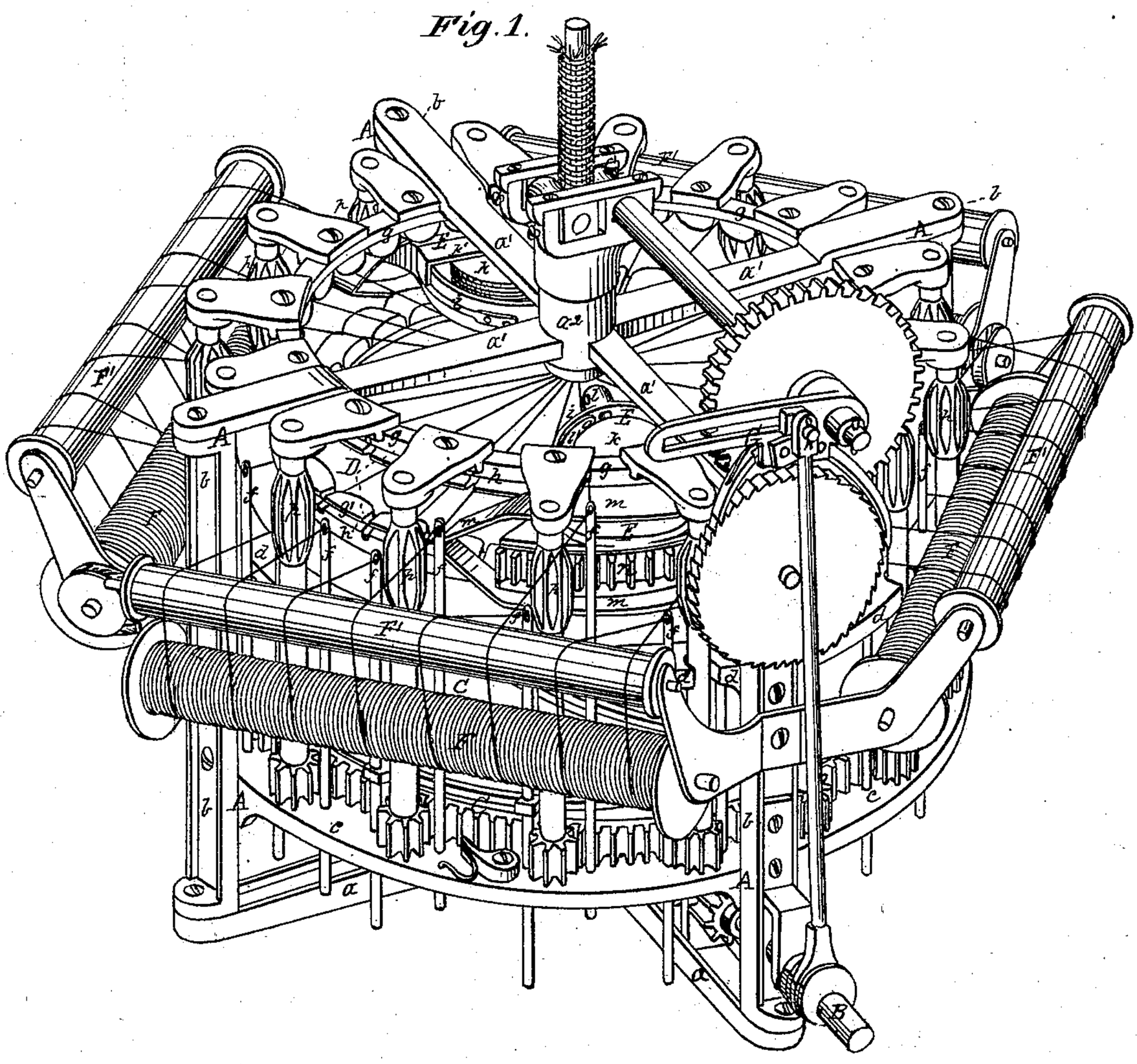
2 Sheets—Sheet 1.

H. MORRIS:
Circular-Loom.

No. 203,183. **Patented April 30, 1878.**

Fig. 1.



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2 Sheets—Sheet 2.

H. MORRIS.

Circular-Loom.

No. 203,183. *Fig. 2.* Patented April 30, 1878.

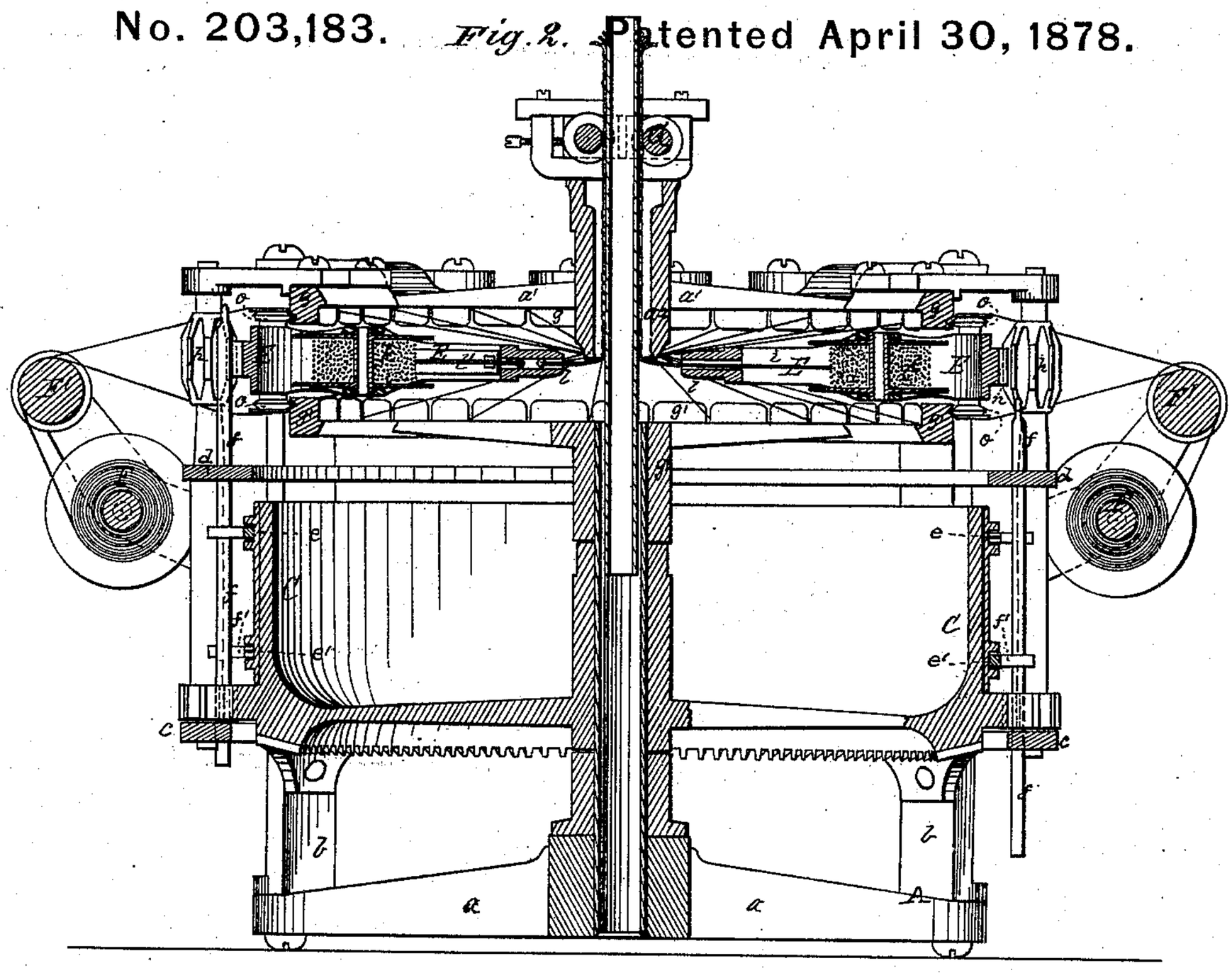


Fig. 3.

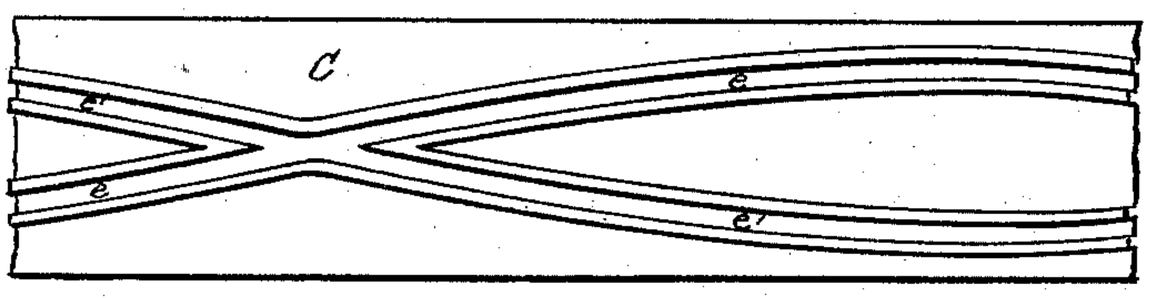


Fig. 4.

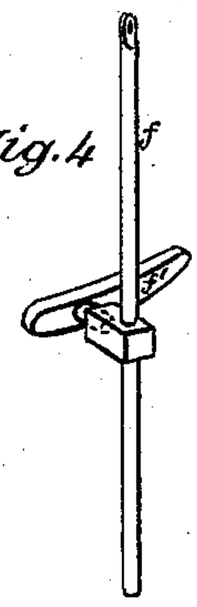


Fig. 5.

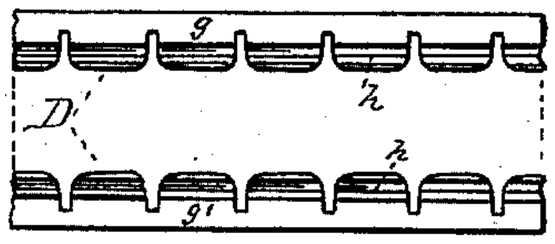
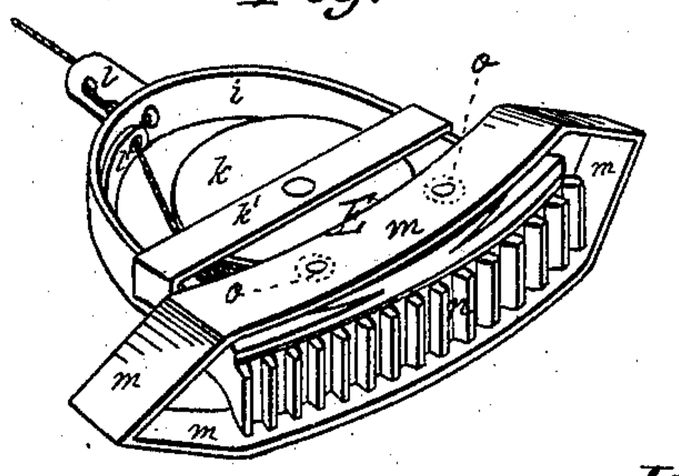


Fig. 6.



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UNITED STATES PATENT OFFICE.

HENRY MORRIS, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR OF ONE-HALF HIS RIGHT TO THOMAS L. REED, OF SAME PLACE.

IMPROVEMENT IN CIRCULAR LOOMS.

Specification forming part of Letters Patent No. **203,183,** dated April 30, 1878; application filed May 8, 1876.

To all whom it may concern:

Be it known that I, HENRY MORRIS, of the city and county of Providence, in the State of Rhode Island, have invented certain new and useful Improvements in Circular Looms for Weaving Tubular Fabrics; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part thereof, is a clear, true, and complete description thereof.

The object of my invention is the economical and rapid production of a woven seamless hose, or other closely-woven tubular fabric.

My invention consists, partially, in the combination of a cam-ring; a series of warp-carriers, which are alternately raised and lowered by the cam-ring; a set of warp-beams and warp-rollers, located outside of the cam-ring; one or more shuttles, which are continuously driven in one direction; a race for the shuttles, composed of upper and lower sections, which afford upper and lower bearings for the heel of each shuttle while delivering filling under a high tension; and a central hub, which receives the tubular fabric, and has its receiving end in the same plane with the shuttle-race and the tops of the warp-rollers.

My invention further consists in a circular shuttle-race, composed of upper and lower sections, having a groove in each extending around the race, in combination with a shuttle provided with friction-rollers in its heel, which occupy the grooves in the race-sections.

Referring to the drawings, of which two sheets are presented, Figure 1, Sheet 1, represents one of my looms in perspective. Fig. 2, Sheet 2, represents the same in central vertical section. Fig. 3 represents, in plan, a portion of the cam-ring which operates the shed-forming devices. Fig. 4 represents a warp-carrier detached from the loom. Fig. 5 represents, in side view, a portion of the shuttle race. Fig. 6 represents one of the shuttles detached.

A denotes the frame of the machine. It is composed of a four-armed base, *a*, on the ends of which are four uprights, *b*, which are united at the top by four arms, a^1, which unite with a hollow central hub, a^2. At a short distance above the base is a ring-plate, *c*, secured to the uprights *b;* and midway between said ring *c* and the tops of the uprights, and secured thereto, is another ring-plate, *d*. These parts constitute the main portion of the frame.

B denotes the main shaft, to which power is applied. It has bearings in one of the uprights, and in a standard mounted on one of the arms of the base. It is geared directly with the cam-ring C at its under side. The cam-ring is mounted on a hollow vertical central spindle. On the outer periphery of the cam-ring are two cam races or grooves, at *e* and e^1, which cross each other at intervals, in a manner well known. This ring controls and operates the vertically-reciprocating warp-carriers *f*, which are guided by holes fitted to receive them in the ring-plates *c* and *d*. The upper ends of the warp-carriers *f* are provided with thread-eyes, arranged to obviate undue friction with the warp. Each carrier *f* has a lug at *f'*, which occupies a groove, *e* or *e'*, in the cam-ring, and each lug is swiveled to the carrier so that about two-thirds of its length is on one side of the carrier, and one-third on the opposite side, in a manner well known, in order that when the junctions of the cam-ring grooves arrive at a lug it will surely remain in its proper groove, and properly pass the point of junction.

D denotes a stationary sectional shuttle-race. It is composed of two distinct members or sections, constituting its upper and lower sides. The upper side, at *g*, is supported horizontally by the four arms a^1 of the top of the frame. The lower side *g'* is in the form of a wheel with spokes and hub, and is supported at its hub on the vertical hollow spindle around which the cam-ring revolves. Each section of the shuttle-race has a vertical flange. The flange of the lower section projects upward, and the flange of the upper section projects downward. Opposite each warp-carrier there is a radial slot in each section of the shuttle-race, for the reception of the warp-threads during the passage of the shuttle. Each side of the race has also, at its periphery, an annular V-shaped groove, as at *h*, for the reception of friction-pulleys on the shuttle, hereinafter to be described.

E denotes one of two or more shuttles.

(Shown at Fig. 6.) The frame *i* of the shuttle is semicircular in form, and has a central space for the reception of a large horizontal bobbin, *k*, having a vertical axis, the lower end of which has bearing in a stationary cross-bar, while the upper axis has bearing in the detachable cross-bar *k'*, so arranged that the bobbin may be readily put in or taken from the shuttle. At the point of the shuttle is a delivery-tube, *l*, and tension-spring *l'*, inside the shuttle, through an eye in which the thread is drawn from the bobbin, thence laterally through an eye in the tube, thence inward through another eye, out of the center of the tube, to its proper position in the shed.

The heel of the shuttle is provided with a clearing-plate, *m*, which occupies the upper and lower sides of the heel, and presents a pointed projection at each end. It is also provided with a horizontal segmental rack-gear, *n*. The shuttle is also, at its heel, provided with four friction-pulleys, *o*, on vertical axes. Two of these pulleys enter and occupy each of the upper and lower annular V-shaped grooves *h* in the outside of the shuttle-race, before referred to. The shuttle is driven by numerous pinions, *p*, mounted on vertical spindles located at short intervals around the loom, and geared at their lower ends to a large gear on the periphery of the cam-wheel. The pinions *p*, at their upper and lower ends, are elongated and tapered, so that the warp-threads can by no possibility engage therewith during the movement of the yarn-carriers. The segmental rack *n* has a length sufficient to enable three of the pinions *p* to engage with it at one time, so that at all times two of said pinions will be engaged therewith, and keep the shuttle at all times in proper relation with its race.

F denotes one of four warp-beams, mounted in suitable standards projecting from the uprights of the frame, and provided with suitable tension let-off devices and a warp-roller, as at F'. These warp-rollers are sometimes termed "whip-rolls," and they may be provided with axes, so that they may revolve; or they may be stationary, as their main function is to elevate the warp to a proper height, and to maintain it at all times in the same position regardless of the quantity of warp on the beams. Each of these warp-beams carries one-fourth of the threads requisite for producing the desired fabric. They are laid on the beam in such a manner that each thread will be evenly delivered. The hollow central hub a^2, at the top of the loom, constitutes a foundation for the rolls of the take-up mechanism G, which is operated from the main shaft, as shown. This take-up constitutes no portion of my invention. Any other suitable take-up may be employed in this connection.

The fabric is woven around an arbor located within the hub a^2. The lower end of this hub is located in the same horizontal plane with the upper sides of the warp-rolls F', and in a plane midway between the planes of the upper and lower sides of the shuttle-race.

In some cases the woven fabric is delivered to the take-up above, and sometimes below, the loom. The end of the hub which receives the fabric will be the receiving end, whether it be the lower end of the hub or tube, as shown, or the upper end in a loom which has the take-up located below the loom.

A spring-pawl is mounted on the ring-plate *c*, and arranged to engage with the gear on the cam-ring, for preventing any backward movement thereof.

It is obvious that woven hose should be closely laid, so as to render the fabric as solid as possible. To do this on a circular loom it is essential that the filling-threads be delivered from the shuttle at a maximum of tension consistent with the tensile strength of the thread. By means of a tension-spring, *l'*, and the two or more thread-eyes in the tube *l*, I attain any desired tension. The filling being of great strength, there is also a heavy strain on the shuttle in the line of the filling toward the center of the loom. This strain is well provided for by the friction-pulleys on the shuttle, which occupy the V-shaped grooves in the shuttle-race. By having the shuttle at all times engaged with at least two of its driving-pinions, it is held firmly to its race and smoothly driven. By having the fabric-receiving end of the central hub in the same plane as the tops of the warp-rollers F', and having the yarn-carriers extend in their movements alternately equally above and below said plane, and having the filling delivered with great tension directly into the V of the shed, the filling and warp are brought into favorable relations for making a close-woven fabric, and each lay of the filling serves to tighten up the warp upon the last preceding lay.

In order that the fabric be closely woven, it is essential that the warp-threads be at their full tension at the point where the filling is being delivered, and this is effected by the vertically-reciprocating warp-carriers, (operating as heddles,) which at that moment are alternately at their respective highest and lowest points.

The carriers draw upon the warp of each beam with absolute uniformity, because the warp is regularly beamed, and because the carriers extend in their movement equally above and below the horizontal plane occupied by the tops of the warp-rollers and the bottom of the central hub, at which the shed closes.

It is also important, for the production of good woven hose, that the warp be continuous throughout its length with as few piecings as possible; and this I attain by having the warp on a large beam, which also lessens the labor of drawing in new ends, as is frequently the case when warp-bobbins are employed as heretofore. The filling should also be pieced as

seldom as is possible; therefore my shuttle-bobbins are constructed so as to carry a large quantity of thread or twine.

In weaving hose on a core I employ a fusible separator thereon, in accordance with the invention set forth in Letters Patent granted to Thomas L. Reed April 2, 1872, No. 125,331, whereby I am enabled to operate my loom with the warp and filling at the maximum tension, and at the same time to readily remove the tightly-woven hose from the core. When such a core is not desired, I employ a stationary arbor, with its upper end projecting a short distance above the lower end of the central hollow hub, and withdraw the hose flatly therefrom by having it wound upon a roll controlled by the take-up motion.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, in a circular loom for weaving tubular fabrics, of a cam-ring, a series of sliding warp-carriers alternately raised and lowered by the cam-ring, a set of warp-beams and warp-rollers outside of the cam-ring, one or more continuously-driven shuttles, a race for the shuttles composed of upper and lower sections, which afford bearings for the heel of the shuttle when delivering filling under high tension, and a central hub, having its fabric-receiving end in the same plane as the shuttle-race and the tops of the warp-rollers, substantially as and for the purposes specified.

2. The circular shuttle-race composed of upper and lower sections, having a groove in each extending around the race, in combination with a shuttle provided with friction-rollers in its heel, which occupy the grooves of the race, substantially as and for the purposes specified.

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