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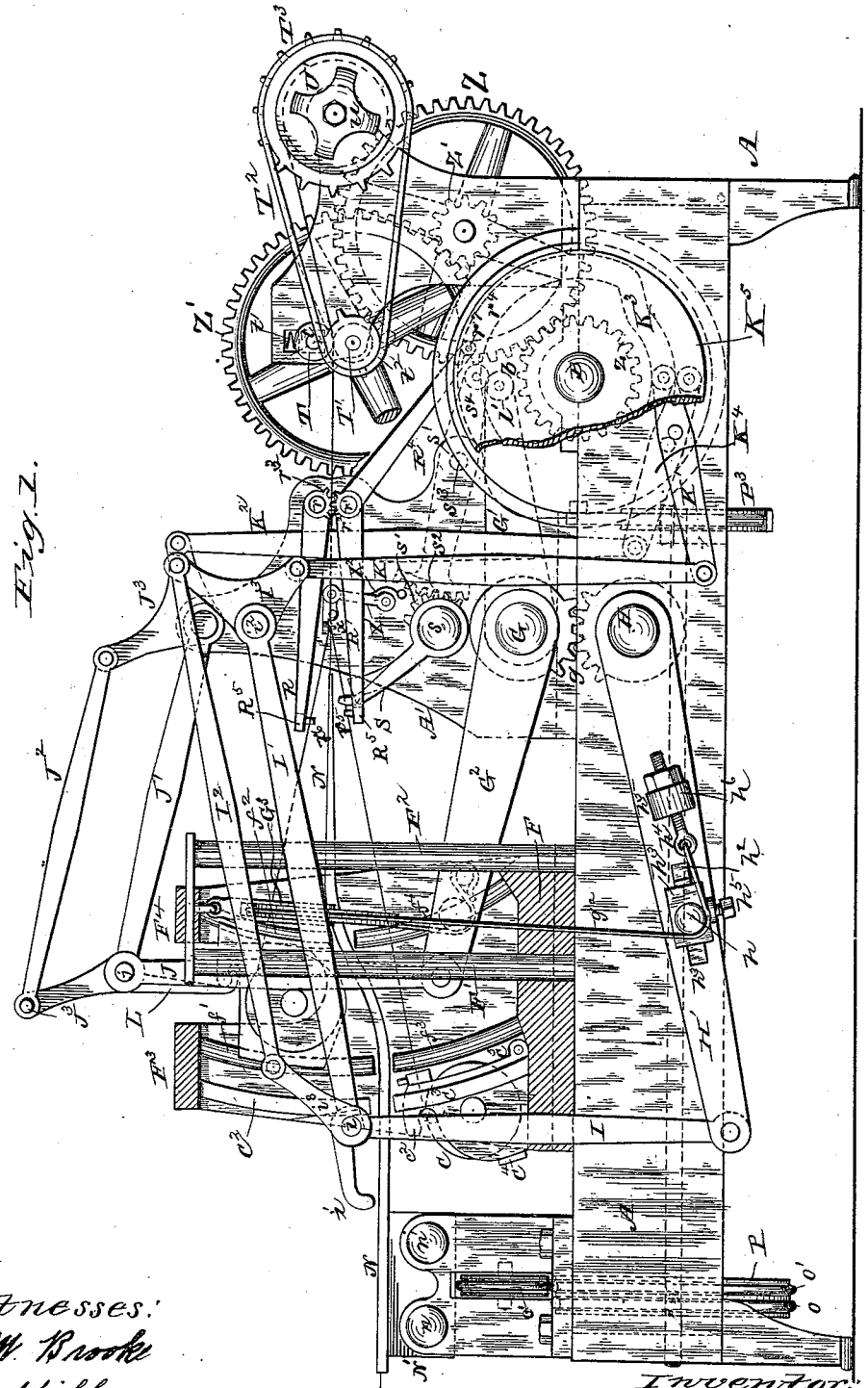
H. B. MORRIS.

LOOM.

No. 427,105. Patented May 6, 1890.



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(No Model.) 4 Sheets—Sheet 2.

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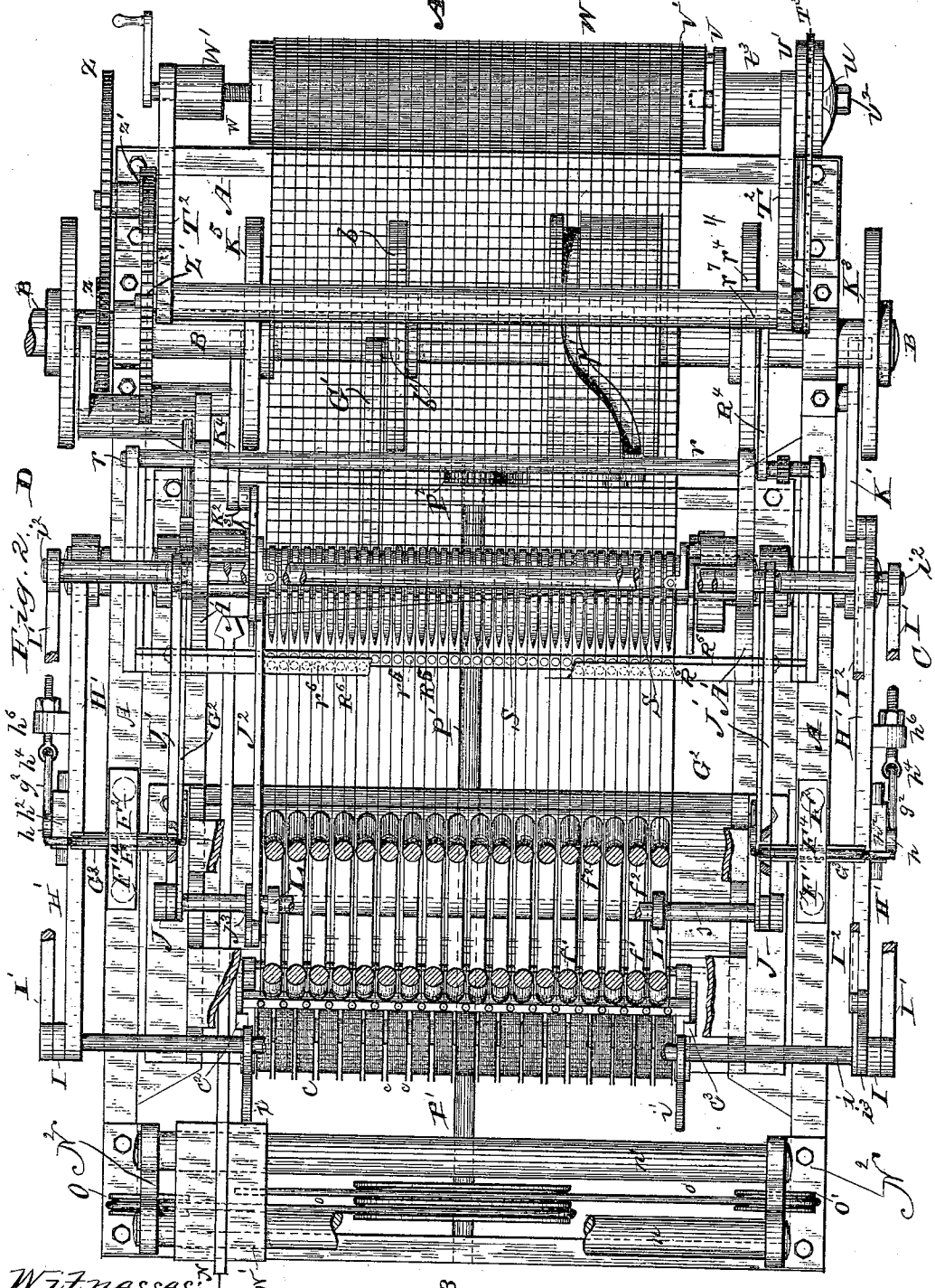

Fig. 2.

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LOOM.

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Fig. 4.

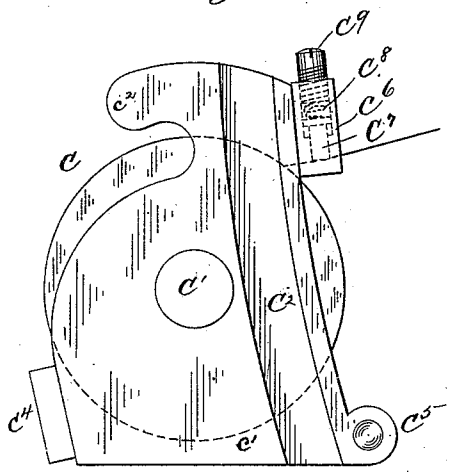


Fig. 3.

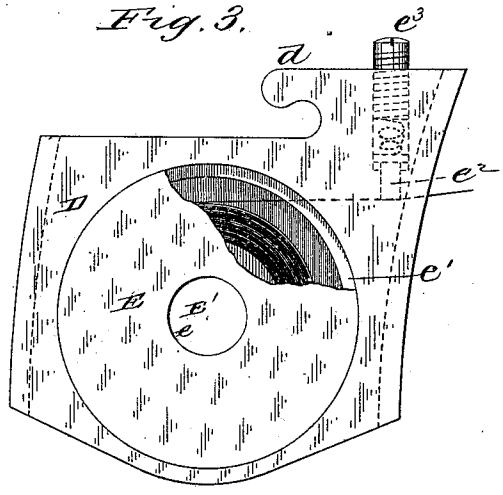
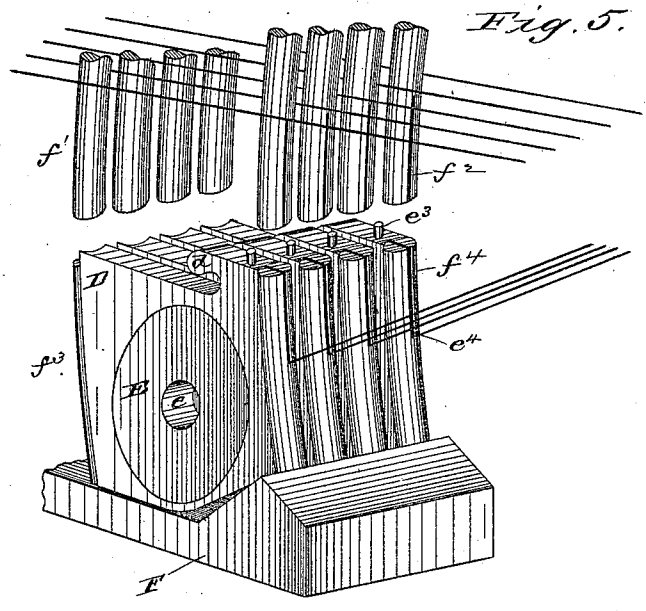


Fig. 5.



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(No Model.) 4 Sheets—Sheet 4.

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LOOM.

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Fig. 6

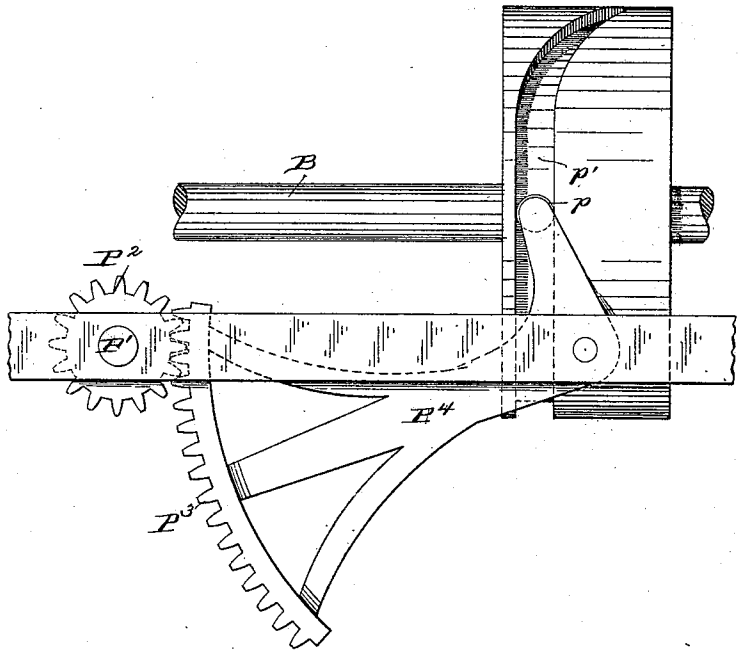
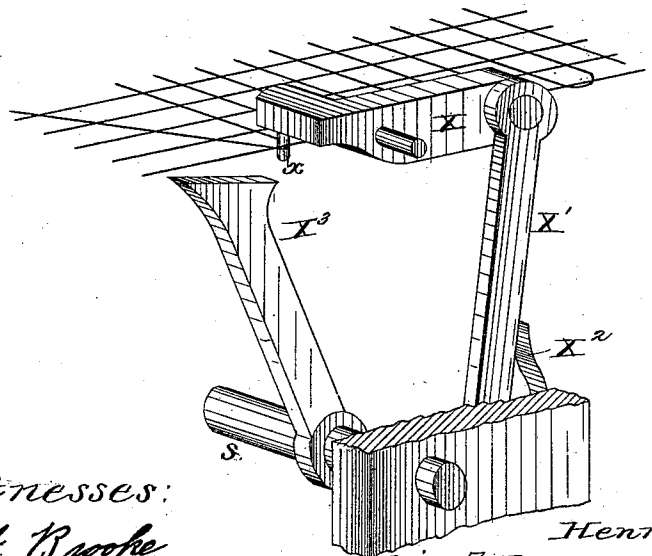


Fig. 7.



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UNITED STATES PATENT OFFICE.

HENRY B. MORRIS, OF GENEVA, NEW YORK, ASSIGNOR TO THE MORRIS WEAVING COMPANY, OF NEW YORK.

LOOM.

SPECIFICATION forming part of Letters Patent No. 427,105, dated May 6, 1890.

Application filed April 9, 1889. Serial No. 306,617. (No model.)

To all whom it may concern:

Be it known that I, HENRY B. MORRIS, a citizen of the United States, residing at Geneva, in the county of Ontario and State of New York, have invented certain new and useful Improvements in Looms for Weaving Wire-Cloth, of which the following is a specification.

This invention relates chiefly to looms of that class in which the warp-threads are mounted on carriers capable of being separated in opening the shed, so as to permit the traverse of a weft-guide whose path intersects that of the carriers, in contradistinction to the ordinary way of opening the shed by separating the warps between the warp-beam and the reed and passing a shuttle therethrough.

One principal object of my invention is to enable one set of warp-threads to be traversed across the line of the warp independently of the others. This end I attain by mounting each warp-thread in a separate and independent carrier and combining it with mechanism which at the proper time seizes it, traverses it athwart the normal line of the warp, restores it to its normal position, releases it, and retracts, leaving a clear passage for the traverse of the weaving-arm, weft-guide, or weft-carrier.

My invention consists in combining with separate and independent warp-reels traversing athwart the normal line of the warps corresponding guides divided in that line, from one set of which guides to the other the warp-reels are transferred in their traverse.

My invention further consists in combining with a separate and independent set of warp-reels such as above mentioned a corresponding set of warp-reels arranged in a different plane and so organized that the entire series traverses simultaneously athwart the line of warp, so as to simplify the organization without impairing the efficiency of its operation.

My invention further consists in combining with warp-reels such as described a tubular weft-carrier through which the weft-thread passes, which weft-carrier traverses periodically from selvage to selvage of the fabric to lay the weft-wire in the shed.

My invention further consists in combining with the warp-reels and weft-carriers a comb or combs regulating the warp-threads and conforming to their movements, so as always to maintain control thereof.

My invention further consists in combining with the weft-carrier a reed whose path intersects that of the weft-carrier to lay the weft-thread in position.

My invention further consists in combining with the weft-carrier temples periodically intersecting its path to hold the weft while being laid in the shed.

My invention further consists in combining with the mechanism above described a positively-actuated feed and a friction-feed to insure uniform tension on the fabric.

My invention further consists in certain other novel constructions, organizations, and combinations of instrumentalities.

The subject-matter claimed is hereinafter designated in the claims at the end of this specification.

The accompanying drawings represent so much of a loom for weaving wire-cloth embodying all my improvements, in the best way now known to me, as is necessary to illustrate the subject-matter herein claimed. Some of these improvements, however, may be used without the others, and in machines differing in its details of construction from those herein shown.

As my invention contemplates the application of these improvements to the most highly organized looms of the present day, I do not confine myself to the details of construction and organization herein shown; but when specifying a particular construction or organization intend to include well-known equivalents therefor. That end of the loom carrying the cloth-beam I term the "front end," the opposite one the "rear end" or "back." That side of the machine on the right of the person standing at the back end of the loom and facing it I term the "right-hand side," the opposite one the "left-hand side."

Figure 1 represents a view in elevation of

the right-hand side of the loom with some of its framing or standards removed the better to show its working parts. Fig. 2 is a plan or top view thereof with portions of the guide-supports removed to show the parts beneath more clearly. Fig. 3 shows an enlarged detail side view of one of the independent warp-reels and its carrier; Fig. 4, a similar view of one of the set of connected warp-reels and their carrier. Fig. 5 is a similar diagrammatic detail perspective view showing several of the independent warp-carriers, their guides, and the relation of the unwoven warp-wires thereto. Fig. 6 is an enlarged detail elevation of the mechanism by which the shaft which drives the weft-carrier is actuated. Fig. 7 is an enlarged diagrammatic perspective view showing one of the temple-pins for guiding the weft-wire, with its actuating and disengaging mechanism.

The mechanism is carried on a strong frame or bed-plate A, as usual. A main driving-shaft B, journaled in this frame, is driven in ordinary ways from any suitable prime mover. Cams, hereinafter described, actuating the various working parts are mounted on this shaft. In this connection each warp-wire is shown as carried by a separate reel. The reels of the alternate wires are arranged in separate sets in different transverse vertical planes, so as to traverse in parallel vertical longitudinal planes without interference with each other, which organization economizes space and affords other advantages hereinafter enumerated. The reels, necessarily being wider than the space ordinarily desired between the warp-threads, if all arranged in the same plane would necessarily occupy a much greater space laterally than that required under this organization, and would require corresponding modifications of the loom to meet this contingency.

The rear reels C, Fig. 4, each consists of a central hub with two disks attached to the sides thereof. Each reel turns freely independently of the other upon a transverse shaft C′, mounted in bearing-blocks c' near each end, each of which has a curved recess into which the guides C^2 C^3 enter. These guides preferably are made in the form of pins polygonal in cross-section, curved in an arc of which the point where the weft-wire is laid in the shed, which I term the "weaving-line," is the center, the recesses being correspondingly shaped in outline and curvature. These guides are shown as arranged in two transverse rows or sets on opposite sides of the normal or medial line of traverse of the warps, which I shall hereinafter term the "warp-line," one set of guides being secured upon a base F and the other set upon a transverse bar F^3, mounted on suitable standards on the frame.

The bearing-blocks c' are united near their lower ends and on opposite sides thereof by transverse bars C^4 C^5, and near their opposite forward ends by a corresponding bar C^6, provided with a series of longitudinal openings corresponding with the distance between the reels, from the inner side of which or that next the warp-line each warp-thread passes through its respective slot, proper tension being given each wire in its passage therethrough by means of a pin C^7, (shown in dotted lines, Fig. 4,) movable endwise and transversely thereto in a hole in the bar C^6 and pressed against the wire by a coil-spring C^8, the tension of which is adjusted by set-screw C^9 in a well-known way.

Each bearing-block is provided with a catch c^2, with which a lifting-hook, hereinafter described, engages at the proper time to traverse the reels athwart the warp-line. As a consequence of this organization, all the reels of this set are simultaneously traversed, which matter will be hereinafter further explained. The other or front set of reels is differently constructed and organized. They each consist of a metallic frame or carrier D, whose front and rear edges are grooved and curved to fit their respective guides in an arc of which the weaving-line forms the center. A transverse central opening in each frame receives a reel consisting of a central hub e, to the ends of which two flat disks E of sheet metal are attached, their diameter somewhat exceeding that of the above-mentioned transverse opening, which disks fit countersunk recesses e' in the frame, so as to hold the reel securely in position, while allowing it to turn freely, with its disks flush with the surface of the frame.

Each reel is provided with a central opening for the insertion of a shaft to facilitate the winding of the warp thereon; but each reel, unlike the other set, enters separately and independently of the others, and will hereinafter be more fully explained. The wire passes from the reel through a narrow vertical slot e^4 in the front part of the frame, proper tension being maintained thereon by a spring-pressed pin e^2 and adjusting-screw e^3, similar to those hereinbefore described, the wire being supported against this pressure by the wall of the slot above mentioned. A rearwardly-projecting catch d likewise engages with its appropriate lifting-hook at the proper time, as hereinafter explained. The movements of these reels are regulated by guide-pins f' f^2 f^3 f^4, mounted on suitable supports on the frame, the lower support being the same as that of the rear reel-guide hereinbefore mentioned, while the others are supported on transverse bars, one of which F^4 is mounted in suitable standards on the frame, while the other F^3, similarly mounted, is the same as the support of the corresponding guides of the rear reel. These guide-pins, it will be observed, are arranged in four sets, two front and two rear ones, on opposite sides of the warp-line, all curved in the arc of which the weaving-line forms the center, the object of which is to maintain the reels at a uniform distance from said weaving-

line, and consequently maintain a uniform tension on the warp-threads. The upper and lower front pins, it will be observed, are slotted longitudinally for some distance at their ends next the warp-line, so that the warp-wires from the front reels may pass therethrough and be properly guided. The rear warp-wires, it will be observed, pass toward the weaving-line between the guide-pins of the front set, which thus serve as lateral guides therefor. These pins, it will be observed, are of such relative lengths that the opening between the forward pins f^2 f^4 is considerably higher than that between the rear pins f' f^3, the object of this organization being that the rear warp-wires shall always be under the guidance of the forward pins, as by it the wires in their transverse movements pass between one set of pins before escaping from the other. The organization is such, it should be noted, that the front and rear sets of reels traverse alternately in opposite directions athwart the warp-line, so that when the rear wires are crossing the space between the adjacent ends of the guide-pins the forward reels are doing the same in the opposite direction. Consequently they close this space and prevent the rear wires from escaping laterally therethrough. In order still further to prevent possible entanglement of the rear wires with the forward reel-frames, the latter are made slightly thinner than the diameter of their forward guide-pins, thus leaving room for the wires to pass between the pins without interference from the reel-frames. These forward reels, as before remarked, are not mounted upon a common shaft, as are the rear ones, but each turns in a separate and independent frame, so as to permit the wires to pass between as they traverse athwart the warp-line, this traverse being effected by lifting-hooks engaging their catches in the following manner: Transverse rock-shafts G H are respectively mounted on the main frame just below the weaving-line, and are connected by sector-gears g, causing them to rock alternately in opposite directions, this movement being caused by a cam b on the main shaft B engaging a friction-roller b' on one end of a rocking arm G', fixed on the rock-shaft G. Each of the rock-shafts G H extends beyond the frame and carries rocking arms G^2 H' at each end thereof, one set being on the inside and the other on the outside of the bed-plate or side pieces of the frame, so as to prevent interference. Each of the rocking arms G^2 is connected to its fellow H' by a chain or rope g^2, preferably of metal, passing from the arm G^2 over a pulley G^3, thence backward to its fellow arm H'. This pulley is suspended from a bar F^4, mounted on the bars F' F^2. The rope above mentioned encircles a lug h on a block h^2, longitudinally adjustable on a guide h^3 on the rocking arm H', locked in any desired position by a set-screw h^5, the end of the rope being attached to an eyebolt h^4, passing through a lug h^6 on the rocking arm, provided with a suitable adjusting-nut to tighten the rope, thus affording means for correcting the radial distance of the rope from the center of motion, so that it may at all times be kept tight and preserve the proper counterbalance and relation of the rocking arms G^2 H'. Owing to this method of connecting the rocking arms their respective sets of reels will be counterbalanced, which is important, as their weight is constantly varying, the reels being gradually lightened as the wire is unwound therefrom. The free ends of the rocking arms above mentioned are respectively connected by connecting-rods I J to the rock-shafts i j, extending across the machine. Hooks i' upon the opposite ends of the rear rock-shaft i engage at proper times the corresponding catches c^2 upon the lifting-blocks c' of the rear reels, hereinbefore described. The rocking motion necessary to effect the engagement and disengagement of these traversing blocks and hooks is effected in the following manner: Radius-bars I' oscillate on a shaft i^2 in standards on the main frame. A crank-arm i^3 on the rock-shaft i is connected by a parallel rod I^2 to bell-crank lever I^3, rocking on the same shaft as the radius-bars above mentioned. The other end of the bell-crank is connected by a link-rod K with rocking lever K', carrying a friction-roller traversing a grooved cam K^3 on the driving-shaft. The organization is such that when the lifting-hooks are nearest their lifting-blocks when in their normal position they are locked into engagement therewith by means of the link-connections above described in a manner that will be readily understood.

The organization of the apparatus for controlling the front set of reels is similar to that above described, and the parts are correspondingly lettered. In this case an independent hook L, mounted upon a transverse rock-shaft j, is provided for each reel, the shaft and hooks being operated through radius-bars J', bell-crank J^3, connecting-rods K^2, rocking lever K^4, cam K^5, crank-arms j^3, and parallel rods J^3, similar to those in the front set.

The weft-thread is laid between the warp-threads by what I call a "weaving-arm," "weft-guide," or "weft-carrier," alternately traversing from side to side of the fabric. This weft-carrier consists of a hollow tube N, preferably flattened and widened at its forward end to enable it to work close to the weaving-line and to render it less liable to catch in the warp-wires, across which it moves laterally, through the entire length of which tube the weft-wire passes and is deposited between the wires at each shed. The rear end of the weft-carrier is mounted upon a block N', sliding in a transverse guide consisting in this case of two parallel guide-bars n n', extending across the rear end of the machine and secured in standards N^2 thereon. The weft-carrier block is preferably oscil-

lated by means of chains or ropes *o o'*, preferably of metal, being attached, respectively, at one end to the sliding block, extending in opposite directions from the sliding block and encircling pulleys O O', mounted, respectively, in the standards above mentioned. Both of these ropes are wound in opposite directions upon a pulley P, mounted on a central longitudinal shaft P', turning in proper bearings in the frame. A gear-wheel P^2 on this shaft is actuated by a rack P^3 on a bell-crank lever P^4, rocking on a central pivot in the frame. The opposite end of this bell-crank carries a friction-roller *p*, engaging with a grooved cam *p'* on the driving-shaft, by which means it will be seen that the weaving-arm is caused at proper intervals to traverse the shed from selvage to selvage in one direction, deposit the weft-thread therein, to pause until another shed is opened, and then return in the opposite direction, this operation being alternately repeated from time to time as the weaving progresses.

The warp-threads are guided at a point between the reels and the weaving-line by combs, in this instance constructed as follows: Transverse bars R^5 are provided with short upright teeth r^5 r^6, preferably formed of small wires separated a distance apart equal to that the warp-wires are desired to be in the woven fabric, the warp-threads being designed to be laid between the teeth of the comb and retained laterally in position thereby. Two combs are shown, an upper and a lower one, both movable, respectively mounted on parallel radius-bars R R', vibrating around shafts *r r'*, connected by sector-gears r^2 r^3 to insure their coincident movement, the lower radius-bar being provided with an extension-arm R^4, operated by a friction-roller r^7, engaging a cam r^4 on the main shaft. The teeth r^5 of the lower comb are set slightly nearer the front of the machine or the weaving-line than those r^6 of the upper comb, the two being caused to oscillate correspondingly with the warp-wires in shedding and opening correspondingly as the shedding is completed, so that each comb moves coincidently with the warps with which it is engaged and separates them one from the other, thereby keeping them always correctly arranged laterally, so that the blades of the reed will pass properly between the wires. This reed consists of a series of oscillating blades S, rigidly secured upon a transverse rock-shaft *s*, mounted in the main standard and vibrated at suitable intervals by sector-gears *s'* thereon meshing with corresponding gears s^2 on the end of a lever S', rocking intermediately on a pivot s^3 on the left-hand side of the frame and carrying a friction-roller actuated by a cam s^4 on the driving-shaft.

To prevent the weft-wire from drawing the edges of the fabric together, I use a temple at each side of the fabric, consisting of a vertical pin *x* on each side of the fabric at the weaving-line, mounted on an arm X, oscillating vertically, and curved laterally, so as to be clear of the fabric, while allowing the pin to enter between the outer warp-wires and the adjacent ones on each side. This arm X is pivoted to a vertical oscillating lever X', in turn pivoted on the main standard and acted upon by a spring X^2, so as to hold the temple normally in position in engagement with the fabric, as hereinbefore described. The weft-wire is carried around the temple-pins when in their forward position, and the continuous feed motion, hereinafter described, tends to draw them forward and downward, thus causing the lever X' to swing forward against the pressure of its spring. As the reed advances to lay the newly-deposited weft-wire a wiper or cam X^3 on the reed-shaft strikes a pin *x* in the side of the arm X, thus withdrawing the temple-pins from the fabric. As soon as this is done the spring throws the temple backward over the newly-deposited weft-wire and into position to receive the next one. The temple-pins and arms fall into their places by gravity after the retreat of the cams, but may be so actuated by springs, if desired; but this is not deemed necessary.

The temple mechanism above described is alike on both sides of the loom, except that the temple-levers are of course right and left, or reversed in their curvature.

Two transverse horizontal feed-rollers T T' are mounted one over the other near the forward end of the bed-plate, the upper one T turning in bearings in sliding blocks *t*, pressed together toward the upper roller by springs *t'*, to keep the rollers closely in contact. The feed-rollers are continuously driven in opposite directions proper for feeding by spur-gearing of well-known construction, (clearly shown in the drawings.) A spur-gear *z* on the main driving-shaft actuates a corresponding wheel Z on a counter-shaft carrying a spur-gear *z'*, which drives a spur-wheel Z' on the shaft of the lower feed-roller. A sprocket-wheel t^2 on the lower feed-roller drives through the medium of a chain or perforated belt T^2 a corresponding sprocket-wheel T^3, loosely mounted upon a short transverse horizontal shaft t^3, journaled in the upper forward portion of the right-hand side of the frame. A circular friction-plate U is fixed upon and turned with this shaft. A similar friction-plate U' likewise turns with the shaft, but is connected therewith by a key or spline, so as to be free to move endwise upon the shaft while turning therewith. The sprocket-wheel T^3 has smooth sides compressed between the friction-plates by a spring *u*, bearing against the outer side of the plate U', being compressed against it by an adjusting-screw U^2 on the end of the shaft t^3, so as to regulate the pressure thereon. A disk V is rigidly fixed upon the shaft t^3 near its inner left-hand end. The projecting end of this shaft forms one bearing for the cloth-beam or take-up roller W, the opposite end being mounted in a suitable shaft in the other side of the frame.

An eccentric-pin V′, projecting laterally from the inner face of the disk V, enters a corresponding recess in the end of the take-up roller or cloth-beam W, upon which the woven fabric is wound, the end of said fabric being positively secured thereto at the commencement of the operation. The left-hand shaft W′ of the take-up roller is mounted in a screw-bearing *w* and provided with a crank-arm, so as to admit of the ready removal or displacement of the cloth-beam in a well-known way. The organization is such that the surface of the cloth-beam tends to travel somewhat faster than the surfaces of the feed-rollers; but this tendency is counteracted by the slipping of the friction-plates through which the cloth-beam is driven. The feed-rollers thus tend to detain the fabric and reduce its motion to the proper speed, which would otherwise be irregular, increasing as more cloth is wound upon the beam. The power for winding the fabric is mainly supplied through the sprocket-wheel and friction-plates, while the slower motion of the feed-rollers causes the sprocket-wheel driven positively thereby through the chain to slip between the friction-plates, and thus compensate any difference of movement between the cloth-beam and feed-rollers.

The following is a description of the operation of the loom: Each reel is threaded with a center warp-wire, which is led through its proper guides and through the loom and secured to the cloth-beam, as usual. Normally all the reels rest in their lowest position below the warp-line. The weft-thread is passed through the carrier from a suitable reel and its forward end properly secured in the loom. The weft-carrier, it will be observed, is bent to correspond with the openings between the guides and its flattened and widened point projects between and beyond the teeth of the combs and of the blades of the reed close to the temple and the weaving-line. The operation starts with the weft-carrier at one side of and outside of the line of the warps, as shown in Fig. 1, in which position it is outside of the supporting-shaft of the rear reels and of course outside of the supports of the front ones. The shed is now opened by traversing one set of reels across the warp-line, the others remaining disengaged and in their normal position. The weft-carrier then travels to the other side of the fabric, laying the weft-wire in the shed at the weaving-line, the weft and warp wires being acted upon by the comb, the reed, the temple, and the feed in the manner hereinbefore described. After completing its travel across the warp in one direction the weft-carrier pauses at the opposite end of its stroke, while the set of warp-reels previously traversed across the warp-line is traversed back to its original position, the other one being simultaneously seized and carried to the opposite side, as before. The warp-reels restored to their normal position being disengaged from their lifting-hooks, the weaving-arm or weft-carrier then retraces its steps to its former position, these movements being alternately and successively repeated until the weaving is completed.

The operation of the feed and other devices will be readily understood from the foregoing description, and need not be described herein.

My application, Serial No. 275,764, filed June 1, 1888, shows and describes a loom embodying some of the features herein shown. Nothing claimed, however, in that application is claimed herein; but many of the features herein claimed are shown in other forms in that application.

Having thus fully described the organization and operation of my improved loom for weaving wire-cloth, what I claim herein as new and of my own invention, and desire to secure by Letters Patent, is—

1. The combination, substantially as hereinbefore set forth, of the rear warp-reels, their supporting-shaft, lifting-blocks, and guides.

2. The combination, substantially as hereinbefore set forth, of the rear warp-reels, their supporting-shaft, lifting-blocks, and front connecting-bar slotted for the passage of the warp-wires.

3. The combination, substantially as hereinbefore set forth, of the rear warp-reels, their lifting-blocks, the front connecting-bar slotted for the passage of the warp-wires, and a tension-regulating pin, spring, and adjusting-screw for each warp-wire.

4. The combination, substantially as hereinbefore set forth, of a series of warp-reels mounted on a common supporting-shaft, lifting-blocks at each end of the shaft, connecting-bars uniting the lifting-blocks, and guides for the lifting-blocks.

5. The combination, substantially as hereinbefore set forth, of the transversely-perforated recessed carrier-frame of the front warp-reel, the reel having the disks fitting in these recesses, and the front and rear guides.

6. The combination, substantially as hereinbefore set forth, of the longitudinally-slotted transversely-perforated recessed carrier-frame, the reel having the disks fitting in the recess, and the tension-regulating device in the longitudinal slot.

7. The combination, substantially as hereinbefore set forth, of a series of separate and independent warp-reels, mechanism traversing them athwart the middle line of the warp, a corresponding series of separate guides for each reel, the latter moving endwise on the guides, the rear warp-reels, their supporting-shaft, and mechanism for traversing said reels and shaft athwart the middle line of the warp.

8. The combination, substantially as hereinbefore set forth, of a series of separate and independent warp-reels, mechanism traversing them athwart the middle line of the warp, a corresponding series of separate guides from one set to the other of which the reels are al-

ternately transferred during their operation by moving endwise thereon, the rear warp-reels, their supporting-shaft, and mechanism for traversing said reels and shaft athwart the middle line of the warp.

9. The combination, substantially as hereinbefore set forth, of a series of separate and independent warp-reels, their longitudinally-slotted carriers, and guides correspondingly slotted for the passage of the warp-wires.

10. The combination, substantially as hereinbefore set forth, of a series of rear warp-reels and a series of front warp-reels, each series being in a different vertical transverse plane, so that the warp-wires of the rear reels pass between the corresponding front reels and the wires of each series form one of the sides of the shed of the warp-wires.

11. The combination, substantially as hereinbefore set forth, of a series of rear warp-reels, a corresponding series of front warp-reels, and the guide-pins of the latter, said pins constituting guides for the rear warp-wires.

12. The combination, substantially as hereinbefore set forth, of a series of rear warp-reels, a series of front warp-reels, and their longitudinally-divided guides, which also serve as guides for the rear warp-wires.

13. The combination, substantially as hereinbefore set forth, of a series of warp-reels and a series of guides divided at different levels longitudinally relatively to the line of travel of the warp, so as to transfer it to one set before being released from the other.

14. The combination, substantially as hereinbefore set forth, of a series of rear warp-reels, a series of front warp-reels, and separate sets of guides therefor, each set divided in or about the warp-line or of the medial line of movement of the corresponding set of the reels, and mechanism for operating the reels, whereby the front set of reels moves through the space between the guides as the warps traverse it from the rear reels, and thus prevents their escape laterally.

15. The combination, substantially as hereinbefore set forth, of the rear warp-reels shaft, its lifting blocks and hooks, the rocking hooks engaging therewith, and the connections and cams by which the rocking hooks are actuated to connect, lift, lower, and disconnect the reels, as required.

16. The combination, substantially as hereinbefore set forth, of a series of warp-reels, a separate series of independent warp-reels, and actuating mechanism traversing each series athwart the middle line of movement of the warps of the other series.

17. The combination, substantially as hereinbefore set forth, of two separate series of warp-reels, connections and cams by which they are vibrated in alternately-opposite directions athwart the line of travel of the warps, and a flexible counterbalancing-connection between the two to compensate variations in weight as the warps pass from the reels.

18. The combination, substantially as hereinbefore set forth, of two separate series of warp-reels, connections and cams by which they are actuated, flexible counterbalancing-connections between them, and the counterbalancing adjusting device mounted on one of the link-connections to insure their uniform relation.

19. The combination, substantially as hereinbefore set forth, of the front warp-reel carriers, their hooks, the interlocking lifting-hooks, the rock-shaft carrying them, its crank-arms, parallel bars connecting them with bell-crank levers, their connecting-rods, rocking levers and cams, the rocking arms, their actuating-cams, links connecting them with the rock-shaft of the lifting-hooks, and the radius-rods connecting this shaft with the shaft on which the bell-crank levers rock to both rock and lift the lifting-hooks.

20. The combination, substantially as hereinbefore set forth, of a weft-guide, mechanism traversing it laterally relatively to the warp, warp-reels, and mechanism traversing them athwart the path of the weft-guide without interference therewith.

21. The combination, substantially as hereinbefore set forth, of a weft-guide, mechanism traversing it laterally relatively to the warp, a series of separate and independent warp-reels, and mechanism traversing the reels athwart the path of the weft-guide without interference therewith.

22. The combination, substantially as hereinbefore set forth, of a weft-guide, mechanism traversing it laterally relatively to the warp, a series of warp-reels, mechanism traversing them athwart the path of the weft-guide without interference therewith, and warp-reel guides transversely divided in the path of the weft-guide.

23. The combination, substantially as hereinbefore set forth, of a weft-guide, mechanism traversing it laterally relatively to the warp, a series of warp-reels mounted on a common supporting-shaft, lifting-hooks at each end of the series, and mechanism alternately engaging the hooks to traverse them athwart the path of the weft-guide and releasing them to allow the weft-guide to traverse without interference.

24. The combination, substantially as hereinbefore set forth, of a weft-guide, mechanism traversing it laterally relatively to the warp, two series of warp-reels, one behind the other, mechanism traversing each set in alternately-opposite directions athwart the path of the weft-guide without interference therewith, and corresponding separate sets of warp-reel guides transversely divided in the path of the weft-guide.

25. The combination, substantially as hereinbefore set forth, of a weft-guide, mechanism traversing it laterally relatively to the warp,

combs on opposite sides of the weft-guide between which it traverses, and mechanism reciprocating the combs transversely to the path of the weft-guide.

26. The combination, substantially as hereinbefore set forth, of a weft-guide, mechanism traversing it laterally relatively to the warp, two series of warp-reels, mechanism traversing each set in alternately-opposite directions athwart the path of the weft-guide without interference therewith, combs between which the weft-guide traverses, and mechanism reciprocating the combs transversely to the path of the weft-guide.

27. The combination, substantially as hereinbefore set forth, of a series of separate and independent warp-reels, mechanism traversing them intermittingly athwart the medial line of the warp, two combs, and mechanism reciprocating the combs correspondingly on opposite sides of the warp.

28. The combination, substantially as hereinbefore set forth, of two series of warp-reels, mechanism traversing them intermittingly in alternately-opposite directions athwart the medial line of the warp, two combs on opposite sides of said line, and mechanism reciprocating them correspondingly relative thereto.

29. The combination, substantially as hereinbefore set forth, of the lower comb, its radius-bar, intermediate pivot, and extension-arm and sector-gear, means for actuating said arm, the upper comb, its radius-bar, pivot, and gear, driven from the lower lever to reciprocate the combs.

30. The reed consisting of the combination, substantially as hereinbefore set forth, of a rock-shaft, its radial blades, sector-gears, rock-arm, pivot, cam, and sector-gear on the rock-arm meshing with that on the rock-shaft to oscillate the blades at proper intervals.

31. The combination, substantially as hereinbefore set forth, of a reed, mechanism for actuating it in a path intersecting that of the warp-threads, combs, and mechanism for vibrating them in a path transverse to the warp.

32. The combination, substantially as hereinbefore set forth, of separate warp-reels, mechanism traversing them intermittently athwart the medial line of the warp, two combs, mechanism reciprocating them correspondently on opposite sides of the warp, a reed, and mechanism for oscillating it.

33. The combination, substantially as hereinbefore set forth, of separate warp-reels, mechanism traversing them intermittently athwart the medial line of the warp, a weft-guide, mechanism traversing it laterally relatively to the warp and in the shed thereof, a reed, and mechanism oscillating it in a path intersecting that of the weft-guide.

34. The combination, substantially as hereinbefore set forth, of separate warp-reels, mechanism traversing them intermittently athwart the medial line of the warp, a weft-guide, mechanism traversing it laterally relatively to the warp and in the shed thereof, combs on opposite sides of the warp, mechanism reciprocating them correspondently relatively thereto, a reed, and mechanism for oscillating it in a path intersecting that of the weft-guide.

35. The combination, substantially as hereinbefore set forth, of separate warp-reels, their guides divided in a plane parallel with the warp, mechanism traversing the reels intermittently athwart the medial line of the warp, a weft-guide, mechanism traversing it intermittently athwart the warp and in its shed, combs on opposite sides of the warp overlapping the nose of the weft-guide, mechanism reciprocating them relatively thereto, a reed overlapped both by the weft-guide and combs, and mechanism for oscillating the reed in a path intersecting that of the weft-guide without interference.

36. The combination, substantially as hereinbefore set forth, of a temple, its pivoted support, a thrusting-spring, a reed, its rock-shaft, mechanism oscillating it, and a temple-disengaging cam carried by this rock-shaft.

37. The combination, substantially as hereinbefore set forth, of a temple, its pivoted supports and actuating-springs, a reed, its rock-shaft, mechanism for oscillating it, a temple-disengaging cam carried by this rock-shaft, combs on opposite sides of the warp, and mechanism reciprocating them.

38. The combination, substantially as hereinbefore set forth, of the temples, the reed, the reed-shaft, its temple-disengaging cams, the combs, their actuating mechanism, the weft-guide carrying the weft-thread around the temple-pins, and mechanism traversing the weft-guide from pin to pin.

39. The combination, substantially as hereinbefore set forth, of separate warp-reels, mechanism traversing them intermittently athwart the medial line of the warp, a weft-guide, mechanism traversing it laterally in the shed of the warp, combs on opposite sides of the warp, mechanism reciprocating them relatively thereto, a reed, mechanism oscillating it in a path intersecting the weaving-line, temples on each edge of the warp, their pivoted supports, their thrusting-springs, and disengaging-cams actuated by the reed-actuating mechanism.

40. The combination, substantially as hereinbefore set forth, of the separate sets of reels, their separate guides, the weft-guide, the combs, the reed, the temples, and the respective actuating mechanism.

41. The combination, substantially as hereinbefore set forth, of the driving feed-roller, its sprocket-wheel and belt, the short shaft, its loose sprocket-wheel and friction-plates, the disk on the short shaft, its pivot-pin and

eccentric-pin, the cloth-beam detachably connected with the pins, and the removable pivot for the opposite end of the cloth-beam.

42. The hereinbefore-described loom for weaving wire-cloth, consisting of the combination of separate sets of reels, their divided guides, the weft-guide or weaving-arm, the combs, the reeds, the temples, the positive and friction feed devices, and the mechanism actuating the various parts, the combination being and operating substantially as hereinbefore set forth.

In testimony whereof I have hereunto subscribed my name.

HENRY B. MORRIS.

Witnesses:
C. CLINT. POST,
I. FOSTER CROWELL.