

(No Model.)

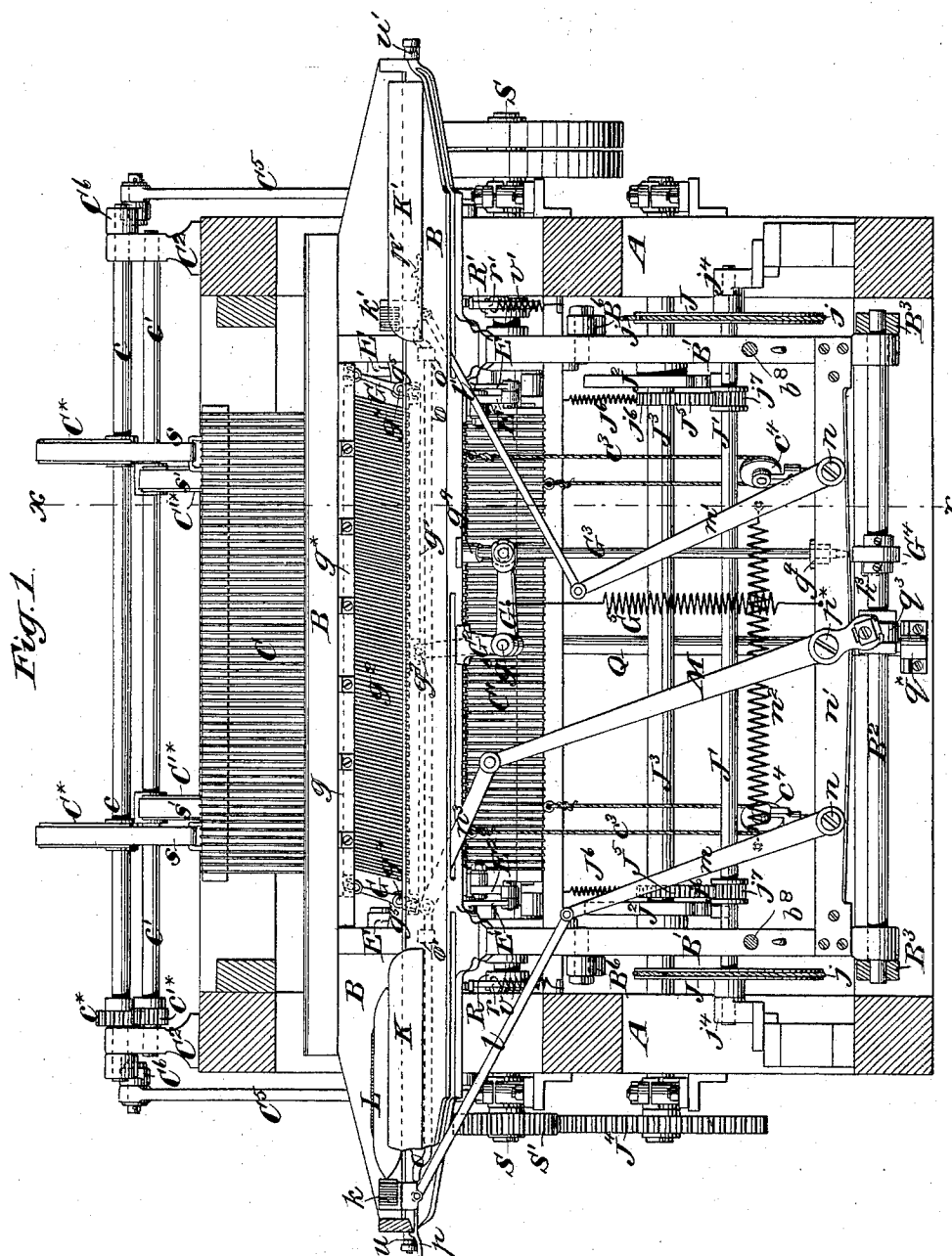
7 Sheets—Sheet 1.

A. BOLLENTIN.

LOOM FOR WEAVING TUFTED FABRICS.

No. 468,479.

Patented Feb. 9, 1892.



Witnesses:

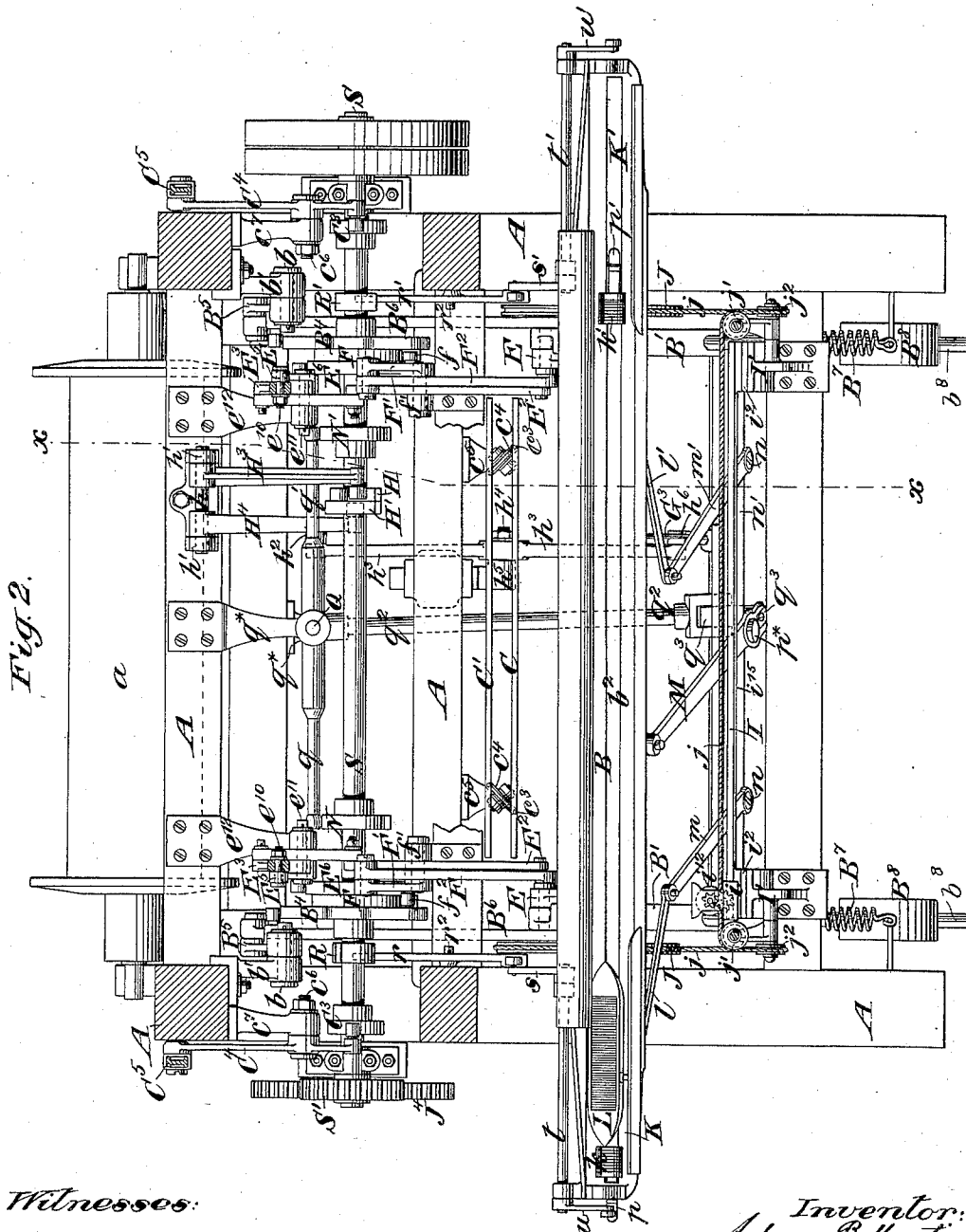
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(No Model.)

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Fig. 3.

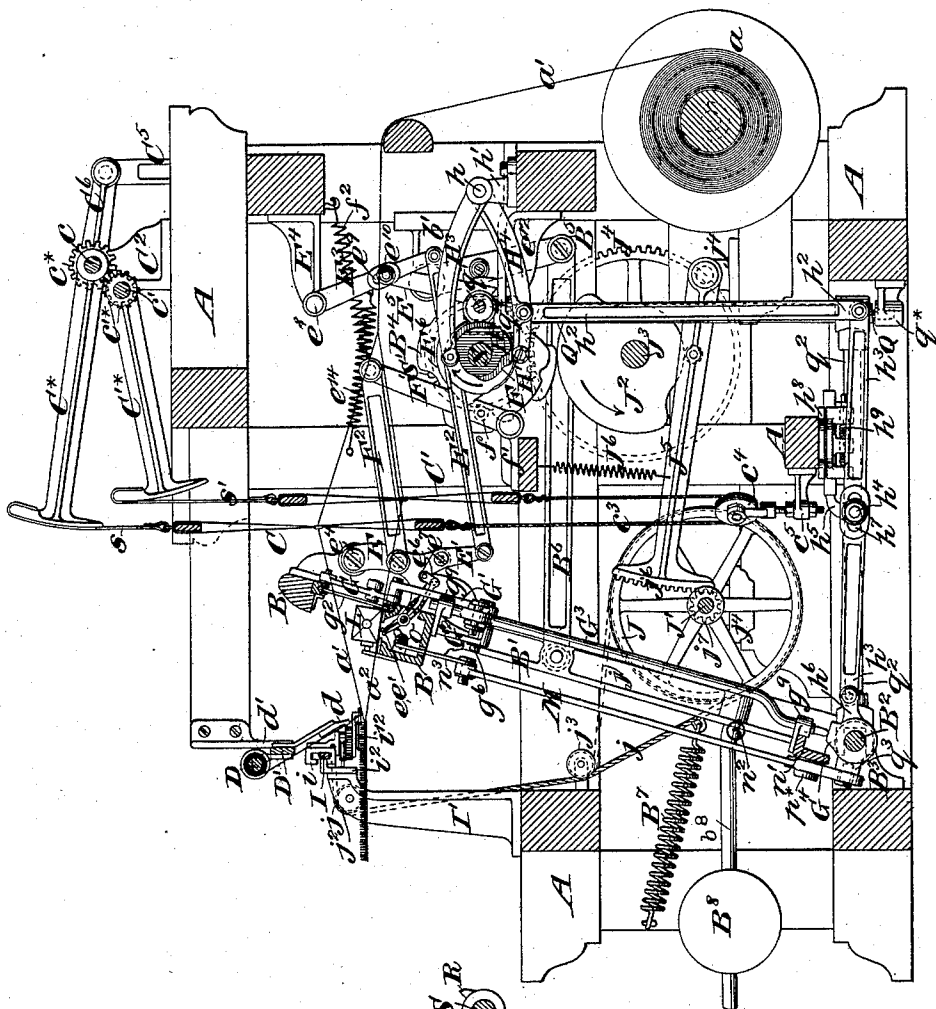
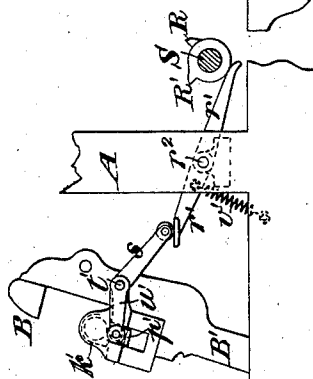


Fig. 3.*



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(No Model.)

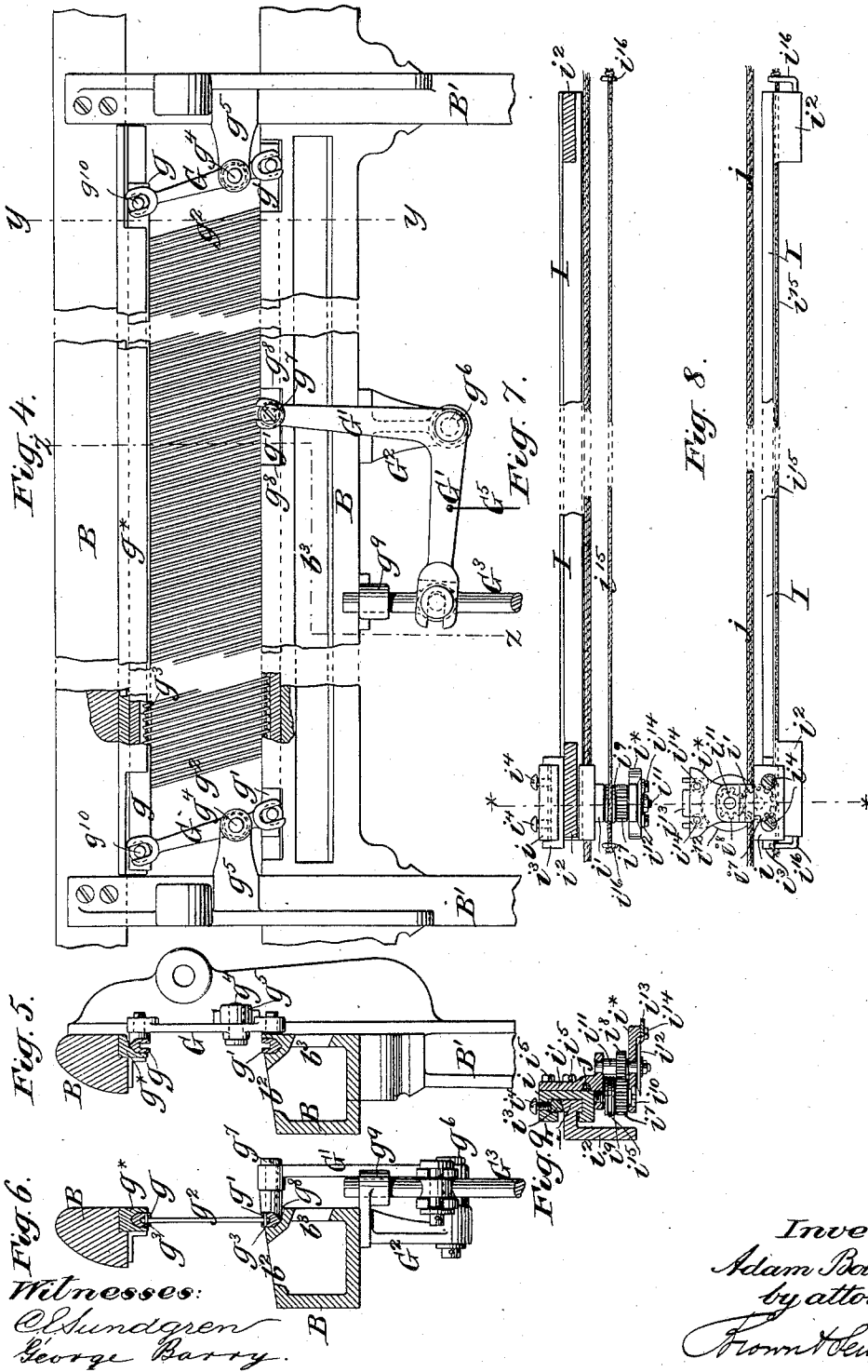
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A. BOLLENTIN.

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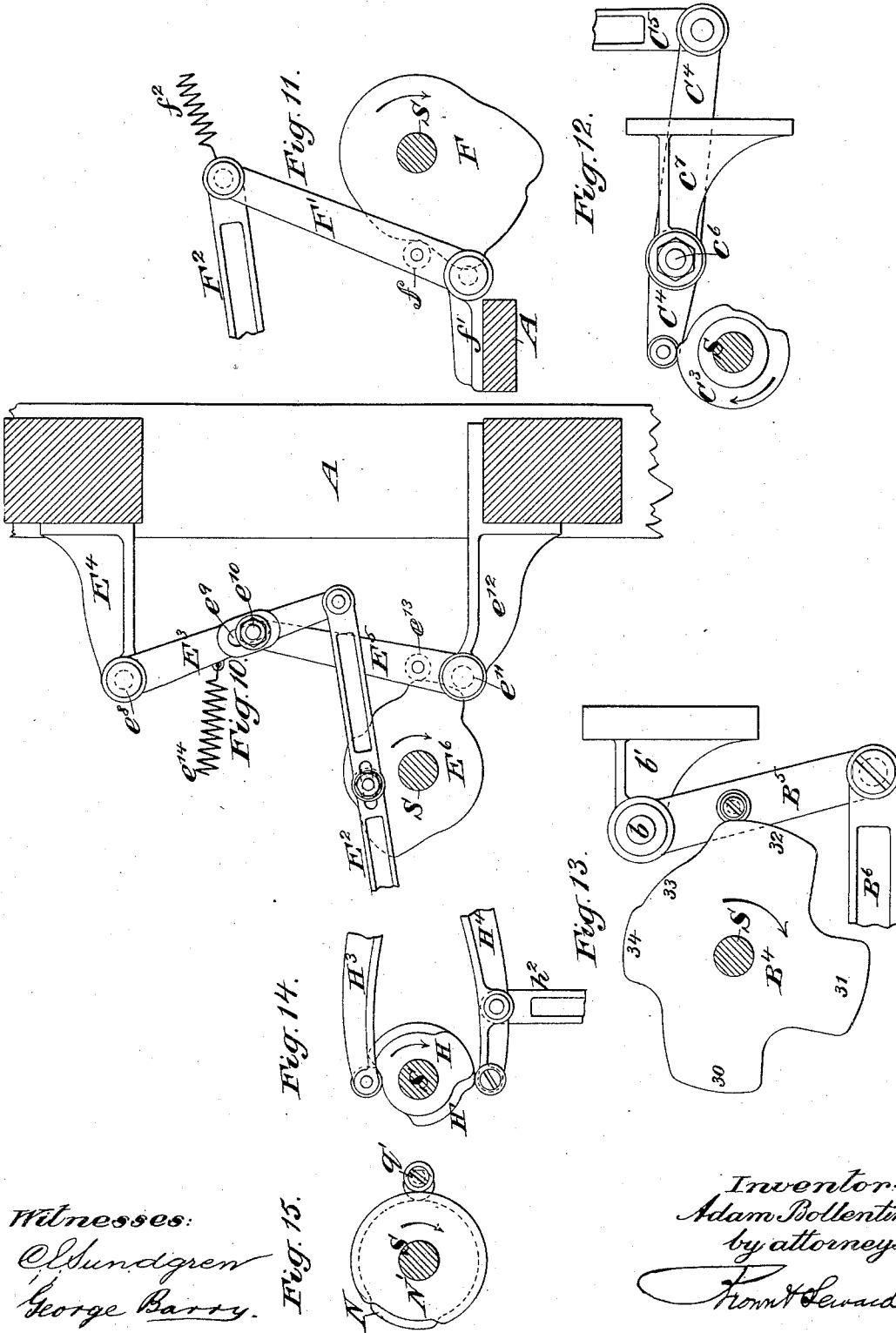
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LOOM FOR WEAVING TUFTED FABRICS.

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Fig. 21.

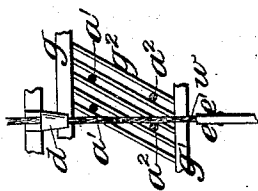


Fig. 20.

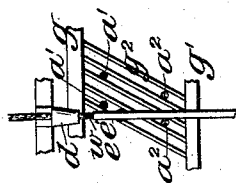


Fig. 19.

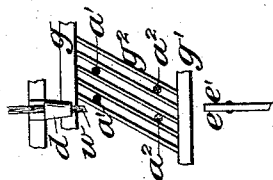


Fig. 25.

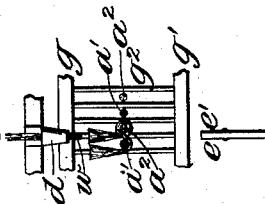


Fig. 24.

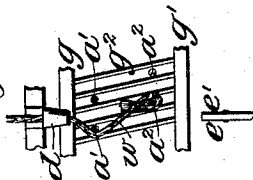


Fig. 23.

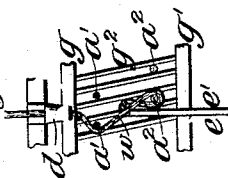
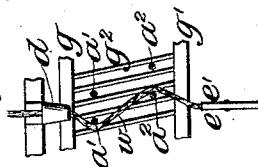


Fig. 22.



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UNITED STATES PATENT OFFICE.

ADAM BOLLENTIN, OF NEW YORK, N. Y., ASSIGNOR OF TWO-THIRDS TO
ROBERT STUNTZ, OF SAME PLACE, AND ADOLPH CUDELL, OF CHICAGO,
ILLINOIS.

LOOM FOR WEAVING TUFTED FABRICS.

SPECIFICATION forming part of Letters Patent No. 468,479, dated February 9, 1892.

Application filed December 20, 1890. Serial No. 375,339. (No model.)

To all whom it may concern:

Be it known that I, ADAM BOLLENTIN, of the city and county of New York, in the State of New York, have invented a new and useful Improvement in Looms for Weaving Tufted Fabrics, of which the following is a specification, reference being had to the accompanying drawings.

The object of this improvement is the weaving of tufted fabrics in which the tufts are looped or secured to the warp of the fabric, and especially the weaving of that kind of tufted fabric which is the subject of my United States Patent No. 423,659, dated March 18, 1890, which consists of a warp and weft and a series of tufts, each of which completely encircles one warp-thread and is looped around the back of the next warp-thread at one side of that which it encircles.

In a loom embodying my invention the tufts are placed in the web of warps and looped around the warp by the combined operations of nippers which are carried with the lay and a reed the dents of which have a lateral movement, and it is in certain combinations, including these nippers and the reed and the means of operating them, that this invention principally consists; but the invention also includes certain novel combinations in which the lay and its operating mechanism and a cutting apparatus for cutting the tufts also constitute elements.

I will first describe in detail a loom represented in the accompanying drawings, embodying the invention, and afterward point out its novelty in claims.

Figure 1 represents a front view of the loom with the front part of the framing and the tuft-yarn-supplying devices and tuft-cutting devices removed. Fig. 2 is a plan view of the loom with the top of the framing and the harness mechanism and tuft-yarn-supplying devices removed. Fig. 3 represents a vertical section taken in the line $x x$ of Figs. 1 and 2, viewed from the right, but omitting the picker-staff and its connecting-rod on the right side of the loom. Fig. 3* shows an end view of the lay and part of the shuttle mechanism. Fig. 4 is a rear view of the upper part of the lay and the reed and mechanism for producing lateral movements of the reed. Fig. 5

represents a transverse section corresponding with Fig. 4, taken in the line $y y$ and viewed from the left. Fig. 6 represents a transverse section in the line $z z$ of Fig. 4, viewed from the left. Fig. 7 is a front view of the tuft-cutting devices. Fig. 8 is a plan view corresponding with Fig. 7. Fig. 9 represents a vertical section taken at right angles to Figs. 7 and 8 in the line $**$. Fig. 10 represents a section, parallel with Fig. 3, of a part of the loom-framing and shows a side view of one of the cams and part of the mechanism upon which it operates for opening and closing the nippers which insert the tuft-yarn in the web. Fig. 11 represents a side view of one of the cams and part of the mechanism upon which it operates for the purpose of producing a to-and-fro movement of the nippers. Fig. 12 is a side view of one of the cams and part of the mechanism through which it acts for producing the operation of the harness. Fig. 13 is a side view of one of the cams and part of the mechanism through which it operates for producing the movements of the lay. Fig. 14 is a side view of the cams and parts of the mechanism through which they operate for producing the lateral movement of the reed. Fig. 15 is a side view of the cams and part of the mechanism through which they operate for working the shuttle-pickers. In Figs. 10, 11, 12, 13, 14, 15 the several cams and the mechanism through which they operate are shown in positions corresponding with the positions of the several parts of the loom shown in Figs. 1, 2, and 3. Figs. 16, 17, 18 are sectional views, taken in the same line as Fig. 3, of the lay and the tuft-nippers, showing the nippers in different positions. Figs. 19 to 25, inclusive, are diagrams illustrating the looping of the tuft-yarns around the warp. Figs. 1, 2, 3, and 3* are on the same scale. The other figures are on a scale double that of Figs. 1, 2, 3, and 3*.

Similar letters and numerals of reference designate corresponding parts in all the figures.

A designates the framing of the loom; a , the warp-beam, and $a' a^2$ the warp.

C C' designate the harness, of which there are two leaves, the front leaf being suspended by straps s from duplex levers C* C* and the

rear leaf being suspended from duplex levers C'^* C'^* by straps s' . The said levers C'^* C'^* are fast to a rock-shaft c and the levers C'^* C'^* are fast to a rock-shaft c' , the said rock-shafts having their bearings in standards C^2 on the top of the framing A and being geared together by spur-gears c^* c'^* , so that when one moves upward the other moves downward. The lower bars of the two leaves of harness are connected together by duplex cords c^3 , which pass under and partly around two pulleys c^4 , which are attached to brackets c^5 , secured to the lower part of the framing.

The harness is operated by duplex cams C^3 , arranged outside the framing of the loom on the main shaft S , acting upon duplex levers C^4 , which work on fixed pivots c^6 in brackets c^7 , secured to the framing of the loom, the rear ends of the levers C^4 being connected by rods C^5 with the arms C^6 on the ends of the rock-shaft c .

B is the lay, the swords B' of which are fitted to oscillate on a horizontal rock-shaft B^2 , supported in bearings in brackets B^3 on the lower part of the framing A , and are provided with counter-balances B^3 on rods b^3 , projecting from their fronts. This lay has given to it peculiar movements, as will be hereinafter described, by means of duplex cams B^4 on the main shaft S of the loom, the said cams operating upon duplex swinging arms B^5 , the upper ends of the said arms working on fixed pivots b in brackets b' , secured to the loom-framing, and the lower ends of the said arms being connected by rods B^6 with the lay-swords. The cams B^4 operate directly to produce the backward movements of the lay, the forward movements being produced by strong spiral springs B^7 , one of which is shown in Fig. 3, connecting the swords B' with the front of the framing. The cams B^4 are of the form shown in Fig. 13, having three offsets 30 31 32 of equal prominence to produce three complete backward movements of the lay during three successive quarters of a revolution of the shaft S , and a less prominent offset 34 between the offsets 30 and 32 to produce a shorter backward movement, the depression 33 between the offsets 32 and 34 not so nearly approaching the axis of the cam as the depressions between the offsets 34 30 31. The body of the lay is box-like or hollow, as shown in Figs. 3, 5, and 6, and has a longitudinal slot b^2 in the top and another longitudinal slot b^3 in the back for the tuft-nippers e e' (shown in Figs. 3, 16, 17, and 18) to work through, the said nippers, which correspond in number with the tufts in a row, being carried by a long flat bar e^2 and a long pivot e^3 , the ends of which bar and pivot are carried by hangers E , which swing from pivots e^4 , secured in the swords B' of the lay, to permit the said nippers to have, besides their movements with the lay, a movement backward and forward within the lay through the shuttle-raceway thereof.

The tuft yarn or yarns may be supplied

from a spool or spools in any suitable manner. In the example represented, D designates a tuft-yarn spool, and D' a carriage in which it runs, the said carriage being furnished with guide-tubes d . This carriage is represented as like those in common use for presenting the tuft-yarns to nippers in looms for weaving tufted fabrics. There may be any number of such carriages and spools in my loom, and they may be supported in any suitable manner. I have in Fig. 3 shown only one such carriage and spool, the carriage being represented as attached to a hanger d' , projecting forward from the upper part of the framing beyond the lay.

The tuft-nippers consist each of two members pivoted together by the long pivot e^3 . The members of which the rear jaws e' constitute parts have their lower parts below the pivot all rigidly secured to the bar e^2 , before mentioned, the ends of which are rigidly secured in the swinging hangers E . The members of which the front jaws e constitute parts and which hang upon the pivots e^3 have their lower parts below the pivot all connected together by a long bar e^2 , from each end of which there projects downward and backward one of two arms e^{5*} , which are connected, as shown in Figs. 16, 17, and 18, by two short links e^6 with the upper arms of two small levers E' , which are pivoted by pivots e^7 to the hangers E . The lower arms of these levers E' are connected by two rods E^2 with the lower ends of duplicate slotted levers E^3 , which are hung on pivots e^8 from fixed brackets E^4 on the framing A . The slots e^9 in these levers E^3 receive pins e^{10} , which project from two nearly-upright levers E^5 , (see Fig. 10,) which are fulcrumed by pivots e^{11} to fixed brackets e^{12} on the framing A . These levers E^5 are furnished with anti-friction rollers e^{13} , bearing against the cams E^6 on the cam-shaft S , the said cams operating through said levers E^5 , rods E^2 , and levers E' to close the nippers which, when allowed to do so by the cams, are caused to open by springs e^{14} , applied to the levers E^3 . The upward movements of the nippers for receiving the tuft-yarns, carrying their ends through the warp and assisting in the looping of the tufts around the warp, are effected by the swinging movement of the hangers E , produced by the duplicate cams F (see Fig. 11) on the shaft S , the said cams acting upon anti-friction rollers f on levers F' , which are pivoted at their lower ends to brackets f' on the framing and the upper ends of which are connected by rods F^2 with the hangers E . The downward movements of the nippers are produced by their own weight and the weight of the parts through which the cams operate upon them, but may be assisted by springs f^2 , applied to the levers F' .

The letters g g' g^2 designate the reed, which is of peculiar construction to co-operate with the nippers for looping the tufts around the warp. The dents g^2 , instead of being rigidly connected with the upper and lower parallel

bars gg' , in which they are held, are loosely connected, so that by moving the said bars lengthwise relatively to each other the dents may have a lateral movement given to them. This loose connection in the example represented is made by grooving the lower edge of the upper bar g and the upper edge of the lower bar g' to receive the ends of the dents and inserting transversely through the grooved portions of said bars small pins g^3 , which serve to properly space the dents which are placed between them. The upper bar g is fitted to slide in a guide g^* , provided on the lay-cap, and the lower bar g' is fitted to slide in a groove in the back part of the body of the lay, as shown in Figs. 4, 5, and 6, and the said bars $g g'$ are connected together near their ends by levers $G G'$, which are fulcrumed by pivots g^4 in brackets g^5 , provided on the lay-swords and which have at their ends forks which receive studs g^{10} on the said bars, as shown in Fig. 4. The bars $g g'$ being thus connected, when one is moved in one direction the other is moved in the opposite direction, and their respective ends of the dents which are received within them move correspondingly. Such a movement is given to the said bars and the dents by means of an elbow-lever G' , pivoted at g^6 on a rigid hanger G^2 , dependent from the lay B , the upper arm of the said lever G' being connected at g^7 with the bar g' through an opening g^8 , provided in the back of the lay, and the lower arm of the said lever G' being connected with an upright sliding rod G^3 , which passes through guides g^9 , provided on the lay, the upward movement of the said rod G^3 to produce the movement of the bar g' in one direction being produced by a cam G^4 , loose on the rock-shaft B^2 , hereinbefore described, upon which the lay swings, and the movement of the said bar g' in the opposite direction being produced by a spring G^5 , Fig. 1, applied to the lever G' .

The rocking movement of the cam G^4 on the rock-shaft B^2 , by which the operation of the rod is produced, is obtained from a pair of cams $H H'$ (see Figs. 3 and 14) on the shaft S , operating between the two arms $H^3 H^4$ of a yoke, which are firmly secured to a short rock-shaft h , (see Fig. 2,) which works in bearings in a small stand h' , secured on the back part of the framing, the lower arm H^4 of the said yoke being connected by a rod h^2 with the rear end of a lever h^3 , which works on a fulcrum h^4 in a bracket h^5 , secured to one of the lower cross-bars of the framing A , the forward end of the said lever being connected with an arm h^6 on the cam G^4 . In order to accommodate itself to the movements of the arm h^6 , the lever h^3 is slotted, as shown at h^7 in Fig. 3, where it receives the fulcrum h^4 . This permits the lever to have a slight movement longitudinally.

To provide for the adjustment of the fulcrum h^4 forward and backward, if necessary, to vary the movement of its farther end and thereby adjust the length of movement of the

reed-bars $g g'$, the bracket h^5 is secured to the cross-bar of the loom by means of a clamp h^8 , in which the said bracket is adjusted by means of a screw h^9 .

The cutting apparatus by which the tufts are cut from the yarn presented through the guide-tubes d is carried by a carriage $i i' i^*$, which runs across the loom on a stationary horizontal bar I , which is bolted through lugs i^2 , provided at its ends in two standards I' , supported on the framing of the loom, the position of the said bar being a little in front of and parallel with that occupied by the guide-tubes d of the spool-carriage for presenting the tuft-yarns.

In Fig. 7 parts of the lugs i^2 are cut away to expose the carriage to view.

The carriage $i i' i^*$ is represented (see Figs. 7, 8, and 9) as consisting of a box i , an upright plate i' , and a horizontal plate i^* . The box i is fitted with a dovetailed gib i^3 and adjusting-screws i^4 to the horizontal transverse bar I . The plate i' , which is of inverted-T-shaped cross-section, is bolted to the back of the said box i , as shown at i^5 in Fig. 9. The horizontal plate i^* is firmly bolted to the lower part of the plate i' , a space being left between them for two small spur-gears $i^7 i^8$ and a small pulley i^9 . The spur-gear i^7 and the pulley i^9 are fast together and both turn freely on a bolt i^{10} , by which the plates $i' i^*$ are secured together, and the spur-gear i^8 , which gears with that i^7 , is fast on the rotary-cutter spindle i^{11} , which is journaled in the said plates $i' i^*$, the said spindle being furnished below the plate i^* with a rotary cutter i^{12} , which forms one blade of a pair of shears, the other blade i^{13} of which is secured rigidly by screws i^{14} to a downwardly-projecting rib at the rear edge of the plate i^* .

The cutting of the tufts is produced by the rotation of the cutter i^{12} in contact with the cutter i^{13} as the carriage is moved across the loom across the bar I , the rotation of the cutter i^{12} being produced by means of the pulley i^9 , running along a cord or band i^{15} , the ends of which are secured to lugs i^{16} , secured to the lugs i^2 of the stationary horizontal bar I , the band having one turn around the said pulley. The rotary motion thus given to the pulley i^9 is also given at the same time to the spur-gear i^7 , and that gives motion to the spur-gear i^8 on the cutter-spindle i^{11} .

The movement of the carriage along the bar I is produced through a cord j , clamped between the plates i and i' , and which runs horizontally, as shown in Figs. 2 and 8, parallel with the said bar and around duplicate horizontal idler-pulleys j' , attached to the standards I' , (see Fig. 2,) and around duplicate vertical idler-pulleys j^2 , also attached to the said standards and in front of upright idler-pulleys j^3 and around duplicate pulleys J (see Figs. 1, 2, and 3) of considerable larger size on the horizontal shaft J' , which works in fixed bearings j^4 , the said cords passing around the said pulleys J in opposite direc-

tions and having their ends secured to the said pulleys. In Fig. 3 said cord j is shown in bold outline passing under one of the said pulleys J, and the direction of the other cord, which passes over the other pulley, is indicated in dotted outline. By turning the shaft J' in one direction the cord j is caused to be wound on one pulley J and unwound from the other and thereby to move the cutter-carriage in one direction across the loom, and by turning the said shaft in the other direction the operation of winding and unwinding the cord is reversed and the carriage is caused to move across the loom in the other direction. This movement of the rock-shaft in one direction is produced at the proper time by means of duplicate cams J² on a shaft J³, which is geared with the cam-shaft S by spur-gears J⁴ and S', one on each of said shafts, to produce one revolution of the shaft J³ for every two of the main shaft. These cams J² operate upon duplicate levers J⁵, the rear ends of which are fulcrumed in stands j⁴ on the framing and the front ends of which are constructed with toothed sectors j⁶, which are geared with pinions j⁷ on the shaft J'. The two cams J² are both alike of the form shown in Fig. 3. Their respective levers J⁵ are kept in contact with them by springs J⁶, Fig. 3, which connect them with the loom-framing, and these springs produce the movement of the cutter-carriage in an opposite direction to that of the movement produced by the cams. The cutters operate in both directions and cut one row of tufts, while their carriage moves across the loom in one direction and the next row while it moves across in the other direction.

The shuttle-operating mechanism is best shown in Figs. 1, 2, 3, and 3*. K K' are the shuttle-boxes. L is the shuttle. $k k'$ are the pickers, which are connected by straps $l l'$ with levers $m m'$, which are pivoted at $n n'$ to a rail n' between the lay-swords, and are connected together by a spring n^2 , which always exerts a tendency to draw the said levers toward each other and throw the pickers toward the center of the loom. o is a rod arranged to slide lengthwise within the lay between the pickers in guides o' , provided in the lay. The length of this rod is such that it will just occupy the space between the two pickers when one is thrown back, as shown at the left of Fig. 1, and the other is thrown forward toward the center of the loom, as shown at the right of Fig. 1, the said rod being shown in the last-mentioned figure as having its ends cranked upward to bring them within the range of the pickers. This rod is for the purpose of moving the pickers backward to positions in which they may be locked by spring-catches $p p'$ to the ends of the lay. The picker at the left side of the loom is shown so locked in Fig. 1. The said rod o is moved longitudinally for the purpose of moving back the pickers through the agency of a lever M, (see Figs. 1, 2, and 3,) which is fulcrumed on a pivot p^* on the lower

rail n' of the lay, the said lever being connected at its upper end with the said rod o by a rod n^3 . The said lever M derives motion from two cams N N' (see Figs. 2 and 15) on the shaft S, which act upon the two arms $q q'$, projecting in opposite directions from the upper part of an upright rock-shaft Q, which works in bearings in brackets q^* on the back part of the loom-framing. From the lower part of the said rock-shaft projects an arm q^3 , which is connected with the lower end of the lever M by a connection q^3 , which slides upon the rock-shaft B³. As no claim is herein made to the mechanism for operating the pickers, and as such mechanism does not differ materially from that in other looms, no further description of it is necessary. It will be understood that as the tension of the spring n^2 always tends to throw both pickers, if both have been pushed back by the rod o , it is only necessary to liberate the catch p or p' of either picker for the spring to produce its operation. To provide for this liberation, there are provided on the shaft S two cams R R', which act on the rear ends of two levers $r r'$, which are fulcrumed on pins r^2 at the sides of the loom-framing and the forward ends of which operate upon the arms $s s'$ of two horizontal rock-shafts $t t'$, which are supported in bearings on the back of the lay, the said shafts being provided with other arms $u u'$, the ends of which are situated above the catches $p p'$. The levers $r r'$ have applied to them spiral springs $v' v'$, which tend to depress their forward ends and hold their rear ends in contact with their respective cams, the cams being in such position when the lay is thrown back that the springs $v' v'$ will be allowed to depress the forward ends of the said levers, so that the arms $s s'$ of the rock-shaft $t t'$ may pass over them, as shown in Fig. 3*, wherein the lay is shown in its extreme backward position, which it occupies when the shuttles are thrown. When the lay moves forward, its arms $s s'$ pass clear of the levers $r r'$.

I will now describe the operation of the loom, first supposing the working parts to be in the position shown in Figs. 1, 2, 3, and 3* and the several cams in the relative positions shown, respectively, in Figs. 10, 11, 12, 13, 14, and 15, the shed being wide open, the nippers being withdrawn entirely within the body of the lay below the raceway and being closed, and the shuttle being at the left-hand side of the loom. During the rotation of the cams from those relative positions the lay is caused to be moved to the position shown in Fig. 16—that is to say, nearly half-way forward—by the back of the offset 32 of the cam B⁴, (see Fig. 13,) passing its bearing on the lever B³, and the concentric depression 33 of the said cam comes into action and keeps the lay for some time at rest in that position. During the short forward movement of the lay just described the forward and upward movement of the nippers through the raceway and through the warp is produced by the rotation

of the cams F, while the opening of the nippers is simultaneously produced by the springs e^{14} . The lay and nippers are now in the position shown in Fig. 16, the open jaws of the nippers having received the ends of the tuft-yarns between them. While the lever B^5 remains on the concentric portion 33 of the cam B^4 , below the offset 32, the nippers are caused by the cams E^6 and F to first close and then move downward to the position shown in Fig. 17, and thus to take hold of the ends of the tuft-yarns and pull them down through the warp a distance equal to the length of yarn required for a tuft, and afterward to return through the warp less than half-way to the position shown in Fig. 18. Before the first rise of the nippers and their subsequent descent the dents of the reed have been sloping, as shown in Fig. 1; but after the descent of the nippers, and before their rise to the position shown in Fig. 18, the bars g g' of the reed are moved in opposite directions by the cams H H' far enough to give the dents of the reed an inclination the reverse of that shown in Fig. 1, and the upper and lower warp-threads are thus caused to move so far in opposite directions that when the nippers rise the second time they carry up the ends of the tufts on the opposite sides of the lower warp-threads to those on which they carried it down, and so they loop the said yarns under the said lower warp-threads. The reed-cams H H' then operate to move the dents of the reed half-way back—that is to say, to upright positions—and the harness-cams C^3 at the same time bring the warp-threads to a level and the nippers open to let go the tuft-yarns, and this brings the upper threads of the previous shed on the opposite sides of the lower threads to which they were situated when the tuft was inserted, and the tuft-yarns are thus caused to surround those warp-threads which were previously at the bottom of the shed and to be looped under those warp-threads which were previously uppermost. The continued movement of the cam B^4 brings its offset 34 into operation on the lever B^5 , and thus causes the lay to move back a short distance. While the offset 34 continues in operation the cutters are operated to cut off the tuft-yarns, and the further movement of the cam B^4 carries the said offset 34 beyond the lever B^5 , and so permits the forward movement of the lay to beat up the tuft-yarns to the fell before any weft is inserted. The offset 30 of the cam B^4 now comes into operation and throws back the lay while the crossing of the shed is completed. While the lay remains back a shot of filling is put in and beaten up by a forward movement of the lay, permitted by the offset 30 of the cam B^4 , passing by the lever B^5 . The warp is again shed, while the lay is again moved back by the offset 31 of the cam B^4 , and another shot of weft is inserted. This second shot is beaten up by the forward movement of the lay, permitted by the offset 31 of the cam passing by

the lever B^5 . The lay is then moved back by the offset 32 of the cam B^4 , and the reed-cams H H' complete the movement of the upper and lower bars of the reed to bring back the dents to the same inclination as first described with reference to Fig. 1. The several parts of the loom are now again in the positions represented in Figs. 1, 2, and 3.

In order to render the actual operations of inserting and looping the tufts more intelligible by avoiding reference to any other parts of the loom than those which actually perform the said operations, I will now briefly explain the diagrams Figs. 19 to 25, with reference also to Figs. 16, 17, and 18. The diagrams Figs. 19 to 25 are front views showing nothing of the loom but a portion of the reed, the nipper parts of one pair of nippers, and a part of a tuft-yarn-spool carriage, including only a single-yarn guide-tube d . Four warp-threads a' a' a^2 a^2 are also shown in section. The parts in Fig. 19 correspond in position with Fig. 3, as hereinbefore described, the shed being open and the upper threads of the warp being to the right of the corresponding lower ones of each two, around which the tufts are to be looped, and the nippers being in their lowest position. Fig. 20 corresponds with Fig. 16, the nippers being represented as having passed up through the warp to take the tuft-yarn w . Fig. 21 corresponds with Fig. 17, the nippers being represented as having drawn off through the warp a sufficient quantity of tuft-yarn for a tuft. Fig. 22 shows the reed reversed and the tuft-yarn as bent in opposite directions against the upper and lower warp-threads a' a^2 . Fig. 23 corresponds with Fig. 18, showing the nippers as having taken the end of the tuft-yarn back into the warp and looped it around one of the lower warp-threads a^2 of the yet open shed. Fig. 24 shows the nippers as having let go the tuft-yarn and returned to their lowest position. Fig. 25 shows the dents of the reed as having been brought to an upright position, the shed as having been closed, and the warp-threads all in the same plane and the tuft-yarn as cut off ready to be beaten up, these changes of position of the parts having caused the warp-thread a' to carry down the yarn over the warp-thread a^2 , so that the latter is completely encircled by the yarn and at the same time having caused the yarn to be left looped under the thread a' . This completes the operation of putting in one row of tufts. These tufts are secured first by being beaten up and afterward throwing in and beating up the weft, (two shots, according to the example represented,) while the dents of the reed are still upright.

The operations of shedding and putting in the weft to complete the securing of a row of tufts should always terminate with the same warp-threads upward, and after these operations have been completed the reed is again moved to bring its dents and the warp-threads into the same position in which the previous

operation of inserting the tuft-yarns commenced, as described with reference to Figs. 1, 3, and 10.

It is obvious that the loom might be organized by a proper change of cams to put in only one shot or more than two shots of filling between the successive rows of tufts.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with the lay, harness-motion, tuft-nippers for inserting tuft-yarns between the warps, and means of giving said nippers a to-and-fro motion and opening and closing movements, of a reed laterally movable relatively to the lay and means of giving the said reed a lateral movement, substantially as herein set forth.

2. The combination, with the lay, of nippers carried thereby to move therewith and mechanism for giving the said nippers movements backward and forward within the lay and through the raceway thereof independently of their movement with the lay itself and an opening and closing movement, substantially as and for the purpose herein described.

3. The combination, with the lay, of attached swinging hangers, a set of nippers consisting of members rigidly secured to said hangers and members pivoted in said hangers, a lever fulcrumed in one of said hangers, connected with the last-mentioned members, and mechanism for giving motion to said lever to open and close the nippers, substantially as herein described.

4. The combination, with the lay and the nippers carried thereby and capable of a to-and-fro motion independently thereof, of a reed capable of a lateral movement relatively to the lay and nippers, and mechanism for producing said independent movement of the nippers and lateral movement of the reed, substantially as herein described.

5. The combination, with the lay, of a reed consisting of two bars fitted to slide within the lay, and dents having their ends loosely connected with said bars, and a lever fulcrumed to the lay and connected with said bars, substantially as and for the purpose herein described.

6. The reed consisting of the combination of two longitudinally-grooved parallel bars, spacing-pins inserted transversely through said bars at regular intervals and intersecting the grooves in said bars, and dents having their ends fitted loosely both within said grooves and within the intervals between said spacing-pins, substantially as herein described.

7. The combination of the lay, a laterally-movable reed fitted thereto, and nippers carried by the lay, but capable of a movement to and fro independently thereof, for insert-

ing tufts into the warp, means for giving the said nippers a movement twice through the warp and back, means for closing said nippers after their first entry and keeping them closed during their first return and second entry, and means of opening them before their second return, substantially as herein set forth.

8. The combination, with the lay and harness of a loom, supports for tuft-yarn spools, and cutters for cutting the tuft-yarns from said spools, of nippers carried by the lay, a laterally-movable reed, means for giving the said nippers a to-and-fro movement relatively to the lay and an opening and closing movement, means for operating the shuttle, means for operating the harness, means for laterally moving the reed, means for operating the cutters, and means for operating the lay, all substantially as herein described, whereby the tuft-yarns are drawn from their spools by the nippers and thereby inserted through and looped around the warp, the tuft-pieces are cut off, and the weft is inserted in the warp and beaten up, as herein set forth.

9. The combination, with the tuft-yarn-spool supports and the guide-tubes thereon for presenting the tuft-yarns, of a stationary guide arranged parallel with said guide-tubes, a cutter-carriage and two cutters therein fitted to slide on the said guide, and means of moving the said carriage to and fro along said guide, substantially as herein described, for cutting the tuft-yarns in both directions of the movement of the said carriage.

10. The combination of the tuft-yarn-spool supports and the guide-tubes thereon for presenting the tuft-yarns, a stationary guide arranged parallel with said guide-tubes, a cutter-carriage, a cutter fixed in said carriage, and a rotary cutter and cutter-spindle fitted to said carriage, means of producing the movement of the said carriage on said guide and means of producing the rotation of the cutter-spindle and rotary cutter, substantially as herein set forth.

11. The combination, substantially as herein set forth, with the lay, the swinging hangers E, attached thereto, and the nippers *ee'*, of which one jaw or member is rigidly attached to said hangers and the other pivoted thereto, of the levers *E'*, pivoted in said hangers and connected with the pivoted member of the nippers, a cam F and operating mechanism, substantially as described, between said cam and said hangers, and a cam *E''* and operating mechanism, substantially as herein described, between said cam and said lever *E'*.

ADAM BOLLENTIN.

Witnesses:

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