No. 628,774. Patented July 11, 1899.

G. E. DE VORE.

WIRE AND SLAT WEAVING MACHINE.

(Application filed July 30, 1898.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 1.

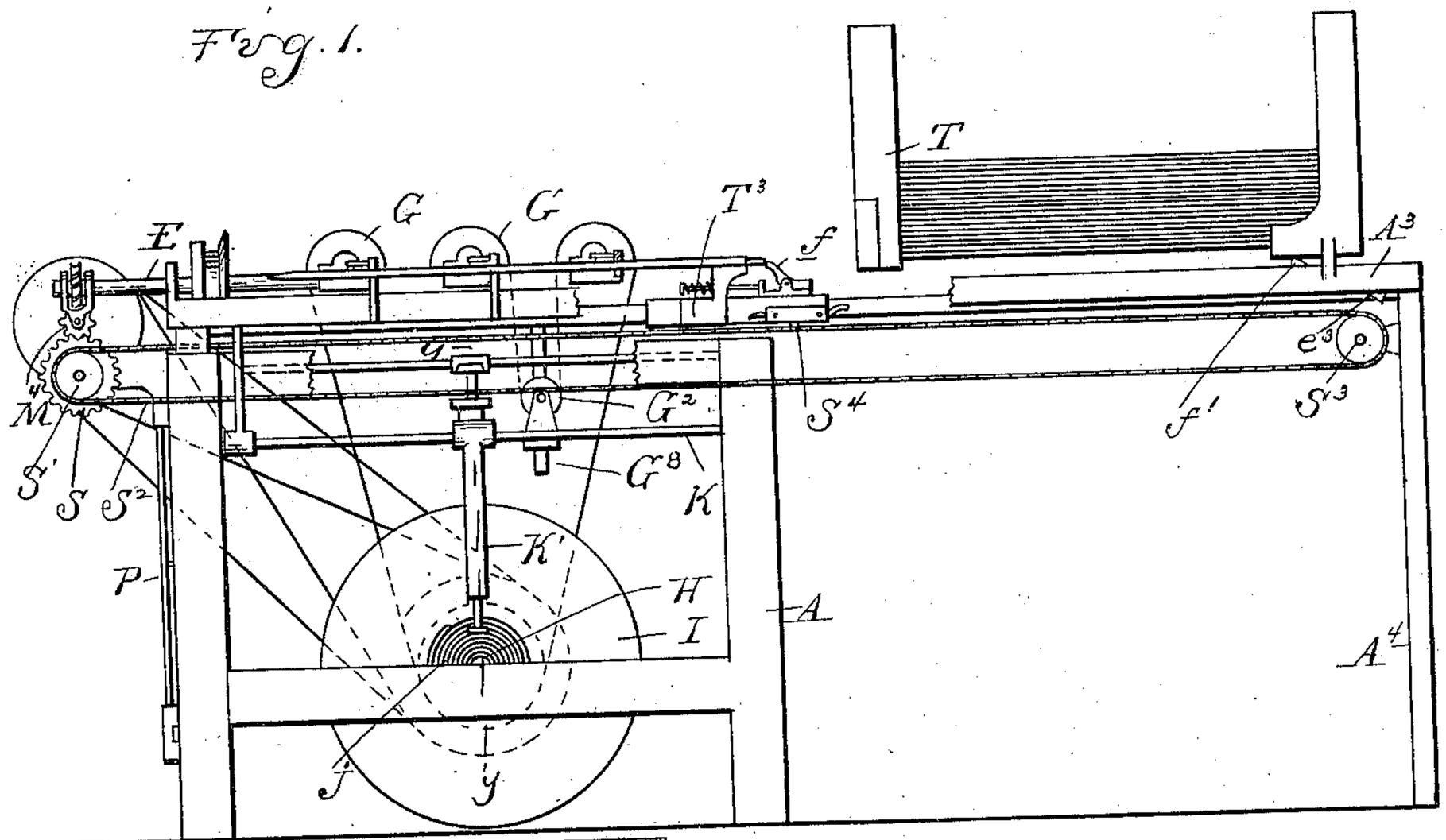


Fig. 2.

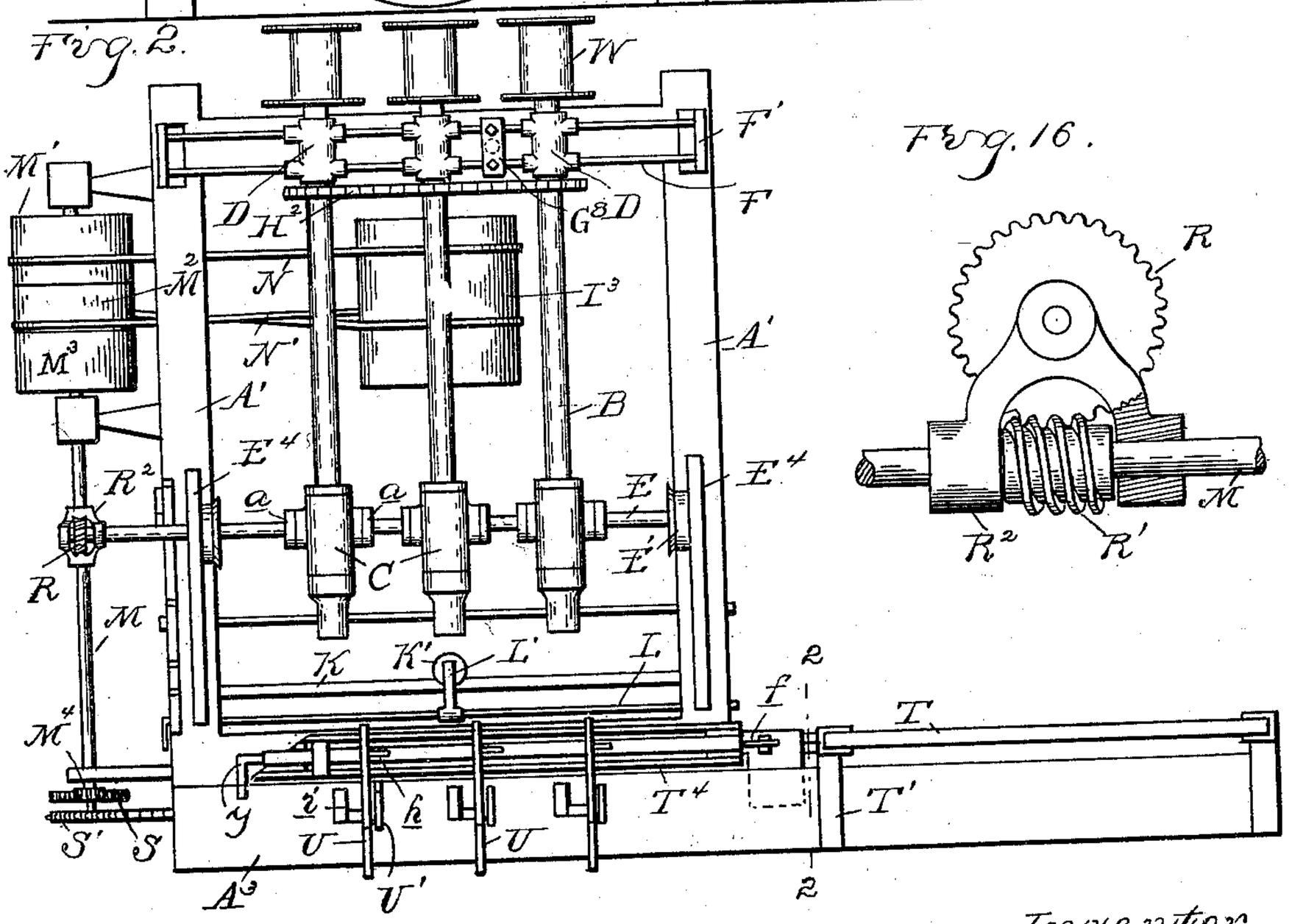


Fig. 16.

Witnesses
A. L. Hobby
P. M. Halbert

Inventor
George E. De Vore
By Thos. A. Sprague & Son,
Attys.

No. 628,774. Patented July 11, 1899.

G. E. DE VORE.

WIRE AND SLAT WEAVING MACHINE.

(Application filed July 30, 1898.)

(No Model.) 5 Sheets—Sheet 2.

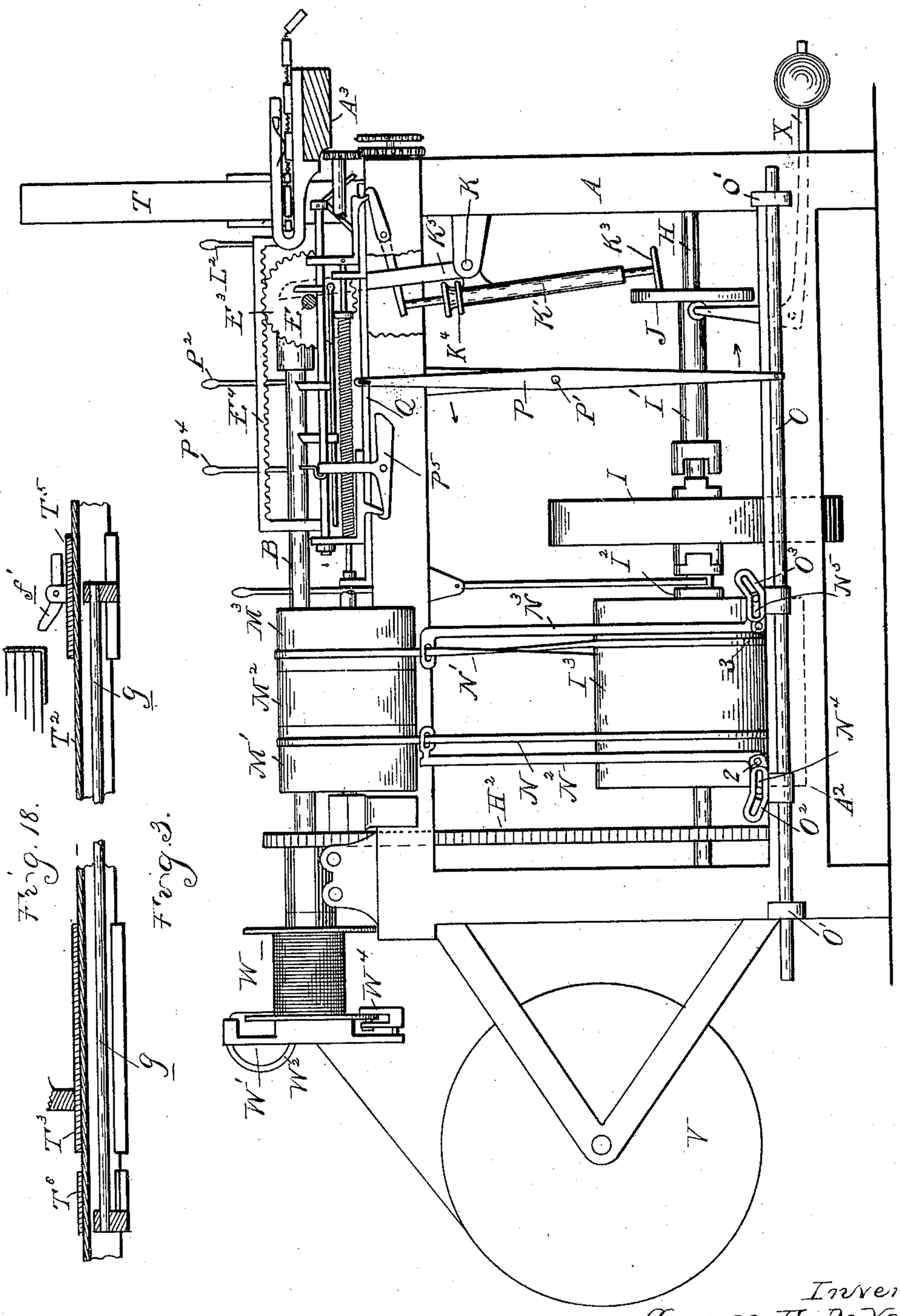


Fig. 18.

Fig. 3.

Witnesses
A. L. Habby.
P. M. Hulbert

Inventor
George E. DeVore
By Lucs. L. Sprague & Son
Attys.

No. 628,774. Patented July 11, 1899.

G. E. DE VORE.

WIRE AND SLAT WEAVING MACHINE.

(Application filed July 30, 1898.)

(No Model.) 5 Sheets—Sheet 3.

Fig. 4.

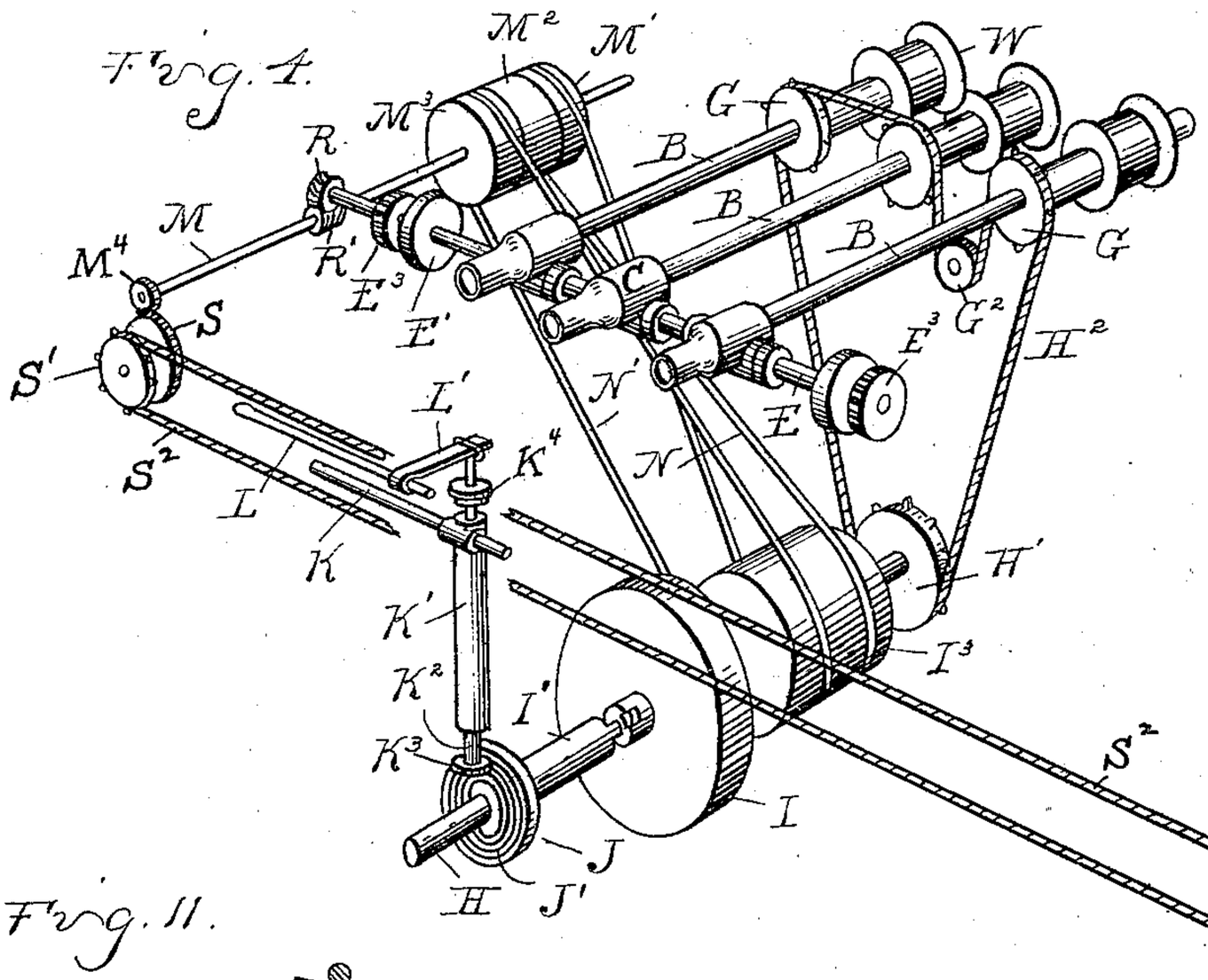


Fig. 11.

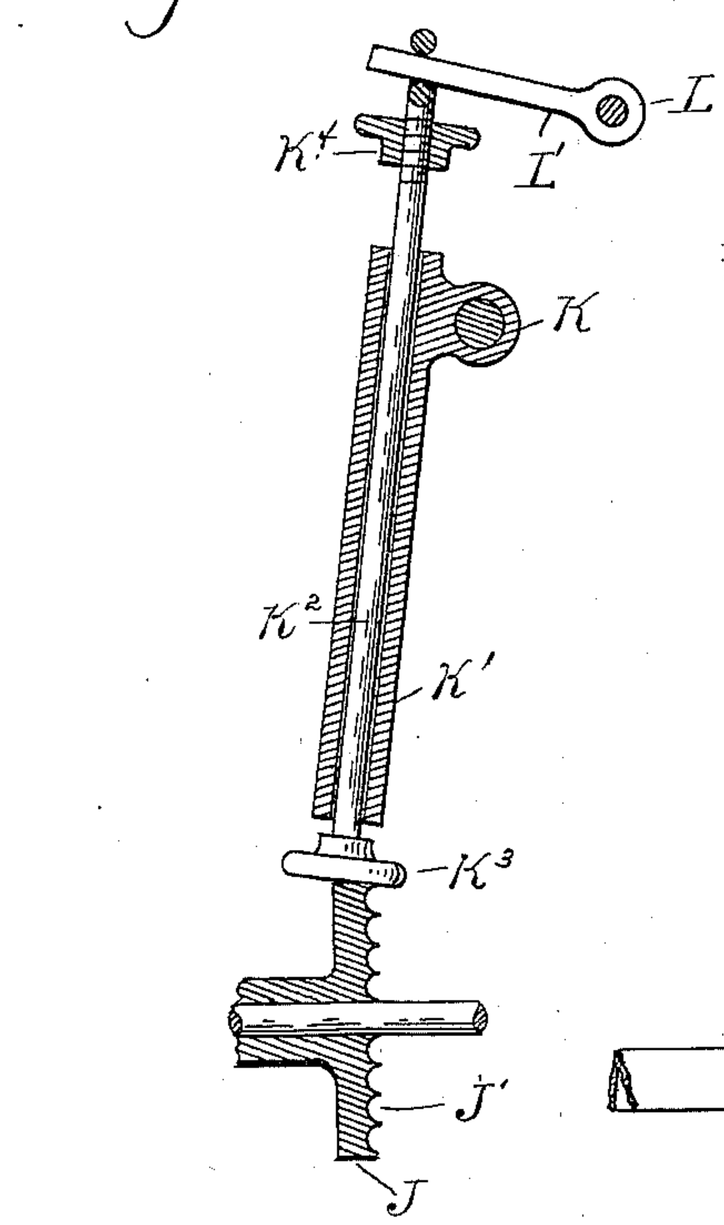


Fig. 17.

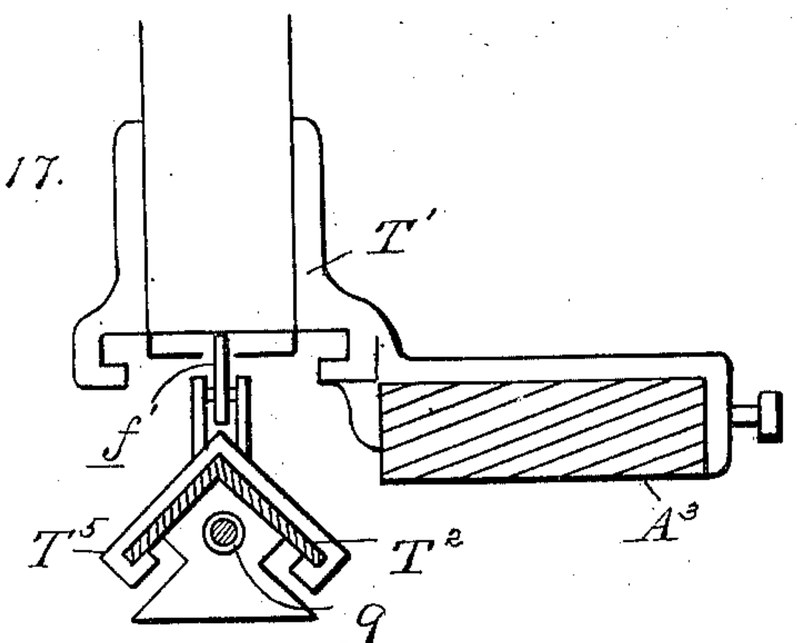
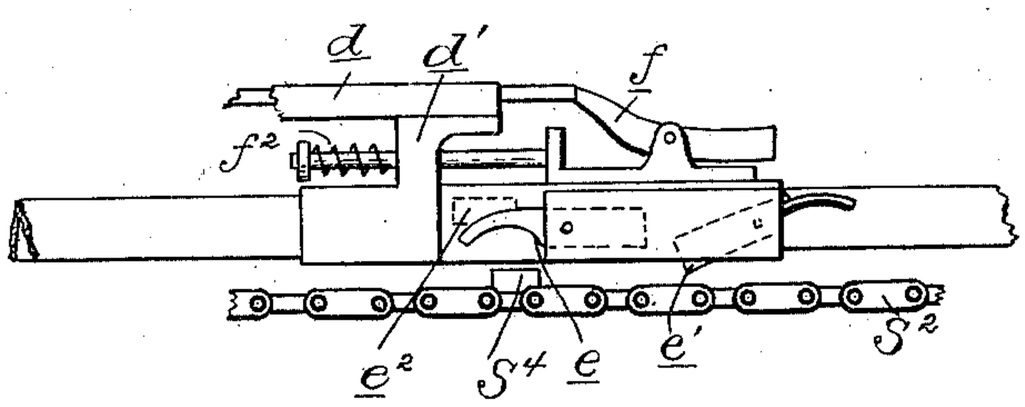


Fig. 12.



Witnesses:
A. L. Habby
P. M. Hulbert

Inventor
George E. DeVore
By Munn & Spencer,
Attys.

No. 628,774. Patented July 11, 1899.

G. E. DE VORE.

WIRE AND SLAT WEAVING MACHINE.

(Application filed July 30, 1898.)

(No Model.) 5 Sheets—Sheet 4.

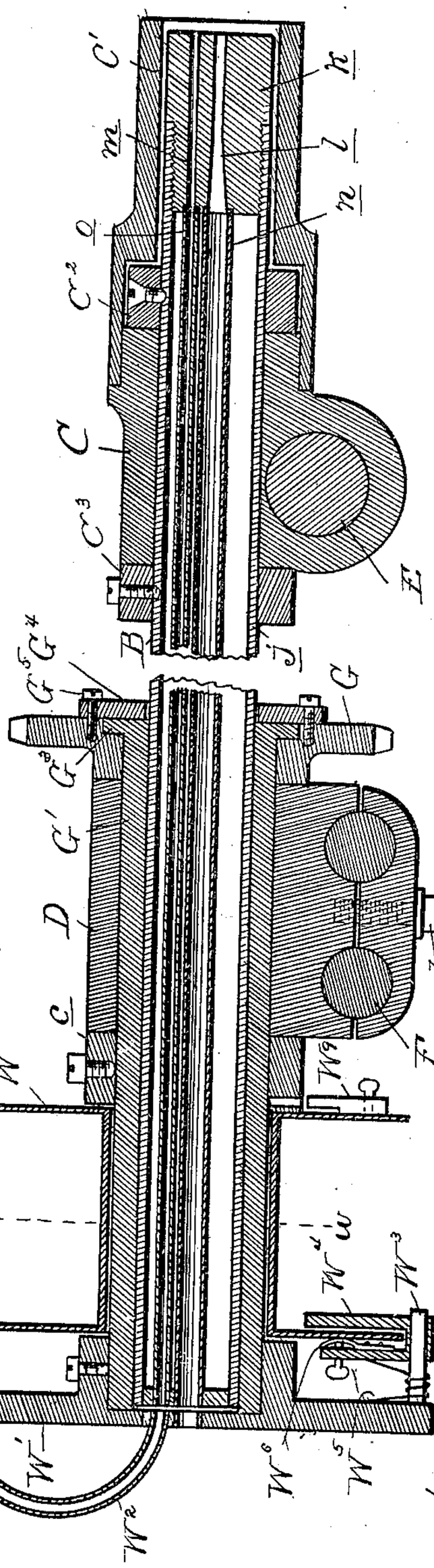


Fig. 9.

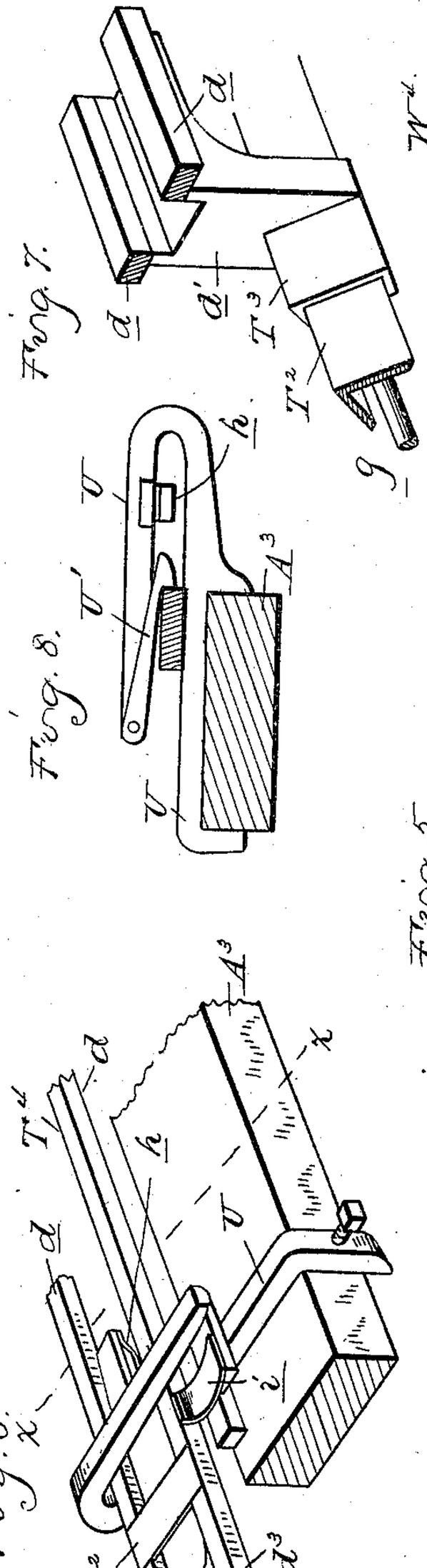


Fig. 7.

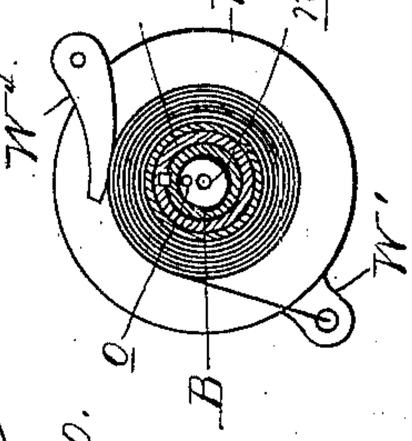


Fig. 10.

Fig. 8.

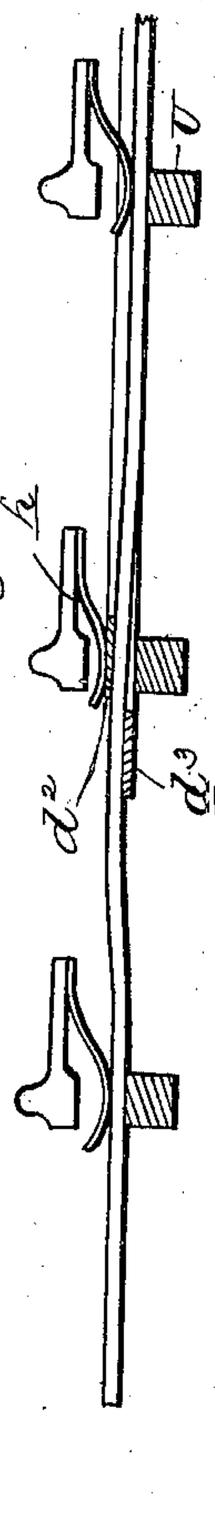


Fig. 5.

Fig. 6.

Fig. 5.

Witnesses
A. L. Hobby
P. M. Halbert

Inventor
George E. De Vore
By Hus. S. Sprague & Son
Attys.

No. 628,774. Patented July 11, 1899.

G. E. DE VORE.

WIRE AND SLAT WEAVING MACHINE.

(Application filed July 30, 1898.)

(No Model.) 5 Sheets—Sheet 5.

Fig. 13.

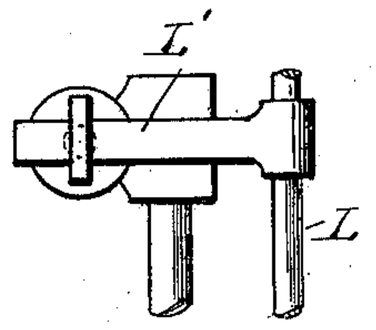


Fig. 14.

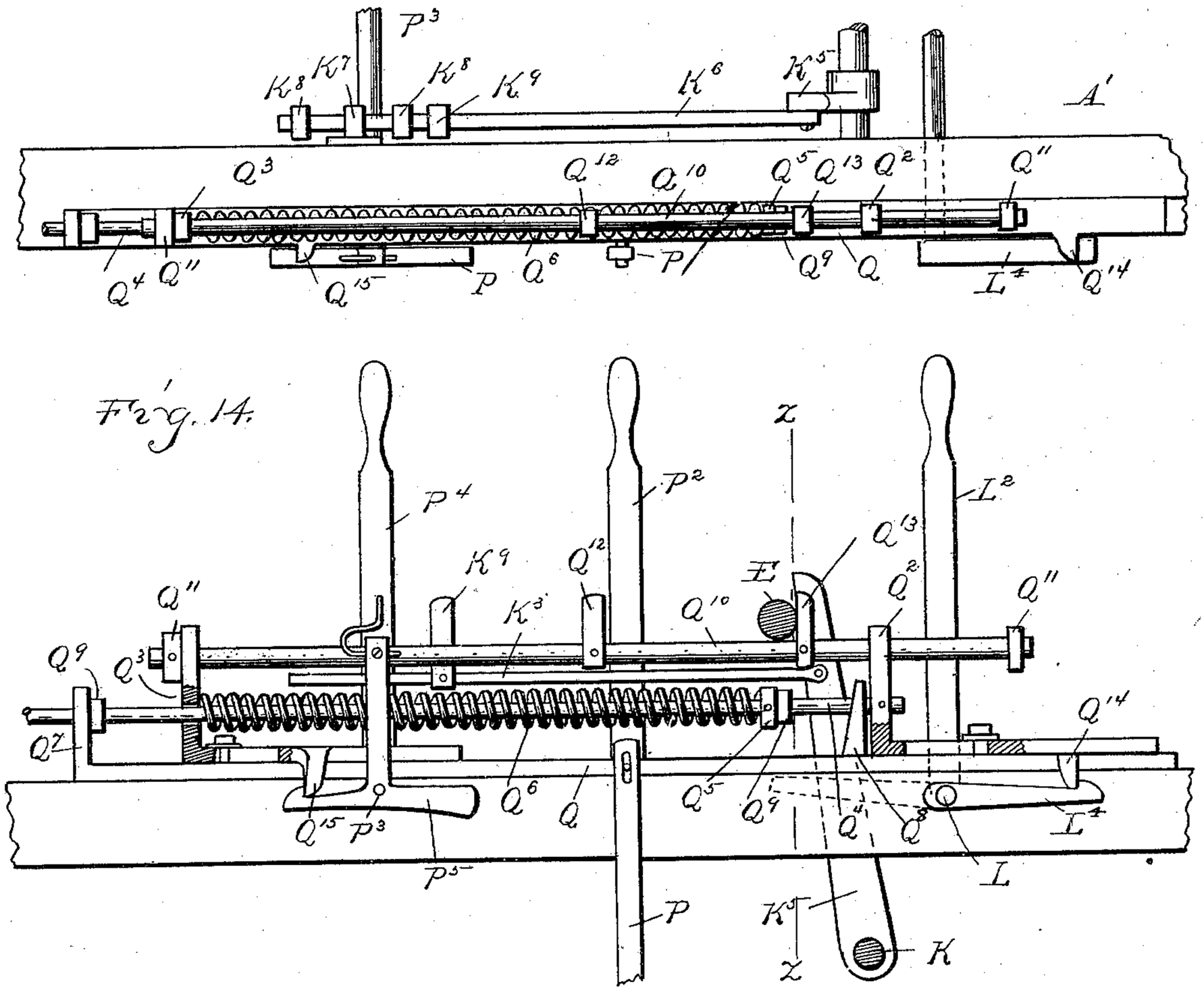
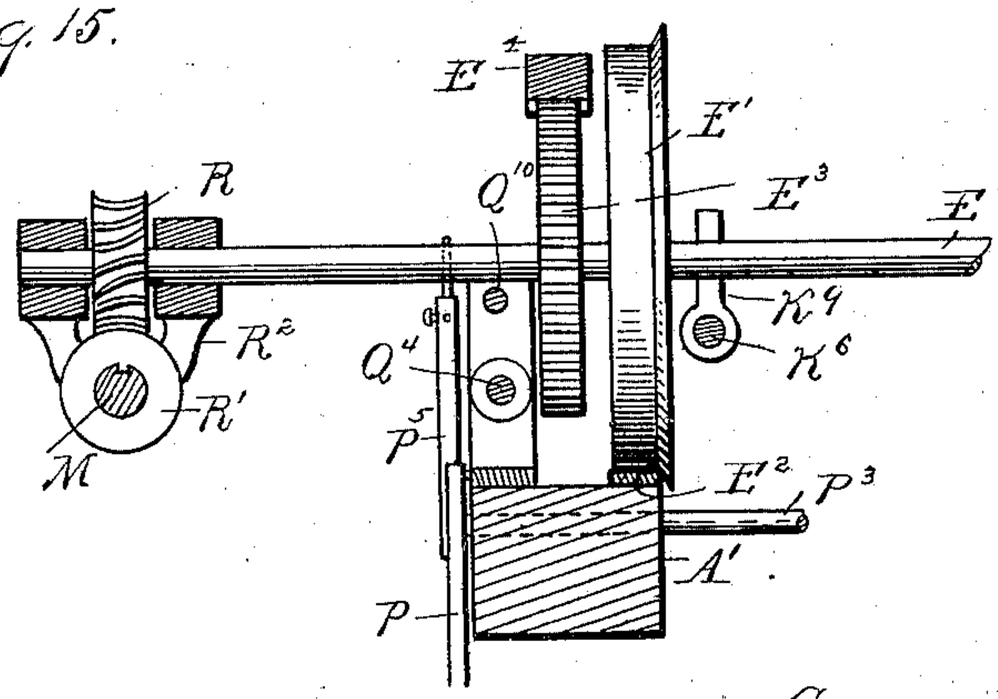


Fig. 15.



Witnesses
A. L. Habby
P. M. Halbert

Inventor
George E. De Vore
By Thos. A. Spragueston,
Attys.

UNITED STATES PATENT OFFICE.

GEORGE E. DE VORE, OF LANSING, MICHIGAN, ASSIGNOR OF ONE-HALF TO ALFRED BEAMER AND CHARLES H. MEAD, OF SAME PLACE.

WIRE-AND-SLAT-WEAVING MACHINE.

SPECIFICATION forming part of Letters Patent No. 628,774, dated July 11, 1899.

Application filed July 30, 1898. Serial No. 687,312. (No model.)

To all whom it may concern:

Be it known that I, GEORGE E. DE VORE, a citizen of the United States, residing at Lansing, in the county of Ingham and State of Michigan, have invented certain new and useful Improvements in Wire-and-Slat-Weaving Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to machines of that class comprising a plurality of twisters for parallel pairs of binding-wires, a clamp or tension device for holding the slat at right angles thereto, means for reciprocating said twisters longitudinally upon the wires toward or from said clamp, and means for intermittently rotating said twisters for a definite number of turns, the whole arrangement being such that the slats may be successively fed in between the wires when the twisters are drawn backward, then pushed into the clamp or tension device by the forward movement of the twisters, and the wires then twisted by the rotation of said twisters.

It is the object of my invention to render the whole operation of the machine automatic and continuous, to facilitate easy adjustment of parts, to vary the character of the work produced, and otherwise to improve the construction and operation of the machine; and to this end my invention consists, first, in the means employed for automatically feeding in the slats; further, in the mechanism employed for reciprocating the twisters and for securing a corresponding and properly-timed movement of the slat-feeding mechanism, and, further, in the peculiar construction, arrangement, and combination of parts, all as more fully hereinafter described and claimed.

In the drawings, Figure 1 is a front elevation of my machine. Fig. 2 is a plan thereof. Fig. 3 is a side elevation. Fig. 4 is a diagram perspective showing drive connection for the feed mechanism, and Fig. 5 is a cross-section centrally through the slat-feed carrier. Figs. 6 and 7 are sectional perspective views of the front and rear portions, respectively, of said carriers. Fig. 8 is a cross-section on line *x x*, Fig. 6. Fig. 9 is a central longitudinal section through one of the twisters. Fig. 10 is a cross-section on line *w w*, Fig. 9. Fig. 11 is a section on line *y y*, Fig. 1. Fig. 12 is an enlarged elevation of a portion of the slat-feed mechanism. Figs. 13 and 14 are, respectively, a plan and side elevation of the mechanism controlling the reciprocation of the twisters, other parts of the machine being omitted. Fig. 15 is a cross-section on line *z z* of Fig. 14, showing, in addition, the carriage on which the twisters are supported. Fig. 16 is an elevation, partly in section, of the worm-gear connection shown in Fig. 15. Fig. 17 is a section on line 2 2, Fig. 2. Fig. 18 is a longitudinal section through the slat-carrier rail.

A is the frame of the machine.

B B B are twister-tubes extending longitudinally of the frame and journaled in forward and rear bearings C and D. The bearings C are sleeved upon the transverse shaft E, mounted upon the wheels or rolls E′, which are adapted to travel forward or backward upon a track E^2, formed upon the top side bars A′ of the frame. The bearings D are sleeved upon a cross-bar F, preferably formed of two parallel rods, secured at their ends in brackets F′ on the bars A′. These bearings C and D are laterally adjustably secured in position, the former by the adjustable collars *a* on the shaft E and the latter by the set-screws *b*, Fig. 9.

G are sprocket-wheels secured to sleeves G′, which are feathered upon the twister-tubes B and extend through the bearings D, being secured therein by collars *c*, fastened to said sleeves in rear of said bearings.

H is a shaft parallel to the twisters and journaled in suitable bearings in the lower part of the frame.

H′ is a sprocket-wheel mounted on the shaft in line with the sprocket-wheels G, and H^2 is a sprocket-chain passing around all of said sprockets. The chain is held in engagement with said sprockets in the different adjusted positions by an idler G^2, vertically adjustably secured upon a standard G^8, which is laterally adjustably secured upon the cross-bar F between the bearings D.

I is a drive-wheel sleeved upon the shaft H and adapted to be connected by a belt to any

suitable source of power. The hub of this wheel is suitably notched at each end to form a common member of two clutches, the other members of which are formed, respectively, by the sleeves I′ and I², the former being feathered and the latter being free to revolve upon the shaft H. At the forward end of the sleeve I′ is secured a disk J, having a spiral groove J′ formed in its forward face and extending from near the center to the periphery.

K is a rock-shaft extending transversely of the frame above the shaft H and journaled in suitable bearings.

K′ is a tubular rock-arm secured to the rock-shaft K in line with the shaft H and extending downwardly toward said shaft.

K² is a rod extending longitudinally through the tubular rock-arm K′, having secured to its lower end the roller K³, adapted to engage with the spiral groove J′ in the disk J.

K⁴ is a stop adjustably secured to the rod K² above the tube K′, preferably by a screw-threaded engagement with said rod.

L is another rock-shaft extending across the frame above and slightly forward of the rock-shaft K. This rock-shaft is provided with a rock-arm L′, with which the upper end of the rod K² has a sliding engagement, and at one end of the shaft is secured the upwardly-extending hand-lever L². The sleeve I² has mounted thereon a drum or pulley I³.

M is a shaft extending longitudinally of the frame at one side thereof and slightly below the plane of the shaft E. This shaft is journaled in suitable bearings on the frame and carries the pulleys M′, M², and M³, the middle pulley M² being fixed and the pulleys M′ and M³ loose upon said shaft.

N and N′ are respectively straight and cross belts, connecting the pulley I³ with the pulleys M′, M², and M³.

N² and N³ are belt-shifters, which are pivotally secured at their lower ends to ears 2 and 3, secured to the bar A² of the frame, and are provided with the laterally-extending rock-arms N⁴ and N⁵.

O is a bar extending longitudinally of the frame in proximity to the rock-arms N⁴ and N⁵ and slidingly secured in bearings O′.

O² and O³ are slotted cam-bearings secured to the bar O and with which pins on the rock-arms N⁴ and N⁵ engage.

P is a lever secured to the rock-shaft P′, journaled in the frame, which lever is connected at its lower end with the bar O and at its upper end to the bar Q, slidingly secured in bearings on the bar A′ of the frame.

E³ are pinions mounted upon the shaft E and engaging with racks E⁴, extending longitudinally of the frame above said pinions and secured to the frame-bars A′.

R is a worm-wheel secured to the shaft E in the vertical plane of the shaft M and engaging with the worm R′ feathered upon said shaft M.

R² is a double bearing-frame adapted to hold the worm R′ and worm-wheel R in proper engagement with each other and to permit the former to freely slide longitudinally upon the shaft M.

Q² and Q³ are arms or standards extending upwardly from the bar Q and secured to said bar so as to have a limited sliding movement thereon.

Q⁴ is a rod secured to the standard Q² and passing through an aperture in the standard Q³ free to slide therethrough.

Q⁵ is a set collar on the rod Q⁴, and Q⁶ is a spring sleeved upon the rod Q⁴.

Q⁷ and Q⁸ are upwardly-extending arms or standards fixedly secured to the bar Q and through which the bar Q⁴ slidingly passes.

Q⁹ are rubber bumpers sleeved upon the rod Q⁴ adjacent to the standard Q⁷ and collar Q⁵.

Q¹⁰ is another rod slidingly secured in the standards Q² and Q³ and having the collars Q¹¹ at opposite ends thereof.

Q¹² and Q¹³ are arms secured to the rod Q¹⁰ between the standards Q² and Q³ and extending up into the path of the shaft E on opposite sides thereof.

Q¹⁴ and Q¹⁵ are lugs or detents attached to the sliding standards Q² and Q³ and adapted to engage, respectively, with a hooked arm L⁴ on the rock-shaft L and with the hooked arm of a bell-crank lever P⁵, the other arm of which extends upward into the path of the shaft E. The bell-crank lever P⁵ is secured to a rock-shaft P³, extending across the frame of the machine and having secured to its other end the upwardly-extending hand-lever P⁴.

P² is a hand-lever secured to the rock-shaft P′.

K⁵ is a rock-arm secured to the rock-shaft K and extending upward into the path of the shaft E.

K⁶ is a rod pivotally connected at one end to the rock-arm K⁵ and slidingly secured at its other end in the standard K⁷ on the bar A′ of the frame.

K⁸ are collars secured to the rod on opposite sides of the standard K⁷.

K⁹ is an arm on the rod K⁶, extending upward into the path of the shaft E.

M⁴ is a pinion on the shaft M, meshing with a pinion S, journaled at the forward end of the frame.

S′ is a sprocket-wheel connected with the pinion S, and S² is a sprocket-chain passing around said sprocket-wheel and extending across the front of the frame and around a corresponding sprocket-wheel S³ at the outer end of a lateral extension of said frame. This lateral extension is preferably formed by a shelf or table A³, slightly below the plane of the twister-tubes and extending completely across the frame and about the same distance to one side thereof, being supported upon the bars A′ and a standard A⁴ at its outer end.

T is a slat-holder secured to the lateral ex-

tension of the shelf A^3 slightly in rear thereof by the brackets T'. This holder is adapted to receive a pile of slats in vertical series, the lower slat resting on a slotted bottom plate and a slot being formed in the end of the holder of sufficient width to allow this lower slat to pass therethrough.

Beneath the holder T is formed a track or guide-rail T^2, preferably an angle-bar, which extends some distance over the main frame.

T^3 is a head or carriage slidingly secured on the rail T^2, to which is secured the slat-carrier or what I shall term the "shuttle" T^4. This shuttle comprises two parallel bars *d*, spaced a distance apart slightly greater than the width of the slats and being also of slightly-greater thickness than the slats. At their rear ends these bars are connected to a supporting-standard *d'* on the sliding head T^3, which holds them in the plane of the lowest slat in the holder. At the forward ends of the bars is formed a tapering shuttle-point comprising top and bottom plates d^2 and d^3, between which the end of the slat is adapted to be engaged.

e and *e'* are oppositely-arranged pivotal dogs secured to a lateral arm or bracket on the head T^3 above the sprocket-chain S^2 and with which the lug S^4 on said chain is adapted to engage. These dogs are provided with releasing-arms adapted to respectively engage with the inclined lugs e^2 and e^3, secured to the lower side of the shelf A^3.

f is a dog pivotally secured upon the head T^3 in rear of the shuttle T^4 and in line with the slot in the bottom of the slat-holder. *f'* is another similar dog secured to a sliding head T^5 near the outer end of the slat-holder, which head is connected by the rod *g* with a similar head T^6, arranged some distance beyond the inner end of the slat-holder.

U are slotted U-shaped brackets secured to the shelf A^3, preferably a little to one side of the line of the twisters, the slots in these brackets being in line with the shuttle and the lower part of the bracket forming rests or bearings for the slat.

h and *i* are presser-springs secured to the upper portion of the brackets U, the former in line with the center of the shuttle and the latter above the shelf A^3.

U' are hooks secured to said guides and extending rearwardly.

The twisters B are preferably formed of the outer tube *j*, the forward ends of which are provided with plugs *k*, having the central wire-passage *l* and the eccentric passage *m*, respectively, for the main and binding wires.

n and *o* are tubes secured to the plug *k* in line with the passages *l* and *m* and extending to the opposite end of the twister.

V are reels at the rear end of the frame adapted to carry the coils of main wires from which the wires extend through the tubes *n* and the twisters.

W are small reels or spools carrying the binding-wires, which are preferably sleeved upon the rear end of the twister-tubes and from which the wires are led into the tubes *o* of the twisters.

The parts being constructed and arranged as shown and described, the operation of the machine is as follows: A pile of slats is first placed in the holder T and coils of wire on the reels V and spools W. The machine may then be set in operation, motion being imparted to the wheel I and through the medium of the clutch-sleeve I^2 to the pulley I^3. From the pulley I^3 motion is transmitted to the belts N and N', which in the initial position of the belt-shifters are respectively in engagement with the loose pulley M^3 and the tight pulley M^2 on the shaft M. The belt N will thus impart rotary motion to the shaft M in one direction, which through the medium of the worm R' and worm-wheel R will rotate the shaft E, causing the pinions E^3 to travel backward on the racks E^4 from their initial position at the forward ends of said racks and carrying with them the shaft E, the bearing C thereon, and the twisters B. At the same time motion from the shaft M is transmitted through the medium of the gear-wheels M^4 and S to the sprocket-wheel S' and the sprocket-chain S^2, causing the latter to travel in a direction to carry the lug S^4 inward. The lug S^4 engages with the dog *e* and causes the head T^3 to slide along the track T^2, carrying with it the shuttle T^4 and a slat therein which is pushed out of the holder by the dog *f*. Before the shaft E and twisters B have reached their rear position the shuttle has carried the slat between the main and binding wires, which extend forward from the twisters and through the slotted guides U, into the position opposite the twisters, where it is to be deposited, at which point in the operation the releasing-arm of the dog *e* will strike against the cam e^2 and disengage said dog from the lug S^4. During the rearward movement of the shaft E the double bearing-bracket R^2 will cause the worm R' to slide along the shaft M, while its feathered engagement therewith compels it to rotate with said shaft. Before the shaft E has completed its rearward movement it will strike against the arm Q^{12} on the rod Q^{10}, pushing said rod backward and causing the collar Q^{11} to carry the sliding standard Q^2 and rod Q^4 with it and placing a tension on the spring Q^6, the rear end of which presses against the standard Q^3. The standard Q^3 is, however, temporarily held from movement by the engagement of the hooked arm of the bell-crank lever P^5 with the detent Q^{15}; but in the further movement of the shaft E it will strike against the upper end of said bell-crank lever and turn it sufficiently to disengage the hook from the detent. The spring Q^6 will then force the frame Q^3 and rod Q backward by a quick movement, which is communicated to the lever P, which in turn will slide the bar O forward, carrying with it the grooved cams O^2 and O^3. The movement of these cams will rock the arms N^4 and N^5 of the belt-shifters

N^2 and N^3 and cause them to shift the belt N from the loose pulley M′ to the tight pulley M^2 and the belt N′ from the tight pulley M^2 to the loose pulley M^3, thus causing a reversal in the movement of the shaft M. (See Fig. 3.) The shaft E in its rearward movement will also strike against the arm K^9 on the rod K^6, which will draw the arm K^5 backward and rock the shaft K. This will rock the arm K′ forward, carrying the roll K^3 in front of the disk J and allowing it to drop by gravity down until the stop K^4 on the rod K^2 rests upon the upper end of the tubular arm K′. The reverse movement of the shaft M will cause the shaft R and twisters B to travel forward and the sprocket-chain S^2 to travel in the reverse direction, the lug S^4 engaging with the dog e' and carrying the sliding head T^2 and shuttle T^4 outward. The slat which is in the shuttle is, however, not carried out again therewith, as the springs *h* will press it against the slotted guide U, and as there are three pairs of these springs and guides two of them will always be holding the slat while the top and bottom plates d^2 and d^3 of the shuttle-point are drawn by the third guide and spring. In passing outward the bars *d* of the shuttle will pass upon opposite sides of the slat-holder T, while the dog *f* will pass through the slot in the bottom plate. The shuttle will be fully withdrawn before the twisters have reached the position of the slat, and when withdrawn the releasing-arm of the dog e' will strike against the cam e^3 and disengage said dog from the lug S^4. The further forward movement of the twisters will carry the slat forward in the slotted guides U and under the springs *i*, which will hold it during the operation of twisting. In the forward movement of the shaft E it will strike against the arm Q^{13}, which will move the rod Q^{10} forward, the collar Q^{11} thereon carrying the sliding standard Q^3 and sliding bar Q with it and compressing the spring Q^6 against the collar Q^5 on the rod Q^4. The latter is held from movement by the detent Q^{14} on the standard Q^2, which became engaged with the hooked arm L^4 in the rearward movement of said standard. The movement of the bar Q will through the medium of the lever P and sliding bar O impart a partial movement to the cams O^2 and O^3, which are so shaped that the shifter N^3 alone will be operated by this partial movement. This will shift the belt N′ from the tight pulley M^2 to the loose pulley and stop the rotation of the shaft M. Before the forward movement of the shaft E is stopped, however, it will strike against the arm K^5 and rock the shaft K, which will rock the arm K′ backward and cause the roll K^3 to push back the disk J, engaging the clutch-sleeve I′, with the clutch-hub of the wheel I. This will start the rotation of the shaft H, which is communicated through the sprocket-and-chain connection to the twisters B, causing them to twist the wires in rear of the slat. As the shaft H rotates the disk J will be turned therewith, causing the roll K^3 to travel outward in the spiral groove J′ until it reaches the periphery of the disk, when a suitable returning device, such as the weighted lever X, will push the disk forward, disengaging the clutch members and stopping the rotation of the shaft. Simultaneously with the releasing of the clutch the hooked arm L^4 will release the detent Q^{14} on the frame Q^2, this being caused by the raising of the rod K^2, which rocks the rock-arm L′ and rock-shaft L, to which the arm L^4 is secured. Upon the releasing of the detent the spring Q^6 will move the frame Q^2, and with it the rod Q, which through the connections before described will complete the movement of the cams O^2 and O^3, causing the belt-shifter N^2 to shift the belt N from the loose pulley M′ to the tight pulley M^2 and start the rotation of the shaft M again in the reverse direction.

From the general description of the operation of the machine as above given it will be seen that its action is entirely automatic, the only attention required being to replenish the pile of slats in the holder as often as necessary.

I wish now to call attention more specifically to certain features of construction and the operation of certain parts as yet not fully described.

First, the construction of the holder for each of the binding-wires and the tension device therefor. The spool W is sleeved upon the rear end of the sleeve G′ free to rotate thereon. W′ is a bar centrally connected to said sleeve G′ in rear of the spool, the opposite arms of which extend outward beyond the flanges of the spool. W^2 is a curved tube extending around from tube *o* to one end of the cross-bar W′. W^3 is a pin on the other end of said cross-bar, on which is pivotally secured a bifurcated lever W^4, extending on opposite sides of the flange of the spool W. One side of this lever is adapted to rest upon the wire on the spool and is compelled to travel inward as the wire is drawn off from the spool by the spring W^5, which is so arranged as to exert a constant inward pull upon said lever. W^6 is an adjustable friction device on the outer arm of the lever W^4, adapted to press against the flange of the spool and place tension upon the wire. In the operation of the machine this device will place a perfectly uniform tension upon the binding-wire, as the friction device W^6 is always applied to the spool at the same distance from the axis thereof as the wire leading off therefrom, and this will not decrease the tension as the amount of wire on the spool diminishes. In order to provide means for readily winding the spool, I place upon each a bolt or catch W^9, adapted to be engaged with a notch in a collar *c*, which is fast upon the sleeve G′ in rear of the bearing D. This will permit of driving the spool with the sprocket G and sleeve G′ and winding the binding-wire on the spool W. In order to allow this

winding to be done independently on each of the spools, I provide means for preventing the rotation of the other spools by loosening the sprocket G upon the sleeves G′. This may be done by providing a collar G^3 at the forward end of the sleeve G′ and a clamping-plate G^4, secured to the sprockets by the screws G^5 and adapted to either clamp said sprocket to the collar G^3 on the sleeve G′ or when the screws are loosened to permit of its freely revolving thereon.

I wish also to call attention to the means employed in my machine for engaging the slat last inserted with the holding-clamps and pushing the woven fabric forward. In former constructions of machines this has been done by the twisters pressing directly against the edge of the slat and forcing it into the holder. The effect of this is that the slat is generally marred when the twisters first begin to rotate. In my construction I obviate this difficulty by placing pushers on the bearing C, which extend slightly beyond the forward end of the twisters and are adapted to bear against the slat. These pushers are preferably in the form of sleeves C′, surrounding that portion of each twister which extends beyond the bearing C, which sleeves are secured to hubs on said bearings. C^2 and C^3 are collars secured to the twisters on opposite sides of the bearing C to prevent end movement in said bearings.

Finally, I will describe more in detail the means for drawing the slats out of the holder and engaging them with the shuttle. Just before the shuttle reaches its inmost position the sliding head T^3 will strike against the sliding head T^6, moving said head, and through the connecting-rod *g* also sliding inward the head T^5, which carries the dog *f*′. As the dog is adapted to engage with the lowest slat in the holder, it will push said slot before it, so that when the shuttle again moves outward the end of the slat will be projecting slightly beyond the holder and free to engage with the socket in the point of the shuttle. The dog *f* will then engage with the rear end of said slat and when the shuttle again moves inward will carry the slat in the manner before described.

As the slats may vary slightly in length, I provide means for keeping them in line at the inner edge of the fabric. This consists of a stop *y*, against which the end of the slat may strike, and to prevent the dog *f* from doing injury in case the slat strikes said stop before the head T^3 has completed its inward movement I secure said dog to said head by the yielding connection, such as the spring f^2.

What I claim as my invention is—

1. In a wire-and-slat-weaving machine, the combination with the work-holder and the rotary twisters adapted to be reciprocated toward or from said holder, of mechanism for feeding the slat endwise between said work-holder and twisters in the retracted position of the latter.

2. In a wire-and-slat-weaving machine, the combination with the work-holder and the rotary twisters adapted to be reciprocated toward and from said holder, of a slat-holder at one side of the machine, and a reciprocating shuttle adapted to carry a slat from said holder between said work-holder and twisters during the interval in which said twisters are withdrawn.

3. A wire-and-slat-weaving machine comprising a work-holder, rotary twisters and a slat-holder, of mechanism for automatically feeding the slats from said holder, for intermittently reciprocating and intermittently rotating said twisters, timed to coöperate in a continuous operation.

4. In a wire-and-slat-weaving machine, the combination with the twisters, of mechanism adapted to alternately longitudinally reciprocate and to rotate said twisters in continuous operation.

5. In a wire-and-slat-weaving machine the combination with the twisters, of mechanism for intermittently longitudinally reciprocating, and mechanism for intermittently rotating said twisters, each adapted to automatically stop itself and start the other.

6. In a wire-and-slat-weaving machine, mechanism for longitudinally reciprocating the twisters consisting of a traveling transverse shaft carrying bearings in which said twisters are journaled, a pinion on said shaft, a stationary rack with which said pinion engages, and means for rotating said shaft and pinion alternately in opposite directions.

7. In a wire-and-slat-weaving machine, mechanism for longitudinally reciprocating the twisters consisting of a transverse traveling shaft carrying bearings in which said twisters are journaled, rolls journaled upon said shaft on opposite sides of said twisters, stationary tracks upon which said rollers are adapted to travel, pinions on said shaft adjacent to said rolls, stationary racks above said pinions and in engagement therewith, and means for rotating said shaft alternately in opposite directions.

8. In a wire-and-slat-weaving machine, mechanism for reciprocating the twisters, comprising a traveling transverse shaft, carrying the bearings in which said twisters are journaled, a pinion on said shaft, a stationary rack with which said pinion engages, a longitudinally-extending drive-shaft adapted to be rotated alternately in opposite directions, and a worm-gear connection between said shafts adapted to travel with said transverse shaft and slide on said longitudinal drive-shaft.

9. In a wire-and-slat-weaving machine, the combination with a traveling transverse shaft for reciprocating the twisters, and a longitudinal drive-shaft, the worm R′ engaging therewith and feathered upon said drive-shaft and the connecting double bearings R^2 for the purpose described.

10. In a wire-and-slat-weaving machine,

the combination with a traveling transverse shaft for reciprocating the twisters, a longitudinal shaft and a traveling worm-gear connection between said shafts, of tight and loose pulleys upon said longitudinal shaft, oppositely-running drive-belts upon said pulleys, and a belt-shifter adapted to be operated by said traveling shaft at each end of its movement.

11. In a wire-and-slat-weaving machine, the combination with a traveling transverse shaft for reciprocating the twisters, a longitudinal shaft and a traveling worm-gear connection between said shafts, of a reversible drive-belt connection for said longitudinal shaft, a belt-shifter therefor, a spring-actuated device for said shifter extending into the path of said traveling shaft and adapted to be placed under tension thereby, a latch for temporarily holding said shifter from movement and means for releasing said latch to permit the spring to actuate said shifter.

12. In a wire-and-slat-weaving machine, belt-shifting mechanism for controlling the reciprocation of the twister-carriage, comprising the sliding bar Q, the standards Q^2 and Q^3 thereon and having a limited sliding engagement therewith, the rod Q^{10} slidingly secured in said standards having the stop-collars Q^{11} at opposite ends thereof and the arms Q^{12} and Q^{13} on opposite sides of the twister-carriage projecting into the path thereof, the bar Q^4 fixedly secured to one of said standards and slidingly secured to the other, the spring Q^6 thereon, the detents Q^{14} and Q^{15} on the standards and the latches P^5 and L^4 adapted to engage therewith, all arranged substantially as and for the purpose described.

13. In a wire-and-slat-weaving machine, mechanism for automatically releasing the clutch for rotating the twisters, and simultaneously starting the reciprocating mechanism for said twisters, comprising the disk J on the movable clutch member having the spiral groove J′ therein, a rock-arm, the rod K^2 slidingly secured thereto, the roller K^3 on said rod engaging with said groove and adapted to run to the periphery of said wheel, and a trip for the reciprocating mechanism adapted to be operated by the raising of said rod K^2.

14. In a wire-and-slat-weaving machine, the combination of the disk J having the spiral groove J′ therein, the tubular rock-shaft K′, the rod K^2 slidingly secured thereon, the roller K^3 at the lower end of said rod engaging with the groove J′, and the adjustable stop K^4 on said rod above said rock-arm, for the purpose described.

15. In a wire-and-slat-weaving machine, the combination with a traveling transverse shaft for reciprocating the twisters, a longitudinal drive-shaft therefor, a traveling worm-gear connection between said shafts, and mechanism for reversing the rotation of said drive-shaft, of an endless transverse chain-carrier, having a drive connection with said longitudinal shaft and a slat-carrying shuttle adapted to be reciprocated by said chain.

16. In a wire-and-slat-weaving machine, slat-weaving mechanism comprising a transversely-extending track or way, a head slidingly secured thereon, a slat-holding shuttle secured to and projecting forward from said head, a slat-holder having a slotted bottom plate, a dog on said sliding head adapted to pass through said slot in the holder and force the lowest slat therefrom into said shuttle, and means for reciprocating said sliding head on said track.

17. In a wire-and-slat-weaving machine, slat-feeding mechanism comprising a transversely-extending track or way, a head slidingly secured thereon, a slat-carrying shuttle secured to said head and consisting of the forwardly-extending separated side bars and a connecting-point having a socket for the end of the slat, a slat-holder having a slotted bottom plate and guides for said shuttle, a dog on said sliding head adapted to pass through said slot in said holder and force the lowest slat out therefrom between the separated side bars of said shuttle, and means for reciprocating said head on said track.

18. In a wire-and-slat-weaving machine, slat-feeding mechanism comprising a laterally-extending track or way, a head slidingly secured thereon, a slat-carrying shuttle extending forwardly from said head consisting of separated side bars and a connecting socketed point, a slat-holder having a slotted bottom plate and guides for said shuttle, a dog on said head in rear of said shuttle adapted to pass through said slot, a second sliding head on said track in rear of said holder, a corresponding dog thereon, means for reciprocating said shuttle-head to carry the lowest slat from said holder, and means for sliding forward said second head when said shuttle is near its forward position to force the end of the next slat from said holder.

19. In a wire-and-slat-weaving machine, the combination with a slat-carrying shuttle comprising separated side bars, a connecting socketed point and a reciprocating head to which the rear ends of said bars are connected, of supporting bars or bearings above which said shuttle passes, and presser-springs adapted to bear upon the slat in said shuttle and hold the same from movement when the shuttle is retracted.

20. In a wire-and-slat-weaving machine, the combination with the longitudinally-reciprocating twisters and transversely-reciprocating slat-carrying shuttle, of the slotted or U-shaped guides through which said shuttle is projected, the presser-springs *h* secured thereto adapted to hold the slat while the shuttle is retracted, the presser-springs *i* forming the work-holding clamps adapted to receive the slat when pushed forward by the twisters and hold the same during the operation of twisting, and the hooks U′ for pre-

venting the withdrawal of said slats by the backward movement of the twisters.

21. In a wire-and-slat-weaving machine, the combination with the reciprocating twisters, of pushers extending beyond the forward end of said twisters and adapted to carry the slat out of contact with the latter.

22. In a wire-and-slat-weaving machine, the combination with the reciprocating twisters and the traveling bearings in which said twisters are journaled, of pusher-sleeves secured to said bearings surrounding the forward ends of said twisters and projecting slightly beyond the same.

23. In a wire-twister, the combination with the spool or reel on which the wire is wound, of a tension device therefor, comprising a friction-brake applied to the flange of said spool and adapted to travel inward thereon as the wire on the spool diminishes.

24. In a wire-twister, the combination with the spool or reel on which the wire is wound, of a tension device therefor comprising a bifurcated pivotal arm embracing the flange of the spool, the inner member bearing against the wire on said spool, a friction-shoe on the outer member bearing against the flange of the spool, a pivot for said arm independent of said spool, and a spring for pressing said arm inward as the wire diminishes on the spool.

25. The combination with a rotary twister, of a wire-holding spool journaled upon said twister and the curved wire tube leading from the periphery of said spool into the end of said twister.

26. The combination of a plurality of wire-twisters, sprockets clamped thereon, a common drive-chain for all of said sprockets, a wire-holding spool loosely sleeved upon each of said twisters, and means for locking any one of said spools to its twister, and for loosening the sprockets of the other twisters, for the purpose of winding said spool.

27. The combination with a rotary wire-twister, of a wire-holding spool loosely sleeved thereon, and means for locking said spool to the twister for the purpose of winding.

28. The combination with a rotary and reciprocating wire-twister, of a sleeve in which said twister is feathered, a stationary bearing in which said sleeve is journaled, a sprocket-wheel secured to said sleeve on one side of said bearing, and a wire-holding spool journaled on said sleeve on the opposite side of said bearing.

29. The combination with a rotary and reciprocating wire-twister, of a sleeve in which said twister is feathered, a stationary bearing in which said sleeve is journaled, a sprocket-wheel clamped to said sleeve on one side of said bearing, a spool journaled on said sleeve on the opposite side of said bearing, and means for locking said spool to said sleeve.

30. A twister comprising a rotary tube, a plug or cap at one end thereof having central and eccentric apertures therethrough, and tubes within said outer tube connecting respectively with said apertures and leading to the opposite end of the twister.

31. In a wire-and-slat-weaving machine, the combination with the reciprocating slat-carrier, of a fixed stop against which the forward end of the slat is adapted to strike in the forward movement of the carrier, and a dog for pushing the rear end of the slat having a spring or yielding connection with said carrier.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE E. DE VORE.

Witnesses:

CHAS. H. CRANE,

L. S. TOBIN.