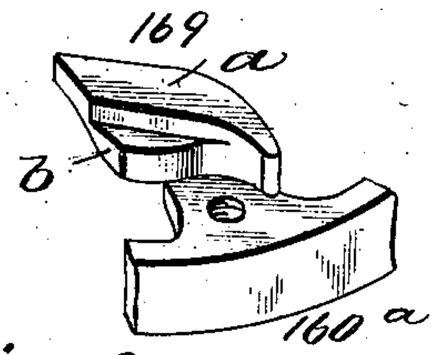

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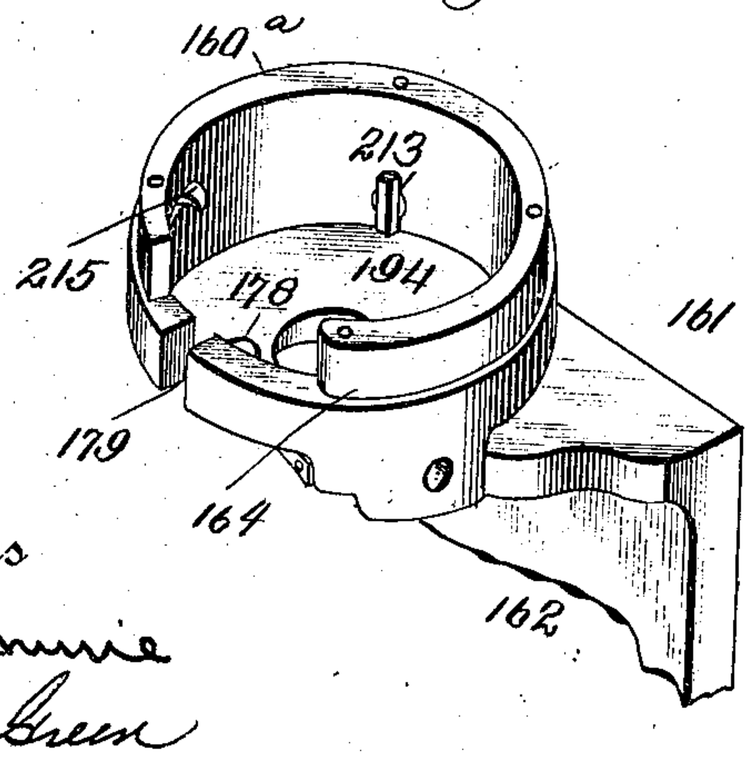

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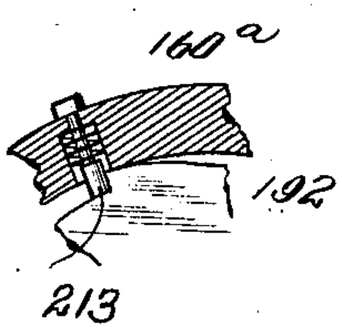

Witnesses
J. Ewd Dennis
Thos. A. Green

Inventor
Edwin N. Stephenson.
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Attorney

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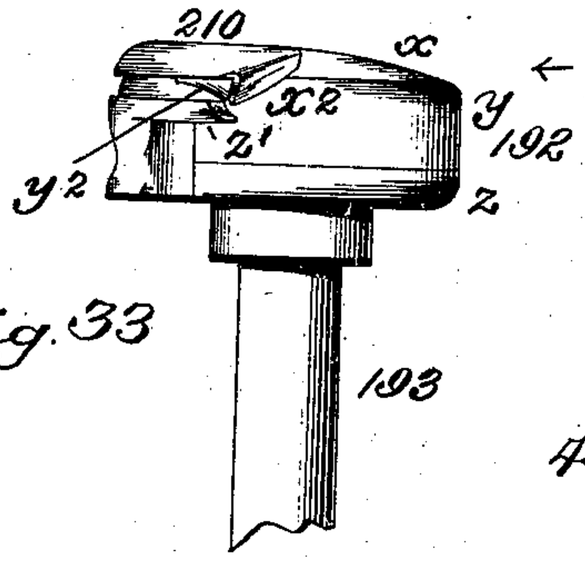
E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.

Fig. 33



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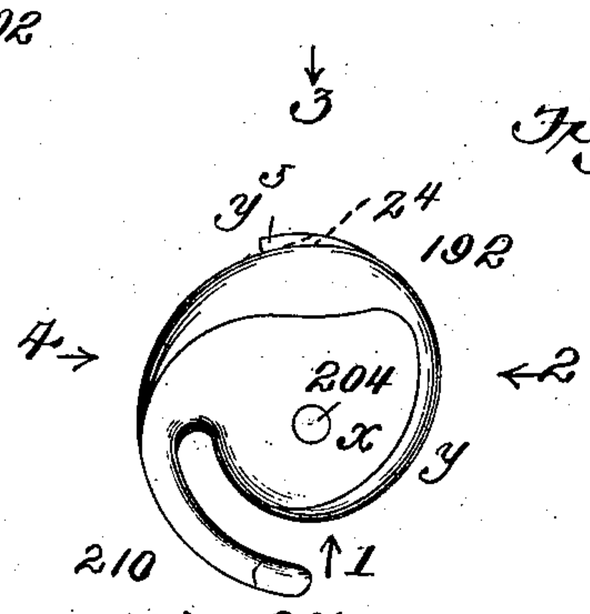

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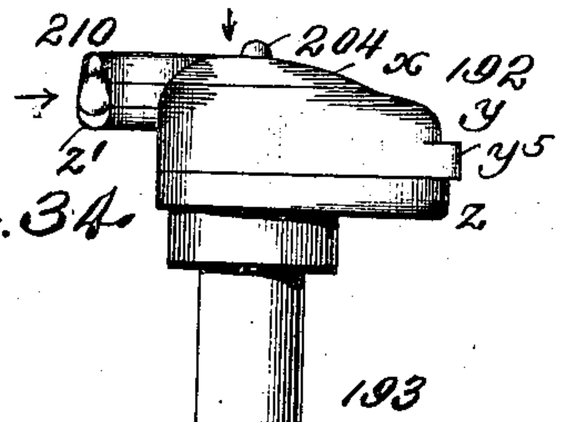

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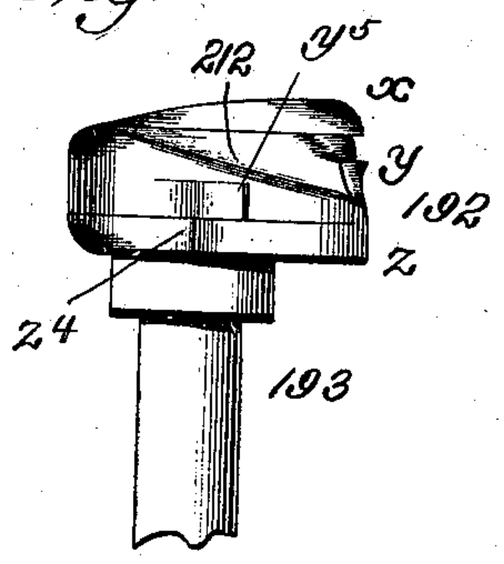

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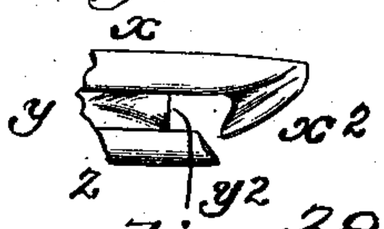

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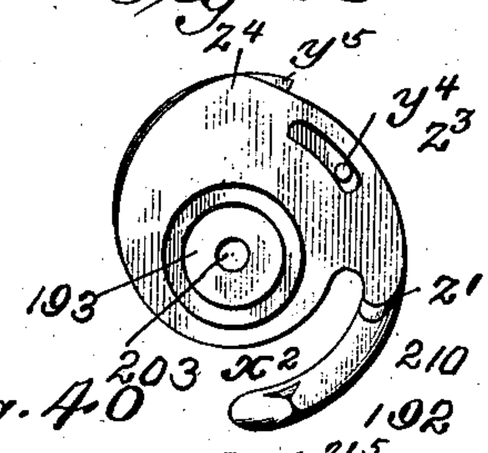

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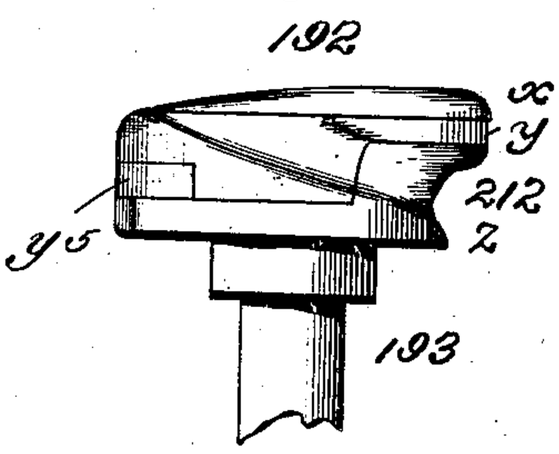

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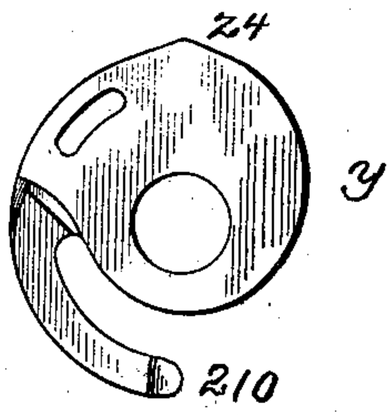

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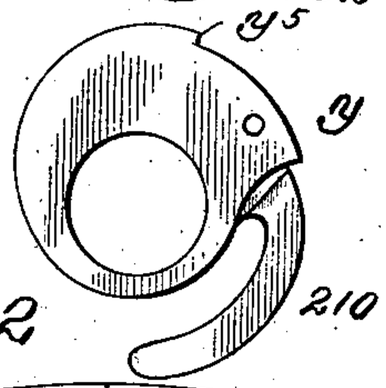

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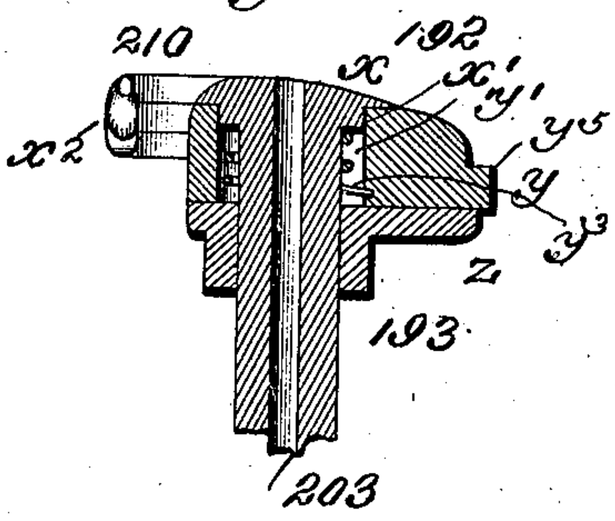

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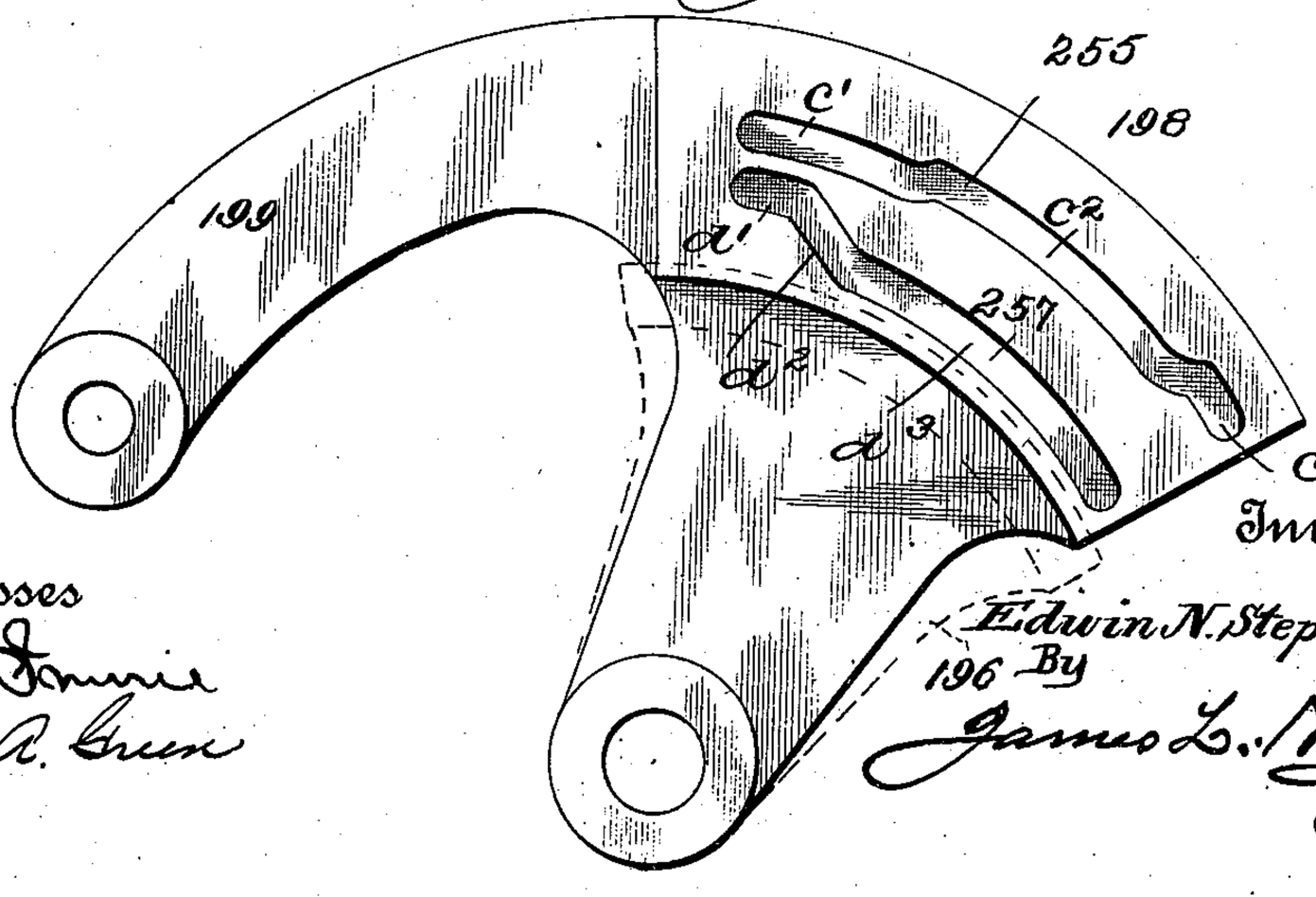

Witnesses
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Thos. A. Green

Inventor
Edwin N. Stephenson.
196 By
James L. Norris.
Attorney

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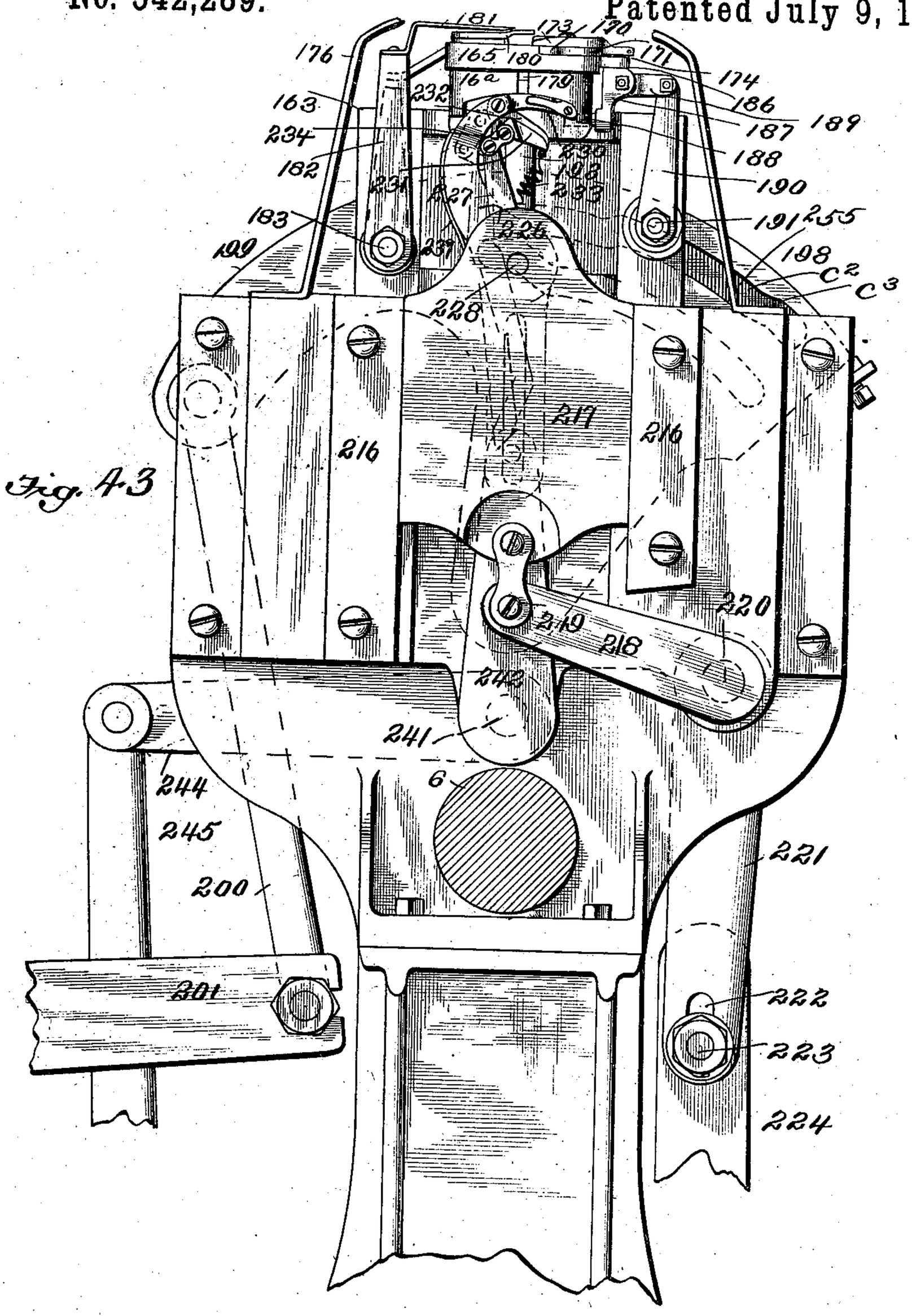
E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.

Fig. 43



Witnesses
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Thos. A. Green

Inventor
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James L. Norris.
Attorney

(No Model.)

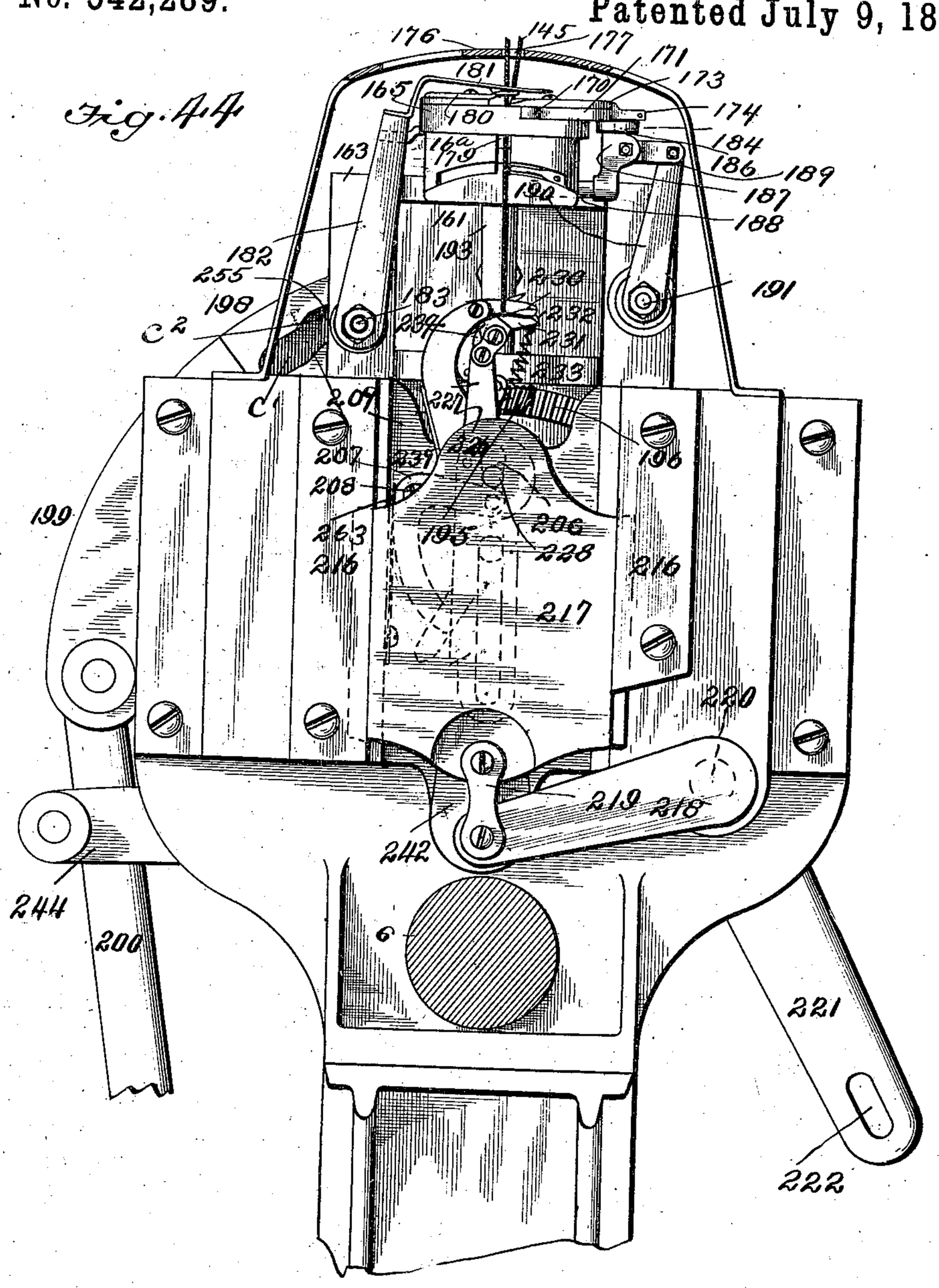
16 Sheets—Sheet 15.

E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.

Fig. 44.



Witnesses
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Thos. A. Green

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Attorney

(No Model.) 16 Sheets—Sheet 16.

E. N. STEPHENSON.

MACHINE FOR TUFTING MATTRESSES.

No. 542,289. Patented July 9, 1895.

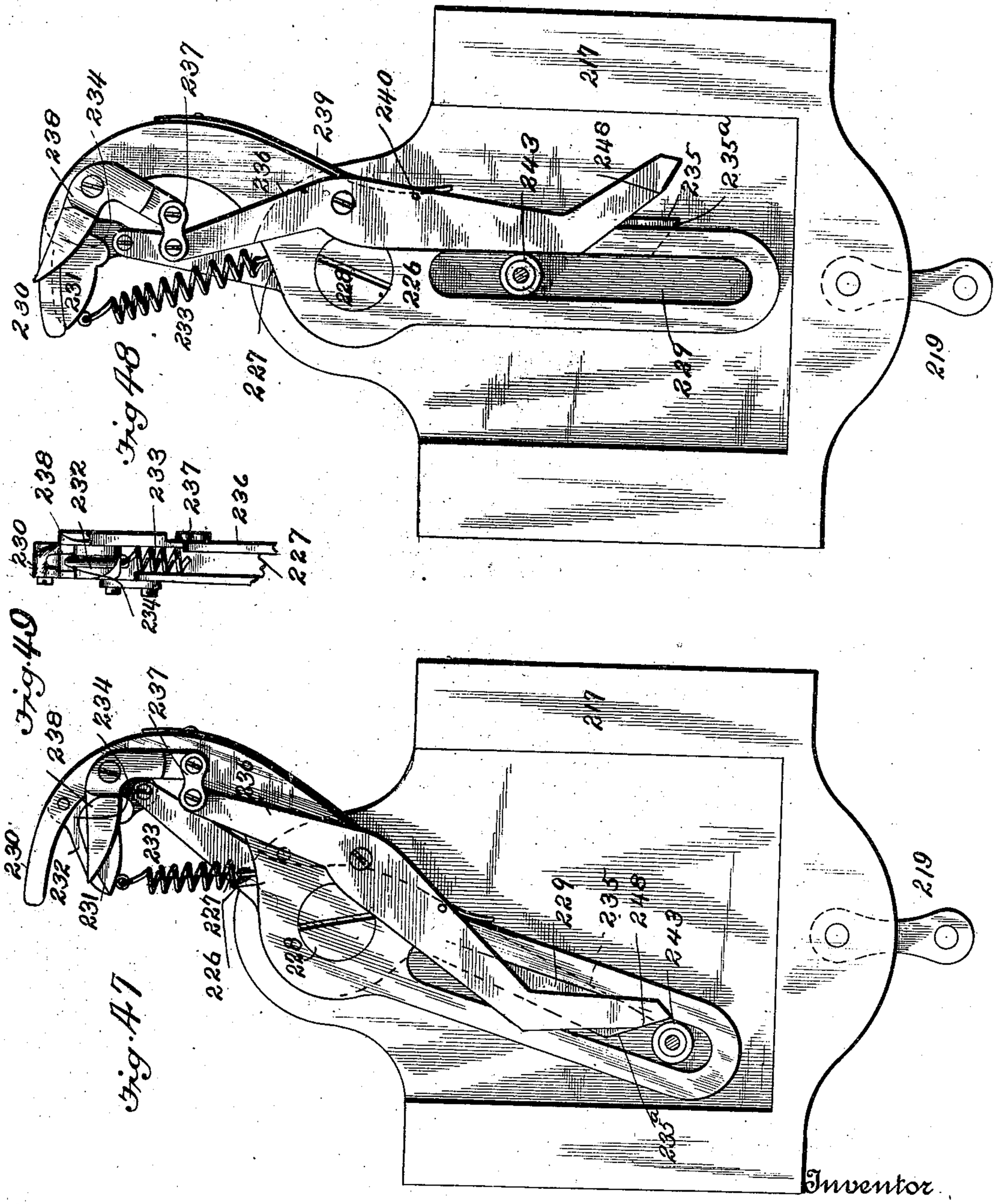

Fig 46

Fig. 48

Fig. 47

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MACHINE FOR TUFTING MATTRESSES.

SPECIFICATION forming part of Letters Patent No. 542,289, dated July 9, 1895.

Application filed July 12, 1894. Serial No. 517,348. (No model.)

To all whom it may concern:

Be it known that I, EDWIN N. STEPHENSON, a citizen of the United States, residing at Waco, in the county of McLennan and State of Texas, have invented new and useful Improvements in Automatic Machines for Tufting Mattresses, of which the following is a specification.

It is the purpose of my invention to provide an automatic machine for tufting mattresses, whereby the tufts or washers are periodically fed to and affixed upon the feed-wheels between which the mattress is intermittently advanced and compressed, said tufts being placed upon the mattress by the periodical fractional revolution of the feed-wheels and secured by stitching the entire transverse series of tufts by the automatic action of a series of needles, and a lower corresponding series of knotter-heads and devices co-operating therewith.

It is a further purpose of my invention to provide means for automatically controlling the periodical and simultaneous operation of the upper and lower series of feed-wheels in such manner that each successive action shall be followed by a period of rest, during which the tufting and knotting mechanisms shall have opportunity to complete their respective functions.

It is my purpose, also, to provide and combine with a machine of the type specified a novel and simple knotting mechanism for securely fastening the twine or thread upon the lower side of the mattress and an automatic severing device for cutting the thread at the proper point when the knot is completed.

It is my purpose, also, to provide and combine with a machine of the type mentioned novel and simple means by which the "tufts," as they are usually termed, may be affixed at suitable intervals to the two series of upper and lower feed-wheels simultaneously, or practically so, suitable means being provided whereby the tufts when placed upon and pressed against said wheels shall remain affixed thereto until by the periodical fractional revolution of said wheels they are placed upon and held firmly against the opposite surfaces of the mattress, which is compressed between the upper and lower series of feed-wheels while the tufting and knotting mechanisms perform their proper functions. In this particular my invention also comprises the provision of novel and simple means for feeding the tufts and affixing them to the feed-wheels, in combination with adjustable devices whereby the feed-stroke may be varied in length to suit the thickness of the tufts, or other circumstances, in order to insure the requisite degree of pressure and the secure attachment of the tufts to the double series of feed-wheels.

It is a further purpose of my invention to provide and combine with the upper and lower series of feed-wheels a system of gearing whereby the two series may be caused to separate, or to approach each other within the limits required without interruption of the meshing engagement and without affecting the practically simultaneous action of both series.

It is my further purpose to provide and combine with the double series of feed-wheels a series of tufting-needles mounted in a corresponding series of gates capable of vertical movement and means for moving the entire series twice to stitch an entire row of tufts, a short period of inaction being allowed between the first and second movement to permit the slight lateral adjustment; whereby the tufting twine is caused to straddle or cross the tufts.

It is my further purpose to improve the type of mechanism specified by rendering it automatic throughout, or practically so, by insuring the application at uniform intervals of successive transverse series of tufts or washers and by rendering the attachment of the several tufts in each series practically simultaneous, certain, and secure.

The invention consists, to these ends, in the novel parts and combinations of parts, hereinafter fully set forth, and then more particularly pointed out and defined in the claims, which form part of this specification.

To enable others skilled in the art to which my said invention pertains to fully understand and to make, construct, and use the same, I will proceed to describe said invention in detail, reference being had for this purpose to the accompanying drawings, in which—

Figure 1 is a side elevation of a mattress-tufting machine organized in accordance with my invention. Fig. 2 is a plan view of the same, the ends of the machine shown in Fig. 1 being omitted. Fig. 3 is a vertical section of Fig. 2 upon the line 3^a 3^a. Fig. 4 is a detail side elevation of one of the tuft-placing devices, showing the two positions assumed thereby in full lines and in dotted lines. Fig. 5 is a central vertical section of the barrel or body of the tuft-placing device shown in Fig. 4. Fig. 6 is a transverse section of the barrel or body of the tuft-placing device upon the line 7 7 in Fig. 5. Fig. 7 is a front end elevation of the barrel with a portion of one of its supporting-brackets. Fig. 8 is a detail perspective showing the tuft-feeding bar, pusher-head, and part of the interior tube of the tuft-feeding barrel. Fig. 9 is a view in front elevation showing one form of tuft or washer used in connection with my machine. Fig. 10 is a detail perspective showing a portion of one of the feed-wheels in the upper series and one of the cushions with its tuft-impaling points and needle-openings. Fig. 11 is a similar detail perspective showing a portion of one of the feed-wheels in the lower series with one of the cushions and its tuft-impaling points and the L-shaped needle-opening in said cushion. Fig. 12 is an end elevation of the machine taken from the right-hand end of the machine in Fig. 1. Fig. 13 is a vertical longitudinal section taken upon the line 13 13, Fig. 12, the line of sight being indicated by the arrow. Fig. 14 is a sectional elevation upon an enlarged scale, showing in detail one of the needle-gates, the needle, tension device, and needle-operating arm with portions of the periphery of an adjacent feed-wheel. Fig. 15 is a transverse section taken a little above the feed-wheel shaft in Fig. 14, said shaft being omitted. Fig. 16 is a perspective view of the vertical shaft and its connections, by which the mattress is moved laterally between two successive strokes of the tufting-needles. Fig. 17 is a vertical longitudinal section of the machine taken on the line 17 17 in Fig. 12, the line of sight being shown by the arrow. Fig. 18 is a detail view showing a portion of the periphery of the movement disk by which periodic advance is imparted to the feed-wheels, and the pawl and part of the pawl-carrying arm by which intermittent movement is given to said disk. Fig. 19 is a diagram showing that portion of a mattress upon which a tuft is placed, a single needle at the end of the first stroke made by the needles in the process of tufting, and part of the mechanism by which the end of the tufting-thread is grasped and held. Fig. 20 is a diagram showing the same parts, the needle having risen part way, the end of the thread being in the jaws, and the hook of the knotter-head having passed into the thread-loop. Fig. 21 is a similar diagram showing the needle nearly at the end of its upward stroke, the bight of the thread caught over the end of a shaft projecting from the rotating knotter-head, and the hook of the latter engaging the loop. Fig. 22 is a diagram showing the needle at the lowest point of its second stroke, the mattress having been moved laterally to carry the thread over the tuft, showing the preliminary engagement of one of the jaws forming part of the knot-closing and thread-cutting devices, and showing the last step in the formation of the knot. Fig. 23 is a diagram showing the needle at the end of its last upward stroke, the thread having been cut, the knot formed, and about to cast off the knotter. Fig. 24 is a diagram showing the last step in the operation of stitching, which consists in drawing the knot closely against the tuft on the lower surface of the mattress. Figs. 19^a, 20^a, 21^a, 22^a, and 23^a are diagrams in plan, showing the parts illustrated in Figs. 19, 20, 21, 22, and 23, respectively, in the positions in which they are seen in plan views corresponding with the figures last mentioned. Fig. 25 is a plan view of one of the knotting mechanisms removed from the machine. Fig. 26 is a detail plan view, upon a somewhat larger scale, of the knotter-head and its immediate adjuncts. Fig. 27 is a detail perspective view of the jaw-supporting annulus removed from the other parts. Fig. 28 is a perspective view of the shell and part of the bracket supporting the knotter-head and its adjuncts. Fig. 29 is a detail view of part of one of the jaws mounted on the annulus shown in Fig. 27. Fig. 30 is a detail view of the other jaw. Fig. 31 is a detail view showing a small portion of the shell and of the inclosed knotter-head, illustrating the operation of the detent-pin lying in a chamber in the circular wall of the shell. Fig. 32 is a plan view of one of the knotter-heads and part of its stem. Fig. 33 is a side elevation of the knotter-head, the line of sight being in the direction of the arrow 1 in Fig. 32. Fig. 34 is a side elevation of the same, the line of view being the direction of the arrow 2 in Fig. 32. Fig. 35 is a side elevation of the same, looking in the direction of arrow 3 in Fig. 32. Fig. 36 is a side elevation of the same, looking in the direction of the arrow 4, Fig. 32. Fig. 37 is a detail view, on an enlarged scale, of the point of the hook on the knotter-head. Fig. 38 is a bottom plan view of the knotter-head. Fig. 39 is a bottom or inverted plan view of the lower or third section of the knotter-head. Fig. 40 is a bottom plan view of the second or middle section of the same. Fig. 41 is a vertical section taken in the axial line of the stem of the knotter-head. Fig. 42 is a face view or front elevation of the sector and its cam-races operating the devices which clamp, hold, and finally cut the twine, the gear-sector on the same shaft for revolving the knotter-head being shown in dotted lines. Fig. 43 is a front elevation of the knotting mechanism and its immediate connections, part of the overhanging shield being removed. Fig. 44 is a similar

view showing the same parts in the position they occupy when the process of tufting has reached the stage illustrated in diagram in Fig. 23. Fig. 45 is a vertical section taken from front to rear of the knotting mechanism and in the axial line of the stem of the knotter-head. Fig. 46 is a horizontal or transverse section of the same, taken in a line just above the bevel-gear which revolves the knotter-head. Fig. 47 is an elevation taken from the rear of Fig. 43, showing the devices for seizing, drawing, and cutting the twine after the knot is formed. Fig. 48 is a similar view of the same parts in a different position. Fig. 49 is a side elevation of the parts shown in the upper portion of Fig. 48. Fig. 50 is a detail view of part of the devices for periodically projecting and withdrawing the central twine-holding shaft in the stem of the knotter-head. Fig. 51 is a face view of the cam-race by which the tufting-needles are operated. Fig. 52 is a like view of the cam-race controlling the sector on the knotting mechanism. Fig. 53 is a similar view of the cam-race which controls the clamping, knot-drawing, and twine-cutting devices shown in Figs. 44, 47, and 48. Fig. 54 is a like view of the cam-race controlling the mechanism by which the mattress is moved laterally between the first and second strokes of the tufting-needles. Fig. 55 is a detail view of the lever which controls the rising and falling stem of the knotter-head.

The reference-numeral 1 in said drawings indicates the frame of the machine, the two parallel upright members thereof being connected by means of transverse braces 2. Upon the middle portion of said frame is mounted an upper auxiliary frame 3, the members of which are connected by transverse bars 4. In the central portion of the upper and lower frames, respectively, are journaled shafts 5 and 6, the former carrying the upper series of feed-wheels 7, and the latter shaft carrying a corresponding lower series of substantially similar feed-wheels lying in the same vertical planes with the members of the upper series, the feed-wheels being arranged upon their shafts at regular intervals. The construction of these feed-wheels will be explained hereinafter.

Upon the ends of the respective shafts 5 and 6, which project beyond the outer faces of the upper and lower frames 1 and 3 upon one side of the machine, are mounted spur-gears 8 and 9 of equal diameter. The journals of the upper shaft 5 are mounted in boxes 10, which are movable in brackets 12, mounted upon the inner faces of the central vertical parts of the frame 3. Mounted upon central vertical extensions 3^a, which rise above the upper auxiliary frame 3, is a transverse bar 13, which is vertically adjustable upon the vertical extensions by means of threaded shafts 14, journaled in the upper ends of the said vertical extensions and hanging parallel with the latter, the threaded portions of said shafts engaging lugs 15, which project from the transverse bar 13 near the ends of the latter.

Upon the upper ends of the threaded shafts 14 are mounted bevel-gears 16, with which bevel-pinions 17 have mesh, said pinions being carried by a horizontal shaft 18, which extends from side to side of the machine and is journaled in any suitable form of bracket 19 upon each of the vertical extensions 3^a. One end of the shaft 18 projects sufficiently to receive a hand-wheel 20, by which the shaft is revolved in either direction to raise or lower the transverse bar 13.

Upon the transverse bar 13 are mounted a series of hangers 21, equal in number to the feed-wheels in the upper series. These hangers appear in Figs. 3, 12, 14, and 15, and consist each of a substantially-rectangular oblong plate, stiffened by flanges 22 upon its edge provided with a bearing 23, which is bolted to the plate and receives the shaft 5. The hangers are bolted at their upper ends to the bar 13, and by operating the threaded shafts 14 they may be adjusted vertically, thereby raising or lowering the shaft 5 and the upper series of feed-wheels carried by said shaft. The purpose of this adjustment will be fully explained hereinafter. The hangers 21 form portions of hanging guide-frames which support the needle-gates, but these will be described in their order.

In order to preserve the gear engagement by which the upper and lower series of feed-wheels are caused to rotate in unison, without regard to the interval of separation between the two series, I journal upon the upper frame 3 a spur-gear 24, which is constantly in mesh with the spur-gear 9 upon the lower shaft 6. Upon the axis of this gear is mounted one end of a carrier-plate 25 in such manner that it may be turned upon said axis in either direction. Upon the other end of this carrier-plate is journaled an intermediate spur-gear 26, which meshes with both the gear 24 and the gear 8, the latter being upon the end of the upper shaft 5. To the carrier-plate 25 is attached the end of an arm 27, curved upon an arc struck from the axial center of the gear 24 and provided with a curved slot 28, which runs upon a set-screw 29, tapped into the frame 3. By loosening this set-screw the upper shaft 5 may be raised and lowered as required, the intermediate gear 26 traveling around the gear 24 as far as may be necessary to enable it to retain its meshing engagement with the gear 8. When the shaft 5 is adjusted to the desired point, the set-screw 29 is turned in far enough to lock the curved arm 27 securely in place. Provision is also made whereby both shafts 5 and 6 may have at suitable intervals a simultaneous movement of limited extent in the direction of their length. The means by which this movement is effected are shown in Figs. 1 and 13, and consist of a vertical rock-shaft 30, supported in brackets 31, projecting from the inner face of one side of the frame.

Upon said rock-shaft 30 are rigidly mounted two parallel arms 32, which lie upon opposite sides of the upper shaft 5, their ends being pivotally connected to link-plates 33, the other ends of such link-plates being pivotally connected to a ring 34, running in a collar 34ª, rigidly mounted on the shaft 5. A similar connection with the vertical rock-shaft 30 is made for the lower shaft 6, the parts being similar to those described and designated by the same reference-numerals. The vertical rock-shaft 30 is partly turned at the proper time by means of an arm 35, rigidly mounted thereon at or near the lower end, and having a connecting-rod 36 pivotally connected to its end and to the end of an arm 37, rigidly mounted upon a shaft 38, Fig. 13, which is journaled in the lower part of the frame 1. A partial rotary movement of this shaft 30 will draw the two shafts 5 and 6 in one direction or the other in the direction of their length, thereby moving both series of feed-wheels in unison. Upon the same shaft 30 is an arm 39, connected at its end to a forked link 40, which latter is pivotally united to a pair of lugs 41, which are a part of the horizontal support for the mattress as it lies between the upper and lower feed-wheels. This arm 39 gives a lateral movement, in unison with that given the feed-wheels, to the mattress support, and this movement is effected periodically for the purpose hereinafter explained. The means, also, by which the shaft 38 is automatically operated to rock the shaft 30 will be described in their proper order.

Revolution is communicated to a large spur-gear 42, carried by a shaft 43, which extends from side to side of the machine, by a small gear 44, journaled upon a bracket 45 upon one side of the machine. The shaft of this spur-gear 44 is provided with a worm-gear 46, with which a worm 47 has mesh, said worm being carried by a shaft 48, supported in bearings 49. Upon the worm-shaft 48 is a pulley 50, by which the shaft is driven from any suitable source of power.

The bearings 49 of the worm-shaft 48 are mounted upon a frame 51, arranged along the outside of the machine-frame 1 and pivotally mounted upon an axis 52, the latter being supported upon a bracket 53, supported by the main frame 1. From the pivotally-supported end of the frame 51 extends an arm 54, upon which is mounted a weight 55, by which the pivoted frame is normally tilted upward, thereby withdrawing the worm 47 from mesh with the worm-gear 46. When the parts are in operative engagement, the pivoted frame 51 is held in proper position to maintain said engagement by means of a lever 56, fulcrumed upon the end of a horizontal bar 57, which projects from the bracket 53. This lever has a shoulder 58, which engages the end of the pivoted frame, and the lower end of said lever, below its fulcrum 59, is provided with an arm 60, which lies at an angle with the lever and carries a weight 61, by which the engagement of the shoulder 58 with the end of the pivoted frame 51 is normally maintained. The weight 55 is adjustable upon the arm which sustains it and is clamped at its proper point of adjustment by a set-bolt 62, which is tapped through the weight and abuts against the arm.

The action of the machine which is derived from the worm-shaft 48 can be instantly arrested by merely swinging the lever 56 far enough to draw its shoulder 58 off the free end of the pivoted frame 51. The moment this release is effected the gravity of the weight 55 raises the pivoted frame 51 and withdraws the worm 47 on the driving-shaft 48 from its operativeengagement with the worm-gear 46.

Intermittent rotation is communicated to the upper and lower series of feed-wheels by means of a disk 63, mounted upon the lower shaft 6 and provided upon its periphery with notches 64, separated by equal intervals. Upon the said shaft 6 is loosely mounted, Fig. 17, a lever 65, which projects beyond the periphery of the disk and is provided with a pawl 66, Fig. 18, which is adapted to engage with the notches 64. The lever 65 is vibrated by a connecting-rod 67, which connects its end with the end of a cam-lever 68, having a fulcrum upon a rock-shaft 38, extending from side to side of the machine. The end of the cam-lever projects upon the other side of its fulcrum-support and is provided with a weight 70. (See Fig. 17.) Rigidly mounted upon the lever 68 is a pin 71, upon the end of which is a friction-roll upon a horizontal axis. This friction-roll lies against the periphery of a heart-shaped cam 72, placed near the gear 42, Fig. 17, and upon the same shaft 43. The form of the cam 72 is such that it will allow the friction-roll to approach the shaft 43 at each revolution, thereby swinging the lever 65 upward until the pawl 66 engages the adjacent notch 64 in the periphery of the disk 63. This rising movement of the pawl-carrying lever 65 is produced by means of the weight 70 acting upon the lever 68 through the connecting-rod 67. After the pawl has engaged the notch 64, the cam-shoulder 72 acts upon the friction-roll upon the pin 71 and draws the lever 65 downward. After each rotary movement of the disk 63 it is held immovable by means of a latch 74, which engages with notches 75, formed in the edge of the disk 63 between the notches 64. The latch 74 is pivoted at one end to a foot-bracket 76, Figs. 3 and 17, and at or near the other end it is connected by a forked link 77 with one end of a latch-operating lever 78, having a fulcrum 79. At the end of lever 78, opposite that to which the link 77 is connected, a spring 80 is attached, by which the latch 74 is normally thrown into and held in engagement with the notches 75. Upon the end of said lever 78, to which the spring 8 is connected, is mounted a friction-roll 81, its horizontal axis projecting toward the disk 67ª, upon the flat face of which is mounted a cam projection 83, having a curved or convex cam-sur-

face 84. At each revolution of the disk this cam-surface is brought under the friction-roll 81 and lifts the end of the lever 78 against the tension of the spring 80, thereby drawing the latch out of the notch 75 in the disk 63, with which it is in engagement, and leaving the disk free to rotate. This disengagement takes place at the moment when the pawl 66, having engaged one of the notches 64 in the disk 63, is about to advance the latter. The latch being tripped at this moment, the disk is free to advance, so that when the cam projection 83 passes off the friction-roll 81 the latch returns to the edge of the disk 63 and rides thereon until the succeeding notch 75 arrives at such a point that the latch may engage therewith under the impulse of the spring 80.

By the intermittent rotation of the upper and lower series of feed-wheels, as described, the mattress is advanced step by step in the direction of the arrow in Fig. 3, moving upon a horizontal bed or support, which is provided at suitable intervals with longitudinal channels 86, through which the feed-wheels of the lower series project. The lateral movement is made in unison with a similar movement of the feed-wheels of the upper series and is effected by the vertical shaft 30, parallel arms 32, connected by link-plates 33 to each of the shafts 5 and 6, and the arm 35 and its actuating devices, as already described.

The mattress rests upon a series of longitudinal slats or bars 87, Fig. 2, which are supported by transverse bars 88, Fig. 12. These bars rest in turn upon longitudinal beams 89, which lie upon shoes 90, one of which is placed near each end of the machine-frame. Each shoe is provided upon its lower surface with a rib or flange 91, which lies in a channel in a transverse Y-shaped rail 92, mounted upon the upper edges of the transverse braces 2, Figs. 12 and 13. The slats 87 and the other parts of the structure are rigidly connected together to form a single frame, to which the forked link 40, Figs. 12 and 16, is secured, whereby the lateral movement of the upper and lower series of feed-wheels will be accompanied by a like movement of the entire structure on which the mattress rests, the shoes 90 sliding upon the rails 92. As the mattress lies upon the slats and is more or less compressed between the upper and lower series of feed-wheels, it will move with them without changing the relative position of the several parts. The purpose of this lateral movement will be explained hereinafter. The mattress being fed intermittently in the direction of its length by the upper and lower series of feed-wheels and being compressed between them to a suitable thickness for tufting, I apply the tufts to the peripheries of said wheels by automatic means in such manner that they are temporarily retained thereon and pressed against the opposite surfaces of the mattress during the process of tufting, by which the tufts are permanently fastened. The mechanism by which the tufts are applied to and retained by the two series of feed-wheels I will now describe.

Referring to Figs. 3, 4, 5, 6, 7, 8, 9, 10, and 11, the upper and lower series of feed-wheels being substantially alike they are both designated by the same numeral. Each individual feed-wheel 7 consists of a circular band of metal having a supporting-frame of skeleton form which radiates from and is rigidly mounted on the shaft carrying said wheel. Upon the outer face of the circular band composing each feed-wheel I place at equal intervals suitable cushions 93, from each of which project sharp points or spurs 94. Upon the bracket 95, which projects from the transverse beams 4 4, extending between the opposite sides of the frame 3, is mounted a rock-shaft 96, upon which is keyed or otherwise rigidly mounted a series of sleeves or collars 97, corresponding in number to the number of feed-wheels in the upper series. As each member of the series of tuft-placing devices is a duplicate of any one of the remaining members, I will confine the description, for the sake of convenience and brevity, to one only.

Referring to Fig. 4, which represents, upon an enlarged scale, a single tuft-placing mechanism for one of the upper series of feed-wheels, the reference-numeral 98 indicates arms, which are formed upon and hang below the sleeve or collar 97, their ends being provided with lugs 99, which are fastened to a barrel 100, which is rigidly secured to the lugs 99 by means of bolts or screws 101, passing through said lugs and tapped into bosses 102 upon the barrel. The rock-shaft 96 is placed so near to the series of feed-wheels that when the barrel 100 is horizontal, or nearly so, its end will lie quite near the face of the feed-wheel 7, and by rocking the shaft 96 said barrel may, by a slight tilting movement, be caused to abut with its end squarely against the face of the feed-wheel. The barrel 100 is provided with an interior longitudinal chamber, which receives a tube 103, the length of which is about half, or a little more than half, the length of the barrel. In cross-section the interior of said tube is shaped, Fig. 8, to correspond, or substantially so, with the outline of the tuft, one of which is shown in Fig. 9. Within the tube 103, and lying in a longitudinal opening in the barrel behind the end of said tube, is a feed-bar 104, provided with a pusher-head 105, both shaped to fit the interior of the tube, the pusher-head having pins or spindles 106, which enter apertures in the forward end of the feed-bar, between which latter and the pusher-head 105 are springs 107, coiled upon the said pins and normally holding the pusher-head at a little distance from the end of the pusher-bar. The latter is provided with a rack of teeth 108 upon its upper side, with which a spur-gear 109 has mesh, said gear being carried by a shaft 110, which passes transversely through

the top of the barrel. Upon one end of this shaft is mounted a ratchet 112, with the teeth of which a holding-pawl 113 engages, said pawl being pivoted upon the flattened side of the barrel below the ratchet and held in engagement by a spring 114. Mounted upon the outer or projecting end of the shaft 110 is an arm 115, upon the rearward end of which is mounted a sleeve 116. Upon the transverse beam 4, over the rear end of the barrel, is secured an angular lug 117, Figs. 4 and 7, to which is pivotally connected one end of a screw-threaded bar or spindle 118, which is capable of vibration upon its pivotal axis 119 in a vertical plane substantially parallel with the axis of the barrel 100. The threaded portion of this bar or spindle passes through and lies loosely in the sleeve 116, and above and below the latter are stop-nuts 120 and 121, turned upon the threaded bar and secured in place by jam-nuts 122. A spring-pressed feed-pawl 123 is mounted upon the inner face of the arm 115 between the sleeve 116 and the ratchet 112, and with the teeth of the latter the nose of the pawl is held in engagement by its spring.

The parts described are duplicated for each one of the upper series of feed-wheels, each separate piece of tufting or tuft-feeding mechanism being mounted upon the rock-shaft 96. Mounted in brackets 124, which project from a transverse frame 125, extended between the sides of the machine-frame 1, is a rock-shaft 126, having the same relation to the lower series of feed-wheels as the rock-shaft 96 bears to the upper series. Mounted upon this rock-shaft 126 in the manner already described are a series of tuft-feeding mechanisms 127, corresponding in all essential respects to those upon the upper rock-shaft 96, the sole difference being that the latter hang from the upper rock-shaft, while the former are supported above the rock-shaft 126. From the upper rock-shaft an arm 128 projects toward the upper series of feed-wheels, and from the rock-shaft 126 an arm 129 projects in an opposite direction, the extremities of said arms being connected by a rod 130. Upon or near the end of the lower rock-shaft 126 is rigidly mounted the end of a lever-arm 131, which extends beneath the shaft carrying the lower series of feed-wheels, its extremity, which is provided with a friction-roll 132, lying beneath the shaft 43 and in the path of revolution of a cam-arm 133, rigidly mounted upon said shaft. At each revolution of the latter the cam-arm 133 depresses the lever-arm 131, rocking the shaft 126 and, through the connecting-rod 130, the shaft 96, thereby swinging both series of tuft-feeding mechanisms toward the upper and lower series of feed-wheels 7 in unison and impaling the tufts which lie in the mouths of the barrels 100 upon the points or spurs 94, projecting from the cushions 93 on the peripheries of the feed-wheels. When the cam-arm 133 passes off the end of the lever-arm, the two series of tuft-feeding mechanisms are restored to the normal position shown in Fig. 3 by means of a lever-arm 134, rigidly mounted on the lower rock-shaft 126, Fig. 1, and provided with an adjustable weight 135. As the barrels 100 move toward the feed-wheels 7, they assume the position shown substantially by dotted lines in Fig. 4, whereby the threaded bars 118 are caused to vibrate or swing over a short arc, as seen by dotted lines in Fig. 4. As the arm 115 is loose upon the shaft 110, the sleeve 116 rests on the lower set-nut 120 during this movement, and as the rear end of the barrel drops and moves toward the feed-wheel 7 the arm 115 is caused to turn on the end of the shaft 110 in such manner as to draw the feed-pawl back over the teeth of the ratchet 112, which is locked by the holding-pawl 113. As the barrel moves back to the normal position, (shown in full lines in Fig. 4,) the sleeve 116 rises on the threaded bar 118 until it strikes the nut 121, which compels it to turn on the shaft 110, thus carrying the feed-pawl 113 forward and giving a rotary motion to the ratchet 112, which drives the feed-bar 104 forward within the tube 103, feeding the tufts contained therein toward the mouth of said tube. The extent of this feed movement can be adjusted with great accuracy by means of the stop-nuts 120 121. The tufts having been placed upon the upper and lower series of feed-wheels 7 in the manner described, the intermittent rotary motion of said feed-wheels brings them upon and presses them against the opposite surfaces of the mattress and directly opposite each other, or substantially so, the two transverse series of tufts lying in the vertical plane passing through the axis of the shafts 5 and 6, as shown in Fig. 3. The feed-wheels 7 being at rest, with the mattress compressed between them, the next step in the order of operation is to fasten the tufts in place, which is accomplished by the following mechanism:

Upon the hangers 21, which drop from the transverse bar 13, are mounted strong horizontal braces 136, Figs. 14 and 15, which lie parallel with the upper feed-wheel shaft 5 and project from the hangers 21, which lie between the wheels 7 within the peripheries of said wheels, Fig. 12. These horizontal braces support vertical guide-plates 137, each having a slot 138 in which the shaft 5 lies. In each plate is also provided a vertical guideway, in which lies a needle-gate 139, consisting of a substantially-rectangular frame having beveled edges 140, which lie in the guideway, and provided with a longitudinal slot 141 of such length as to permit the needle-gate to reciprocate without colliding with the shaft 5. At or near the lower end of the gate is formed or mounted a transverse-projecting needle-head 142, having a central opening to admit the butt of a straight tufting-needle 143, which is fastened by a thumb-screw 144. The needle has an eye near its point and carries a tufting-twine 145, which is carried

around a tension device 146 upon the side of the guide-plate. The spool or other device from which the twine is drawn is placed at any suitable point. Each hanger 21 is provided with one of the vertical guide-plates 137, having a needle-gate, needle, &c., and arranged in the manner described. The needle-gates 137 are operated by means of lever-arms 147, Figs. 3 and 14, mounted rigidly upon a rock-shaft 148, which is journaled in bearings 149, mounted upon the brackets 95. The vibrating ends of these lever-arms are operatively connected to the needle-gates by connecting-rods 150. Rigidly mounted upon the rock-shaft 148, near its end, Figs. 1, 2, and 17, is a lever-arm 151, in the vibrating end of which is formed an elongated eye 152, Fig. 1. By means of this eye the end of a connecting-rod 153 is adjustably connected to the lever-arm 151, said rod extending downward slightly below the top of the main frame 1, where its end is adjustably connected to the actuating-lever 154 by means of an elongated eye 155. The actuating-lever is fulcrumed upon a bearing 156, which projects from a bracket 157, mounted upon the inner face of the frame 1, Fig. 17. The actuating-lever 154 is of the third order of levers, the power being applied between the fulcrum and the weight. It is provided between its ends with a laterally-projecting stud which carries a friction-roll 158, which lies in a cam-race 159, (see Fig. 51,) formed in the inner face of the large spur-gear 42. The purpose of rendering the ends of the connecting-rod 153 adjustable in their connection to the lever-arm 151 and the actuating-lever 154 is to enable a suitable variation to be made in the length of the stroke of the needle-gates by varying the acting distance of the lever-arm or the actuating-lever, or, if necessary, of both.

The specific method of tacking and of knotting the tufting-thread upon the under side of the mattress will be described in its proper order. I will only mention at this point that after the needles 143 have passed through the mattress upon one side of the tufts pressed against its upper and lower surfaces, and after said needles have been withdrawn and again risen above the mattress, leaving the first strands of the tufting-threads drawn through the body of the mattress, it is necessary to shift the mattress and both series of tufts about half an inch, more or less, to one side, to straddle or carry the tufting-twine over the tufts and through the mattress upon the other side of the tufts, as shown in Fig. 22. For this purpose both the upper and lower series of feed-wheels 7, together with the mattress compressed between them, as shown in Fig. 3, and the horizontal mattress-support, are shifted laterally by means of the vertical shaft 30, which is connected to the shafts 5 and 6 and to the horizontal frame, in the manner described in a preceding portion of this specification.

To enable the tufting-twine to be carried through the mattress by the needles 143 first on one side and then on the other of the tufts, needle-openings 160 are formed, Figs. 10 and 11, in each of the feed-wheels 7 and in the metallic cushions 93. These openings are substantially circular in form, one being on each side of the spurs 94, which lie in a circumferential line, the tuft being applied so that the spurs will impale it in its central longitudinal line, or as nearly so as possible. A channel 161 connects the two needle-openings 160 and permits the passage of the tacking-thread over the centers of the tufts. It will be noted that in Figs. 10 and 11 the opening in the latter figure is of peculiar form, being substantially L-shaped, for a purpose which will be explained shortly.

I will now describe the mechanism for seizing the ends of the twine after the needles have passed once through the mattress, and for knotting the tufting-twine upon the under or lower side of the mattress after the tufting-needles have made their second stroke, after which the twine is cut at a little distance from the knots and the mattress is fed forward to bring another series of tufts against each surface upon which the operation will be repeated.

Let it be supposed, Fig. 3, that the mattress is in position, the latch 74 being disengaged from the disk 63, and the mattress about to be fed forward by the action of the upper and lower series of feed-wheels. The heart-shaped cam-edge 72, Fig. 17, now acts upon the friction-roll journaled on the lever 68, and, through the connecting-rod 67 and pawl 66, advances the disk 63, its movement being equal to the distance between the notch 75, from which the latch 74 has been released, and the next succeeding notch with which said latch can engage. By this movement the mattress is brought into the position shown in Fig. 3, in which each feed-wheel 7, in both series, is pressing thereon, with one of its cushions 93 in the same vertical line with one of the similar cushions on the corresponding feed-wheel in the other series. The mattress being now stationary, the cam-race 159 acts upon the lever 154 and the series of needles 143 descends, passing through the mattress and projecting below its lower surface. In making this stroke the needles pass down through one of the needle-openings 160 upon one side of the series of tufts and are brought into the position shown in Fig. 19. After reaching their lowest point, as shown in said figure, the needles are slightly raised by an angular portion 159ª, Fig. 51, of the cam-race, the purpose being to throw out a loop of the thread. As the action is the same in each needle throughout the series, the following description will have reference to a single needle only, as shown in Figs. 19 to 24 and Figs. 19ª to 23ª.

Beneath and projecting partly within the peripheries of the lower series of feed-wheels are a corresponding series of knotting mech-

anisms, which lie immediately beneath the needle-openings in the upper portion of the rims of said wheels, as shown in Fig. 45. Each knotting mechanism comprises a circular shell 160^a, Fig. 28, which forms a rigid part of a bracket 161, the latter forming part of a frame 162, which is bolted to an upright 163, Fig. 45. The upper portion of the circular shell is dressed off upon its exterior to form a shoulder 164, upon which is seated an annulus 165, Fig. 27). This annulus is capable of a swiveling movement upon the shell, which is produced at intervals by a bell-crank or elbow-lever 166, Figs. 25 and 55, fulcrumed upon the back of the upright 163 and connected by a link 167 to a lug 168 on the annulus. Upon the latter is formed a rigid jaw 169, projecting from its inner face at a point almost opposite the lug 168, and upon the base supporting this jaw is pivoted a movable jaw 170, having a lever 171, which is curved around in the line and upon the edge of the annulus for about a quarter of its circumference. The edge of the annulus is cut away to receive the lever and give a flush surface with the top of the lever. Upon the screw-pivot, which forms the axis of the movable jaw 170, is also mounted a cutting-blade 172, operated by a curved lever 173, which lies upon the lever 171. At the end of the lever 173 is formed a lug 174, which drops over the outer edge of the lever 171 and projects radially outward. The end of the lever 171 extends beyond this lug and is straightened, so that it lies in the position of a tangent to the shell 160^a. Its extremity is connected to the end of the lug 174 by a spring 175, by which the jaw 170 would, if not otherwise acted upon, be held closed against the rigid fixed jaw 169. It will be seen in Fig. 30 that the latter jaw has two faces or parts *a* and *b*, one of which is the holding or clamping face, while the other co-operates with the cutting-blade 172.

Overhanging the shell and annulus is a hood 176, Fig. 44, formed of sheet metal and provided with an opening 177, through which the needle 143 descends, passing into an opening 178, which communicates with a vertical slot 179 in the shell 164, Fig. 28. The loose end of the tufting-twine is drawn down with the needle, Fig. 19, into the body of the mattress and the needle passes down till its eye carries the twine considerably below the lower face of the mattress. The needle being then raised slightly, a loop is formed in the twine between the eye and the mattress, in which the loose end of the twine lies. In making this loop the twine moves away from the needle and passes into and is caught by a hook 180, which is rigidly mounted on the top of the shell 160^a, its opening being above and in the vertical plane of the slot 179. Overhanging the hook 180 is a plate 181, having a fork at its free end, which lies close to the opening of the hook, the arms of the fork being at an angle of ninety degrees, or thereabout, with the line of the opening in the hook 180, upon one side of which the fork lies, while the jaws 169 170 lie upon the other side. The plate 181 is mounted upon the upper end of an arm 182, Fig. 44, carried by a rock-shaft 183. The devices operating said rock-shaft will be described hereinafter. When operated the forked end of the plate 181 is driven over the hook 180 until the crotch of the fork intersects the central longitudinal line of the hook-opening, as shown in Fig. 20^a, the loop of the tufting-twine being thus held inclosed upon all sides. As the loop of the twine is caught by the hook 180 the fork 181 moves forward upon one side and the two jaws 169 and 170 move forward upon the other side of the thread, the jaws being closed and held by the following means, in order to clamp and retain this part of the twine during the formation of the knot. Upon the under side of the lug 174 lies a friction-roll 184, mounted on a stud which is rigidly secured to the lug. This friction-roll lies in a race 185, which is curved concentrically with the annulus 165 and is inclosed by a frame 186, which is mounted upon a bracket 187, the latter having a sliding bearing 188 in the base of the circular shell 160^a. To the bracket is attached a link 189, which is coupled to an arm 190 rigidly mounted on a rock-shaft 191, Figs. 25 and 44. By the action of the latter the race 185 is removed from the circular shell by a narrow interval, and the movable jaw 170 is clamped upon the thread. This movement is not sufficient to carry the cutting-blade 172 into operative engagement with the part *b* of the stationary jaw, but is sufficient to put the spring 175 under such tension as to enable the jaws to securely hold the thread. As already stated, this engagement is effected by the needle being lifted somewhat to form a loop between the needle and the clamped portion of the twine.

Within the circular shell 160^a is arranged a knotter-head 192. (Shown in detail in Figs. 32 to 41, inclusive.) This head has a vertical stem 193, which lies in a central opening 194 in the base of the shell 160^a and extends down through the frame 162, in the lower portion of which it catches a bearing. Upon its lower end, which lies beneath said frame, is a bevel pinion 195, with which a sector-gear 196 has mesh. The sector-gear is mounted on a rock-shaft 197, which lies a little above the feed-wheel shaft 6 and is operated by a sector-plate 198, Fig. 42, which is rigidly mounted on the rock-shaft behind the upright 163. An arm 199 on said sector-plate is connected by a bar 200 to the end of a lever 201, Fig. 43, the latter being a rigid part of a rock-shaft 202, Fig. 3. The means for operating this rock-shaft will be referred to hereinafter in explaining the several cam mechanisms.

In the axial line of the stem 193 is an aperture 203, Fig. 41 in which lies a vertically-movable stem 204, the upper end of which rises to the top of the knotter-head, while the lower end extends below the bevel-pinion 195.

Upon its lower end is a head 205, which is connected by a link 206 to one arm of a bell-crank lever 207, having its fulcrum 208 upon the front of a frame-plate 209, bolted to the standard 163. By operating this lever at suitable intervals the end of the stem 204 will be caused to project, temporarily, above the top of the knotter-head 192. The knotter-head is provided with a curved looper-arm 210, having a peculiar construction, which will be explained in detail immediately. At the moment the needle descends the knotter-head is stationary, the point of the looper-arm 210 being close to it, but as the needle forms the loop the head begins to revolve, carrying the point of the looper-arm into the loop. As the needle now draws upward, the knotter-head continues to revolve by the action of the sector-gear 196 and the curved arm 210 passes completely into the loop of the tufting-twine, as shown in Figs. 20 and 20ª, the needle having risen far enough to withdraw from the opening between the knotter-head and looper-arm. At or about the same moment the stem 204 rises and projects above the top of the knotter-head, as seen in Figs. 21 and 21ª, and the twine being caught by the arm 210 is drawn over the outer surface of the head 192, in which a concave channel 212 is formed, Figs. 35 and 36. This channel inclines upward and passes out at the top of the head, and the twine having been caught by this channel is carried up in it as the head turns farther and ultimately passes over the top of the head before the latter completes its revolution, and the loop thus formed is caught by the projecting end of the stem 204, Figs. 21 and 21ª. During this operation, the needle having been withdrawn from the mattress, the latter is moved laterally a sufficient distance to enable the second stroke of the needle to be made upon the opposite side of the tuft and the second stroke is made just before the knotter-head is substantially in the position shown in Fig. 21ª.

The knotter-head and looper-arm are composed of three sections, Figs. 32 to 41, and for convenience I will designate said sections by the letters x, y, and z. The upper section x, which comprises the top of the head and the upper third of the looper-arm, is solid with the stem 193, and the lower section z is rigidly mounted thereon. The middle section y is arranged between and provided with a chamber y', which receives a neck x' on the top section, on which the middle section y is capable of turning. The middle and lower thirds of the looper-arm 210 form part of the middle and lower sections, respectively, and are so fitted together that the middle section of said arm may have a limited sliding movement between the two other parts. The extremity of the upper section is provided with a beveled point, forming a hook x^2, which projects beyond the two sections below. The end z' of the lower section is beveled off to lie quite near the barb of the hook x^2. The end y^2 of the middle section is square, and its outer face is dressed off to enable its edge to properly engage the edge of the depending barb of the hook x^2, which hangs down as far as the bottom or lower edge of the middle section, as shown in Fig. 37. A spring y^3 is coiled in the chamber y' and connected at its ends in such manner that the end y^2 of the middle section is normally held pressed with force against the edge of the barb of the hook x^2. The rotary retraction of this section is limited by a stop-pin y^4, projecting from the flat lower face of the said section into a curved slot z^3 in the lower section. Upon the outer face of the middle section, almost diametrically opposite the point of the looper-arm 210, is a square lip y^5, facing in the direction of revolution of the knotter-head. Upon the lower section, a little behind said lip, but beneath the projecting body of metal forming said lip, is a cam x^4. As the knotter-head approaches the position shown in Fig. 21ª, the end of the thread grasped by the jaws 169 170 is drawn across the path of the looper-arm and the beveled point of the hook x^2 of the upper section strikes it, carrying it downward into the passage between the barb of the hook and the beveled end z' of the lower section. At this instant the lip y^5 is brought against the end of a stop 213, Figs. 25, 26, and 28, lying within the circular shell 160ª, and pressed inward by a spring. The rotation of the middle section y of the head being thus arrested momentarily, its end y^2 is drawn away from the edge of the barb and the thread passes between the two just as the cam z^4 reaches the stop 213 and pressing it outward releases the middle section y, which is instantly restored to normal position by the coiled spring y^3, thereby catching the twine between its end y^2 and the barb of the hook. At this point the needle makes its second stroke, as seen in Fig. 22, passing down between the looper-arm and knotter-head and between the part of the twine now grasped by the said arm and that portion which passes from the end of the stem 204 over the periphery of the head, as shown in Fig. 21ª. After reaching its lowest point the needle rises slightly, as it did upon the first stroke, pauses an instant, in order that the loop thus formed may be caught by the devices shortly to be described, and then is drawn up, but before it rises far enough to impose strain upon the twine the knotter-head 192 begins to turn backward, thereby drawing the end of the twine which is grasped in its point through the eye in the twine which is formed by carrying the latter around the looper-arm, as shown in Figs. 21 and 22. As the retrograde movement of the knotter-head continues, this eye in the twine is swept off the looper-arm by means of a clearing-hook 215, Figs. 26 and 28, arranged inside the circular shell 160ª.

Upon the vertical front face of the frame-plate 209 are bolted two vertical guide-strips 216, Figs. 43, 44, and 46, between which is ar-

ranged a recessed plate 217. This plate has vertical reciprocation by means of a lever-arm 218, connected to its lower end by a link 219 and mounted rigidly at its other end upon a rock-shaft 220. An arm 221 is rigidly mounted on this shaft, its end having an elongated slot 222, in which lies a pivot-bolt 223, connecting the arm to an actuating-arm 224, rigid upon a shaft 225, Fig. 3. Upon the recessed inner face, Figs. 47 and 48, of this plate 217, in its central line and near its extended upper end, are pivoted a jaw-plate 226 and a jaw-operating plate 227. The former extends some distance below the fulcrum or pivot 228, on which it swings, and is provided with a slot 129. Above said pivot it is curved through about a semi-circumference, its upper end overhanging the pivot and extending a little beyond. Its extremity 230 is arched in cross-section, Fig. 49, and in rear of the arched portion is pivotally attached a jaw 231, having a rib 232, which is adapted to enter said arch. The jaw is normally drawn down or opened by a coiled spring 233 and is closed by the action of the jaw-operating plate 227, which is pivotally connected to a lug 234 beneath and behind the pivotal attachment of the jaw. The jaw-operating plate 227 has a lower straight edge portion 235, which lies a little on one side of the center of the pivot 228 and extends downward beyond the center of the slot 229, its lower end 235^a being cut at an angle to the straight parallel edges of about forty-five degrees. Upon the inner face of the jaw-plate 226, at one side of and substantially in the horizontal line of the pivot 229, is pivoted a cutter-plate 236, the upper end of which is inclined and extended upward to a link 237, which connects it to one arm of an angular blade-plate 238, pivoted to the jaw-plate behind the jaw 231. The rear faces of the jaw and the end of the jaw-plate are flush, and against these faces the blade-plate lies, its edge being normally retained in the position shown in Fig. 47 by a leaf-spring 239, attached at one end to the back of the jaw-plate, its lower end bearing against a pin 240, mounted in the edge of the cutter-plate below its pivotal axis.

Upon a rock-shaft 241, arranged just above the shaft 6, is mounted an arm 242, on the end of which is a bearing for a friction-roll 243, which lies in the slot 229 of the jaw-plate. The shaft is rocked by an arm 244, rigid thereon, its end being pivotally connected to a bar 245, which extends downward and at its lower end is connected to an arm 246, rigid on a shaft 247, Fig. 3, which is operated at suitable intervals by means hereinafter to be explained. As this operation is so timed as to be, in a measure, coexistant in point of time with the rise and fall of the recessed plate 217, the lower end of the jaw-plate will be vibrated, by the oscillation of the arm 242, from side to side of the recessed portion of the plate 217, as seen in Figs. 47 and 48, which show the jaw-plate when its movement is partly completed. In making this movement it is evident that the friction-roll 243 will traverse the slot 229 in both directions. By contact with the beveled lower end 235^a of the jaw-operating plate 227 in passing upward in the slot 229 the roll 243 will swing the lower end of said plate to the side toward which the beveled end 235^a is inclined, Fig. 48, and will hold it there until said roll again passes below the beveled end of the jaw-operating plate. On the same upward movement it will engage the angular lower end 248 of the blade-plate 238 and carry it toward the side of the axis 228 on which the plate is pivoted. By these movements the jaw 231 and cutter-plate 236 are both operated, the former being closed and the latter being swept over the rear faces of the jaw and the part against which it clamps.

Referring now to Figs. 43, 44, 45 and the diagrams Figs. 23, 24, 25, and 28, the circular shell 160^a is cut away beneath the channel 179 to permit the vibration of the curved point of the jaw-plate 227. As the needle on its second stroke, Fig. 22, makes a loop in the tufting-twine the jaw-plate swings and catches said loop, the jaw 231 closes, grasping the twine, and at the same time the plate 217 begins to descend and draw upon the twine, the arm 242 being so controlled that the roll 243 shall rise high enough in the slot 229 to close and hold the jaw 231 without causing the blade to sever the twine. As this strain is placed upon the twine held by the jaws below the knotter-head 193 is also turning backward, holding the other twine in the jaws in the point of its looper-arm, and to fully draw up and tightly close the knot which has been formed the forward movement of the mattress for a new row of tufts takes place, the twine having been previously cut. When the knots are thus properly formed, the twine having been severed by the action of the respective cutters already described, the further operation of the machine is practically a repetition of what has already been explained.

I will now refer briefly to those parts of the machine to which reference has been made, but the full explanation deferred. The rock-shaft 38, Fig. 3, which actuates the vertical shaft 30, giving lateral movement to the two series of feed-wheels and to the mattress-supports, is periodically operated by means of an arm 249, Fig. 3, rigid on the rock-shaft 38 and having upon its end a friction-roll 250, which lies in a cam-race 251, upon the flat face of a large disk 252, carried by the shaft 43. This cam-race is also shown in Fig. 54. The bracket 187 and frame 186 are adjusted toward and from the circular shell 160^a in order to close and open the jaws 169 and 170 and operate the cutter 172 by the arm 190 and rock-shaft 191, the latter being provided with a rigid lever-arm 253, lying against the back of the upright 163. On the end of this lever-arm is a friction-roll 254, which lies in a cam-race 255 in the sector-plate 198, Fig. 42. This race is divided into three parts $c' c^2 c^3$, the first

holding the lever-arm in such position that the jaws 169 170 are opened, as in Fig. 25. The second part c^2 shifts the lever-arm sufficiently to close and hold the jaws, and the third part c^3 shifts it still farther, causing the spring 175, Fig. 27, to yield, operating the cutter and severing the twine. The angular lever 166, Fig. 55, which imparts a swiveling movement to the annulus 165, also has an arm which lies flat against the back of the upright 163, a friction-roll 256 being mounted on its end and lying in a cam-race 257 in the sector-plate 198. This race also has three parts d' d^2 d^3, the first holding the lever at such a point that the jaws 169 170 are drawn back in position to await the first stroke of the needle. The second part d^2 swings the lever and throws the jaws forward to clutch the twine, and the third part d^3 holds the annulus in position to maintain the end of the twine in place until it is caught by the end of the looper-arm. The movement of the sector-plate 198 is controlled, as explained, by the rock-shaft 202. Upon this shaft is a lever-arm 258, Figs. 3 and 13, which extends toward the shaft 43. the friction-roll on its end lying in a cam-race 261 in the flat face of a disk 262, Fig. 53. The rock-shaft 247, Fig. 3, which controls the vibration of the arm 242, Figs. 43, 44, and 45, is controlled by a cam-race 259 in a disk 260, Fig. 52. The angular lever 207, Figs. 44, 45, and 50, is operated by the swing of the jaw-plate 226, against the end of which one arm of said lever rests, as shown in Fig. 50. A spring 263 maintains this engagement.

What I claim is—

1. In a mattress-tufting machine, the combination with an upper and a lower series of feed-wheels and with gearing driving the same in unison, of two series of tuft-carrying devices, and means for vibrating the same toward and from the feed-wheels, the latter being provided, at suitable intervals, with tuft-retaining devices, substantially as described.

2. The combination with an upper and a lower series of feed-wheels each provided upon its periphery with tuft-retaining devices, arranged at intervals, of an upper and lower series of tuft-carrying devices, tuft-feeding devices automatically co-operating therewith, and mechanism for intermittently vibrating the tuft-carrying devices toward and from said feed-wheels, substantially as described.

3. The combination with an upper and a lower series of feed-wheels, each provided upon its periphery with tuft-retaining devices arranged at suitable intervals, of an upper and lower series of tuft-carrying devices each consisting of a barrel adapted to contain a number of tufts, automatically operated feed-bars for advancing the tufts in said barrels, and mechanism for vibrating the two series of tuft-carrying devices toward and from said feed-wheels at proper intervals, substantially as described.

4. The combination with an upper and a lower series of feed-wheels, each having tuft-retaining devices arranged at suitable intervals upon its periphery, of an upper and lower series of tuft-carrying devices each consisting of a barrel adapted to contain a number of tufts, a series of toothed feed-bars arranged in said barrels, pinions carried by shafts journaled on said barrels and meshing with said toothed feed-bars, a series of arms loosely mounted on the pinion-shafts, pawls mounted on said arms and meshing with ratchets on said shafts, and mechanism for vibrating the tuft-carrying devices toward and from the feed-wheels at intervals whereby the pawl-carrying arms are vibrated, substantially as described.

5. The combination with an upper and a lower series of feed-wheels, each provided on its periphery with tuft-retaining devices arranged at intervals, of an upper and lower series of tuft-carrying devices each comprising a barrel and an automatically operated feed-bar, an upper and a lower rock-shaft upon which the two series of tuft-carrying devices are mounted, means for intermittently operating one of said rock-shafts to vibrate its tuft-carrying devices toward and from one series of feed-wheels, and a connecting-rod by which simultaneous action is communicated from one rock-shaft to the other, substantially as described.

6. The combination with a feed-wheel provided at suitable intervals on its periphery with tuft-retaining spurs, or points, of a tuft-feeding device, consisting of a barrel adapted to contain a number of tufts, a toothed feed-bar lying in said barrel, a pinion engaging said bar and carried by a shaft journaled on the barrel, a ratchet fixed on said shaft, an arm loosely mounted thereon and carrying a pawl engaging the ratchet, a screw-threaded spindle pivoted on a fixed support and passing through a sleeve on the end of said arm, said spindle being provided with stop-nuts above and below said sleeve, a rock-shaft on which is mounted the barrel-supporting arms, and means for operating said rock-shaft at intervals to vibrate the tuft-feeding device toward and from the feed-wheel, substantially as described.

7. The combination with an upper and a lower series of feed-wheels, each provided at intervals upon its periphery with tuft-retaining spurs, or points, of an upper and lower series of tuft-carrying devices, automatic tuft-feeding devices, an upper and a lower rock-shaft upon which the two series of tuft-carrying devices are rigidly mounted, an actuating lever-arm rigid upon one of said rock-shafts, a cam-arm revolving in the same plane with the end of said lever, and a connecting-rod uniting arms upon the upper and lower rock-shafts said arms extending in opposite directions from the shafts, substantially as described.

8. The combination with an upper and a lower series of feed-wheels, between which the mattress is advanced and compressed, of

a vertically adjustable support for the shaft carrying the upper series, spur-gears mounted on both upper and lower shafts, a gear mounted on a fixed axis and meshing with the spur-gear on the shaft carrying the lower series of feed-wheels, and an intermediate gear meshing with the gear on said fixed axis and with the spur-gear on the shaft carrying the upper series of feed-wheels, said intermediate gear being mounted on an arm which is loose on said fixed axis, substantially as described.

9. The combination with an upper and a lower series of feed-wheels carried by a vertically adjustable and a non-adjustable shaft respectively, of spur-gears mounted on said shafts, a gear mounted on a fixed axis lying in the same vertical line with said upper and lower shafts, an intermediate gear meshing with both the gear on said fixed axis and the spur-gear on the adjustable upper shaft, and a carrier-plate loosely mounted on the fixed axis and carrying a bearing for the intermediate gear, said carrier-plate being provided with an arm having a slot curved on a line struck from the fixed axis, as a center, and receiving a set-screw which is tapped into the machine frame, substantially as described.

10. The combination with an upper and a lower series of feed-wheels and with mechanism for imparting intermittent rotary motion thereto, of a series of tufting-needles, a series of needle gates carrying said tufting-needles and movable in brackets which lie adjacent to the feed-wheels of the upper series, and mechanism for reciprocating said needle-gates in unison, substantially as described.

11. The combination with an upper and a lower series of feed-wheels and with mechanism for imparting intermittent rotary motion thereto, of a series of tufting-needles, a series of needle-gates carrying said needles and movable in brackets which lie adjacent to the feed-wheels of the upper series, means for reciprocating the needle-gates in unison, and a series of knotters to knot the tufting-twine on the under side of the mattress, substantially as described.

12. The combination with an upper and a lower series of feed-wheels, each provided, at intervals upon its periphery, with tuft-retaining devices, of a series of tufting-needles carried by needle-gates which move vertically in brackets arranged adjacent to the feed-wheels of the upper series, means for reciprocating said needle-gates at intervals, and mechanism for giving, between two successive reciprocations of said needle-gates, a limited lateral movement to the support for the mattress and to both series of feed-wheels, between which the mattress is compressed, substantially as described.

13. The combination with an upper and with a lower series of feed-wheels, each having, at intervals upon its periphery, suitable tuft-retaining devices, of an upper and lower series of tuft-carrying devices, rock-shafts on which said tuft-carrying devices are mounted, means for operating said rock-shafts at intervals, to cause both series of tuft-carrying devices to approach and recede from the feed-wheels in unison, a series of tufting-needles and needle-gates movable in brackets which lie adjacent to the feed-wheels of the upper series, means for reciprocating said needle-gates at intervals, and mechanism for moving the mattress support and both series of feed-wheels laterally, between two successive reciprocations of the tufting-needles, substantially as described.

14. The combination with an upper and a lower series of feed-wheels, each provided with tuft-retaining devices arranged at intervals on the periphery, of an upper and lower series of tuft-carrying devices, means for vibrating the same, at intervals, toward and from the feed-wheels, a series of tufting-needles carried by needle-gates which move in brackets lying adjacent to the feed-wheels of the upper series, means for reciprocating said needle-gates at intervals, a series of knotters lying beneath the peripheries of the feed-wheels of the lower series, means for operating said knotters, and mechanism for giving a limited lateral movement to the mattress support and to both series of feed-wheels, simultaneously, between two successive reciprocations of the needle-gates, substantially as described.

15. The combination with an upper and a lower series of feed-wheels, each provided with tuft-retaining devices arranged at intervals on its periphery, of longitudinally movable shafts carrying the upper and lower series of feed-wheels, and mechanism for imparting a limited longitudinal movement to both shafts simultaneously, at suitable intervals, substantially as described.

16. The combination with an upper and a lower series of feed-wheels mounted on shafts which are movable longitudinally, of mechanism for imparting a limited, longitudinal movement to said shafts simultaneously, substantially as described.

17. The combination with an upper and a lower series of feed-wheels mounted on shafts which are movable longitudinally, of a rock-shaft having rigid arms linked to both of the feed-wheel-shafts, and means for operating said rock-shaft at intervals, substantially as described.

18. The combination with an upper and a lower series of feed-wheels mounted on shafts which are longitudinally movable, of a vertical rock-shaft having rigid arms which extend immediately above and beneath each of the feed-wheel-shafts, to which said arms are linked, said rock-shaft being also provided with a lever-arm, and means for operating said lever-arm at suitable intervals to give a limited longitudinal movement to both the feed-wheel-shafts simultaneously, substantially as described.

19. The combination with an upper and a lower series of feed-wheels mounted upon

shafts which are longitudinally movable, each feed-wheel being provided with tuft-retaining devices arranged at intervals on its periphery, of an upper and lower series of automatic tuft-carrying devices, a series of tufting-needles carried by a series of needle-gates which move in brackets adjacent to the feed-wheels of the upper series, a series of operating levers linked to the needle-gates, a rock-shaft carrying said levers, means for operating said rock-shaft, a rock-shaft having arms linked to the shafts of the feed-wheels, means for operating said rock-shaft at intervals, and a series of knotters arranged within the peripheries of the feed-wheels of the lower series, substantially as described.

20. The combination with an upper and a lower series of feed-wheels mounted on longitudinally movable shafts each feed-wheel being provided at intervals upon its periphery with tuft-retaining devices, of an upper and lower series of tuft-carrying devices each consisting of a barrel adapted to contain a number of tufts, a series of automatically operated feed-bars arranged in said barrels, an upper and lower rock-shaft carrying the two series of tuft-carrying devices, said rock-shafts having oppositely extending arms connected by a rod, a cam-actuated lever arm mounted on one of said shafts, a series of tufting needles, a series of needle-gates movable in brackets arranged adjacent to the feed-wheels of the upper series, a series of lever-arms linked to the gates, a rock-shaft carrying said lever-arms, a rock-shaft having rigid arms which are linked to both the feed-wheel-shafts, means for operating both of said rock-shafts at different times, and a series of knotters arranged within the peripheries of the feed-wheels of the lower series, substantially as described.

21. The combination with an upper and lower set of feed-wheels for advancing the mattress intermittently, of a series of needles, a series of intermittently rotating knotter-heads having looper-arms, an upper series of twine clamping devices upon the shells inclosing the knotter-heads, a lower series of twine clamping devices and means for automatically operating said parts in relation to each other, substantially as described.

22. The combination with automatic means for advancing the mattress, of a series of tufting-needles, an upper series of twine-clamping devices, a series of knotter-heads having looper-arms, vertically movable stems arranged in and adapted to rise at intervals above said knotter-heads, a pair of twine-clamping jaws mounted on an annulus surrounding each knotter-head, means for swiveling said annuli at intervals and for operating the jaws, mechanism for rotating the knotter-heads, and a series of twine-clamping and knot-drawing devices arranged below the knotter-heads, substantially as described.

23. The combination with a series of tufting-needles of a corresponding series of knotter-heads arranged beneath the mattress, each head comprising a looper-arm and having a metallic section capable of a limited rotary movement between an upper and lower section, the upper section of the looper-arm projecting beyond the others and having a hooked end with a hanging barb, a spring normally pressing the end of the middle section against the edge of the barb, stems adapted to rise periodically above the knotter-heads, mechanism for revolving the latter, means for catching and holding the cut ends of the twine, as the needles descend the first time, and a series of twine-clamping and knot-drawing devices to catch the twine-loops as the needles descend the second time, substantially as described.

24. The combination with a series of tufting-needles of an upper and lower series of feed-wheels, a series of needles and needle-gates arranged within the peripheries of the upper series of feed-wheels, means for moving the shafts of both series longitudinally between two successive strokes of the needles, a series of knotter-heads having looper-arms arranged within the peripheries of the lower series of feed-wheels, means for rotating said knotter-heads at suitable intervals, a series of vertically movable stems lying in said knotter-heads, means for projecting the same upward, a series of pairs of jaws mounted on annuli surrounding the knotter-heads, means for giving rotary movement to said annuli, cutters mounted upon the movable jaws, means for operating the jaws and cutters, and a series of twine-clamping and knot-drawing devices arranged below the knotter-heads. substantially as described.

25. In a mattress-tufting machine, a revoluble knotter-head having a stem, and a looper-arm, the head and looper-arm being formed in three sections, the upper and lower thereof rigid with the stem and the middle section capable of a limited rotary movement between them, the upper section of the looper-arm being prolonged beyond the others and provided with a hanging barb, against the edge of which the end of the middle section is held by a spring, substantially as described.

26. In a mattress-tufting machine, a revoluble knottter-head having a looper-arm the whole being formed in three sections, the middle section capable of a limited rotary movement, the upper section of the looper arm extending beyond the other sections and being provided at its end with a hook having a hanging barb, the beveled extremity of the lower section lying near the point of said barb, and a spring normally pressing the end of the middle section against the edge of said barb, substantially as described.

27. In a mattress-tufting machine, a knotter-head having a looper-arm, the whole formed in three sections, the middle section being capable of a limited rotary movement, a spring by which the end of the middle section of the looper-arm is normally pressed against the edge of a hanging barb on the prolonged end

of the upper section, a circular shell in which said knotter-head revolves, an inwardly pressed stop adapted to engage a lip on the outer face of the middle section, which overhangs a release-cam on the lower-section, an annulus mounted on an outer shoulder on said shell and having a rigid jaw, a movable jaw having a curved lever, a cutter mounted on the same axis and having a similarly curved lever the end of which has a lug hanging against the outer face of the jaw-lever and connected to the end of the latter-lever by a spring, a frame inclosing a curved slot adapted to receive a friction-roll on a stud hanging from the lug on the cutter lever, a bracket supporting said frame, means for moving said bracket toward and from the circular shell, and mechanism for swiveling the annulus and revolving the knotter-head, substantially as described.

28. In a mattress-tufting machine, a device for catching and holding the twine and drawing the knot, consisting of a jaw-plate pivoted upon a vertically movable support, a jaw pivoted to the upper, curved end of said jaw-plate, near its point, a jaw-operating plate mounted on the same pivot with the jaw-plate, the latter having a straight slot in the portion below its pivot, and the former having a straight-edged continuation below and upon one side of the pivot, the lower extremity being beveled off, an angular cutter-blade pivoted on the rear face of the jaw-plate, behind the jaw, a cutter-operating plate pivoted on the jaw-plate and having an angular lower end, a lever having a friction-roll lying in the slot in the lower part of the jaw-plate and adapted to engage the edges of the cutter and jaw-operating plates, and means for raising and lowering the movable support and for operating the lever carrying the friction-roll, substantially as described.

29. In a machine for tufting-mattresses, a mattress support, a series of tufting needles, and means for shifting said support automatically between two successive strokes of the needles, to carry the twine over the tufts, substantially as described.

30. In a machine for tufting-mattresses, the combination with a movable support for the mattress of an upper and lower series of wheels between which said mattress lies and by which it is compressed and the tufts held against its opposite surface, a series of needles, and means for moving both series of wheels and the mattress-support to one side, in unison, between the first and second strokes of the needles, substantially as described.

In testimony whereof I have hereunto set my hand and affixed my seal in presence of two subscribing witnesses.

EDWIN N. STEPHENSON. [L. S.]

Witnesses:
C. C. BARRETT,
J. E. ANDERSON.