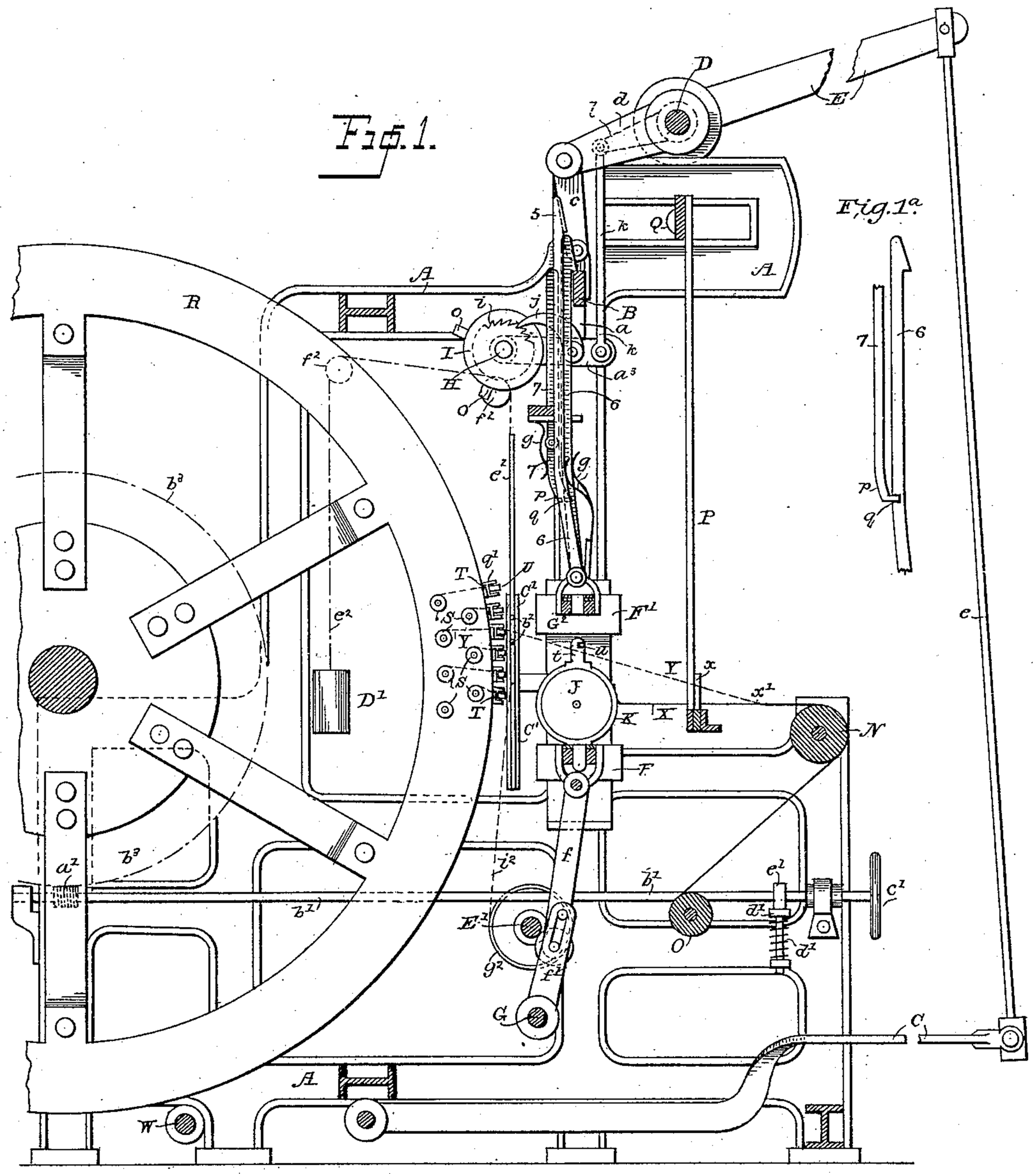
(No Model.) 7 Sheets—Sheet 1.

A. SIRET.

LOOM FOR WEAVING TUFTED FABRICS.

No. 411,067. Patented Sept. 17, 1889.

Fig. 1.



Witnesses
W. H. Courtland
C. K. Fraser.

Inventor
Antonne Siret,
By his Attorneys
Arthur G. Fraser & Co

(No Model.) 7 Sheets—Sheet 2.

A. SIRET.

LOOM FOR WEAVING TUFTED FABRICS.

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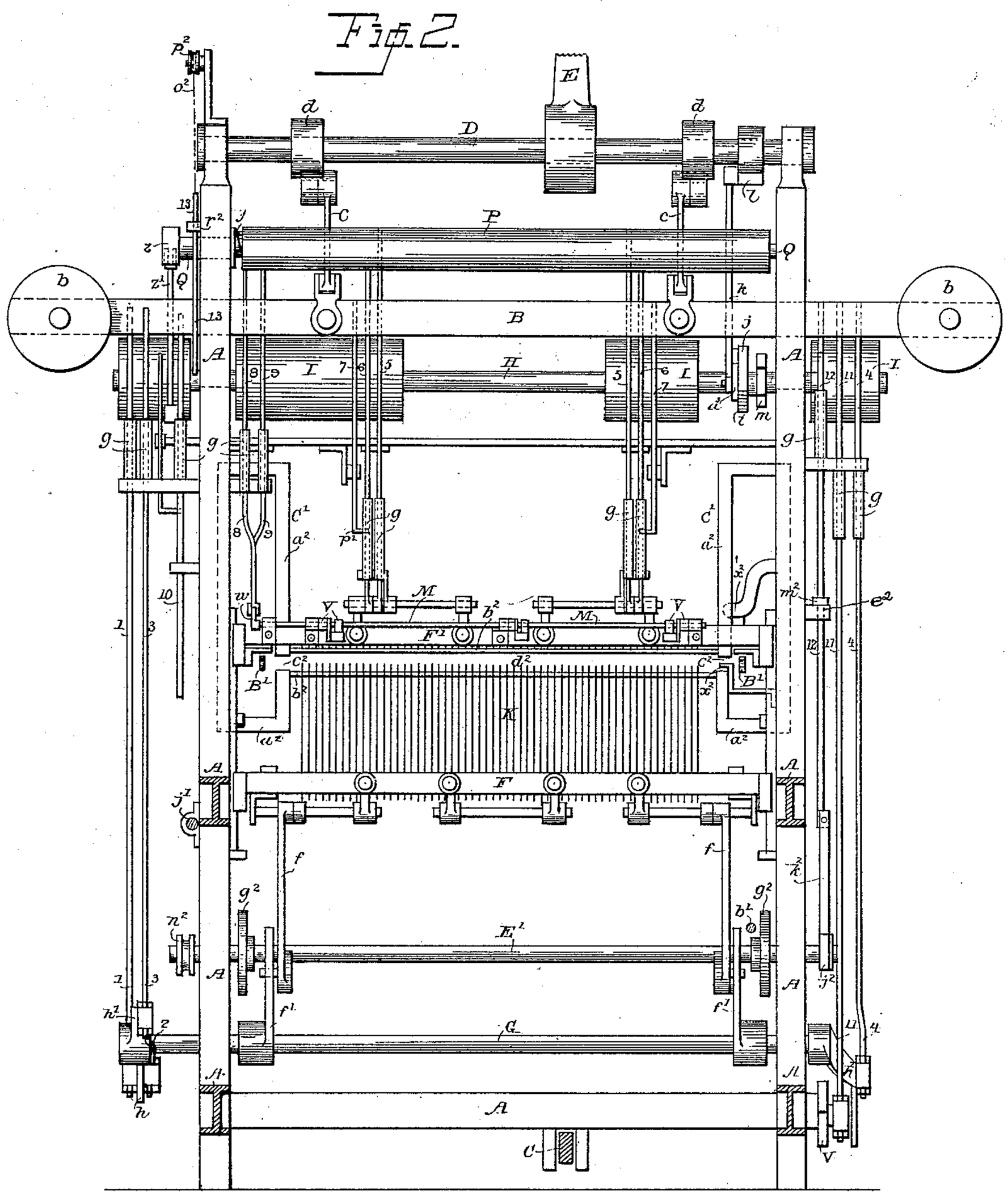
Fig. 2.



WITNESSES
W. A. Courtland,
C. K. Fraser.

INVENTOR
Antoine Siret;
By his Attorneys
Arthur G. Fraser & Co

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A. SIRET.

LOOM FOR WEAVING TUFTED FABRICS.

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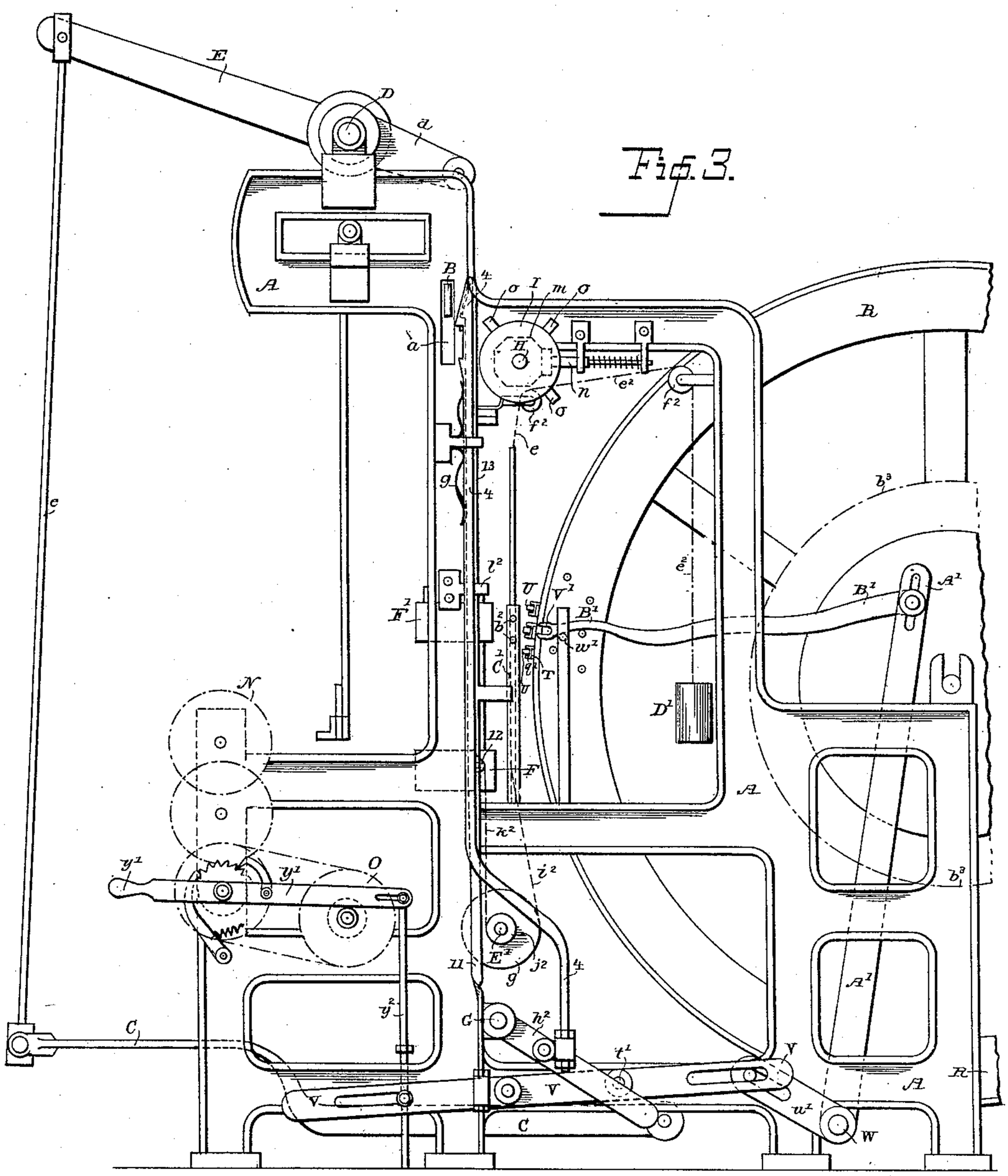
Fig. 3.



Witnesses:
W. A. Courtland
C. K. Fraser.

Inventor:
Antoine Siret;
By his Attorneys,
Arthur G. Fraser & Co

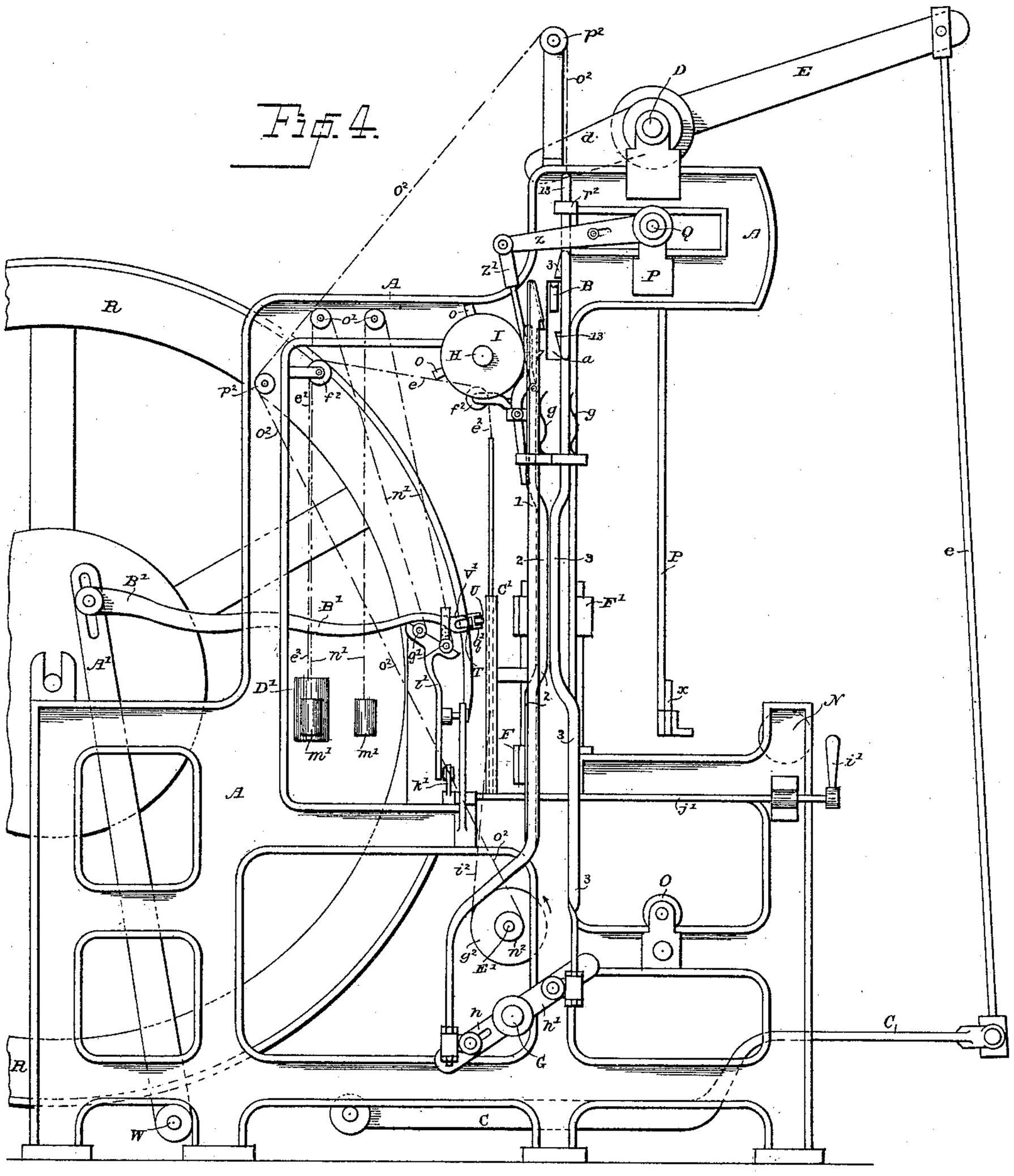
(No Model.) 7 Sheets—Sheet 4.

A. SIRET.

LOOM FOR WEAVING TUFTED FABRICS.

No. 411,067. Patented Sept. 17, 1889.

Fig. 4.



Witnesses:
W. A. Courtland
C. K. Fraser.

Inventor:
Antoine Siret,
By his Attorneys
Arthur G. Fraser & Co

(No Model.) 7 Sheets—Sheet 5.

A. SIRET.

LOOM FOR WEAVING TUFTED FABRICS.

No. 411,067. Patented Sept. 17, 1889.

Fig. 13.

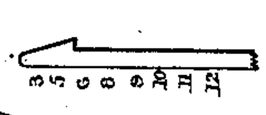


Fig. 14.

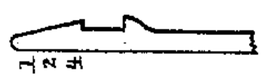


Fig. 15.

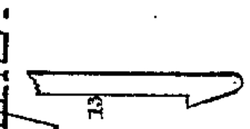


Fig. 12.

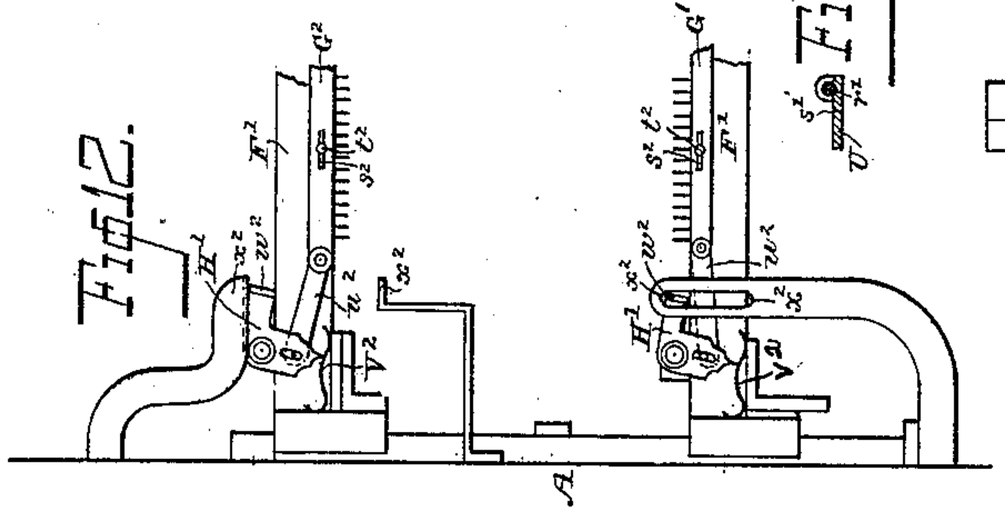


Fig. 8.

Fig. 9.

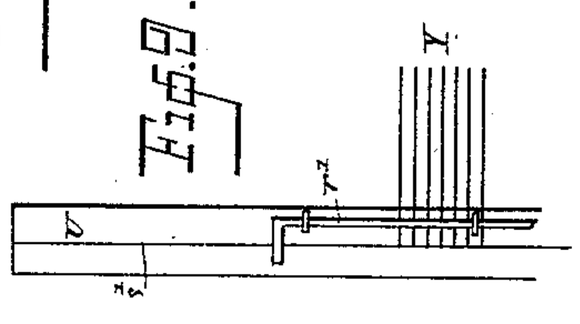


Fig. 10.

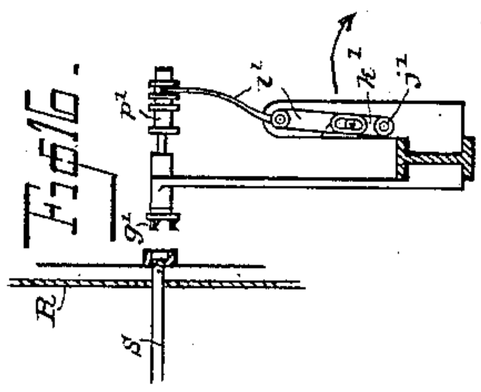


Fig. 7.

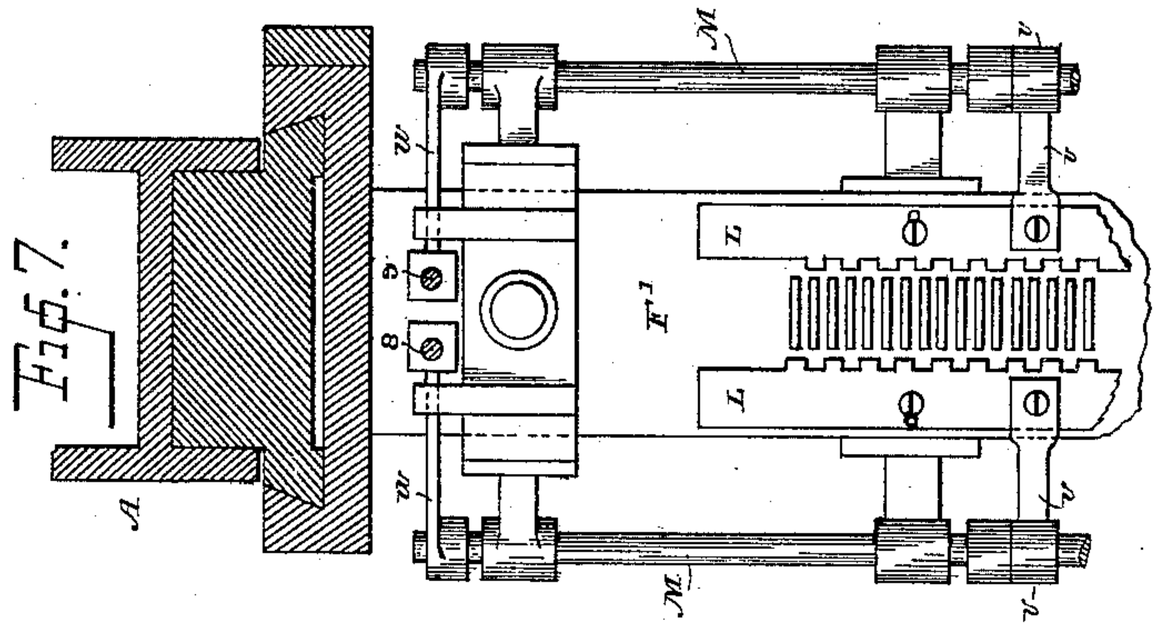


Fig. 10.a

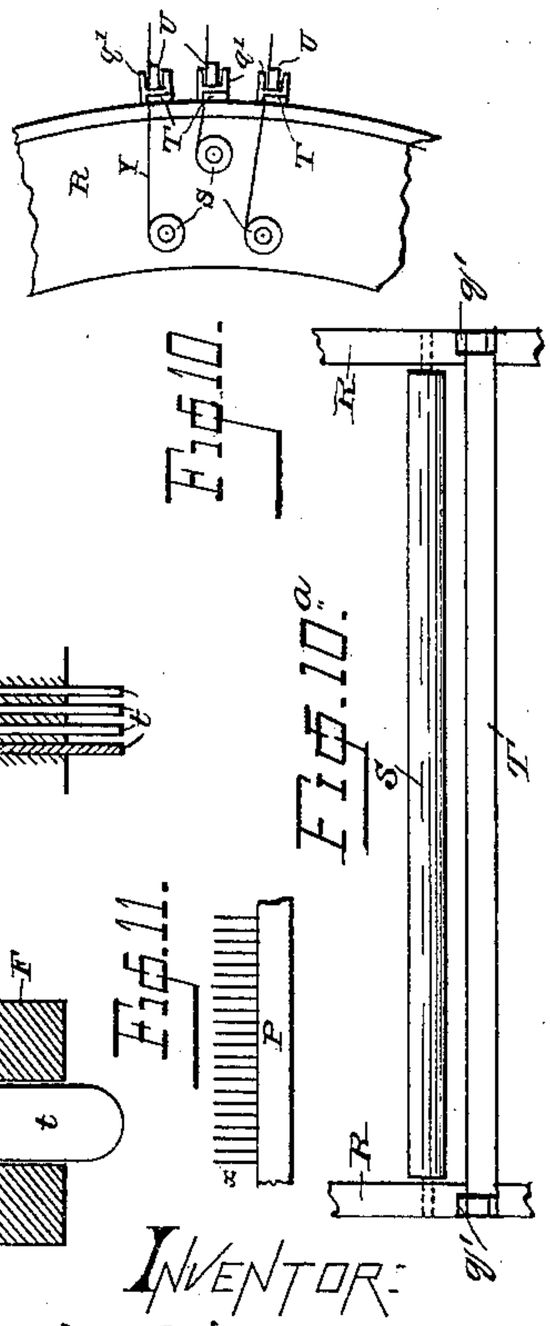


Fig. 6.

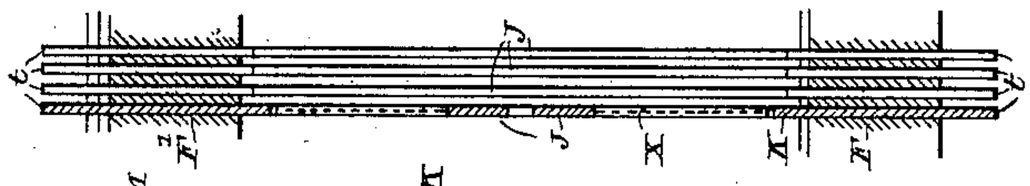


Fig. 5.

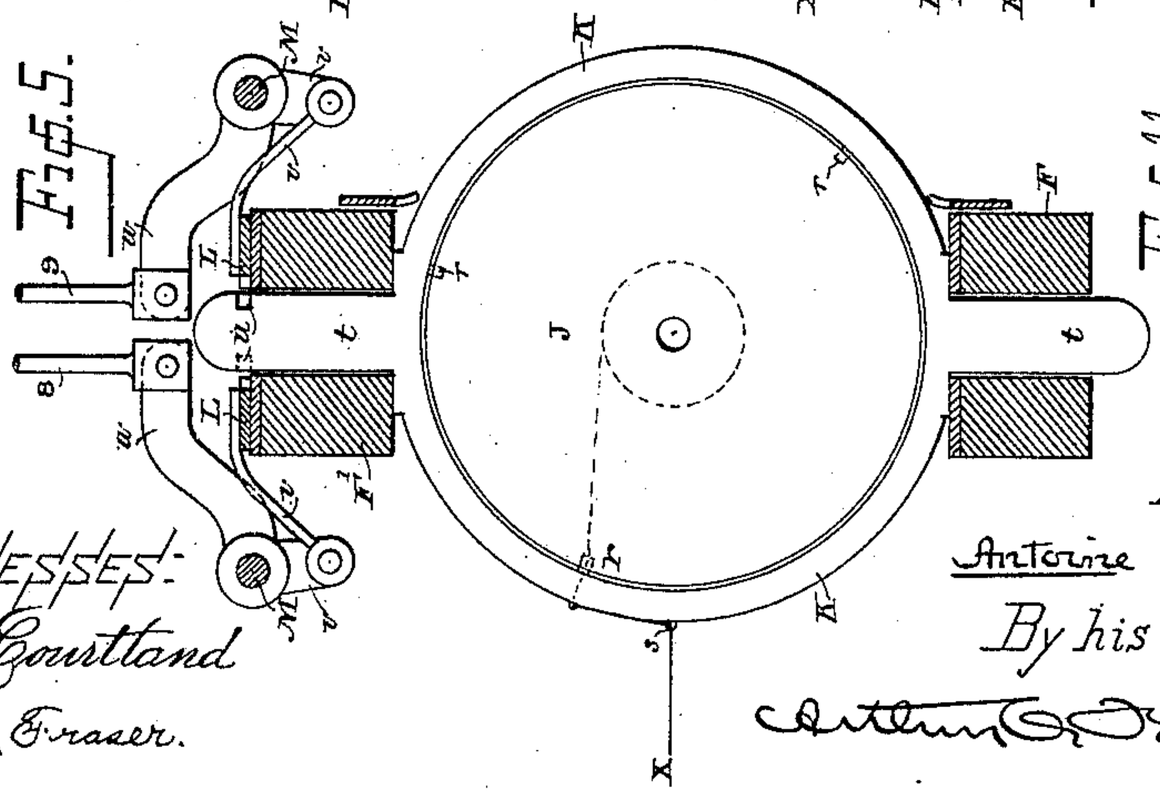


Fig. 11.

WITNESSES:
W. H. Courtland
C. K. Fraser.

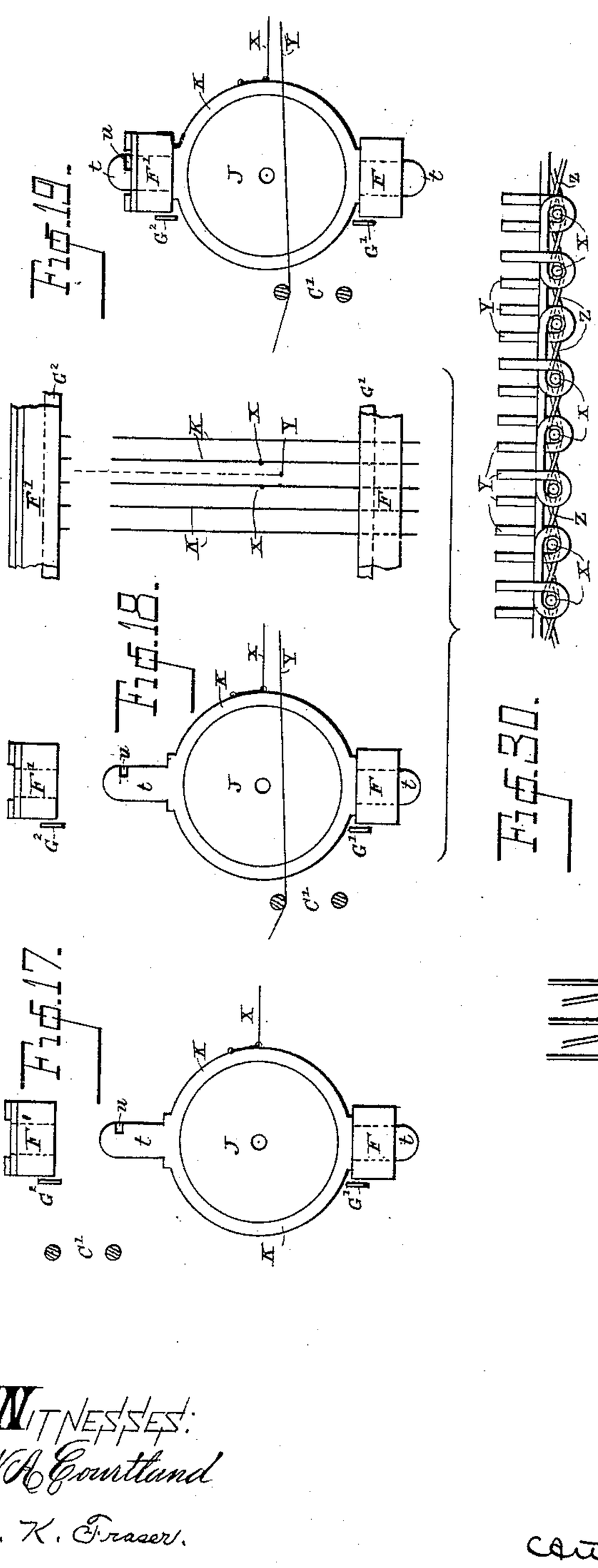
INVENTOR:
Antoine Siret,
By his Attorneys
Arthur O. Fraser & Co

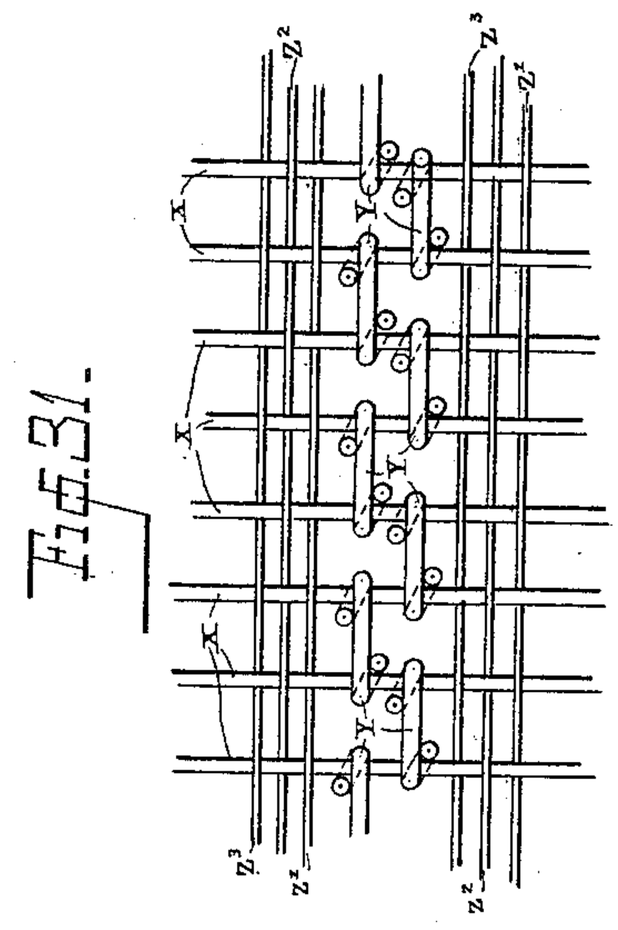
(No Model.) 7 Sheets—Sheet 6.

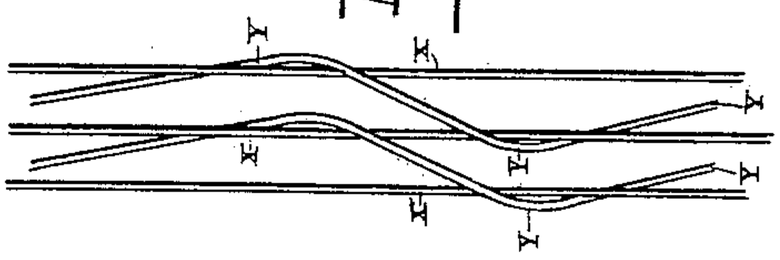
A. SIRET.

LOOM FOR WEAVING TUFTED FABRICS.

No. 411,067. Patented Sept. 17, 1889.







Witnesses:
W. A. Courtland
C. K. Fraser.

Inventor:
Antonine Siret,
By his Attorneys
Arthur G. Draper & Co.

(No Model.) 7 Sheets—Sheet 7.

A. SIRET.

LOOM FOR WEAVING TUFTED FABRICS.

No. 411,067. Patented Sept. 17, 1889.

Fig. 25.

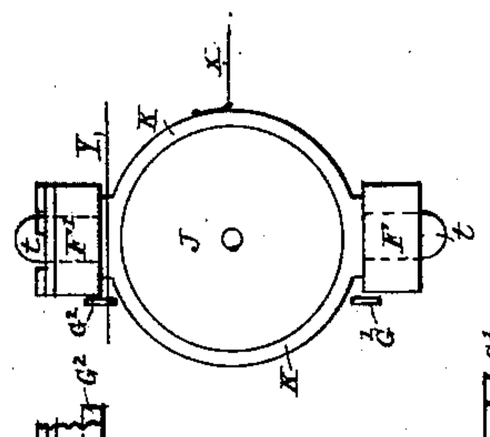


Fig. 24.

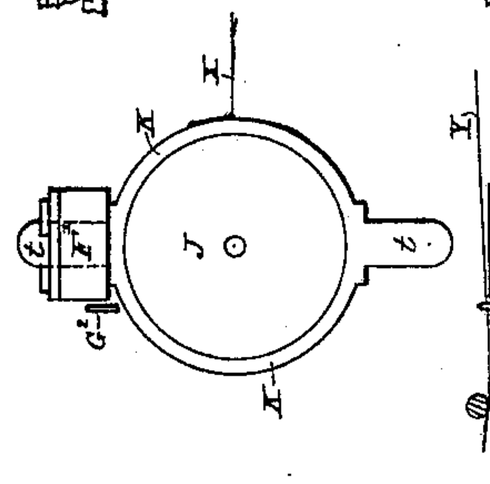


Fig. 21.

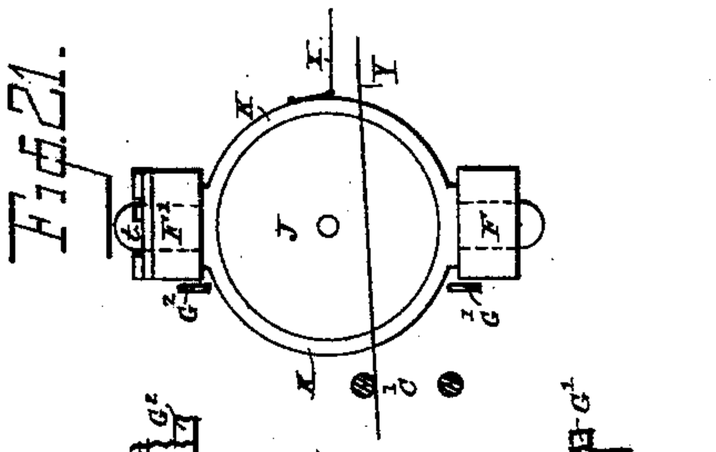


Fig. 20.

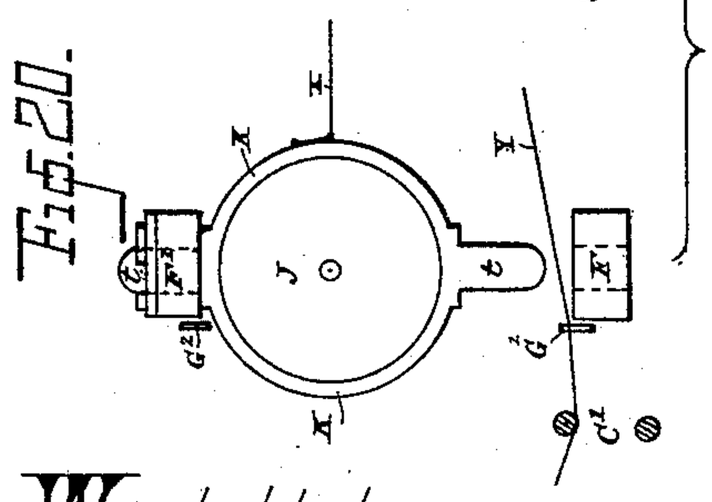


Fig. 27.

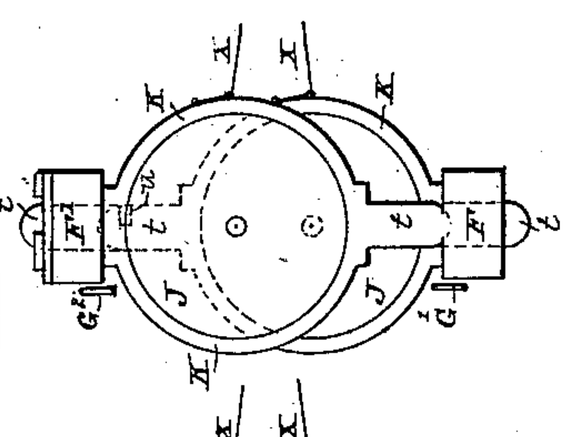


Fig. 26.

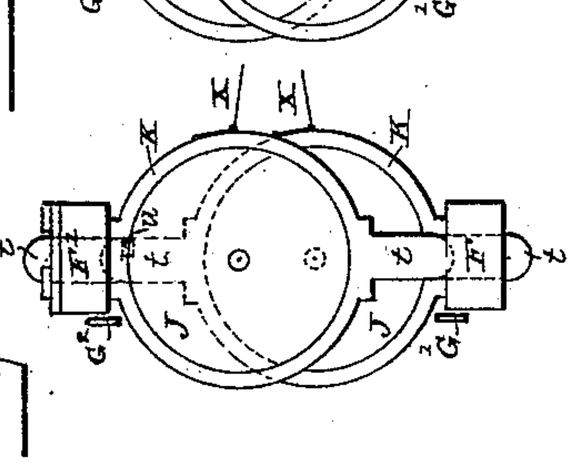


Fig. 23.

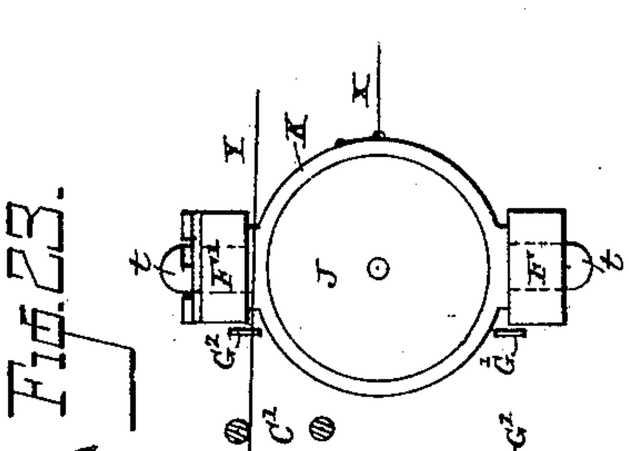
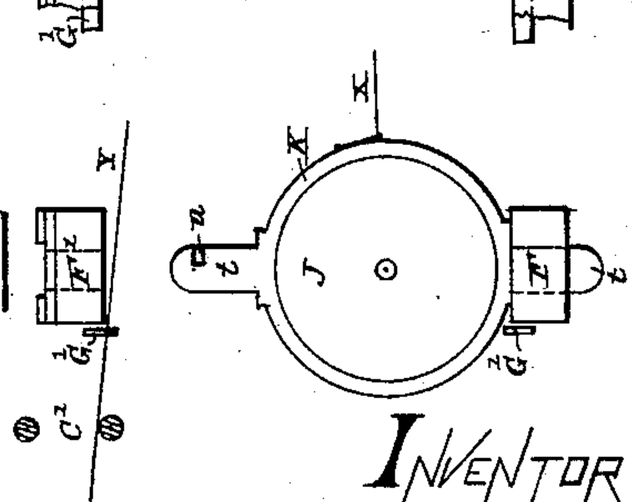


Fig. 22.



WITNESSES
W. A. Courtland,
C. K. Fraser.

INVENTOR
Antoine Siret,
By his Attorneys
Arthur G. Fraser & Co

UNITED STATES PATENT OFFICE.

ANTOINE SIRET, OF ROUBAIX, FRANCE, ASSIGNOR OF ONE-HALF TO JULES LEON FERDINAND SAULNIER, OF SAME PLACE.

LOOM FOR WEAVING TUFTED FABRICS.

SPECIFICATION forming part of Letters Patent No. 411,067, dated September 17, 1889.

Application filed May 8, 1888. Serial No. 273,172. (No model.) Patented in France September 18, 1886, No. 178,612; in Belgium October 2, 1886, No. 74,713; in England October 2, 1886, No. 12,543, and in Germany October 15, 1886, No. 42,835.

To all whom it may concern:

Be it known that I, ANTOINE SIRET, residing at Roubaix, in the Department of Nord, France, have invented certain new and useful Improvements in Looms for Weaving Tufted Fabrics, of which the following is a specification.

This invention is the subject of the following Letters Patent in foreign countries: France, No. 178,612, dated September 18, 1886; Belgium, No. 74,713, dated October 2, 1886; Great Britain, No. 12,543, dated October 2, 1886, and Germany, No. 42,835, dated October 15, 1886.

This invention relates to looms for weaving pile carpets of the Smyrna kind and other similar pile fabrics, wherein the woolen or pile warps are tied around the ground warps, producing a pile of the Smyrna kind. In its general construction the loom comprises a series of bobbins, upon which the ground warp-threads are wound, said bobbins being journaled in carriers which are mounted in and between two vertically and independently movable beams, to which the bobbin-carriers are removably attached, so that the bobbins may be held in place alternately by each beam, in order that the pile warp-threads may be passed both above and beneath the bobbins. The pile warp-threads are each wound upon a spool-roller or bobbin, all of the said spools being mounted upon a rotary drum, by means of which they are brought into action as desired. The pile warp-threads are tied around the ground warp-threads, and after being so tied the weft-threads are shot in the usual manner, and are then beaten up. The several mechanisms for effecting these operations are all actuated by a series of hooked rods, which are brought into engagement in the proper sequence with a single vertically-reciprocating beam, which is in turn actuated by a treadle.

The loom is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of the loom. Fig. 1ª is a detail view of part of the mechanism shown in Fig. 1. Fig. 2 is a vertical cross-section of the loom. Figs. 3 and 4 are side views, looking, respectively, at opposite sides of the loom. Fig. 5 is a detailed cross-section, on an enlarged scale, of the bobbin-carrying beams, showing the relation of the bobbins thereto. Fig. 6 is a longitudinal vertical section through a small portion of the bobbin-carrying beams, showing one of the bobbins and its carrier in section. Fig. 7 is a plan view of one end of the upper bobbin-carrying beam, showing its guides in section. Figs. 8, 9, and 10 are detail views showing the means for retaining the ends of the pile warp-threads in place. Fig. 10ª is a face view of a fragment of the pile-warp drum, showing the position of one of the pile-warp rollers and of one of the warp guide slats or rods thereon. Fig. 11 is a detail fragmentary view of the batten-teeth. Fig. 12 is a side view of one end of the two bobbin-carrying beams, showing the means for reciprocating slide-combs carried thereon. Figs. 13, 14, and 15 are detailed views of the hook ends of the actuating-rods, showing the several constructions thereof. Fig. 16 is a detail view of clutch mechanism for giving the proper tension to the pile warp-threads. Figs. 17 to 28, inclusive, are detail views, partly diagrammatic, showing the various positions of the principal parts which effect the formation of the pile and which correspond to the various phases of the work. Fig. 29 shows in plan the formation of the pile. Figs. 30 and 31 show in section and plan, respectively, a diagram of a Smyrna pile fabric as produced by the loom.

Referring to the first four figures, A is the frame-work of the loom, and B is the vertically-reciprocating beam extending transversely across the frame-work, which actuates the various mechanisms and which slides in vertical slots *a* in the frame-work. This beam is weighted by weights *b*, so that it descends by its own weight, and it is raised by connection with a treadle C, suitably journaled to the frame-work. The beam is pivotally suspended by pivoted links *c* from lever-arms *d*, rigidly secured to a rock-shaft D, and the treadle is connected by a pivoted rod *e* to a lever-arm E, also rigidly secured to the same rock-shaft.

For convenience in describing the loom the

treadle end of the loom will be considered the front.

F F′ are the two bobbin-carrying beams, extending transversely across the loom beneath and parallel with the operating-beam B. Said beams F F′ are movable, vertically sliding on suitable guides on the frame-work. When the loom is at rest, the lower beam F is supported in its uppermost position by pivoted links *f f*, the lower ends of which are held in slotted lever-arms *f′ f′*, which are rigidly secured to a rock-shaft G, journaled in the frame-work beneath and parallel with the bobbin-beams, as best shown in Figs. 1 and 2. The vertical reciprocation of the lower beam F is effected by the rocking of the shaft G, and said shaft is rocked by the operating-beam B, with which it is connected by means of four hooked rods 1, 2, 3, and 4, the hooks of which are at the proper times projected across the path of the operating-beam; but of these four rods three—1, 2, and 4—are ordinarily held out of co-operation therewith by springs *g g*. Three of these rods—viz., 1, 2, and 4—have their hooked ends shaped, as shown in Fig. 14, so that when they engage the operating-beam they embrace the same, whereby said rods are affected by the movement of the beam in either direction, and the fourth hook 3 has its hooked end shaped like that shown in Fig. 13, so that it is effected only by the upward movement of the operating-beam. The rods 1, 2, and 3 are all connected to the rock-shaft at one end of the same, as shown in Figs. 2 and 4. The rods 1 and 2 are pivotally connected to the outer end of a downwardly-extending crank-arm *h*, secured to the rock-shaft, and both extend upwardly toward the operating-beam B, their upper hooked ends being held, when the loom is at rest, just in the rear of the path of the beam, and opposite its lowest position, such being the position shown in Fig. 4. The rod 3 is pivotally connected at its lower end to the outer end of an upwardly-extending crank-arm *h′*, secured to the rock-shaft G diametrically opposite to the arm *h*. This rod passes in front of the operating-beam, and its upper hooked end is normally held in the plane of the path of the operating-beam, but above the upward limit of the movement thereof. The rods 2 and 3 are near their central parts bent toward each other, and they are held at all times in contact with each other by the spring *g* of the rod 3. Owing to the location of the arms *h h′* on the shaft G, when the rods 1 and 2 are raised the rod 3 will be depressed, and when the rod 2 is swung forward to bring its hook into connection with beam B the rod 3 will be swung away from the beam, and its hook will thus be carried beyond the plane of the path of the beam. The fourth rod 4 is pivotally connected at the other side of the frame-work (see Fig. 3) to a downwardly-extending crank-arm h^2 on the opposite end of the rock-shaft G, said arm being parallel with the arm *h*, to which the rods 1 and 2 are connected. This rod extends behind the beam B, and has its hooked end arranged in the same manner as those of the rods 1 and 2. If, then, any one of the rods 1, 2, or 4 is swung forward at the proper time when the beam B is at its lowest position, the hooked end of such rod will embrace said beam, and the movement then of the beam will rock the shaft G back and forth, depressing the bobbin-beam F when the beam B is raised, and raising the bobbin-beam when the operating-beam is lowered, as will be evident from an examination of Figs. 1, 2, and 4; but if the rod 3, when in its lowermost position, has its hooked end projected across the path of the beam, so that its hook is engaged by the beam, said rod will only be affected by the upward movement of said beam, (owing to the shape of its hooked end, shown in Fig. 13,) and such upward movement would cause the shaft G to be rocked in the direction to raise the bobbin-beam F to its normal position.

The movement of the rods 1, 2, and 4 across the path of the operating-beam is effected by the following mechanism: In the rear of said rods is journaled, crosswise of the frame-work, a rotary shaft H, carrying a ratchet-wheel *i*. Co-operating with this ratchet-wheel is a pawl *j*, pivoted to a link a^3, which is hung at one end upon the shaft H, and the other end of this link is pivotally suspended by a rod *k* from a lever-arm *l* on the main rock-shaft D; hence each rocking of the shaft D rotates the shaft H a certain uniform distance. As will appear hereinafter, a complete sequence of operations in the weaving is effected by eight depressions of the treadle, and hence the parts are so proportioned that the shaft H will be rotated one-eighth of a complete rotation at each rocking of the shaft D. To insure the shaft H being held in the proper place at each movement, it carries an octagonal disk *m*, against the periphery of which presses a spring-actuated bar *n*. The shaft H carries a series of drums I, located at proper intervals, and on the peripheries of these drums are fixed tappet-pins *o*, one for each of the rods 1, 2, and 4, as well as for other rods, to be referred to hereinafter. These tappet-pins are so located that at the proper moment each will be brought in contact with its rod to swing the same across the path of the operating-beam, and when said tappet-pins are moved away from their rods the rods will be returned to their normal positions by their respective springs *g*.

The upper bobbin-carrying beam F′ normally occupies its lowermost position when the loom is at rest, and it is held in this position by resting on the bobbin-carriers, which are in turn supported by the lower beam F. This beam F′ is lowered by means of its own weight, and is raised by means of two pairs of hooked rods 5 5 and 6 6, pivotally connected, one of each pair, at opposite ends of the beam. These rods have hooks like those shown in Fig. 13, and when the rods are at rest these

hooks are in the rear of the lowermost position of the beam B, being held away from the same by springs *q*. In proper order one of these pairs of rods is swung across the path of the beam by two of the tappet-pins *o*, so that when the beam B ascends the bobbin-beam F′ is also raised. When the rods 5 5 are thus engaged by the beam B, the bobbin-beam drops on the descent of the beam B; but when the rods 6 6 are engaged by the operating-beam and are elevated thereby they are held elevated by pivoted spring-levers 7 7, having catches *p p* on their lower ends, which engage notches *q q* in the rods 6 6. When the beam B then descends, the downward movement of the bobbin-beam F′ will not be affected, and it remains elevated until other tappet-pins *o* strike the upper ends of the catch-levers 7 7 and move their catches out of engagement with the rods 6 6. The bobbin-beam then descends of its own weight. The bobbin-beam may thus be raised, lowered, and held in its upper as well as in its lower position.

Referring now to Figs. 5, 6, and 7, J J are narrow metal bobbins upon which the ground warp-threads X are wound. These bobbins are mounted in annular bobbin-carriers K K, in which they are retained by studs *r r* on the carriers which enter between the cheeks of the bobbins. The outgoing end of each ground warp-thread passes out through an eye in one of the studs *r* and another guide-eye *s* on the bobbin-carrier. These bobbins and their respective carriers supply the ground warp-threads, and are consequently equal in number to that of these threads. Each bobbin-carrier terminates at top and bottom in projecting feet *t t*, which enter in slots in the upper and lower bobbin-beams F′ F, whereby the bobbin-carriers are held and guided in place. Since the lower feet of the bobbin-carriers rest in and are held by the lower bobbin-beam, the carriers will be held in place thereby when the upper bobbin-beam is raised, so that the upper bobbin-beam may be raised clear above the upper feet of the carriers to enable the pile warp-threads to be passed over and between the bobbins. It is also essential for the weaving of the fabric, as will appear hereinafter, that the pile warp-threads should be passed beneath some or all of the bobbins and their carriers, and to enable this to be done it is necessary either that the bobbin-carriers should be lifted with the upper bobbin-beam, or should be supported thereby when the lower bobbin-beam is depressed. To this end the upper end of the upper foot *t* of each bobbin-carrier has a notch *u* cut therein, which, when the loom is at rest, is above the upper surface of the upper bobbin-beam. The notches on adjacent bobbin-carriers are arranged on opposite sides of the feet *t*, so that the notches alternate. The notches on both sides are engaged and disengaged by sliding serrated bars L L, which are mounted on the upper bobbin-beam, so as to be moved to and from the bobbin-carrier feet *t*. These sliding bars are connected with lever-arms *v v*, which are secured to rock-shafts M M, journaled in brackets on the bobbin-beam. These rock-shafts are actuated by hooked rods 8 9, which are pivotally connected with lever-arms *w w* on the rock-shafts M M. The upper ends of these rods have hooked ends of the character shown in Fig. 13, and they are arranged to be swung into co-operation with the operating-beam B by means of the tappets *o o* in the same manner as the hooked rods already described, and they are held normally out of co-operative position by springs *g* in the manner already described. The relative position of these rods 8 and 9 is shown in Fig. 2. When in their normal position, when the loom is at rest, the sliding bars L L are out of engagement with the bobbin-carriers, and they are brought into engagement therewith only when the rods 8 and 9 are acted upon by the tappet-pins. If only one rod 8 is acted upon, only one half of the bobbins will be affected thereby, and the other alternate half will be affected by the action of the other rod, whereas if both rods are acted upon simultaneously all the bobbins will be affected. When the bobbins and their carriers are thus engaged, if the lower bobbin-beam is depressed the bobbins will be held suspended from the upper bobbin-beam, and if when so engaged the upper bobbin-beam is raised the bobbins will be raised therewith.

The ground warp-threads pass forward over a roller N in the front of the loom and thence to the cloth-beam O. Between the bobbins and the roller N the ground warp-threads pass between the teeth *x* of the swinging batten P. The batten is pivotally suspended from a rock-shaft Q, mounted in the upper part of the frame. The batten is arranged so as to be shifted laterally a distance equal to double the distance between two of the warp-threads. This is effected by mechanism shown in Figs. 2 and 4. The shaft Q carries a cam *y*, of sufficient size and shape to cause the batten to move the proper distance, and this cam bears against a part of the batten-frame. The shaft is rocked by means of lever *z* and rod *z′*, which connect it with a hooked rod 10, to which the rod *z′* is pivoted. This rod 10 has its end hooked in the manner shown in Fig. 13, and is brought into co-operation with the operating-beam B (away from which it is normally held by spring *g*) by one of the tappet-pins *o*.

The woolen or pile warp-threads are all carried by a rotating drum R, journaled in the frame-work behind the bobbin-beams. This drum carries near its periphery and entirely around the same a series of rotating bobbins or rollers S S, which are journaled in opposite ends of the drum, and which extend crosswise of the loom. Only a few of these rollers are shown in the drawings, but it will be understood that they will be arranged around the entire periphery of the drum. There is a

pile warp-thread Y for each point of the surface of the fabric to be produced, and the pile warp-threads to form a series or row of points clear across the fabric are all wound upon a single roller S. When one line of points has been woven in, the drum is then rotated to bring the next pile-thread roller into position, and so on. For obtaining designs in weaving, care must be taken to arrange the threads of different colors upon each roller and upon the several rollers on the drum, so as to be only obliged to apply successively to the several rollers to obtain from each the lengths of thread for one line of points of the fabric, and to produce automatically by this means the desired design. The drum thus provided with the separate rollers permits of the production of designs on pile fabrics without the use of Jacquard apparatus.

The drum is turned, after the formation of each line of points, either directly by hand or, preferably, by being provided with a gear-wheel b^3, which engages with a worm-gear a' on a shaft b', operated by a hand-wheel c'. The drum is held stationary during the work by means of a spring-actuated bar b', which bears against a four-sided disk e' on the shaft b'.

The proper tension is given to the pile warp-threads Y during the formation of the points by the clutch mechanism coacting with the pile-warp roller S in operation, which is shown in Figs. 4 and 16, Fig. 16 being a fragmentary vertical cross-section through the periphery of the drum. The sliding and rotary clutch member g' is adapted to engage the end of each roller S in turn, and it is brought into engagement therewith by means of a crank-handle i' and shaft j', which is connected with the sliding clutch member by crank-arm k' and lever l'. As shown in Fig. 10, the pile-warp rollers S are, for the sake of compactness, staggered, and hence two clutching devices are necessary.

The proper tension is given to the clutch members by weights m', which are connected to cords n', which pass over pulleys o', and wind upon spools p' on the clutch-shafts. When the clutch members are out of engagement with the pile-warp rollers, they are held from being turned by the weights m' by the grip of the lever l'.

In order to apply tension to the particular roller S, in operation the crank-handle i', Fig. 4, is turned so as to rotate shaft j' in the direction indicated by the arrow in Fig. 16, thus moving crank-arm k' in the same direction. This movement of the crank-arm oscillates the lever l', thus sliding the clutch member g' toward and into engagement with the end of roller S. The weight m' then acts upon the spool p', exerting a force in the proper direction to give tension to the pile warp-threads on the roller S.

On the periphery of the drum, extending crosswise of the same, equal in number and parallel with the roller S, are a series of slats or rods T, (see Fig. 10^a,) over which the pile warp-threads Y pass in being carried to the ground warp-threads, whereby the pile warp-threads are properly guided and directed.

The tying of the pile warp-threads to the ground warp-threads is accomplished (see Figs. 30 and 31) by carrying the ends of the pile warp-threads over the ground-warp bobbins to a point between the bobbins and the roller N, the pile warp-threads being equal in number to the ground warp-threads. With their ends held above the ground warp, each pile warp-thread is then placed beneath one of the ground warp-threads, then over two ground warp-threads, and then down around one thread, and thence up, where the other end of the pile warp-thread is left free. These general operations, which will hereinafter be more specifically set forth, it is seen consist of forward, up-and-down, and lateral movements of the pile warp-threads, which movements are effected by mechanisms, as follows:

Held in position in brackets q' on the periphery of the drum R, and immediately in front of the guide-bar T, is a pile-warp-carrying bar U, the ends of which project on each side beyond the drum. (See Figs. 8, 9, and 10.) To this bar U the ends of the pile-threads are nipped by a nipping-rod r', journaled on the bar U. In front of this nipping-rod is a groove s', over which the ends of the pile warp-threads are placed, and along which a knife is passed to render the ends of the threads uniform. This pile-carrying bar is free to be moved forward away from the drum toward the roller N.

Pivoted to one side of the frame at t' (see Fig. 3) is a sway-beam V, which at its rear end is pivotally connected to a crank-arm u' on a rock-shaft W. Secured to this shaft W on opposite ends of the drum R (see Figs. 3 and 4) are two oscillating arms A', to the upper ends of which are pivotally connected cam-shaped sliding arms B', having forked ends v', which rest on guide-rollers w' immediately in the rear of the projecting ends of the pile-carrying bar U.

In front of the pivotal point t' of the sway-beam a hooked rod 11 is pivoted thereto. This rod has a hooked end of the character shown in Fig. 13, and it coacts with the main operating-beam B in the same manner and is actuated by the same mechanism as the hooked rods already described. When this rod 11 is raised by the beam B, the sliding arms B' are moved forward, taking up the pile-bar U and carrying it forward and downward to the point x' (see Fig. 1) above the ground warp-threads immediately behind the roller N. The bar U remains in this position during the subsequent weaving, being held in position in the forked ends of the arms B' by the tension of the pile warp-threads, and is then retracted by the lever y' and rod y^2, acting upon the sway-beam V. (See Fig. 3.) The pile-bar U is carried forward in front of the ground-warp bobbins at a time when the

upper bobbin-beam F′ is raised above the bobbin-carriers, so that the pile-bar passes above the bobbin-carriers and beneath the upper bobbin-beam. The pile-bar is also carried forward in front of the batten and above the batten-teeth, passing between the suspension-bars of the batten-tooth bar. When the pile-bar is carried to its extreme forward position, where it rests on the ground-warp, the pile-warp threads are located between the batten-teeth, as indicated in Fig. 1. The movement of the pile-bar U in the proper path is determined by the curved or cam-shape of the sliding arms B′. These arms move in the spaces between the upper and lower bobbin-beams at the ends of the same which are not filled with the bobbins, as shown in Fig. 2.

The vertical movements of the pile warp-threads are effected by means of a vertically-movable thread-shifting frame C′, located between the drum R and the bobbin-beams F F′. This pile-thread-shifting frame, which is best shown in Fig. 2, consists of two rectangular slides a^2 at opposite sides of the loom, which slide vertically in the frame-work, and these two slides are connected by two rods b^2, extending crosswise of the loom. The rectangular slides are on their inner sides cut away to form openings c^2, which constitute continuations of the space d^2 between the rods b^2. When the pile-bar U is carried forward, it passes through the space d^2 and openings c^2, the sliding levers B′ passing through the spaces formed by the rectangular slides, Figs. 1 and 2. Accordingly, when the pile-bar is carried forward to the point x', the pile warp-threads Y are between the two rods b^2, and any vertical movement of the shifting-frame C′ thus would cause the portions of the pile warp-threads between the ground-warp bobbins and the drum R to be moved up or down. The shifting-frame C′ is suspended at its opposite ends by cords or straps e^2, which pass over pulleys f^2, and to which are attached weights D′, which normally hold the frame when the loom is at rest in its most elevated position, being the position shown in Fig. 1. In this position the space d^2 between the rods b^2 is in line with the pile-bar U when held in operative position on the drum, and also with the upper ends of the bobbin-carriers.

The shifting-frame C′, when lowered, is automatically raised by the weights D′, and it is lowered by the following mechanism: Beneath the shifting-frame C′ and journaled in the main frame-work A is a rotary shaft E′, carrying near its opposite ends two drums or disks g^2, to each of which is secured the end of a strap i^2, the other end of which is secured to the frame C′. When the shaft E′ is rotated in the direction of the arrow in Fig. 4, the shifting-straps are wound upon the drums, thus depressing the frame. This shaft is connected to be thus rotated to depress the shifting-frame C′ in two ways, either when the main operating-bar B is depressed or when it is raised. Referring to Figs. 2 and 3, j^2 is a disk or drum secured to the extreme right of the shaft E′, and to this is attached one end of a strap k^2, which is partly wound around the disk or drum, so that when the strap is pulled it will rotate the shaft. The other end of this strap is secured to the lower end of a hooked rod 12, which passes through a guide-bracket l^2, the rod having a stop m^2, coacting with said bracket to hold the rod in normal position. The hooked end of this rod is shaped as in Fig. 13, and it is normally held out of and is brought into co-operation with the beam B in the same manner as the hooked rods already described, so that when in co-operation with the beam B the elevation thereof will lift the rod and rotate the shaft E′.

Referring now to Figs. 2 and 4, n^2 is a grooved pulley secured to the extreme left end of the shaft E′. Secured to and partly wound upon said grooved pulley is a cord o^2, which passes upward around pulleys p^2 p^2 to the highest part of the loom, and thence downward, where its other end is attached to a hooked rod 13, which itself constitutes a weight to hold the cord taut. This rod 13 slides freely in a vertical direction through a guide-bracket r^2. The hooked end of this rod is shaped as shown in Fig. 15, being different from the previously-described hooked rods, and having a different action, not being acted upon by a spring or by a tappet-pin. Normally, when the loom is at rest, the hooked rod 13 is held elevated above and out of reach of the main beam B. The cord o^2 winds upon its grooved pulley n^2 in the same direction that the strap k^2 winds on the drum j^2, so that when the beam B, on being raised, unwinds the strap k^2 the cord o^2 is also partly unwound. The unwinding of the cord o^2 allows the rod 13 to drop until it occupies the position shown in Fig. 4—that is, with its hook just below and in the path of the beam B. When now the beam descends, it comes in contact with the rod 13, still further depressing the same, and so still further lowering the shifting-frame C′.

The diagrams Figs. 17, 18, and 20 show the three positions to which the shifting-frame C′ may be moved.

The lateral movements of the pile warp-threads are effected by the batten, the operation of which has already been described, and also by longitudinally-sliding combs G′ G^2, mounted on the lower and upper bobbin-beams, respectively, on their sides next the drum R. The pile warp-threads are brought into engagement with these combs by the vertical movements of the shifting-frame C′. The mechanism for shifting these combs laterally is best seen in Fig. 12. Each comb is mounted on its beam by slots s^2 and pins t^2, so as to permit of their sliding, and each is connected by a pivoted link u^2 to one arm of a bell-crank lever H′, pivoted to the beam, which is held in either position to which it

is moved by a spring r^2. On its other arm each bell-crank lever carries a laterally-projecting stud w^2, which comes in contact with two stationary tappets x^2 x^2, fixed to the framework, by the movements of the bobbin-beams. The distance between the tappets encountered determines the distance which the comb is moved. The comb G′ on the lower beam F is moved the distance between two adjacent bobbins, whereas the upper comb on the upper bobbin-beam is moved just twice as far.

As previously stated, the fabric is woven on this loom by sequences of eight depressions of the treadle, eight operations being required to complete each point. These operations are as follows:

First operation.—The first depression of the treadle causes the rods 6 6 and 11 to be brought into gear with the movable beam B and the beam to be raised. This elevates the upper bobbin-beam F′ clear above the bobbin-carriers by means of the rods 6, and the elevation of rod 11 causes the pile-bar U to be carried forward between the upper bobbin-beam and the bobbin-carriers to the point x', thus leaving the pile warp-threads between the teeth of the batten above the ground warp-thread. The foot is then taken from the treadle and the beam B descends. The upper bobbin-beam, however, remains elevated, being held up by the levers 7 7. At the end of this operation the parts are left in the position shown in Fig. 1 and in the diagram Fig. 17.

Second operation.—The second depression of the treadle raises the beam B, with the rod 12 in gear. This depresses the pile-thread-shifting-frame C′ to the position shown in Fig. 18, with the pile warp-threads just below the ground warp-threads. When the beam B reaches the upper end of its movement, tappets strike the levers 7 7, thus releasing the upper bobbin-beam and permitting it to resume its normal position, as shown in Fig. 20. When the beam descends on the release of the treadle, it comes in contact with the rod 13, thus further depressing the shifting-frame C′ and causing the pile warp-threads to be engaged in the lower comb G′.

Third operation.—The third depression of the treadle raises the beam with the rods 2, 8, and 9 in gear. The rods 8 and 9 cause all of the bobbin-carriers to be engaged with the upper bobbin-beam, and the rod 2 causes the lower bobbin-beam to be depressed below the bobbin-carriers. The descent of the lower bobbin-beam actuates the lower comb G′, moving it to the left, (see Fig. 20,) and thus carrying the pile warp-threads to the left of and crossing the ground warp-threads. When the treadle is released, the beam B again descends, and the hooked rod 2 again raises the lower bobbin-beam to its normal position and the parts are left as shown in Fig. 21. This movement also releases the rods 8 and 9.

Fourth operation.—The next depression of the treadle releases the rod 13, causing the shifting-frame C′ to resume its highest position, engaging the pile-threads with the upper comb G² and raising their rear parts above the ground warp-threads. At the same time the rods 5 5 and 10 are in gear with the beam B, so that the upper bobbin-beam is raised empty and the batten is shifted two places to the right. The raising of the bobbin-beam B also causes the comb G² to be shifted two places to the right, and as the pile warp-threads are now engaged by said comb they are shifted two places to the right, thus passing above and across two ground warp-threads, as indicated in Fig. 22. The treadle is then released, the beam B descends, and the parts resume the position shown in Fig. 23.

Fifth operation.—When the treadle is next depressed, the rods 2, 13, 8, and 9 are in gear. The bobbins are thus suspended from the upper bobbin-beam, the lower bobbin-beam is depressed, and the shifting-frame C′ is lowered, bringing the pile warp-threads between the teeth of the comb G′. This movement carries the pile-threads down between the ground warp-threads. At the same time the descent of the lower bobbin-beam actuates the comb G′, moving it one space to the left, so that the pile warp-threads are crossed beneath the ground warp-threads. This phase of the work is illustrated in Fig. 24. On then releasing the treadle the parts assume the position shown in Fig. 25, the pile warp-threads passing upward between the same ground warp-threads that they passed down between at the first movement.

These five operations complete the tying of the pile warp-threads, they having been passed around the ground warp-threads in the manner shown in Fig. 29. The pile-bar U is then disconnected from the pile warp-threads by separating from the threads the nipping-rod r'.

Sixth operation.—When the treadle is next depressed, the hooked rods 1, 4, 5 5, and 8 are in gear. Rod 8 causes one half of the bobbin-carriers (the even numbers) to be connected with the upper bobbin-beam, rods 5 5 cause the upper bobbin-beam to be raised, and rods 1 and 4 cause the lower bobbin-beam, carrying the other half of the bobbins, (the uneven numbers,) to be lowered. This separates the alternate ground warp-threads, as shown in Fig. 26, and a weft-thread Z′ is then shot (see Fig. 31) and the treadle is allowed to rise.

Seventh operation.—On the next depression of the treadle the hooked rods 1, 4, 5 5, and 9 are in gear. Rod 9 causes the uneven-numbered bobbin-carriers to be connected and raised by rods 5 5 with the upper bobbin-beam, the even-numbered bobbin-carriers being lowered with the lower bobbin-beam, as shown in Fig. 27. A second weft-thread Z^2 (see Fig. 31) is then shot and the treadle left free.

Eighth operation.—When the treadle is depressed for the eighth and last time, the

hooked rods 1, 4, 5 5, and 8 are in gear, the same as in the sixth operation. The bobbin-carriers are separated, as shown in Fig. 28, and the third weft-thread Z^3 is shot, (see Fig. 31,) the batten is moved one stroke, and the treadle is left free. The pile-bar U is then placed below the rear parts of all the pile warp-threads, its edge being applied to the last weft-thread. The pile warp-threads are then nipped by the bar r', and a knife is passed along the groove s^2, thus cutting off the threads and leaving their ends projecting the same distance as the first ends. The pile-bar U is then replaced on the drum, which is turned one space, and the loom is ready for weaving the next point.

Each of the points of the transverse line of points thus completed has two tufts of the same length, and is similar to the Smyrna point, except that the two tufts are raised on different sides of the part of the pile-threads that lies across the two threads of the ground-warp, (see Fig. 31,) whereas in the Smyrna point both tufts project up from the same side.

I claim as my invention—

1. Two vertically and independently reciprocating bobbin-beams and bobbin-carriers mounted in and between said bobbin-beams, said carriers resting upon but detachable from the lower of said bobbin-beams, and said carriers having notches at their upper ends, the notches on alternate carriers being located on opposite sides, in combination with two independently-sliding bars adapted to said notched carriers, said bars being mounted on the upper of said bobbin-beams on opposite sides of said carriers, whereby either half or all of said bobbin-carriers may be connected with said upper bobbin-beam.

2. A vertically-reciprocating bobbin-beam and the vertically-reciprocating main operating-beam, in combination with a rock-shaft located beneath said bobbin-beam, lever-arms secured to said rock-shaft, links connecting said lever-arms with said bobbin-beam, crank-arms connected with said rock-shaft, and hooked rods pivoted to said crank-arms and co-operating with the main operating-beam, substantially as set forth.

3. Two vertically and independently movable bobbin-beams and the vertically-reciprocating main operating-beam, in combination with hooked rods pivotally connected with the upper only of said bobbin-beams, and co-operating with said main operating-beam when said upper bobbin-beam is to be raised, and means for moving said lower bobbin-beam independently of said upper bobbin-beam, substantially as set forth.

4. The vertically-reciprocating main operating-beam and the upper vertically-movable bobbin-beam, in combination with hooked and notched rods pivotally connected with said bobbin-beam and co-operating with said operating-beam to raise said bobbin-beam, and spring-catch levers which engage the notches in said hooked rods when the same are raised, whereby said bobbin-beam may be held in an elevated position, substantially as set forth.

5. The main operating-beam, the upper bobbin-beam, the notched bobbin-carriers, and the sliding bars mounted on the bobbin-beam, which engage said notched carriers, in combination with rock-shafts mounted on said bobbin-beam, lever-connections between said shafts and said sliding bars, lever-arms secured to said shafts, and hooked rods pivotally connected with said lever-arms and co-operating with said main operating-beam, substantially as set forth.

6. A swinging and laterally-movable batten having batten-teeth and the main operating-beam of the loom, in combination with a rock-shaft from which said batten is suspended, a cam on said shaft for moving said batten laterally, a hooked rod co-operating with said main beam, and lever-connections between said hooked rod and said rock-shaft, substantially as set forth.

7. A rotary drum and a series of rollers journaled in said drum near its periphery, upon which the pile warp-threads are wound, in combination with a gear-wheel on said drum, a rotary shaft having a hand-wheel, and a worm on said shaft engaging said gear-wheel, substantially as set forth.

8. A rotary drum and rollers journaled therein, upon which the pile warp-threads are wound, in combination with a sliding rotary clutch member adapted to said rollers, a weight connected with said rotary clutch member by an intervening cord for giving tension thereto, and means for sliding said clutch member, substantially as set forth.

9. A rotary drum and a series of rollers journaled therein, upon which the pile warp-threads are wound, in combination with pile-carrying bars removably mounted on said drum, to which the ends of the pile warp-threads are secured.

10. A rotary drum and a series of rollers journaled therein, upon which the pile warp-threads are wound, in combination with a pile-carrying bar removably mounted on said drum, to which the ends of the pile warp-threads carried by one of said rollers are secured, and a nipping bar or rod for securing the ends of said threads to said pile-bar, substantially as set forth.

11. A rotary drum, a series of rollers journaled therein, upon which the pile warp-threads are wound, and a pile-carrying bar removably mounted on said drum, to which the ends of the pile warp-threads are secured, in combination with sliding bars which engage said pile-bar and move it from said drum, and mechanism for actuating said sliding bars, substantially as set forth.

12. A rotary drum, a series of rollers journaled therein, upon which the pile warp-threads are wound, and a pile-carrying bar removably mounted on said drum, to which the ends of the pile warp-threads are secured,

in combination with curved or cam-shaped sliding bars which engage said pile-bar and move it from said drum, guide-rollers upon which said sliding bars rest and travel, and mechanism for actuating said sliding bars, substantially as set forth.

13. A rotary drum, a series of rollers journaled therein, upon which the pile warp-threads are wound, a pile-carrying bar removably mounted on said drum and to which the ends of the pile warp-threads are secured, and sliding bars which engage said pile-bar and move it from said drum, in combination with a rock-shaft, levers connecting said rock-shaft to said sliding bars, a pivoted sway-beam, a lever-arm connecting said sway-beam to said rock-shaft, the main operating-bar B, and a hooked rod pivoted to said sway-beam and co-operating with said main operating-bar, substantially as set forth.

14. The pile-warp drum, the ground-warp bobbins, and mechanism for actuating said bobbins, in combination with a reciprocating pile-thread-shifting frame located between said pile-warp drum and said ground-warp bobbins, the pile warp-threads passing through said shifting-frame.

15. A vertically-reciprocating pile-thread-shifting frame, and weights connected therewith by intermediate cords and pulleys, whereby said frame is normally held in an elevated position, in combination with a rotary shaft beneath said frame, drums on said shaft, straps connecting said drums and said frame, the main operating-bar B, a hooked rod co-operating with said main bar, and a cord or strap connected at opposite ends to said hooked rod and to said shaft, substantially as set forth.

16. A vertically-reciprocating pile-thread-shifting frame, weights connected therewith by intervening cords and pulleys, a rotary shaft, drums on said shaft, straps connecting said drums with said shifting-frame, the main operating-bar B, a hooked rod co-operating with said bar, and a cord or strap connected at opposite ends to said rod and to said shaft, in combination with a second gravitating hooked rod, and a cord connecting the same with said rotary shaft, said gravitating hooked rod being brought into co-operation with the main operating-beam when the shaft has been rotated by the instrumentality of the first-named hooked rod, substantially as set forth.

17. The vertically-reciprocating bobbin-beams, bobbin-carriers, the bobbins thereon, and the pile-warp rollers, in combination with a laterally-movable comb mounted on each of said beams, between the teeth of which the pile warp-threads pass, and means for moving said comb laterally, substantially as set forth.

18. The vertically-reciprocating bobbin-beams, bobbin-carriers, the bobbins thereon, and the pile-warp rollers, in combination with a laterally-movable comb mounted on each of said bobbin-beams, between the teeth of which the pile warp-threads pass, the lateral movement of the comb on one beam being double that of the comb on the other beam, and mechanism for moving said combs laterally, substantially as set forth.

19. A vertically-reciprocating bobbin-beam and a laterally-movable comb mounted on said beam, in combination with a rock-lever pivoted to said bobbin-beam, one arm of which is connected with the comb, and stationary tappets fixed to the frame-work of the loom, which are encountered by the other arm of said rock-lever, substantially as set forth.

20. Two reciprocating bobbin-beams and the bobbins for carrying the ground warp-threads mounted in and between the same and supported alternately by each of said beams, in combination with rollers upon which the pile warp-threads are wound, a movable bar, to which the ends of the pile warp-threads are secured, which bar carries the pile-threads between the bobbins and one of said bobbin-beams when the latter has been separated from the bobbins, and mechanism for carrying said movable bar between said bobbin-beams, substantially as set forth.

21. Two reciprocating bobbin-beams and the bobbins for carrying the ground warp-threads, mounted in and between the same and supported alternately by each of said beams, in combination with rollers, upon which the pile warp-threads are wound, a vertically-movable pile-thread-shifting frame between said pile-rollers and said ground-warp bobbins, and a movable pile-carrying bar which carries the pile-threads through said shifting-frame and between said bobbins and one of said bobbin-beams, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ANTOINE SIRET.

Witnesses:

AMAND MARCOTTE,

E. PHILIPION.