No. 718,901. PATENTED JAN. 20, 1903.

F. BENOIT.

MACHINE FOR TUFTING MATTRESSES.

APPLICATION FILED MAY 25, 1898.

NO MODEL. 11 SHEETS—SHEET 1.

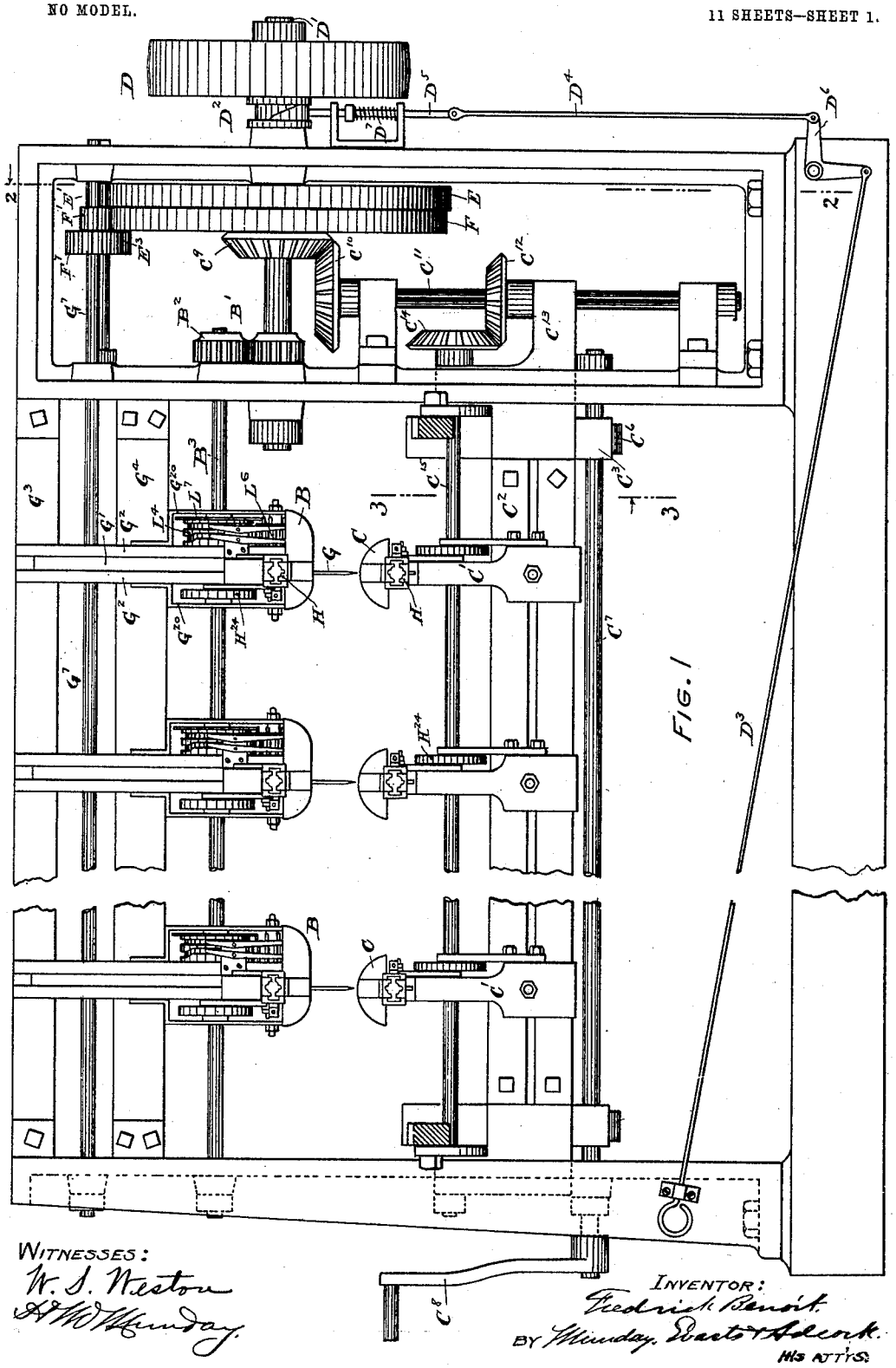


FIG. 1

WITNESSES:
W. S. Weston
H. W. Munday.

INVENTOR:
Friedrich Benoit.
BY Munday, Evarts & Adcock.
HIS ATTYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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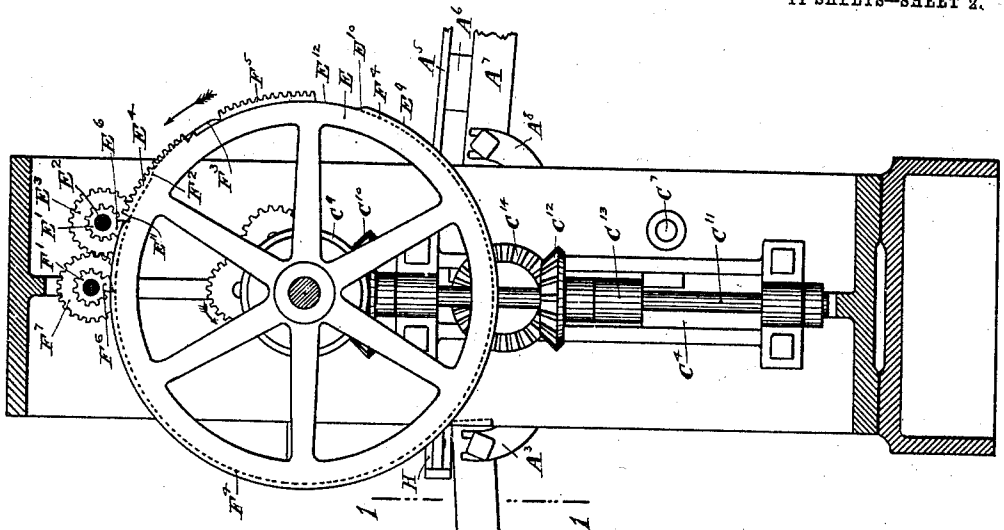


FIG. 2

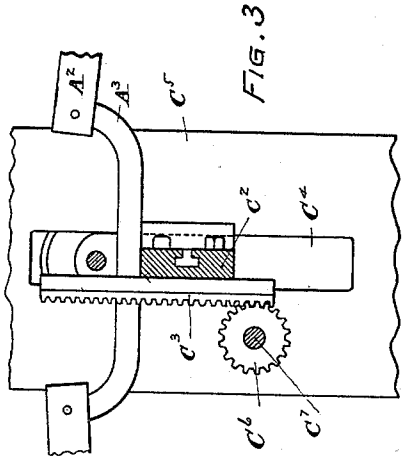
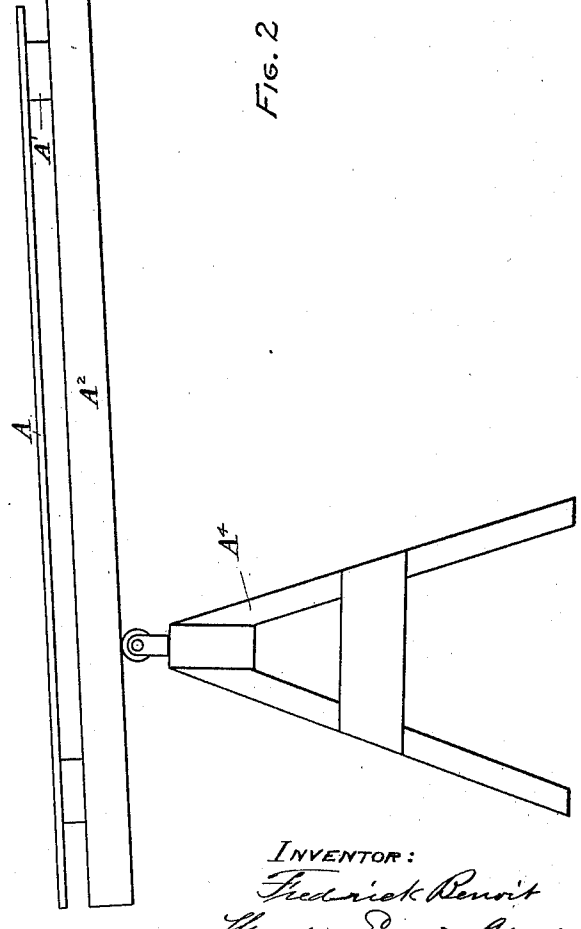


FIG. 3



WITNESSES:

W. S. Keaton

H. C. Munday.

INVENTOR:

Frederick Benoit

BY Munday, Evarts & Adcock

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NO MODEL. 11 SHEETS—SHEET 3.

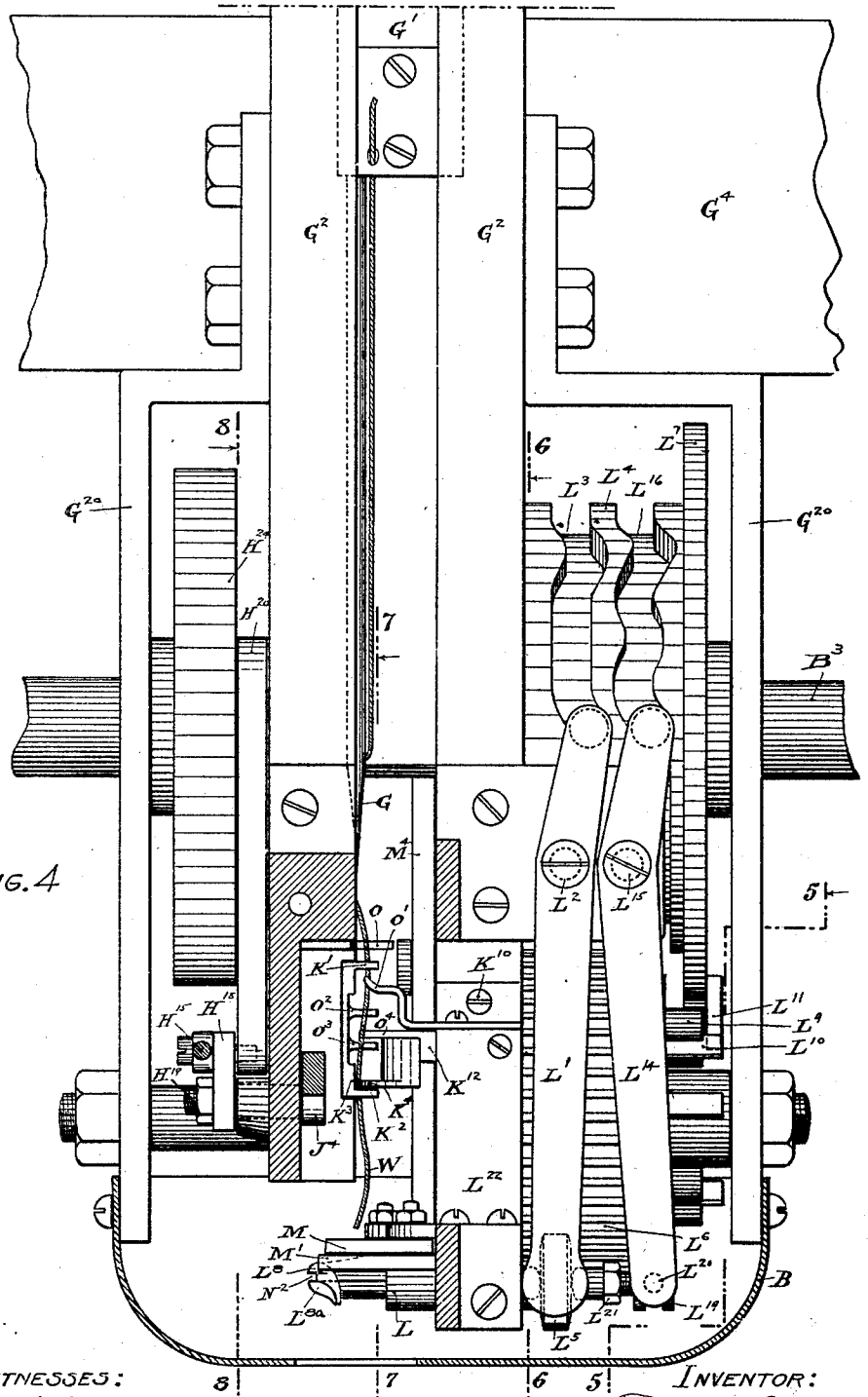


FIG. 4

WITNESSES:
W. S. Weston
A. W. Munday.

INVENTOR:
Frederick Benoit
BY Munday, Evarts & Adcock
HIS ATT'YS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 718,901. PATENTED JAN. 20, 1903.

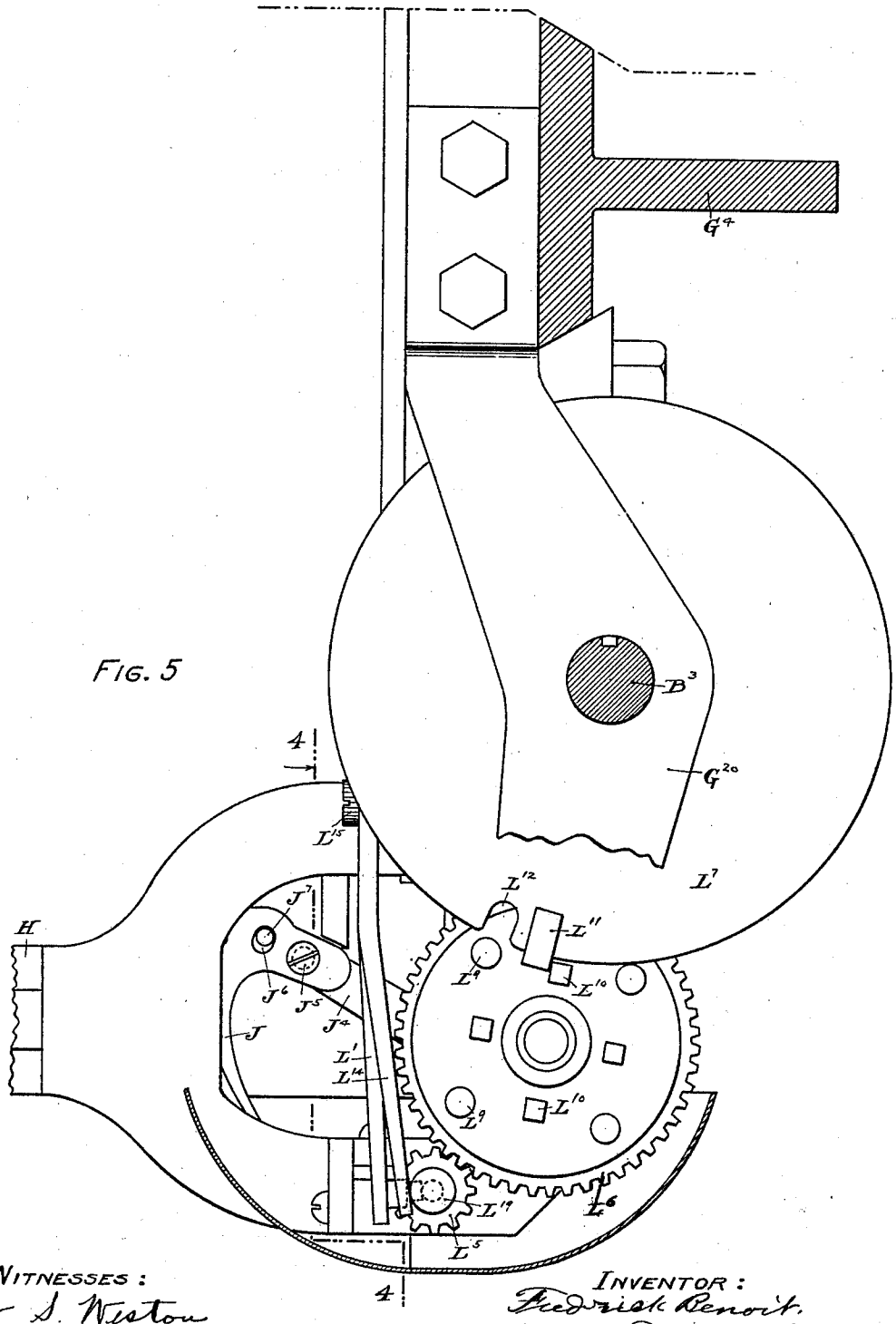
F. BENOIT.

MACHINE FOR TUFTING MATTRESSES.

APPLICATION FILED MAY 25, 1898.

NO MODEL. 11 SHEETS—SHEET 4.

FIG. 5



WITNESSES:

W. S. Weston

W. W. Wheeday.

INVENTOR:

Frédéric Benoit.

BY Munday, Evarts & Adcock.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 718,901. PATENTED JAN. 20, 1903.

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APPLICATION FILED MAY 25, 1898.

NO MODEL. 11 SHEETS—SHEET 5.

Fig. 6a

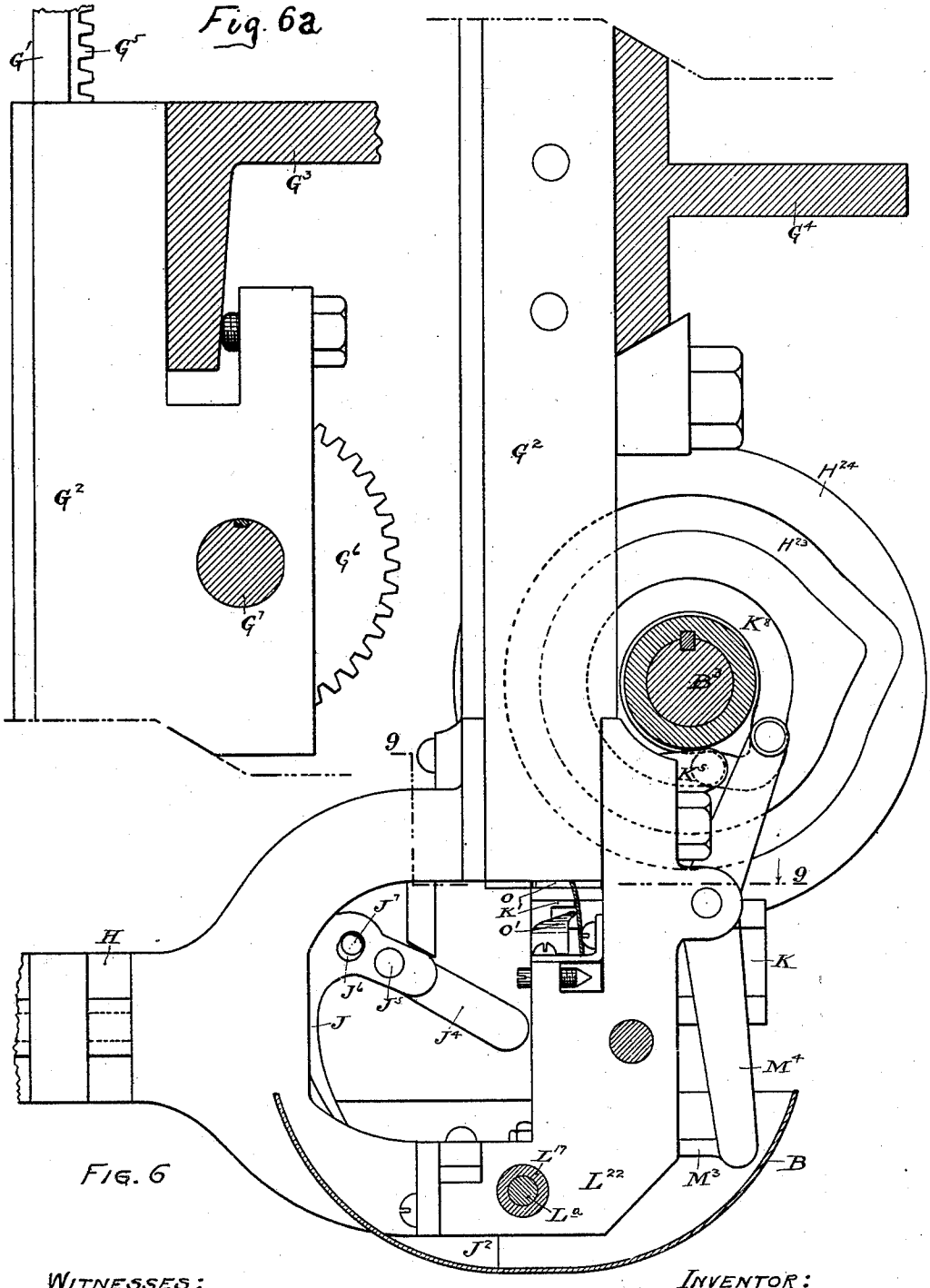


FIG. 6

WITNESSES:
K. S. Keston
A. D. Sunday

INVENTOR:
Frederick Benoit
BY Munday, Evarts & Adcock.
HIS ATTYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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F. BENOIT.

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APPLICATION FILED MAY 25, 1898.

NO MODEL. 11 SHEETS—SHEET 6.

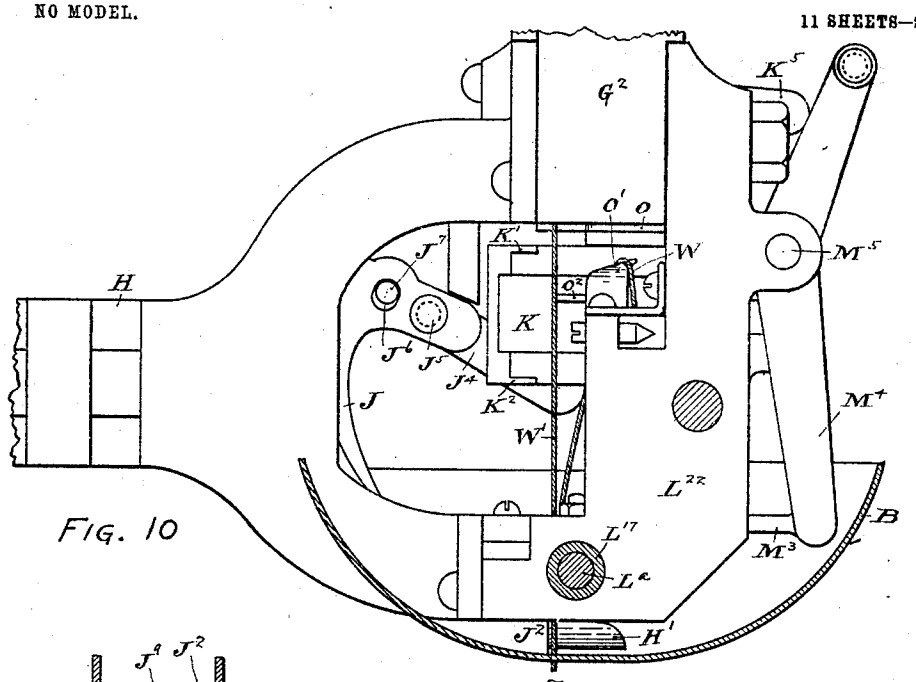


FIG. 10

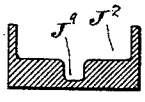


FIG. 11

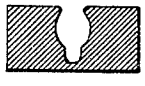


FIG. 12

FIG. 7

WITNESSES:

W. S. Weston

H. M. Munday.

INVENTOR:

Frederick Benoit

BY Munday, Evarts & Adcock.

HIS ATTYS.

No. 718,901. PATENTED JAN. 20, 1903.

F. BENOIT.

MACHINE FOR TUFTING MATTRESSES.

APPLICATION FILED MAY 25, 1898.

NO MODEL. 11 SHEETS—SHEET 7.

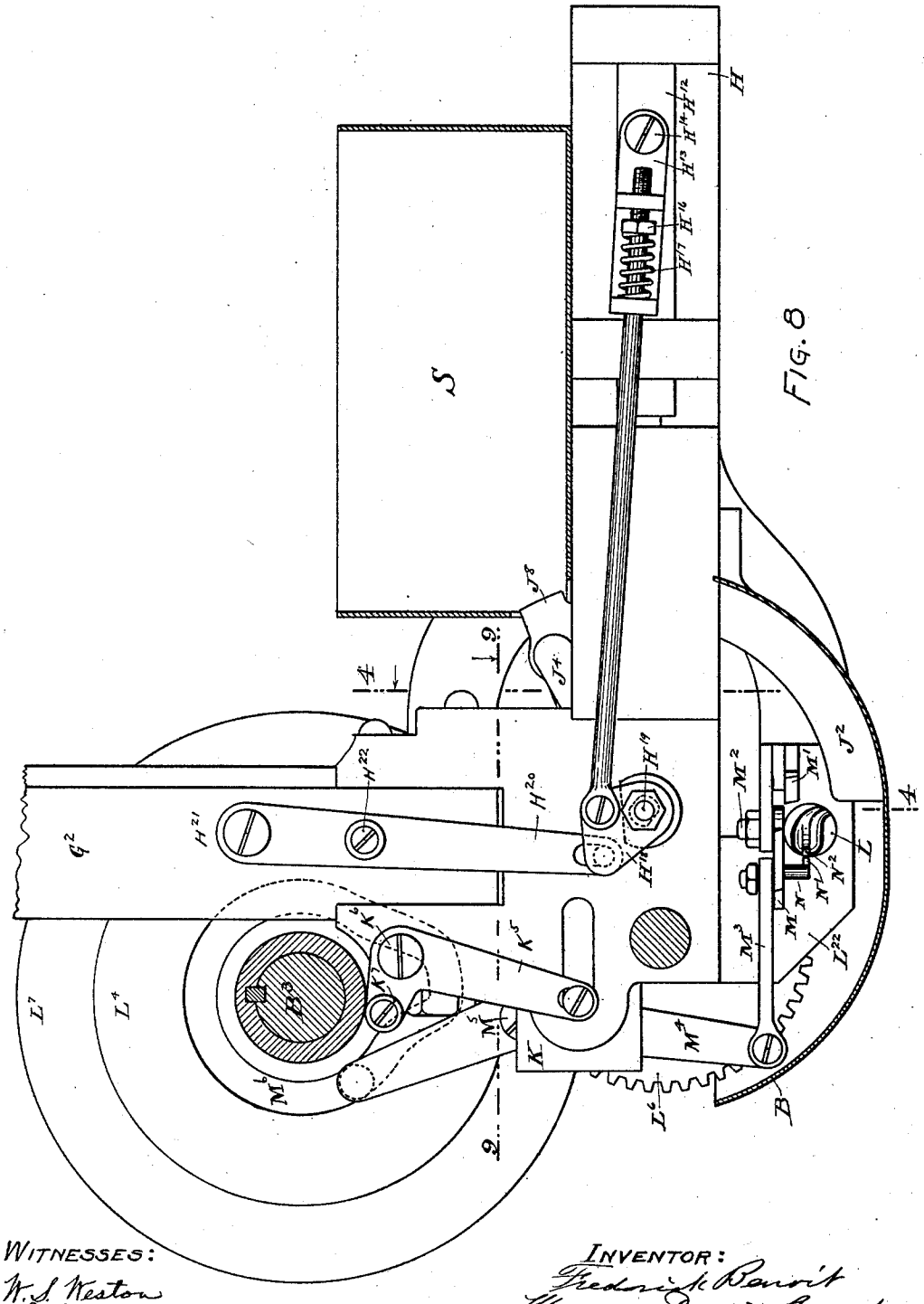


FIG. 8

WITNESSES:
W. S. Weston
A. W. Munday

INVENTOR:
Frederick Benoit
BY Munday, Evarts & Adcock.
HIS ATTYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

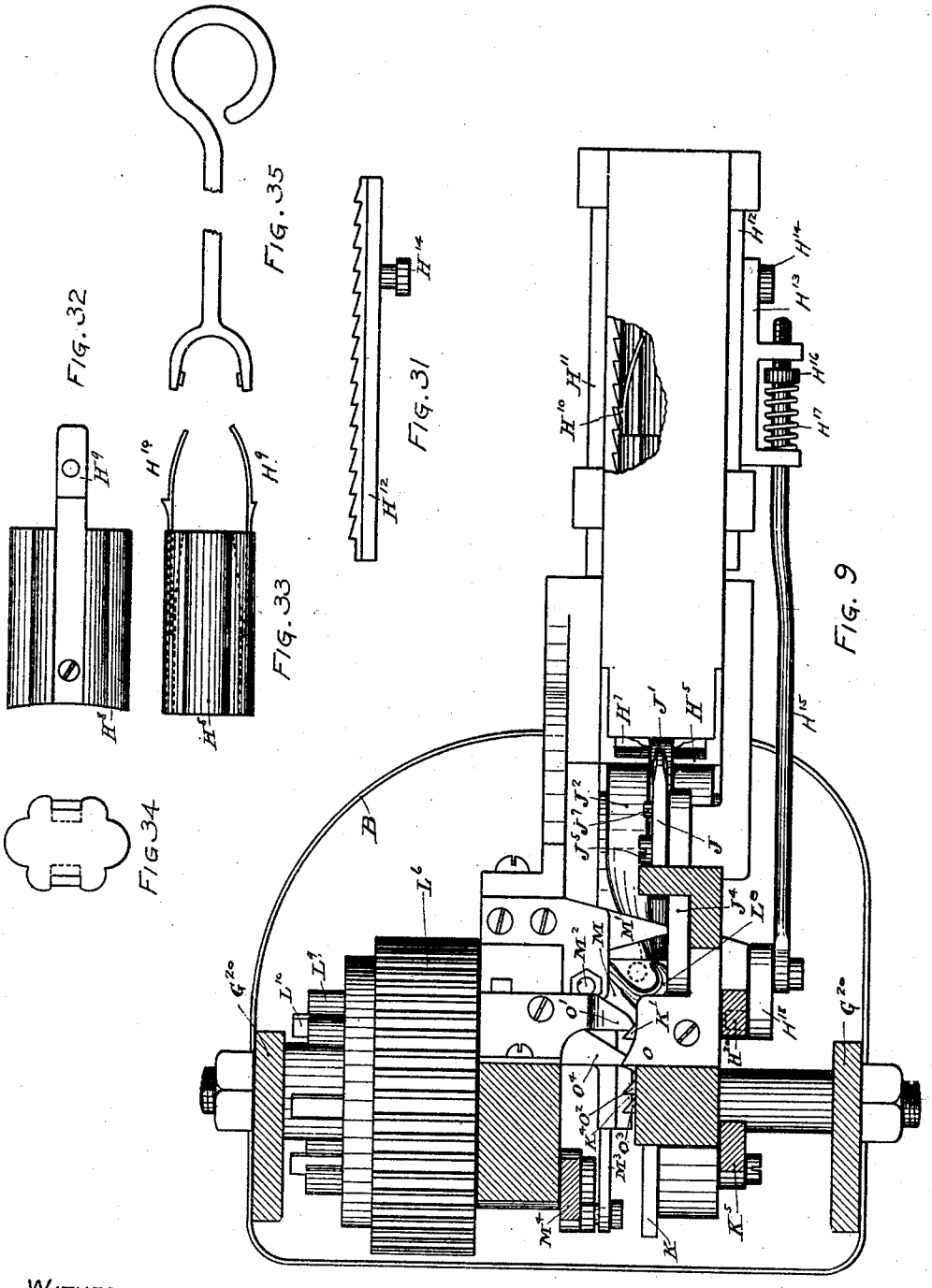
No. 718,901. PATENTED JAN. 20, 1903.

F. BENOIT.

MACHINE FOR TUFTING MATTRESSES.

APPLICATION FILED MAY 25, 1898.

NO MODEL. 11 SHEETS—SHEET 8.



WITNESSES:
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Frederick Benoit
BY Munday, Evarts & Adcock.
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No. 718,901. PATENTED JAN. 20, 1903.

F. BENOIT.

MACHINE FOR TUFTING MATTRESSES.

APPLICATION FILED MAY 25, 1898.

NO MODEL. 11 SHEETS—SHEET 9.

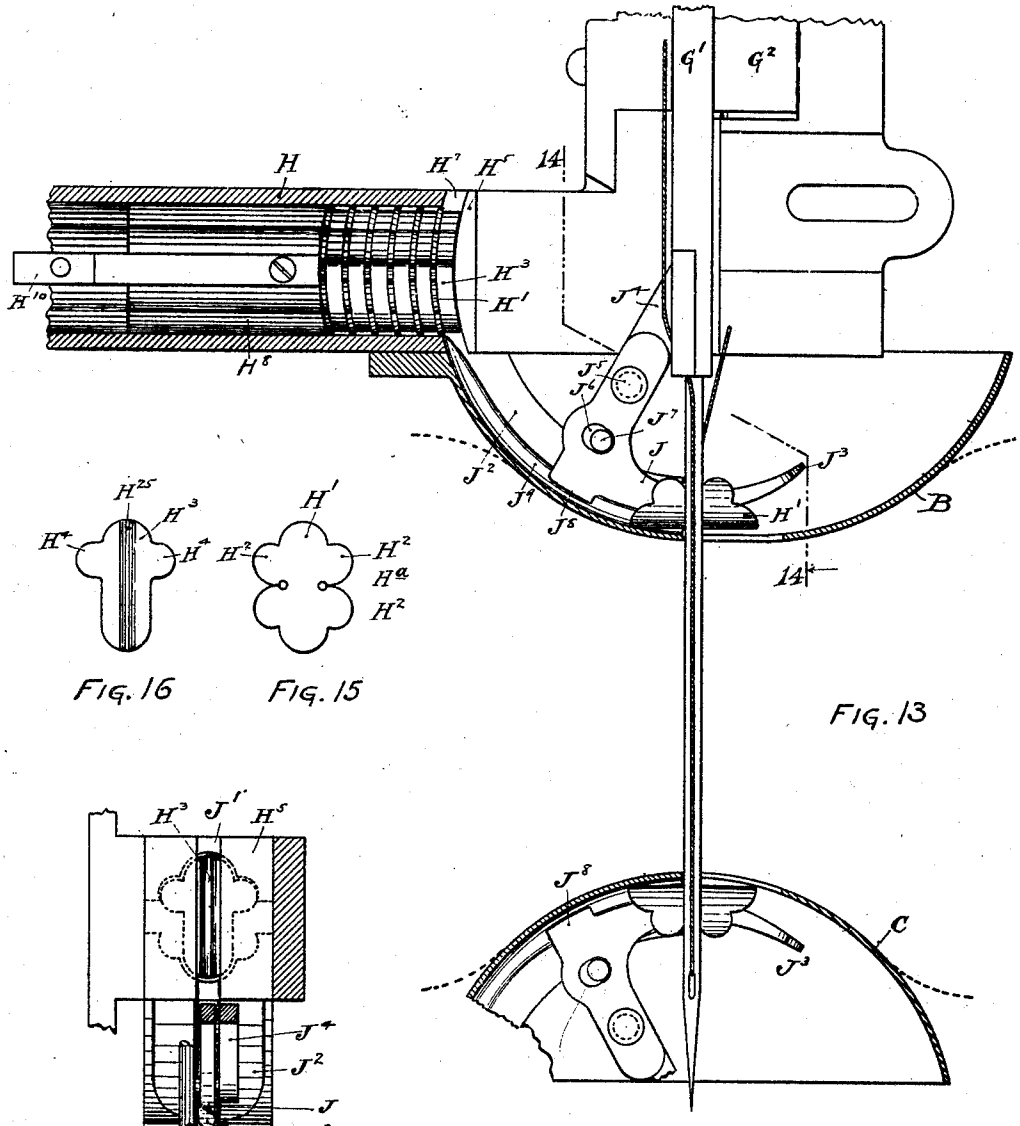


FIG. 16 FIG. 15

FIG. 13

FIG. 14

WITNESSES:
W. S. Weston
H. W. Munday

INVENTOR
Frederick Benoit.
BY Munday, Evarts & Adcock
HIS ATTYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 718,901. PATENTED JAN. 20, 1903.

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NO MODEL. 11 SHEETS—SHEET 10.

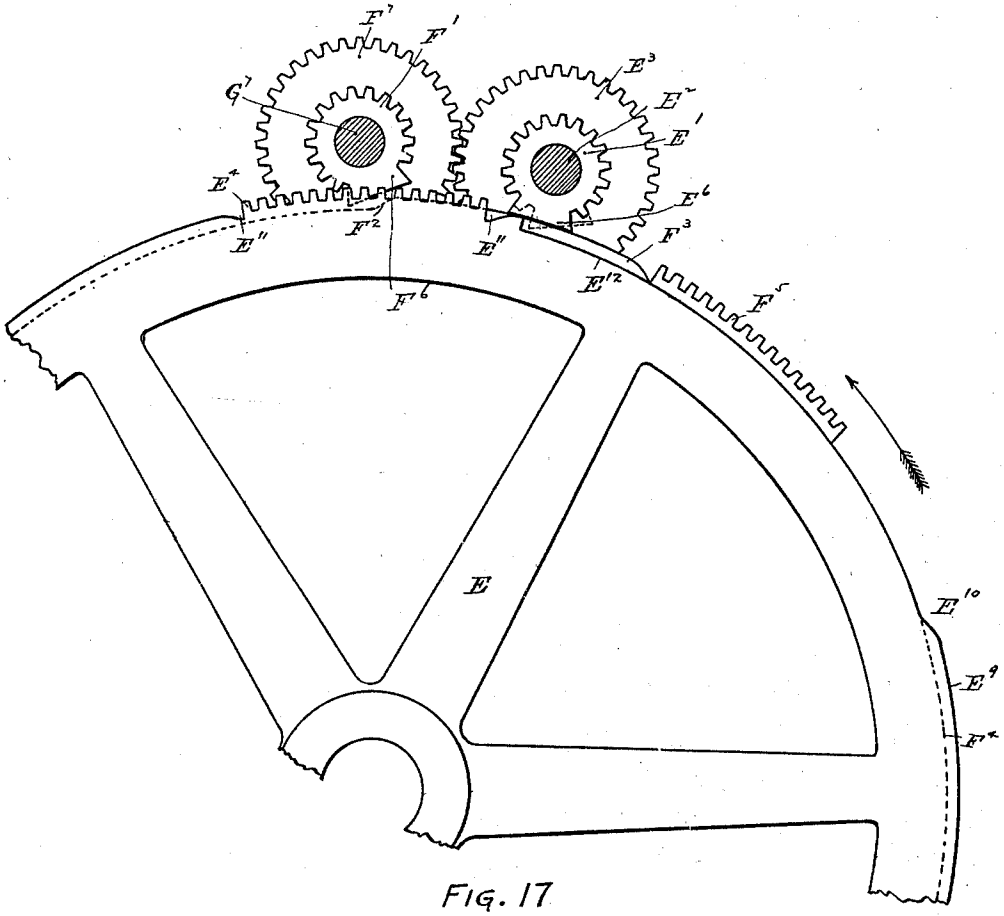


FIG. 17

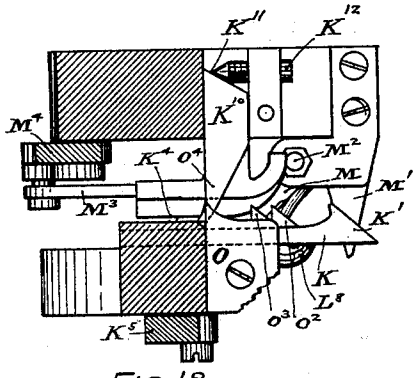


FIG. 18

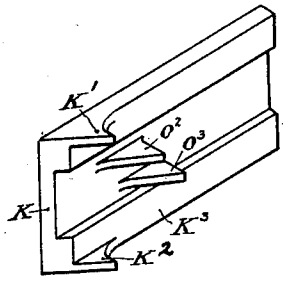


FIG 19

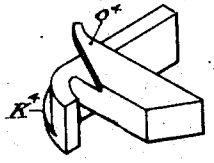


FIG. 20

WITNESSES:

W. J. Weston

A. D. Munday.

INVENTOR:

Frederick Benoit

BY Munday, Evarts & Evarts

HIS ATTYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 718,901. PATENTED JAN. 20, 1903.

F. BENOIT.

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NO MODEL. 11 SHEETS—SHEET 11.

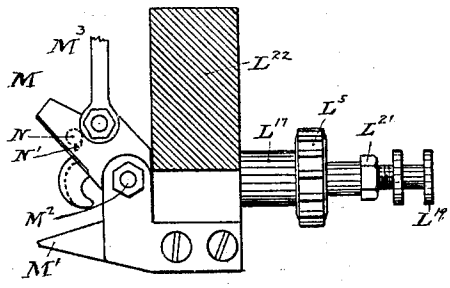


FIG. 21

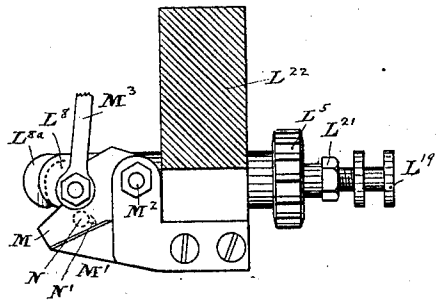


FIG. 22

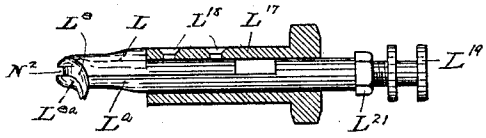


FIG. 23

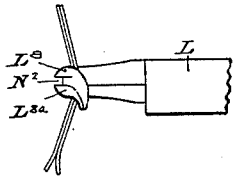


FIG. 24

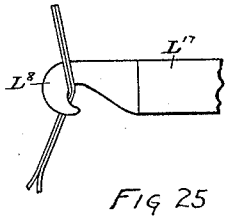


FIG 25

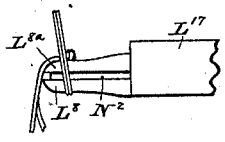


FIG 26

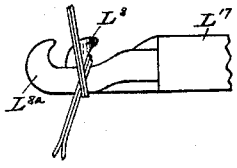


FIG. 27

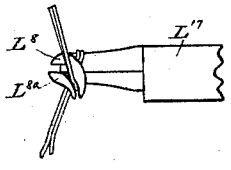


FIG. 28

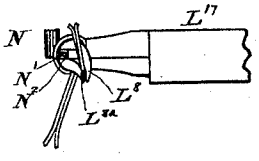


FIG 29

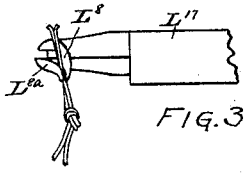


FIG. 30

WITNESSES:
K. S. Weston
A. W. Munday

INVENTOR:
Frederick Benoit
BY Munday, Evarts & Adcock.
HIS ATT'YS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FREDRICK BENOIT, OF CHICAGO, ILLINOIS, ASSIGNOR TO HIMSELF AND FREDERICK SCHULTZ, OF CHICAGO, ILLINOIS.

MACHINE FOR TUFTING MATTRESSES.

SPECIFICATION forming part of Letters Patent No. 718,901, dated January 20, 1903.

Application filed May 25, 1898. Serial No. 681,673. (No model.)

To all whom it may concern:

Be it known that I, FREDRICK BENOIT, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Machines for Tufting Mattresses, of which the following is a specification.

The object of this invention is to provide a machine adapted to use in tufting mattresses. It possesses the following features of operation: The needle moves through the mattress but once at each tuft-applying operation, and in so doing it forms a loop in the thread, in the ends of which loop the tufts are subsequently positioned. The tufts are thus positioned while the needle remains in its lowermost position or only slightly retracted, the tuft-feeding device being provided with a point adapted to separate the thread from the needle and allow the entrance between them of the tuft. The needle is retracted before the knotting operation begins, and the two sides of the loop are also drawn together before the tying. The machine retains a sufficiently positive hold upon the end of the thread so that the needle in moving through the mattress draws fresh thread in with it instead of drawing upon such end portion, and consequently the needle is never unthreaded. The friction devices at the time of the knotting control both the end and the fresh portions of the thread, but nevertheless allow both portions to be drawn through sufficiently to permit the formation of the knot. The thread-controlling devices do not become clogged by any accumulation of the waste ends, inasmuch as those ends are automatically discharged as fast as they are formed. By retracting the needle partially immediately after it has moved through the mattress I create upon the under side of the mattress a sufficient slack in the thread to permit the ready insertion of the under tuft, while upon the top of the mattress the friction-surfaces allow the drawing in of such amount of fresh thread as may be necessary to make an opening for the upper tuft. The compressing devices act only at the points where the tufting is done, and they are separated, so as to relieve the compression after each tufting operation. The needles and tuft-feeding mechanisms are multiplied to any extent necessary to enable the machine to apply all the tufts occurring in a row across the mattress at the same time, and these various mechanisms are preferably adjustable laterally, so as to permit the number of tufts to be varied as the different kinds or qualities of mattresses may require.

The nature of the invention, as well as the construction of the various devices and mechanisms and the various combinations of devices and mechanisms embodied in it, is fully set forth in the description given below and also illustrated in the accompanying drawings, in which latter—

Figure 1 is a transverse section of the machine upon the line 1 1 of Fig. 2. Fig. 2 is a section upon the line 2 2 of Fig. 1. Fig. 3 is a detail section on the line 3 3 of Fig. 1. Fig. 4 is a vertical section on the line 4 4 of Fig. 5 and also on the line 4 4 of Fig. 8. Fig. 5 is a section on the line 5 5 of Fig. 4. Figs. 6 and 6^a are sectional views on the line 6 6 of Fig. 4. Figs. 7 and 8 are sections on the line 7 7 and 8 8, respectively, of Fig. 4. Fig. 9 is a section on the lines 9 9 of Fig. 6 and 9 9 of Fig. 8. Fig. 10 is a section similar to Fig. 6, showing a portion of the parts given in said figure in a different position. Figs. 11 and 12 are detail sections on the lines 11 11 and 12 12 of Fig. 7. Fig. 13 is a partial section in the plane of the needle, showing the needle in its lowest position. Fig. 14 is a section on the line 14 14 of Fig. 13. Fig. 15 shows one of the tufts in the flat. Fig. 16 is a detail view of one of the tuft-separators. Fig. 17 is a section showing the needle-operating gears. Fig. 18 is a sectional view showing the means for adjusting the tension. Fig. 19 is a perspective of the reciprocating hook employed in controlling the thread. Fig. 20 is a perspective of the stationary retainer. Figs. 21 and 22 are partial horizontal sections showing the knife for cutting the thread in different positions. Fig. 23 is a sectional view of the knotter or tying device. Figs. 24 to 30, inclusive, are detail views showing the operation of the knotter. Fig. 31 is a plan of one of the tuft-feeding racks. Fig. 32 is a side

elevation, Fig. 33 a plan, and Fig. 34 an end view, of the tuft-follower. Fig. 35 shows the tool used in withdrawing the follower.

The mattress to be operated upon is first filled and placed in front of the machine upon a table composed of longitudinal slats or planking A, cross-bars A′, and side bars A^2, the latter supported at one end in brackets A^3, which are supported at one end upon an adjustable part of the machine, as hereinafter explained, and at the other end upon the horse A^4. The table may be given any inclination desired by adjusting the horse longitudinally of the table. After being tufted the mattress, which is shown in outline at Fig. 13, is discharged onto a similar table composed of the top slats or planking A^5, cross-bars A^6, and side bars A^7, supported at one end upon brackets A^8, also attached to the same adjustable part of the machine as brackets A^3, and at the other end upon a horse similar to the horse A^4, but not shown. From the table A the mattress is passed into the machine between mechanisms for applying the upper tufts and mechanisms for applying the under tufts, these mechanisms being combined with mechanisms for securing the tufts to the mattress. I prefer to employ a series of the tuft feeding and securing mechanisms and, in fact, to employ such number thereof as may be necessary to apply all the tufts lying in the same transverse line of the mattress at one time, and I have shown in the drawings a machine adapted to the simultaneous attachment of a series of the tufts. I prefer also that these tuft feeding and securing mechanisms shall be adjustable laterally, so that they may be shifted in position for different classes or sizes of mattresses and so that the number employed may be varied. The construction by which these results are obtained will fully appear from the detailed description thereof.

It is desirable that the mattress be compressed at the point where the tufts are located at the time of the application of the tufts, and hence I provide both the upper and lower tuft-feeding mechanisms with rounded or hemispherical shields, those of the upper mechanisms being designated by B and those of the lower by C, and support one or the other of these series of shields upon a movable support, so that the shields may be moved toward each other to produce this compression. In the drawings the shields C are shown as being thus provided with a vertically-movable support, such support consisting of the standard C′, to which the shield is attached, and the cross-head C^2, having a rack C^3, attached to each end and moving in slots C^4 in the uprights C^5 at each end of the machine. The racks C^3 mesh with pinions C^6 upon a cross-shaft C^7, operated by the crank C^8. By turning this crank the operator, after the mattress has been positioned between the shields B and C, raises the shields C, so as to compress the mattress between them and the shields B. After the tufting the operator lowers the cross-head C^2 and adjusts the mattress for the application of another row of tufts and then again raises the head C^2, and so on with each tuft-applying operation. The mattress being now in position in the machine power is applied for accomplishing the fastening and the tuft-feeding, as follows:

D is a pulley belted to a source of power. It is mounted upon the shaft D′ and is clutched to the shaft, so as to operate the latter, by a self-releasing trip-clutch, (shown at D^2,) adapted to carry the shaft through one revolution only at each operation. This clutch is thrown into operation by the operator through the medium of rods D^3, D^4, and D^5, and elbow-lever D^6, and these parts are returned to their normal position by the spring D^7, so that the clutch will be thrown out of operation at the conclusion of the revolution of the shaft. I do not describe this clutch in detail, as its construction is well known among mechanics. The shaft D′ carries two mutilated gears E and F, through which the needles are operated, as hereinafter set forth, and it also carries bevel-gear C^9, meshing with a similar gear C^{10} on the vertical shaft C^{11}, and from this shaft C^{11} by means of a bevel-gear C^{12}, feathered upon the shaft and supported by the projecting bracket C^{13} upon the cross-head C^2, so that it will move with said cross-head in the vertical adjustments of the latter, and a corresponding bevel-gear C^{14} upon the shaft C^{15}, supported from and arranged parallel to the cross-head C^2. I actuate the mechanism for feeding the lower tufts into position through this shaft C^{15}. Said shaft D′ also carries a pinion B′, meshing with a similar pinion B^2 upon the end of the shaft B^3, through which the mechanisms for feeding the upper tufts are driven.

All the operations necessary for the application of a series or row of tufts are performed by the machine during a single revolution of the shaft D′, and the first of these in point of time is the driving of the needle through the mattress. In their initial movement the needles are first carried down through the mattress to the extreme of their stroke and then retracted a short distance in order to create a sufficient amount of slack in the thread below the mattress to enable the feeding of the tufts into the bite thereof. The needles are shown at G and are each carried by a needle-bar G′, moving vertically between guides G^2 G^2, supported by the cross-bars G^3 G^4 at the top of the machine. The needle-bars are provided with racks G^5, with which the gears G^6, fast upon the shaft G^7, mesh, (see Fig. 6,) and the shaft G^7 is actuated from the gears E and F as follows: Said gears E and F are both mutilated gears, and their construction is best shown at Fig. 17. The former is provided with a series of teeth at E^4 and is also notched out both in front and in the rear of these teeth, as shown at E^{11}. Its periphery is also sunken, as shown

at E^{12}, such sunken portion extending from the rear notch E^{11} to the outward incline E^{10}, connecting the sunken surface with the continuous surface E^9, and said continuous surface extends from E^{10} to the forward notch E^{11}. The gear F is provided with a series of teeth F^5, and its periphery is sunken, as shown by the broken line at F^4, to correspond with the surface E^{12} of the other gear, such sunken portion extending from the rear end of said teeth F^5 to the outward incline F^2, which leads outward to a plain raised surface F^3. This surface F^3 extends from the incline F^2 to the forward end of the teeth F^5 and dips inward just before it reaches the teeth. Both gears are fast upon the shaft D' and are relatively arranged thereon, as shown. The gears E and F each mesh with a separate pinion, and each of such pinions is provided with a series of teeth corresponding to the teeth carried by the mutilated gears and also with a projecting stop-tooth similar to the teeth of the Geneva stop-wheel. These pinions are shown at E' and F'. The stop-tooth of pinion E' is shown at E^6 and that of pinion F' at F^6, and these stops are adapted to ride on the surfaces E^9 and F^3 of the mutilated gears and while so riding to lock the shafts by which they are carried. Pinion E' is mounted upon a shaft E^2, and this shaft carries a second pinion E^3, meshing with a pinion F^7 on the needle-shaft G^7. Pinion F' is also mounted on the needle-shaft, so that when either stop-tooth is locked by its mutilated gear the other is also necessarily locked. The normal positions of the mutilated gears and the stop-pinions is given in Fig. 2, and one of the pinions is adapted to actuate the needle in its downstroke and the other to return it. The stops of the two pinions normally stand as shown in said Fig. 2, that upon pinion F' being idle and the one upon pinion E' riding upon the surface E^9. If the mutilated gears are now started in the direction of the arrow, the first of the teeth E^4 will engage the stop E^6, which will move into the first notch E^{11} and allow the teeth of the pinion to mesh in regular order with the teeth E^4. The actuation thus given to pinion E' and its shaft will carry them through a complete revolution, as will be seen from Fig. 17, where the teeth E^4 have passed entirely beyond the pinion. The incline F^2 on gear F now encounters the stop-tooth F^6 of pinion F' and brings that stop into position so it will ride on the surface F^3 of gear F, thus causing a slight backward movement by both pinions and the forcing of stop E^6 to the position given in broken lines at Fig. 17. This backward movement lifts the needle slightly from its lowermost position, so as to create the necessary slack in the thread. The parts will now be locked against movement until the stop-tooth F^6 is encountered by the forward one of the teeth F^5, when further backward rotation will be imparted by said teeth F^5, leaving the two pinions and their respective shafts in the position shown at Fig. 17. The stop-tooth E^6 in this position is parallel with the surface E^9, upon which it will ride during the balance of the revolution of the mutilated gears.

It will be seen from the above that the needles perform their operations during the early part of the rotation of the main shaft and in advance of the thread-tying, so that when the latter operation occurs the needles are out of the way. The needles pass through openings in the shields B and C, as plainly seen at Fig. 13.

The tufts are supplied to the machine by suitable feed mechanisms, which I will now describe, limiting my description in the first instance to the means employed for feeding the upper tufts. All the tufts are first arranged in tubes H, with separators H^3 between each adjacent pair thereof. They are indicated at H' in several of the figures and are of the shape given at Fig. 15. They are formed with two projections H^2 upon each side, the space or slit H^a between the projections at each side giving entrance to the thread by which they are secured to the mattress. The feed-tubes correspond interiorly with the shape of the tufts, and the separators are provided with two side projections H^4, as appears from Fig. 16, corresponding to the upper projections H^2 upon the tufts. The discharge end of each tube is partially closed by two side cheeks or keepers H^5, and discharge-openings are provided in its top and bottom just in advance of the keepers, one permitting the discharge of the tufts and the other the discharge of the separators. The discharge-opening for the tufts is shown at H^6 in Fig. 7, while that for the discharge of the separators is shown at H^7. In order to permit the ejectment of the separators, that portion of the interior surfaces of the tubes above the projections H^4 of the separators is cut away at each side immediately below said openings H^7, while upon the under side the interiorly-projecting portions of the tube may be simply rounded off to facilitate the ejectment of the tufts. The arms H^4 of the separators prevent their moving out with the tufts by reason of their engagement with the central ridge of the tube; but in practice I prefer to make the tuft-discharge opening of such dimensions that the separator could not pass out through it even if it were so disposed. The tufts, of course, keep the separators immediately back of them from fully reaching their discharge positions and are only moved up into such position after the tuft has been ejected. This feature of their operation also assists in preventing the separators from moving out at the tuft-opening. The feeding of the series of tufts and separators through the tubes is accomplished by a follower H^8. This follower is shaped in cross-section to correspond to a cross-section of the tube and is given a forward step-by-step movement by any appropriate means. I prefer to construct the mech-

anism by which this movement is imparted as follows: The follower at its rear end and upon its opposite sides is provided with two spring-pawls H^9 and H^{10}, and these pawls engage racks H^{11} and H^{12}, which are let into the sides of the tube. The rack H^{11}, engaging with the pawl H^{10}, is stationary and acts to hold the follower from moving back while the other rack H^{12}, which is movable and engages with the pawl H^9, is moving back preparatory to making a fresh engagement with its pawl. The forward impulses of the follower are thus received from the movable rack H^{12} by such suitable mechanism connected with the source of power—such, for instance, as the following: A two-armed bracket H^{13} is attached to the outside of rack H^{12} by a screw H^{14}, and through the arms of this bracket a connecting-rod H^{15} is passed. That portion of the rod between the arms is provided with the adjusting-nut H^{16} and a spring H^{17}, the nut serving to regulate the tension of the spring. The rod at its farther end is attached to an oscillating crank H^{18}, secured upon a short shaft at H^{19} and actuated by a lever H^{20}, pivoted stationarily at H^{21} and having a stud H^{22}, carrying a roll moving in the grooved cam H^{23} in the side face of the cam-wheel H^{24}, mounted upon the shaft B^3. This cam is adapted to actuate the movable follower to the extent necessary to bring one of the tufts and the separator immediately following it into position ready for ejectment from the tube. The follower, however, may not move the whole distance at the time the cam operates, inasmuch as the spring H^{17} yields a little and thus allows the follower to accommodate the thickness of the separator. As soon, however, as the tuft has been ejected the follower under the power of the spring will move up and carry the separator up against the cheeks H^5 at the end of the tube and into position to be ejected. The feeding impulses are thus preferably partly positive and partly yielding; but I do not wish to be limited to the use of the yielding feature. When the tufts are moved forward into the position for ejectment from the tube, they come in close contact with the cheeks and at the same time are engaged by a series of short teeth, pins, or projections J^a upon an oscillating shoe J. This shoe moves through the vertical space J′, formed between the cheeks, and projects into such space to insure the engagement by the tufts with its teeth or projections, so that when the shoe is actuated and moved through its circular path it will carry the tuft with it. The forward faces of the separators are grooved vertically, as seen at H^{25}, so as to avoid contact by the shoe-pins with the separators. The separators are also curved, as appears plainly from Fig. 13, to conform to the arc of the circle described by the shoe. As the tufts move out of the tubes H they enter a race J^2, formed upon the interior surface of the shield B, and are by this race folded or doubled along their central longitudinal plane, so that when they enter between the needle and the thread their sides will be nearly vertical, as seen at Figs. 13 and 14. The construction of the race by which the doubling of the tufts is accomplished will be understood from Figs. 11 and 12. The race extends down to the needle or needle-opening in the shield, and when the tufts have reached their position for receiving the thread they lie partly in the race and are thus retained in the doubled state. The shoe is made thin, so that it allows the folding or doubling of the tuft as described. The shoe at its toe end J^3 is adapted to enter between the thread and the needle and to separate the thread from the needle sufficiently to allow the entrance of the folded tuft. The shoe is mounted upon an arm J^4, secured to the shaft H^{19}, already described, and from that arm and shaft receives the oscillating movement which carries it from its position in front of the tuft-tube seen at Fig. 7 to its position between the needle and thread seen at Fig. 13. The shoe is given some movement upon its carrying-arm and independent of the arm by pivoting it thereto at J^5 and providing it with an elongated opening J^6, receiving the stop-pin J^7, which is let into the arm. This construction allows it to take the position shown at Fig. 7 when the tuft is brought against it, and when it moves with the tuft the resistance created by the latter will swing the shoe upon pivot J^5, so that the pin J^7 will stand at the other end of the opening J^6, as shown at Fig. 13. This movement of the shoe upon the arm, although it is slight, allows the forward end of the shoe to lift sufficiently to free its engaging points from the leather after the tuft has been finally positioned and before the shoe moves back into position for another operation. Upon its backward movement the shoe ejects the separators from the tube H in the following manner: Each shoe is provided with a heel J^8, which traverses the groove J^9 in the bottom of the race. After the shoe has withdrawn the tuft from the tube the separator is moved over by the follower to the position shown at Fig. 13, thus occupying the space just vacated by the tuft, and consequently when the shoe moves back to its starting position the heel J^8 will engage the separator and throw it out through the opening H^7 into a receptacle S.

In the case of the tufts applied to the under side of the mattress the mechanism for feeding and positioning the tufts is a duplicate of that above described, except that they receive power from shaft C^{15} and the parts are inverted, the tufts being discharged upward from the tubes instead of downward and the separators being discharged downward instead of upward, as in the case of the upper tufts and separators. I do not, therefore, describe it, and, so far as it appears in the drawings, I give the like parts the same designating-letters. The under mechanisms are all supported by the standards C′, and the

races J^2 are formed upon the under surfaces of the shields C. It will be understood, of course, that both the upper and lower tuft mechanisms operate simultaneously, and also, inasmuch as both tufts are positioned at the sides of the shields opposite to those in contact with the mattress, the needle-openings in the shields are necessarily made large enough to permit the free passage of the tufts through the shields after the tufts have been fastened to the mattress.

For purposes of making clear the description yet to be given of the machine I distinguish the end of the thread from the incoming or subsequently fed parts thereof by lettering such end as W, while the incoming portion of the thread I have lettered as W'. After the needle has moved down through the mattress and retreated the portion W' of the thread is associated with the end W, so that they may be close together at the time the knot is tied, and in order to accomplish this I provide associating or gathering hooks K' K^2, mounted upon a reciprocating plate K. This plate K is advanced as soon as the needle is retracted and catches the portion W' of the thread and then immediately retraces its movement, so as to carry the thread W' into the bite of two friction-surfaces, one, K^3, formed on the plate K and the other a stationary opposing surface K^4. The end W is already held by the friction-surfaces, and the part W' is by this movement carried into close proximity to it. The plate now remains in this position until it is again operated in the next following tuft-applying operation and retains the two portions of the thread close together and parallel during the interval. The friction created upon the thread by the friction-surfaces mentioned should not be such as to prevent absolutely any movement of the thread through them inasmuch as the knotting device should draw both from the end W and from the portion W' to some extent in forming the knot. The plate K is operated by an elbow-lever K^5, pivoted at K^6, having a dolly-roll K^7 working in the cam-groove K^8 in the cam-wheel H^{24}.

The knotting or tying head is composed of two parts L and L^a, and the ends L^8 and L^{8a} of these are bent so as to form a hook and so as to form jaws, between which the threads may be clamped, as hereinafter stated. Both parts L and L^a of the knotter are inserted in a sleeve L^{17}, and the part L is made fast thereto by screws L^{18}. The part L^a, which is movable longitudinally independently of part L, extends back of the sleeve and is there provided with an adjustable grooved extension L^{19}. The longitudinal movements of the latter are imparted by two levers L' and L^{14}. The first of these is pivoted at L^2 and operated by the peripheral cam-groove L^3 upon the cam-drum L^4 upon the shaft B^3. The other end of the lever is joined to the knotter by being forked so as to enable it to set down upon opposite sides of the gear L^5, formed upon the sleeve. The other lever L^{14} is pivoted at L^{15} and receives motion from the cam-groove L^{16} in the cam-drum, and it is connected to the knotter at its other end by the pins L^{20}, entering the groove of the adjustable extension L^{19}.

L^{21} is a check-nut for holding the extension against unscrewing.

The knotter is supported in a bearing in the bracket L^{22}, such bearing inclosing part of the sleeve. The hooked end of the knotter lies normally in close proximity to the associated threads, and after they have been associated as above described it is moved backward, so that they are forced to enter the embrace of its hook, this backward movement being due to the cams and levers above described and both parts of the knotter moving in unison therein. The position to which the knotter is now moved will be understood from Fig. 24. A rotary movement is next imparted to the knotter which carries it through one revolution, such movement being received from the meshing of the gears L^5 and the intermediate gear L^6, said intermediate gear receiving motion from a wheel L^7 upon the shaft B^3. The intermediate gear is provided with a series of studs or pins L^9 and also with a second series L^{10}, and the wheel L^7 carries a projecting stop L^{11} and is also notched at L^{12} to receive the pins L^9. The continuous motion of the wheel L^7 is thus converted into an intermittent motion by the intermediate wheel, the stop and pins L^{10} actuating the intermediate wheel through a part of each intermittent motion and the notch and pins L^9 moving it through the balance of each intermittent operation. It will also be noticed from the construction shown that while the intermediate gear receives only one-quarter of a complete revolution at each revolution of the shaft B^3 the knotter will receive a complete revolution at each actuation. When the knotter has moved to the position shown at Fig. 27, (or at some previous time after the thread has entered the embrace of its hook,) the independently-movable part L^a of the knotter is moved longitudinally to a slight extent, so as to separate the jaws L^8 and L^{8a}, as seen at Fig. 27, this movement being caused by the lever L^{14}. After the jaws are thus opened the continued rotation of the knotter causes the entrance of the associated threads between the jaws, and the movable part of the knotter is then retracted by its cam-lever, so as to close the jaws and grip the threads tightly, as seen at Fig. 28. These cam-grooves act together and alike when it is desired to move the entire knotter; but when the movable part L^a is to be moved independently then the groove L^{16} varies from the other groove. While the thread is thus held wrapped around the knotter and also gripped between the jaws thereof the severing mechanism is actuated. The knives of this mechanism are shown at M and M', the part M being movable and pivoted at M^2 and actuated at the proper time by the rod M^3, which in turn is actuated

by a lever M^4, pivoted at M^5, and controlled by the cam-groove M^6 in the side face of the cam-drum, before mentioned. The knives are shown at Fig. 21 as open to allow the entrance of the thread between them and as closed at Fig. 22. The severing takes place in close proximity to the knotter and is plainly indicated as having taken place at Fig. 29. At the time the severing mechanism operates that portion of the thread upon the top of the knotter is thrown off by a stripper, consisting of a pin N, mounted in and projecting laterally from the movable knife-blade and having a projecting tooth N', adapted to move along the groove N^2, formed in the outer surface of the knotter-jaws. As the knife-blade descends to cut the thread this stripping device is carried through said groove, which forms a circular path coincident with the arc described by the stripper, and hence is adapted to engage the thread upon the upper part of the knotter and throw it off. It is shown in Fig. 29 as having partly completed this operation, and when the parts have reached this stage the knotter is moved forward longitudinally, the stripper still retaining a hold upon the thread, and this forward movement completes the throwing-off or stripping operation and also completes and tightens the knot. The thread and knotter are now in the condition shown at Fig. 29. The movable jaw of the knotter is next moved forward independently sufficiently to open the jaws and allow the release of the thread and is immediately moved back to close the jaws, and then the entire knotter retreats sufficiently to get out of the way of the stripper, so that the knife and stripper may return to their normal positions given at Fig. 21. The knotter is now returned to its starting position. All these longitudinal movements of the knotter and its movable jaw are received from the cam-drum, and the grooves of the drum are so constructed as to impart them. The entire periphery of the cam-drum is not shown in the drawings; but the construction will be understood from the description which I have given of the movements of the knotter. By means of the threaded extension and the set-nut the action of the lower jaw may be regulated to give it a more or less firm grip upon the thread. The mattress being under considerable compression at the point where the tufts are applied at the time the machine operates upon it and the tufts being positioned so that the thread enters the notches upon the sides thereof, it follows that when the mattress is released from the compression it will expand sufficiently to draw the thread tight, so that the tufts will then be held against any danger of slipping out of the embrace of the thread.

The operations above described have left the parts in readiness for another operation; but some features of the operation of the plate K and its coacting thread-controlling devices occurring during the return movement of said plate have not been described, and I will now detail the same. When said plate is moved back as already set forth, it positions the part W' of the thread immediately in front of a deflecting-guide O, and this guide acts when plate K again advances to shift thread W' onto a stationary retaining-hook O', by which it will be retained until stripped therefrom by the stripping hook or point O^2, borne by the plate K, in the return movement of the plate. In this same return movement another hook or projection O^3, borne by the plate, and which I call the "clearance-hook" and which is below and farther back than hook O^2, so it will act on a lower part of the thread and a little earlier than hook O^2, acts to carry the thread beyond a second retaining-hook O^4, by which it will be prevented from again moving toward the needle. By this time the part W' of the thread will by the cutting off of the previous section or stitch have become in reality the end part, corresponding to the part lettered W, and will be held between the friction-surfaces and be drawn through the same by the knotter in the formation of the next knot. Each time the thread is severed a small portion at the extreme end is left in the embrace of the friction-surfaces. These remnants are ejected from between said surfaces by the clearance-hook O^3 in the return movements of plate K. It may be desirable to adjust one or the other of the friction-surfaces K^3 and K^4, so that they may create a greater or less amount of friction on the thread. In order that this may be done, I support the stationary surface K^4 upon a laterally-extending arm K^{10} and provide this arm with a sloping surface ^{11}, so that an adjusting-screw K^{12}, supported in a stationary part of the machine, will bear upon the sloping surface K^{11} and move the friction-surface K^4 toward the opposing surface K^3 to any extent necessary.

The operation of the machine will be fully comprehended from the foregoing description, and consequently I do not here detail the same.

It will be understood that while I have described what I conceive to be the best construction I do not wish to be limited thereto, except where the claims specifically require a limited construction, inasmuch as obviously many of the devices may be greatly varied in their construction without departing from the spirit of the invention.

The upper tuft-feeding devices, as well as the knotting and cutting mechanism, are all supported from the cross-bar G^4 by metal brackets G^{20}.

It will be understood that the shafts B^3 and C^{15} are both splined, so that all the parts actuated by them may be moved along these shafts without destroying their operative relation thereto.

I claim—

1. The combination with means for com-

pressing the mattress, a needle for carrying a loop of thread through the mattress, and means for holding the free end of the thread while the needle is operating, of means for positioning the tuft in the loop of the thread, and means for tying and means for severing the thread, substantially as specified.

2. The combination with means for compressing the mattress, a needle for carrying a loop of thread through the mattress, and means for holding the free end of the thread while the needle is operating, of means for positioning the lower tuft in the loop of the thread, and means for tying and means for severing the thread, substantially as specified.

3. The combination with means for compressing the mattress, a needle for carrying a loop of thread through the mattress, and means for holding the free end of the thread while the needle is operating, of means for positioning both the upper and lower tufts in the loop of the thread, and means for tying and means for severing the thread, substantially as specified.

4. The combination with means for compressing the mattress, a needle moving down but once at each tufting operation and acting to carry a loop of thread through the mattress, and means for operating said needle, of means for positioning the lower tuft in such loop, means for causing the thread to secure the tuft, and means for severing the thread, substantially as specified.

5. The combination with a needle acting by a single descent to carry a loop of thread through a mattress, and means for operating said needle, of means for positioning both upper and lower tufts in such loop, and means for causing the thread to secure the tufts, substantially as specified.

6. The combination with a needle acting by a single descent to carry a loop of thread through a mattress, and means for operating said needle, of means for positioning both upper and lower tufts in such loop while the needle remains down, and means for causing the thread to secure the tufts, substantially as specified.

7. The combination with the needle acting to carry a loop of thread through the mattress, of means entering between and separating the needle and thread so as to permit the feeding of the tuft into the loop of the thread, and means for causing the thread to secure the tuft, substantially as specified.

8. The combination with the needle for passing the thread through the mattress, of means for separating the needle and thread below the mattress to permit the feeding of the lower tuft into position, means for separating the needle and thread above the mattress to permit the feeding of the upper tuft into position, and means for causing the thread to hold the tufts after they have been positioned, substantially as specified.

9. The tufting-machine wherein are combined a needle carrying a loop of thread through the mattress, means for operating the needle, and means acting both to separate the thread from the needle sufficiently to admit the tuft, and also acting to position the tuft, substantially as specified.

10. In a tufting-machine the combination with means for compressing and holding the mattress, of means for securing the tufts comprising an eye-pointed needle, means for holding the end of the thread above the mattress while the needle is descending, means for tying the thread and means for imparting a long stroke to the needle, whereby the needle is enabled to form a loop extending below the mattress by a single descending movement, substantially as specified.

11. In a tufting-machine the combination with means for compressing and holding the mattress, of means for securing the tufts comprising an eye-pointed needle, means for holding the end of the thread above the mattress while the needle is descending, means for tying the thread, means for imparting a long stroke to the needle, and means for inserting a tuft in the loop formed by the needle, substantially as specified.

12. In a mattress-tufting machine, devices for compressing the mattress at the point of tufting, provided with openings through which the tufts may pass after they are secured to the mattress, in combination with tuft-feeding mechanism feeding the tufts at the back of said compressing devices, substantially as specified.

13. The combination in a mattress-tufting machine, of opposing devices for compressing the mattress at the point of tufting, one of said devices having an opening to permit the passage of the secured tuft, and tuft-feeding mechanism feeding the tuft into position at the back of said compressing device, substantially as specified.

14. The combination in a tufting-machine, of mechanism for forcing a needle through the mattress, mechanism for feeding the upper tufts between the thread and needle, mechanism for feeding the lower tufts between the thread and needle, means for tying the thread, and reciprocating means for compressing the mattress at the point of tufting, substantially as specified.

15. The combination with the needle and the tying mechanism, of means for feeding the tufts and acting also to fold them, substantially as specified.

16. The tufting mechanism comprising in combination the needle, means for controlling the end of the thread, a tuft-guide race and a feeding device traversing said race and carrying the tufts through the same, said race being gradually narrowed toward its delivery end, thus causing the tufts to double up, substantially as specified.

17. The tufting mechanism comprising in combination the needle, the thread-controlling devices, a guide-race having gradually-narrowing sides, and a device for moving the

tufts through the race, substantially as specified.

18. The tufting mechanism comprising in combination the needle, the thread-controlling devices, a guide-race having gradually-narrowing sides, and an oscillating shoe acting both to move the tuft through the race and to confine it between the narrowing sides thereof, substantially as specified.

19. The combination with means for presenting the tufts to the shoe, of an oscillating shoe having teeth for engaging the tufts, and a race through which the tufts are moved by the shoe, the race being grooved to give room to said teeth, substantially as specified.

20. The combination with the tuft-race, of an oscillating shoe for moving the tufts through the race, said shoe having teeth or pins for engaging the tufts and being also pivoted to its carrying-arm, substantially as specified.

21. The combination with the oscillating shoe and race, of the tube H, the intermittently-actuated follower, the separators, the shoe acting both to feed the tufts and to eject the separators, substantially as specified.

22. The combination with the oscillating shoe and race, of the tube H, the intermittently-actuated follower, the separators, the shoe acting to feed the tufts in one direction, and to eject the separators in the other direction, substantially as specified.

23. The combination with the oscillating shoe and race, of the tube H, the intermittently-actuated follower, the separators, the shoe acting to feed the tufts in its acting stroke and to eject the separators in its return stroke, substantially as specified.

24. The combination with the tuft-tube and its follower, of a series of separators placed in the tube between the tufts, and feed through the tube therewith, substantially as specified.

25. The tufting mechanism comprising in combination a needle acting to carry the thread through the mattress, means located upon the side of the mattress from which the needle starts in said movement and acting to hold the end of the thread against the pull caused thereby, and means for opening the loop thus formed and enabling it to receive the tuft, substantially as specified.

26. The combination with the needle of friction-surfaces located upon the side of the mattress from which the needle starts, and serving to hold the end of the thread against the pull of the needle in its movement through the mattress, and means for entering the thread between said surfaces prior to said movements of the needle and during the tying and severing operations, substantially as specified.

27. The combination with the reciprocating hook-plate furnished with associating hooks, and also with a stripper-hook, of a tying mechanism, a stationary deflecting device and a stationary retaining-hook, substantially as specified.

28. The combination with tying mechanism of the reciprocating hook-plate having a clearance-hook and the stationary hook O^4, substantially as specified.

29. The combination with tying mechanism and the friction-surfaces for retaining control of the thread, of means for cutting the thread, and means for ejecting the waste ends from between said surfaces, substantially as specified.

30. The combination with tying mechanism and the friction-surfaces for controlling the end portion of the thread, of the reciprocating clearance-hook for removing the waste ends of the thread from between said surfaces, substantially as specified.

31. The combination with the tube H and its racks, one stationary and the other movable, of the follower having spring-pawls engaging said racks, and actuating devices for the movable rack consisting of the rod H^{15} attached to the rack by the bracket H^{13}, and having a spring mounted between the arm of the bracket and a nut on the rod, substantially as specified.

32. In a tufting-machine, a device for positioning the tuft in the loop of the thread, such as the shoe J, and provided with a point J^3 adapted to move the thread so as to provide room for the entrance of the tuft, substantially as specified.

33. The tufting mechanism comprising in combination the needle, the tying mechanism, and the horizontally-reciprocating plate K having associating hooks, substantially as specified.

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