(No Model.) 3 Sheets—Sheet 1.

# F. ECKERMANN.

## LOOM FOR WEAVING LOOM HARNESS.

No. 383,215. Patented May 22, 1888.

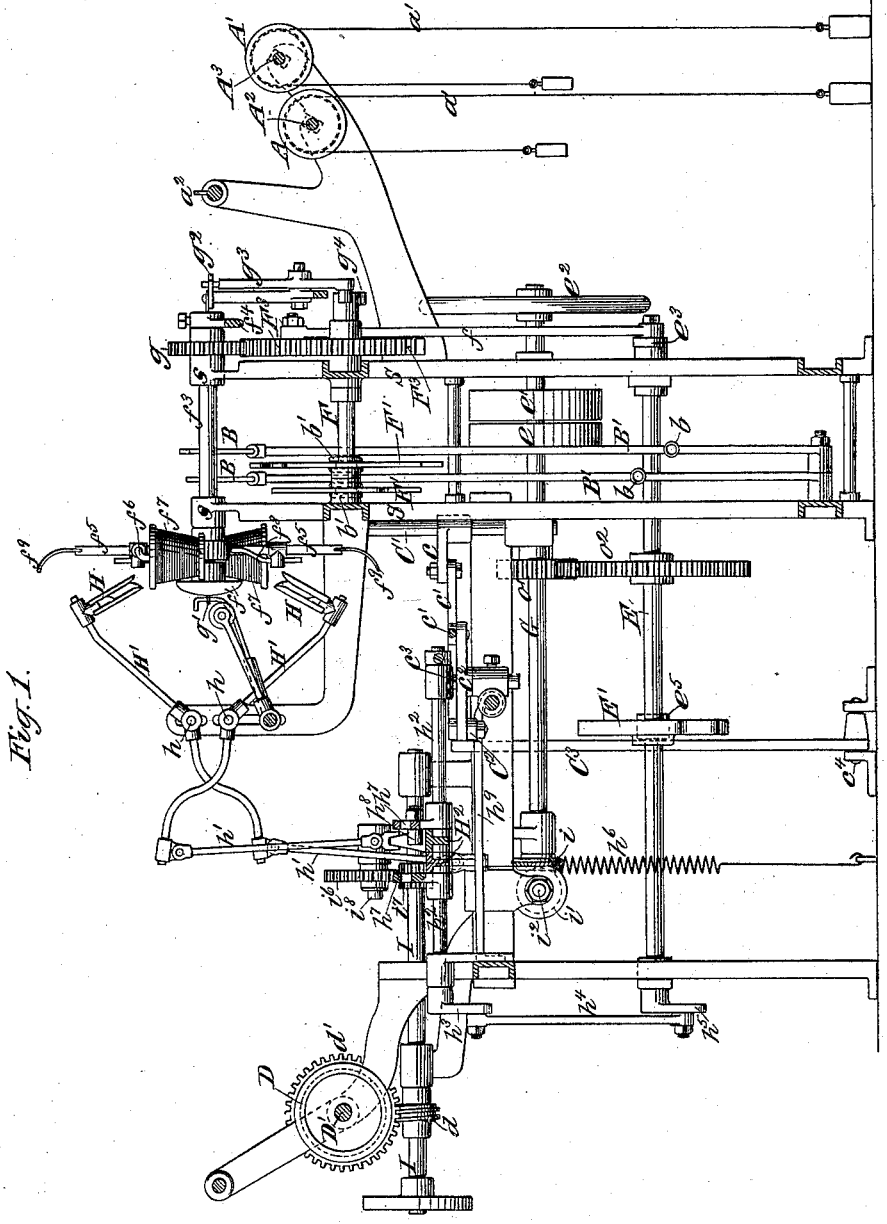

Fig. 1.

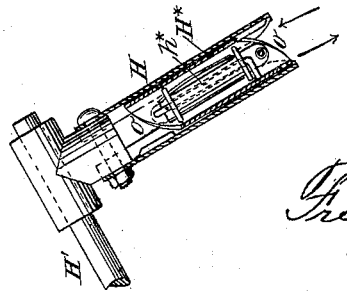

Fig. 2.

Witnesses:
C. L. Sundgren,
Emil Herter.

Inventor:
Fred. Eckermann.
by his Attys
Brown & Hall

(No Model.) 3 Sheets—Sheet 2.

# F. ECKERMANN.

## LOOM FOR WEAVING LOOM HARNESS.

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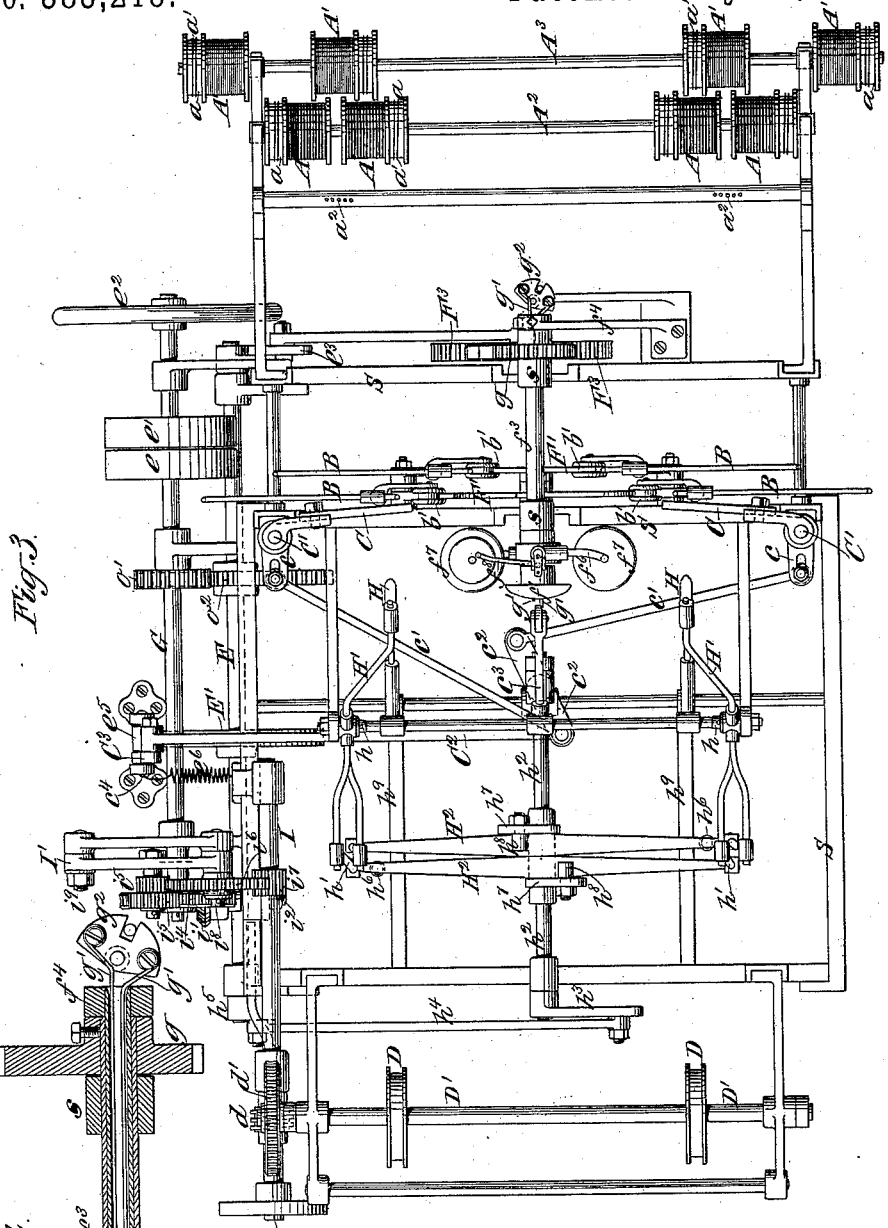

Fig. 3.

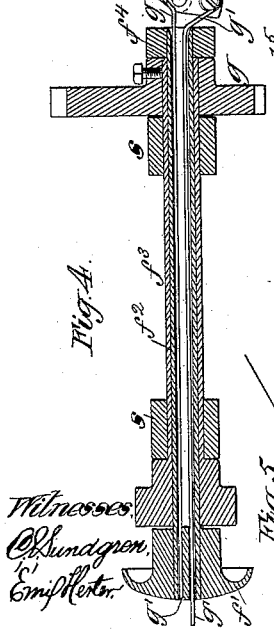

Fig. 4.

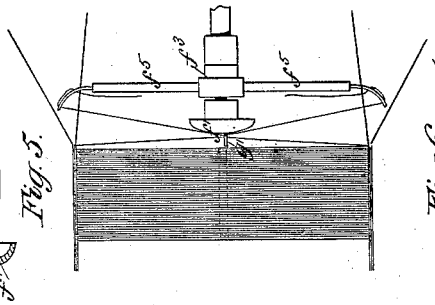

Fig. 5.

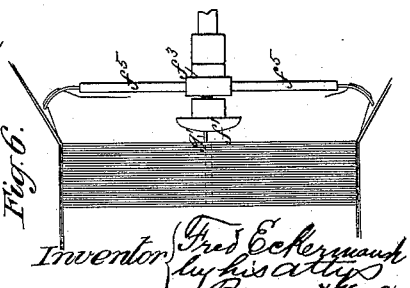

Fig. 6.

Witnesses
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(No Model.) 3 Sheets—Sheet 3.

# F. ECKERMANN.

## LOOM FOR WEAVING LOOM HARNESS.

No. 383,215. Patented May 22, 1888.

Fig. 7.

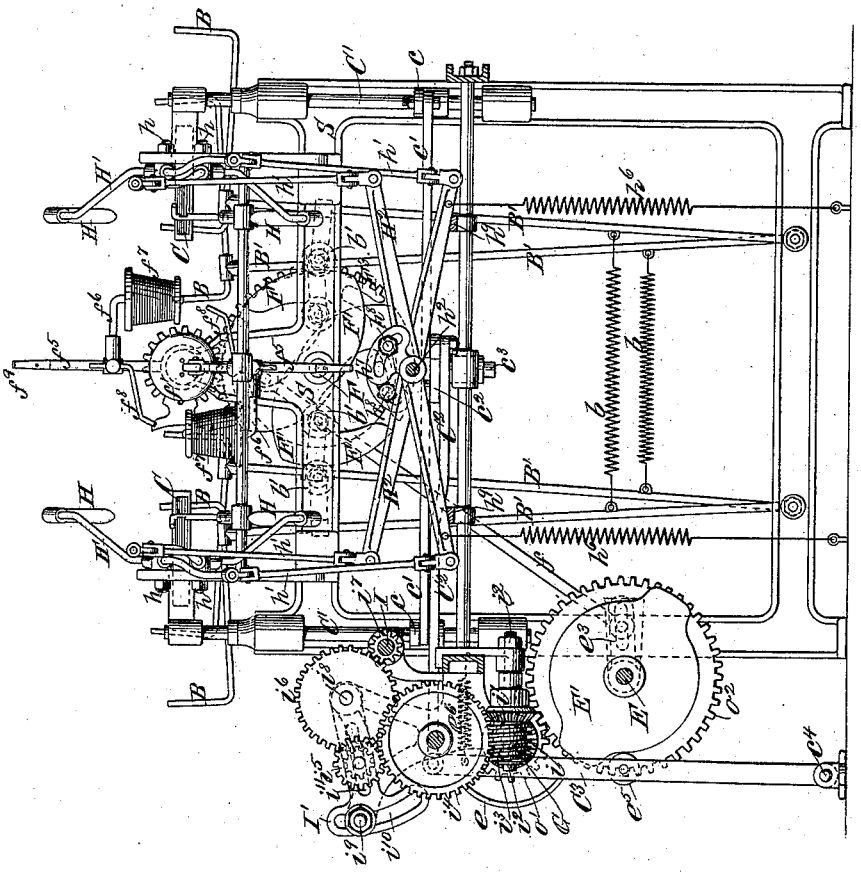


Fig. 8.

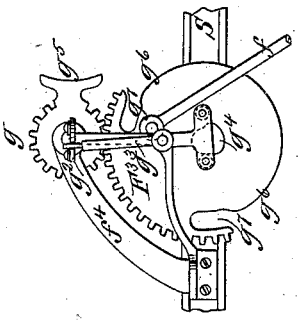
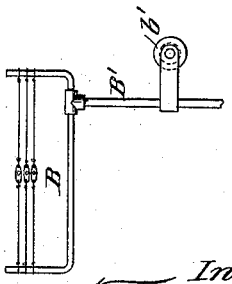


Fig. 9.



Witnesses:
C. A. Sundgren,
Emil Herter

Inventor:
Fred Eckermann,
by his Attys
Brown & Hall.

# UNITED STATES PATENT OFFICE.

FRED ECKERMANN, OF PATERSON, NEW JERSEY, ASSIGNOR TO PAUL A. WAGNER, OF SAME PLACE.

## LOOM FOR WEAVING LOOM-HARNESS.

SPECIFICATION forming part of Letters Patent No. 383,215, dated May 22, 1888.

Application filed August 30, 1887. Serial No. 248,304. (No model.)

*To all whom it may concern:*

Be it known that I, FRED ECKERMANN, of Paterson, in the county of Passaic and State of New Jersey, have invented a new and useful Improvement in Looms for Weaving Loom-Harness, of which the following is a specification.

In many looms, particularly those for weaving silk, there is employed for the warp a harness which is itself woven upon a loom; and my invention relates to a loom for weaving or making such harness. In such harness the warps are at opposite edges only, forming what are called in the ordinary harness "rig-bands." Each consists of a limited number—six, for example—of cords or threads, and the loops for receiving the future warps are formed by weft-threads, which extend in pairs inward from the warps of the harness and are looped one into the other, the loop between the opposite wefts being extended slightly to receive the warp of the loom through it. These weft-threads in the harness, which extend inward from opposite edges and are looped one into another, are formed around pins, and commonly there are employed two pins which are alternately withdrawn and projected beyond the center head, and which are a slight distance apart, so that in the finished harness there will be two lines of loops for receiving the warp-threads at a short distance—say three-eighths of an inch apart. In most looms for weaving this character of harness the weft-threads have been carried by shuttles which have traveled in shuttle-races of peculiar form or character around one or the other of the pins; but in my loom there is concentric with the center head a rotary weft-carrier, which supports the spools of weft-thread, and also two looper-arms through which the weft-threads are conducted from the spools, and which serve, by an entire revolution, to loop these threads one into the other and around the pin which is at that time projected. The looper-arms, which have thread-eyes in them, cannot, of course, carry the weft-threads around the warp, but they serve to carry them against the warps, and I employ shuttle-carriers at the two warps of the loom, each of which has a shuttle carrying a locking-thread, and which by their proper motion serve to loop the locking-threads around the last weft-threads and to draw said weft-threads into the warps, where they are locked by the changing of the warps. I employ at opposite sides or warps of the loom shuttle-carriers which work alternately upward and downward through the warps, and which are carried by levers or pivoted arms, and these levers or pivoted arms are connected with opposite ends of other levers, which in turn are operated by a rocker and crank-shaft, so that shuttle-carriers at opposite edges of the loom or at opposite warps are simultaneously thrust downward through one warp to loop a locking-thread around one weft-thread and upward through the other warp to loop a locking-thread upward around the other weft-thread.

Having thus briefly referred to the principal parts of my invention, I follow with a detailed description thereof, referring to the accompanying drawings; and the invention consists in novel combinations of parts, hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of a loom embodying my invention. Fig. 2 is a partly-sectional view of one of the shuttle-carriers, its supporting-arm, and its contained shuttle. Fig. 3 is a plan of the loom. Fig. 4 is a longitudinal section of certain parts thereof, illustrating the center head, its reciprocating pins, and portions of the weft-carrier. Fig. 5 is a diagram of certain of these parts, illustrating the shed or warp as divided for receiving through it the shuttle-carriers. Fig. 6 is a similar diagram, showing the warp as shifted to permit the full rotation of the looper-arms. Fig. 7 represents an end view of the loom near the delivery side thereof, portions of certain shafts being shown in transverse section. Fig. 8 is an end view of the mechanism for operating the weft-carrier and the reciprocating pins around which the weft-threads are looped, and Fig. 9 represents one of the sections of harness whereby one-half of one of the warps is carried.

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

In making up each warp there are employed a certain number of caudle-warps or large cords, and also smaller cords or ordinary warps.

I have here represented the loom as adopted for forming each warp of two caudle-warps and four ordinary warp-cords.

A A designate two drums at each side of the machine, from which two caudle-warps are taken, and A′ A′ designate two other drums, also at each side of the machine, from which the ordinary warps are taken. A caudle warp may be taken from each of the drums A A, and two ordinary warps are taken from each drum A′.

Connected with each of the drums A A′, I have represented a brake-wheel, $a$, from which may pass a brake cord or strap, $a'$, suitably weighted, and I have shown the four drums A upon one shaft, $A^2$, while the drums A′ are upon a second shaft, $A^3$. The several threads forming each warp are conducted through or between pins $a^2$, adjacent to their drums, and are thence carried through the sections of harness. I have here represented two sections of harness for each warp, each arranged in a fork, B, as is best shown in detail in Fig. 9, and from the sections of harness the warps pass through lays C, and are thence conducted to take-up drums D, which are upon a shaft D′.

I will first describe the mechanism for operating the harness-sections which are in forks B and for operating the lays C or beaters at opposite sides of the loom.

E designates the main cam-shaft of the loom, which is operated by wheels $o'$ $o^2$ from a main shaft, G, provided with fast and loose pulleys $e$ $e'$ and a fly-wheel, $e^2$. The shaft E is provided with a slotted crank-arm, $e^3$, and with a cam, E′. The lays C are each upon an upright shaft, C′, provided with a slotted arm, $c$, connected by a rod, $c'$, with the end of the lever $c^2$, pivoted at $c^3$. One end of this lever is also connected by a rod, $C^2$, with the upper end of a lever, $C^3$, fulcrumed at $c^4$, and having a truck-roller, $e^5$, which bears against the cam E′, and a spring, $e^6$, for drawing it toward said cam. It will be understood, therefore, that the combined action of the cam E′, the spring $e^6$, and the lever $C^3$ upon the lever $c^2$ will cause it to oscillate on its center or pivot $c^3$, and will simultaneously operate the rock-shafts C′ and the lays C in the same direction.

The forks B, which control the sections of warp-harness, are upon the upper ends of levers B′, which are connected in pairs by springs $b$, so as to insure the simultaneous operation of the harness-sections which are on opposite sides of the loom.

F designates a shaft which extends lengthwise of the loom and carries cams F′, of S-shaped form, which act upon truck-rollers $b'$ on the levers B′ and serve to operate the forks B, carrying the sections of harness. The cams F′ are upon a shaft, F, which is mounted in the frame S of the machine, and this shaft carries a sector, $F^3$, which is operated by a rod, $f$, extending from the crank-arm $e^3$. Consequently it will be seen that as the shaft E is rotated, the shaft F will receive a rocking motion through a substantial part of a rotation.

Near the upper part of the machine I have represented a center head, $f'$, which is upon an inner shaft, $f^2$, as shown in Fig. 4, and this shaft $f^2$ is prevented from turning by an arm, $f^4$, which is secured to a portion, S, of the framing of the machine. About the shaft $f^2$ is a sleeve, $f^3$, which is fitted in bearings $s$ in the main framing S, and which has upon it a pinion, $g$, engaging the sector $F^3$, by which the sleeve $f^3$ is rotated in one or other direction, while the head $f'$ remains stationary. From the head $f'$ are alternately projected and retracted two pins or rods, $g'$, which extend entirely through the shaft $f^2$ and are connected to a rocker, $g^2$, upon the farther end of the shaft. With the rocker $g^2$ engages a pivoted lever, $g^3$, on the opposite end of which acts a cam, $g^4$, formed upon the end of the shaft F, and by this mechanism the pins $g'$ are alternately projected from and sheathed within the head $f'$. Upon the sleeve $f^3$ are arms $f^5$, which extend in diametrically-opposite directions, and are bent slightly forward at their outer extremities, as shown best in Fig. 1, and at such outer extremities are provided with thread-eyes. From these arms $f^5$ extend supplemental arms $f^6$, which carry the spools, $f^7$, of weft-thread, and from these spools $f^7$ the weft thread is drawn off the ends and conducted through tubes $f^8$, attached to the arms $f^5$, and thence to thread guides or eyes $f^9$ at the ends of said arm. By the operation of the sector $F^3$, which is rocked alternately in opposite directions, the sleeve $f^3$ and its weft-carrier arms and looper-arms are rotated a complete revolution substantially and alternately in opposite directions.

In Fig. 8 I have shown clearly a peculiar construction of the pinion $g$ and the sector $F^3$, whereby the weft-carrier is operated. The pinion has upon it a shoe or projection, $g^5$, which constitutes in effect a lock, and the sector $F^3$ has a locking-surface, $g^6$, of smaller radius than the sector, and against which the concave face of the lock or stop shoe $g^5$ may come to a positive and extensive bearing. The sector is also provided at the ends of its toothed portion with notches $g^7$, and as the rotary motion of the sector operates the pinion $g$ its shoe or lock projection $g^5$ finally comes to a bearing upon the locking-surface $g^6$ and stops these parts in accurate position, and the notches $g^7$ upon the sector and at the ends of the locking-surface $g^6$ receive the ends of the lock or stop shoe $g^5$ as the rotary motion terminates and permits said shoe to come to a solid bearing upon the locking-surface $g^6$.

At opposite warps or sides of the loom are arranged upper and lower shuttle-carriers H, which are upon levers H′, pivoted at $h$, to operate by rods $h'$, connected with their rear arms.

$H^2$ designates other levers fulcrumed upon the shaft $h^2$ and extending crosswise of the looms, and with each lever $H^2$ are connected the rods $h'$, which operate the lever H′ and shuttle-carrier H, pertaining to the top of

the warp on one side of the loom and to the bottom of the warp on the other side of the loom; hence it will be understood that as one shuttle-carrier H at one side of the loom is thrust downward through the warp another shuttle carrier H at the opposite side of the loom will in exact time therewith be thrust upward through the warp.

The shaft $h^2$, on which the levers $H^2$ are loosely pivoted, has an arm, $h^3$, connected by a rod $h^4$, with a crank-arm, $h^5$, upon the shaft E, and it will be understood that as the shaft E is rotated a rocking motion will, through the rod $h^4$, be transmitted to the shaft $h^2$. This does not affect the levers $H^2$ directly, as they are loose upon the shaft $h^2$, and are drawn in one direction by springs $h^6$; but fast upon the shaft $h^2$ are segmental slotted rockers $h^7$, which have in them adjustable pins $h^8$, and as said rockers are moved by the working of the shaft their pins $h^8$ act upon the levers and operate them until they are arrested by stops $h^9$, as shown in Fig. 7.

The construction of the shuttle carrier H, which is secured upon the arm H′, is best shown in Fig. 2. The shuttle-carrier is forked, as there shown, and contains a shuttle, H*, in which is a bobbin, $h^*$, carrying a locking-thread. The opposite ends of this shuttle H* are oblique in substantially parallel planes, as shown at *o*, so that if the shuttle carrier is thrust downward over a thread the thread will pass between the exterior of the shuttle and one fork or arm of the carrier H in the direction of the arrow pointing upward in Fig. 2 and will pass from the shuttle-carrier between the the other wall of the shuttle and the carrier H in the direction of the arrow pointing downward in Fig. 2; hence it will be seen that by one reciprocating movement of this shuttle-carrier H a locking-thread which is upon a bobbin in the shuttle H* will be looped around a thread upward and downward on which the shuttle-carrier works.

As before stated, the main driving-shaft G of the machine, which carries the fast and loose pulleys *e e′* and the fly-wheel $e^2$, is geared with a cam shaft, E, by a pinion, *o′*, and a wheel, $o^2$, and said main shaft carries at its end a bevel-wheel, *i*, which engages with a corresponding wheel, *i′*, upon a short cross-shaft, $i^2$. This cross-shaft $i^2$ has upon it a worm, $i^3$, gearing into a worm or spur wheel, $i^4$, and through pinions $i^5$ this worm or spur wheel $i^4$ transmits motion to a spur-wheel, $i^6$, which in turn transmits motion to a pinion, $i^7$, upon a longitudinal shaft I. This longitudinal shaft I has upon it a worm, *d*, which, through a worm-wheel *d′*, transmits motion to the take-up shaft D′. The two pinions $i^5$, which rotate upon a common axis and as one, are supported by a swinging arm, I′, and that arm is pivoted at $i^8$ and is supported near its opposite ends by a clamping-bolt, $i^9$. The arm I′ has slots $i^{10}$ $i^{11}$, which afford provision for changing the pinions $i^5$ for others larger or smaller, and thus varying the speed of the take-up.

The operation of my machine will now be described, reference being particularly had to the diagrams, Figs. 5 and 6. One of the pins *g′* being protected beyond the head *f′*, and the one end of the weft-threads from the spools $f^7$ being understood to be fastened in the warps, and the warps having been opened to the position shown in Fig. 5, the sector $F^3$ is operated to rotate the sleeve $f^3$, and thus cause the looper arms $f^5$ to make a substantially complete revolution and carry the weft-threads around the pin *g′* which is projected. By this operation of the looper-arms the weft-threads which extend inward from opposite warps are looped around the same pin *g′*, and by this operation are looped one into the other, and the looper-arms come to the position shown in Fig. 5, placing the weft-threads one upon the uppermost and the other upon the lowermost warp-threads. The shuttle-carriers H then advance, that on one side of the machine downward over the top weft and into the warp and that on the opposite side of the machine upward over the bottom weft and into the warp, and by the advance and recession of these shuttle-carriers the locking-threads which they carry are looped around the last weft-threads on opposite sides of the loom and draw these weft-threads into the warps. The warps now make their change, those warps which are nearest being carried outward first to leave a clear path for the rotation of the looper-arms $f^5$, as shown in Fig. 6. The looper-arms make a new revolution to loop the weft-threads around the other pin *g′*, which was before sheathed, and by the time they complete their revolution the warps which were before outermost have been brought inward, and the entire mechanism resumes the position shown in Fig. 5. In the meantime the lays C or beaters are operated by other suitable mechanism, before described, and the take-up mechanism also operates.

From the above description it will be understood that the simple rotary weft-carrier, with its weft-spools and looper-arms, and the shuttle-carriers at the warps of the loom which loop the locking-threads around the last weft-thread constitute important elements of my invention, and it is believed that such a combination of parts has never been used in a loom for weaving harness or for any other purpose.

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

1. The combination, with the warp-carriers, harness, and the beaters or lays at opposite sides of the loom, of a centrally-arranged weft-carrier and rotary looper-arms, a pin around which the weft-threads from their spools or bobbins are carried and looped one into the other, shuttles carrying locking-threads at each side of the loom, and shuttle-carriers by which said locking-thread shuttles are ad-

vanced into the open shed, looped over the last weft-thread, and then withdrawn to pull the weft-thread into the shed, and mechanism, substantially as described, for operating the harness, the beaters or lays, the weft-carrier and its looper-arms, and the shuttle-carriers, substantially as herein set forth.

2. The combination, with the warp-carriers, harness, and beaters or lays at opposite sides of the loom, of a centrally-arranged rotary shaft carrying the weft-spools and looper-arms, a central head and pins protruding therefrom, around which the weft-threads are alternately looped one into the other, a rocker and a cam and cam-actuated lever for alternately withdrawing and projecting the pins, a pinion and sector through which the shaft is operated, and a crank and connecting-rod for rocking the sector, shuttle-carriers at the opposite warps, each having a shuttle adapted to carry a thread for looping around the weft-threads and drawing them into the warps, and mechanism, substantially as described, for operating the harness, the lays, the said crank, and the shuttle-carriers, substantially as herein set forth.

3. The combination, with the warp carriers, the harness, and the lays at opposite sides of the loom, of the shaft with its looper-arms and weft-spool spindles, the pinion $g$, having a locking shoe or block, $g^5$, projecting beyond its periphery, and the sector $F^3$, having the locking-surface terminating in the notches $g^7$, the central head and its alternately-presented pins $g'$, the shuttle-carriers at opposite warps, each having a shuttle adapted to carry a locking-thread for looping around the weft-threads and drawing them into the warps, and mechanism, substantially as described, for operating the harness, the lays, the said sector, the pins, and the shuttle carriers, substantially as herein set forth.

4. The combination, with the warp carriers, the harness, and the lays at opposite sides of the loom, of a center head and its alternately-presented pins, a rotary weft-carrier and looper-arms provided with tubes through which the weft-threads are conducted to their guides at the ends of the arms, shuttle-carriers at the warps, each containing a shuttle adapted to carrying a locking-thread for looping around the weft-threads and drawing them into the warps, and mechanism, substantially as described, for operating the harness, the lays, the reciprocating pins, the weft-carrier and looper arms, and the shuttle-carriers, substantially as herein set forth.

5. The combination, with the warp-carriers, the harness, and the lays at opposite sides of the loom, of a center head and its alternately-presented pins, a rotary weft-carrier and looper-arms, shuttle-carriers at the warps, each containing a shuttle adapted to carry a locking-thread for looping around the weft-threads and drawing them into the warps, levers at opposite ends of which the shuttle-carriers are placed, each lever connected, as described, with shuttle carriers which enter the two warps in opposite directions, rockers and a rock-shaft for operating said levers, and mechanism, substantially as described, for operating the harness, the lays, the pins, the weft-carrier, and the said rock-shaft, substantially as herein set forth.

6. The combination, with the warp-carriers, the harness, and the lays at opposite sides of the loom, of a center head and its alternately-presented pins, a rotary weft-carrier and looper-arms, shuttle-carriers at the warps, each consisting of a fork and each containing a shuttle having its opposite ends oblique in substantially parallel planes, and mechanism, substantially as described, for operating the harness, the lays, the reciprocating pins, the weft-carrier, the looper-arms, and the shuttle-carriers, substantially as herein set forth.

In testimony that I claim the foregoing I have hereunto set my hand in the presence of two subscribing witnesses.

FRED ECKERMANN.

Witnesses:

FREDK. HAYNES,

EMIL HERTER.