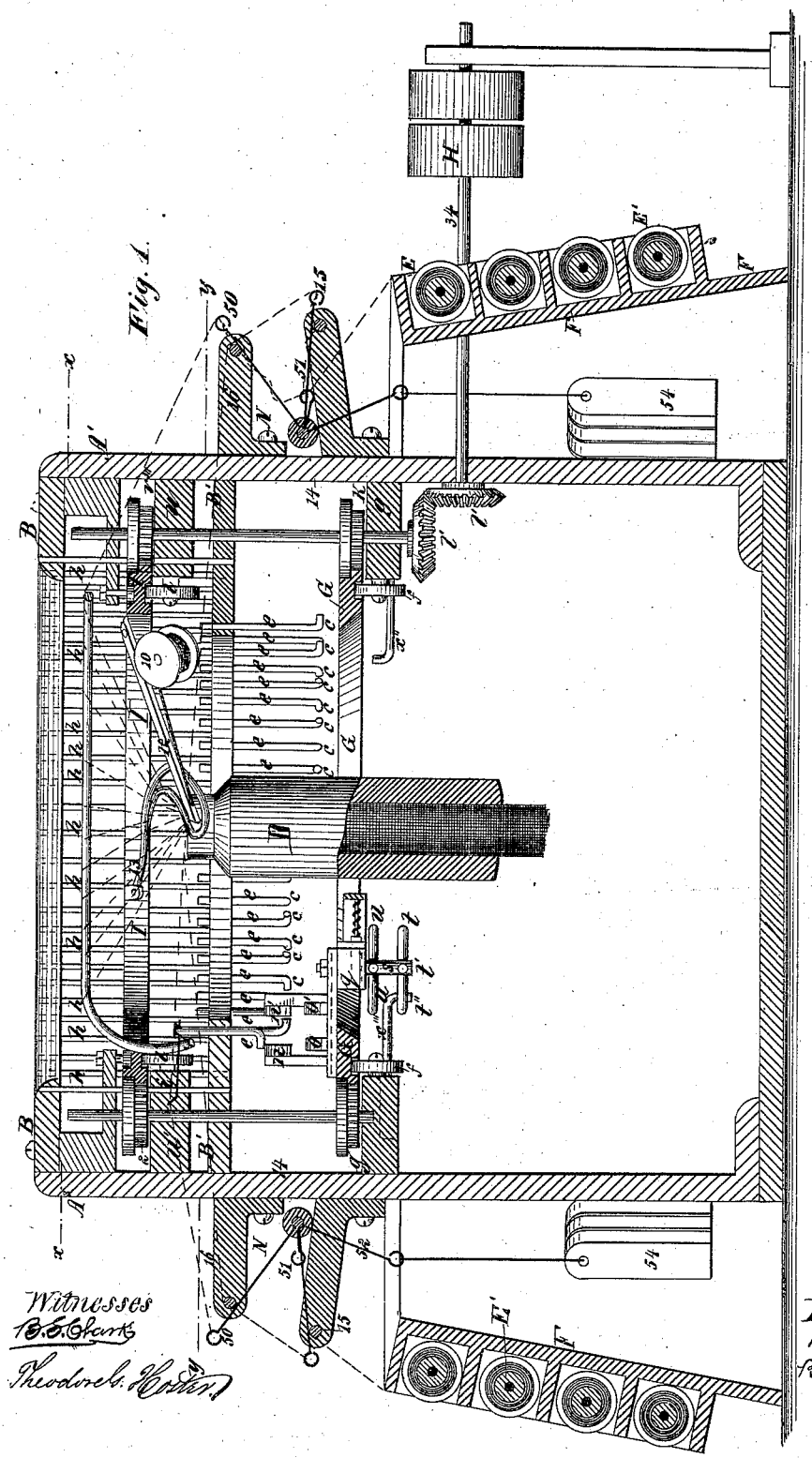
4 Sheets—Sheet 1.

B. L. STOWE.

CIRCULAR-LOOMS.

No. 194,740. Patented Aug. 28, 1877.

Fig. 1.



Witnesses
C. E. Clark
Theodore L. Hoskin

Inventor
Benjamin L. Stowe
by L. P. Hitch
his attorney

4 Sheets—Sheet 2.

B. L. STOWE.

CIRCULAR-LOOMS.

No. 194,740. Patented Aug. 28, 1877.

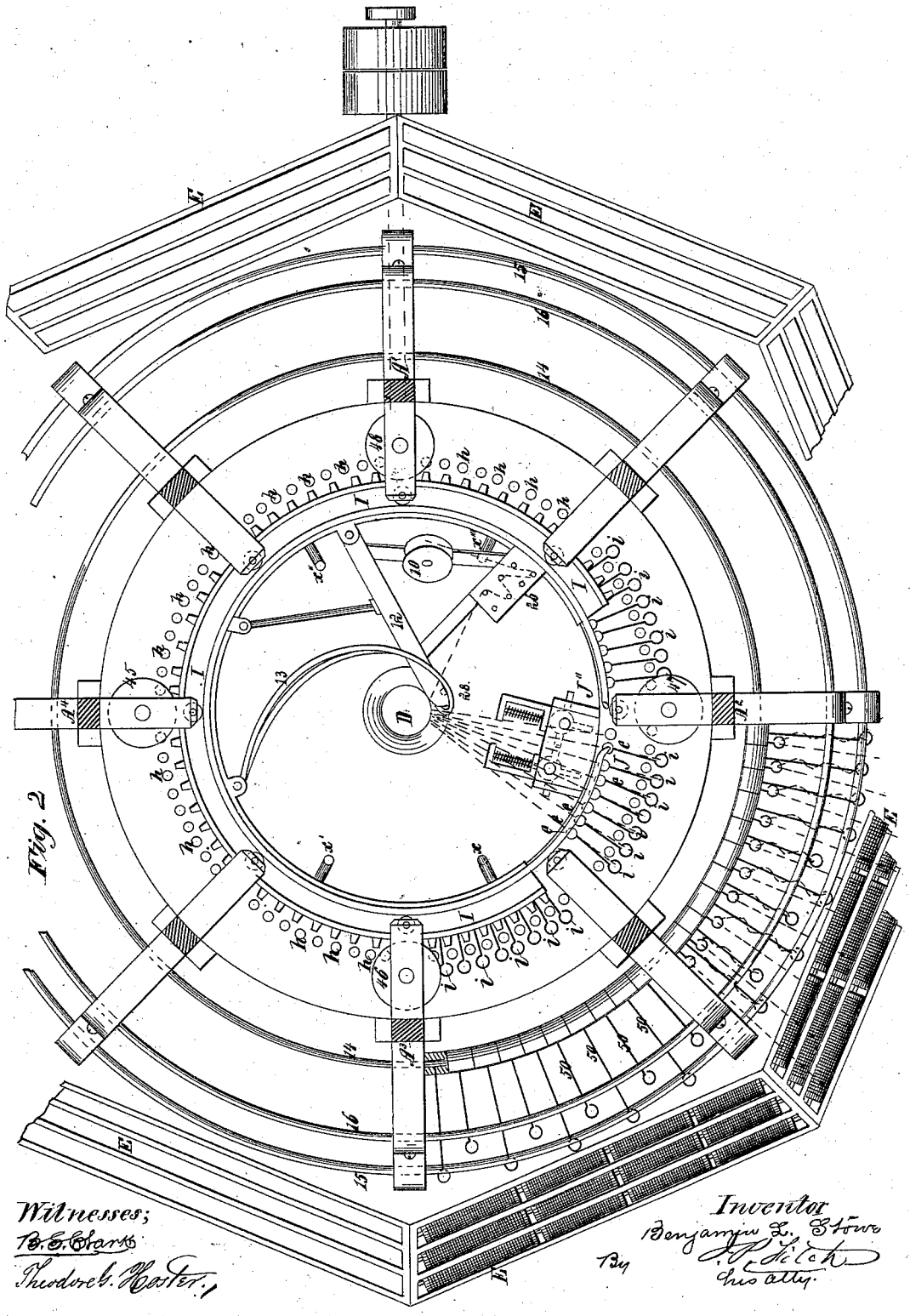


Fig. 2

Witnesses;
B. E. Harris
Theodore b. Baxter.

Inventor
Benjamin L. Stowe
By A. P. Hitch
his atty.

4 Sheets—Sheet 3.

B. L. STOWE.

CIRCULAR-LOOMS.

No. 194,740. Patented Aug. 28, 1877.

Fig. 3.

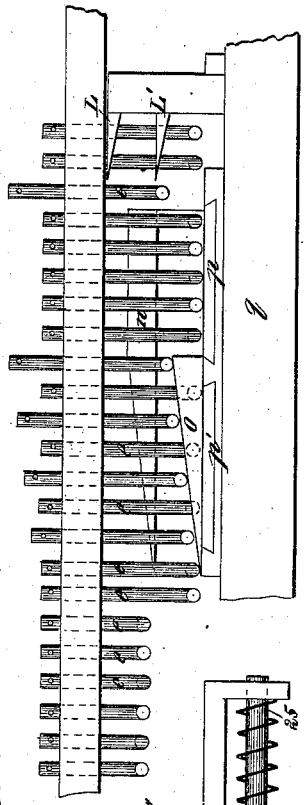


Fig. 5

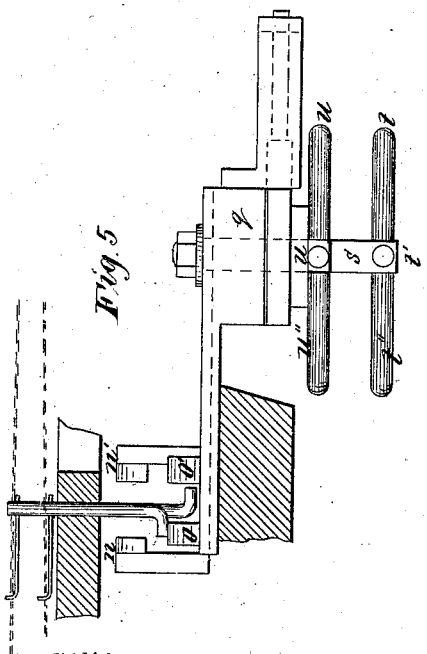
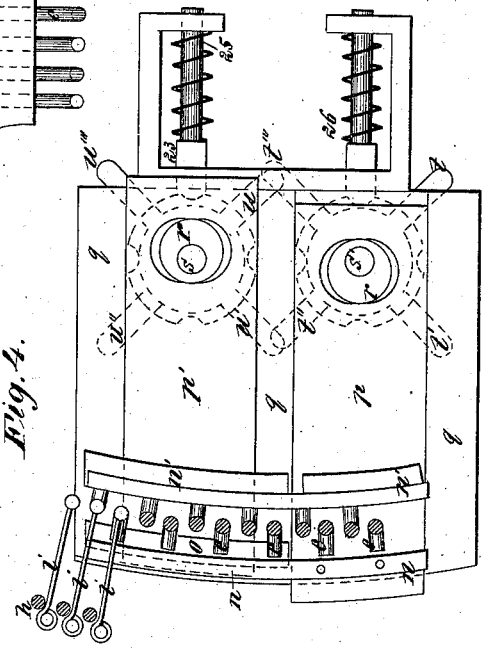


Fig. 4.



Witnesses;
B. S. Clarke
Theodore L. Foster.

Inventor
Benjamin L. Stowe
By J. P. Lilley
his attorney

4 Sheets—Sheet 4.

B. L. STOWE.

CIRCULAR-LOOMS.

No. 194,740. Patented Aug. 28, 1877.

Fig. 7.

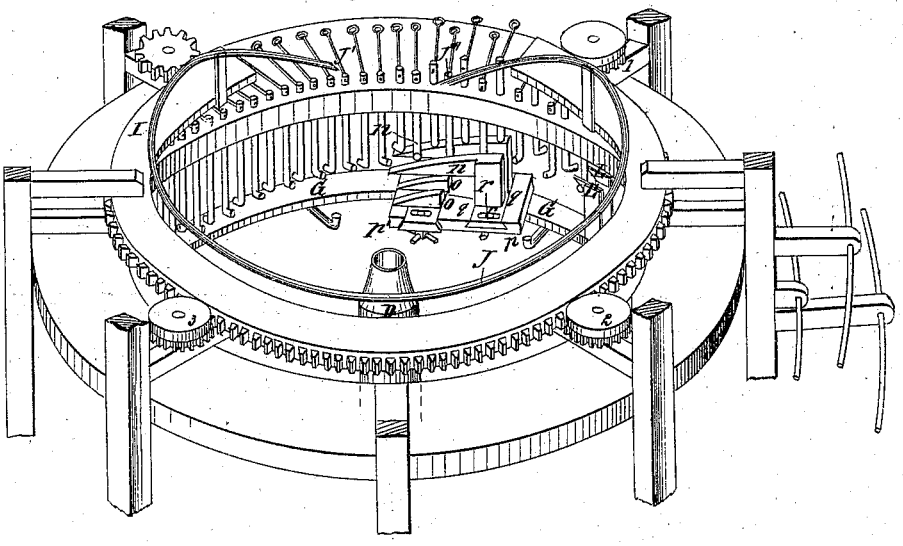
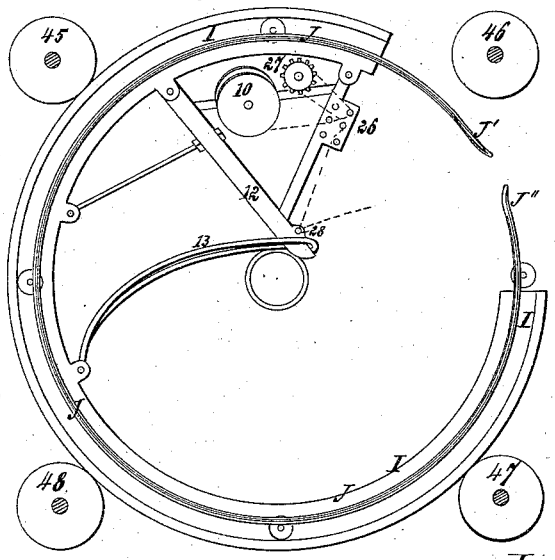


Fig. 8.



Witnesses;
B. S. Clark
Theodore L. Wooster

Inventor
Benjamin L. Stowe
By H. P. Fitch
his atty.

UNITED STATES PATENT OFFICE.

BENJAMIN L. STOWE, OF NEW YORK, N. Y., ASSIGNOR TO JOHN VAN DUSSEN REED, OF SAME PLACE.

IMPROVEMENT IN CIRCULAR LOOMS.

Specification forming part of Letters Patent No. **194,740**, dated August 28, 1877; application filed August 15, 1877.

To all whom it may concern:

Be it known that I, BENJAMIN L. STOWE, of the city of New York, county and State of New York, am the inventor of certain Improvements in Looms for Weaving Fire-Hose and other Fabrics, of which the following is a specification, reference being had to accompanying drawings, forming part thereof.

My invention relates to looms for weaving fabric in the form of a hollow cylinder or tube, used principally for fire-hose; and consists of the devices and combinations hereinafter particularly described and claimed, whereby hose of any desired length may be woven.

Figure 1 is a vertical central section of a loom containing my invention. Fig. 2 is a plan of the same. Figs. 3, 4, and 5 are detailed views of several parts of the loom, Fig. 3 being a front view of a number of what I denominate "pick-ups." Fig. 4 is a top view or plan of the apparatus for operating the pick-ups. Fig. 5 is a vertical sectional view of the same. Fig. 6 is a perspective view of the portion of the loom in which are held and operated the pick-ups and the apparatus for operating them, being the top view presented by a section of the loom upon the dotted lines *x x*, Fig. 1; and Fig. 7 is a top face view of the segmental woof-carrier detached from the loom.

The working parts of my loom are mounted upon a circular frame, which is supported on suitable posts, preferably four in number, placed at equal distances apart. Two of these posts are shown in Fig. 1, and designated A^1 A^3, and an end view of the four is shown in Fig. 2, and designated A^1 A^2 A^3 A^4. Two cross-beams, crossing each other at the center, tie the posts together at the bottom. A section of one of these beams is shown in Fig. 1, and designated C. The body of the frame consists of two or more rings, fixed one over the other, and supported by said posts. Sections of these rings are shown in Fig. 1, and designated B and B′. In the center of the frame rises a hollow pillar or tube, D, which may rest upon the bars C at their crossing. The upper end of this hollow pillar is about on a level with the ring B′.

The object of this loom being to weave a fabric in the form of a tube (such as fire-hose) of indefinite or any desired length, the warp-threads of the web are delivered from spools, (each thread having preferably its own separate spool,) which are arranged around the loom and held in suitable racks. These spools and racks are seen in section in Fig. 1 and in plan in Fig. 2, the spools being designated by the letter E and the racks by the letter F. These warp-threads run off from the spools upon and across the upper surface of the ring B′, and all converge to and around the open upper end of the tube D, and pass down into it, the said tube furnishing a support for the warp-threads at the point of weaving, and by its size or diameter, in conjunction with the shuttle-arm and beater, determining the diameter of the woven tube or hose. The weaving operation takes place around the rim of this tube.

The letter *e* represents what may be called "pick-ups," consisting of a series of small rods or pins fitted to slide up and down in holes in the ring B′. The series extends around the entire circle, there being one for each thread or strand of the web. The holes in which these pick-ups work are near the inner edge of the plate B′, and in the upper end of each is fixed an arm, *i*, which extends outward at right angles, or nearly so, across the upper face of said ring, and on the outer end is a hook or bend, in which a warp-thread may lie. The lower ends of these pick-ups are bent, forming short arms *c*, at right angles to their bodies, the alternate arms being turned in opposite directions, one half inward and the other outward, for a purpose to be presently described. The letter *h* indicates a series of wires or bars fixed in and between the rings B and B′, the series extending around the entire circle of the loom, corresponding in number to the pick-ups. They are arranged preferably near the inner edges of the said rings B and B′, and the looped or bent ends of the arms *i* lie immediately between them, so that the warp-threads run between these wires, a single strand between each two of the wires, and lie in the bent ends of the arms *i*.

G is a revolving annulus or ring, provided with a groove in its under face, to run upon a

series of wheels or disks, *f*, secured to brackets or arms *g'*. It is provided with gear-teeth on its outer edge, which mesh into the teeth of the gear-wheel *k*, to which motion is communicated from the driving-pulley H through the beveled gears *l l*. By these means the ring G is rotated, running upon the wheels or disks *f*, which fit into the annular groove before mentioned. Upon this annulus or ring are mounted inclined planes or cams *n n' o o'*, which, as the annulus or ring G is rotated, operate to throw up the pick-ups *e* one after another around the circle.

One half of these pick-ups upon one side of the loom are somewhat shorter than the other half on the opposite side, as seen in Fig. 1, for a purpose to be presently more fully described. Then there are two pairs of the cams or inclined planes, one pair, *n n'*, being of sufficient elevation to operate the shorter pick-ups, the other pair, *o o'*, of less elevation, to operate the longer pick-ups. Each pair is fixed upon a movable plate, the pair *n n'* on the plate *p*, the pair *o o'* on the plate *p'*, Fig. 4. One of the cams of each pair is intended to operate upon every alternate pick-up around one-half of the circle—that is to say, the cam *n* is to operate upon all the short pick-ups the lower ends of which turn outward, and the cam *n'* on all the short pick-ups whose lower ends turn inward. Then the cam *o* is to operate on the long pick-ups whose ends turn outward, and the cam *o'* on those whose ends turn inward. The two cams of each pair are arranged side by side, parallel to each other, and just far enough apart, so that, when one is thrown under the bent ends of the pick-ups it is intended to operate upon, the other will be thrown out of range with its pick-ups, or the alternates. These cams, as we have said before, are fixed to the plates *p p'*, which are fitted to slide in ways in a bed-plate, *g'*, which is secured to the annulus or rotating ring G. During one revolution of this annulus or ring G the plates *p p'* are placed in position to bring one of each pair of the cams under the pick-ups whose ends turn inward; then, for the next revolution, the positions of the said plates are shifted to bring the other cams of the two pairs under the pick-ups whose ends turn outward.

This shifting of the position of the plates *p p'* is accomplished by the eccentrics *r r* fixed on shafts *s s*, and working in slotted openings in said plates. The shafts *s s'* pass through the bed-plate *g*, and in the lower end of each are fixed four arms, *t t' t'' t''' u u' u'' u'''*. Suitable stops *x x' x'' x'''* are fixed to the frame of the loom at points where the said arms in their revolution with the annulus G will come in contact with them, and in passing give a quarter-revolution to the shafts *s s'* and eccentrics *r r'*. Two of these stops will be encountered by the arms at each revolution of the ring G, and thus at each revolution a half-revolution will be given to the said eccentrics, and such shifting of each of the plates *p p'* takes place during that half of their revolution, respectively, around the circle when they are not operating on the pick-ups—that is to say, the plate *p'* is shifted while it, with its cams *o o'*, is passing through that half of the circle in which are placed the short pick-ups, and the plate *p* is shifted while it, with the cams *n n'*, is passing through that half of the circle in which are placed the long pick-ups. Thus the shifting takes place when the cams are freed from contact with the pick-ups. As will be understood, the said stops are so arranged and placed as to accomplish this result.

I is what may be denominated the "woof-carrier and warp-separator." It consists of an annulus (resembling the ring G) with a small segment cut out. It is also provided with a groove on its lower face, and rests and runs upon small wheels *v v'* revolving on axes fixed to brackets or arms *w w'* on the frame of the loom. It is also provided with gear-teeth on its outer edge, meshing into a gear-pinion, *v'''*, on the same shaft with the gear *k*.

Arranged around the loom are three other similar shafts and gear-wheels, 1 2 3, Fig. 7, the three lower gear-wheels receiving motion from the annulus or ring G, and thereby motion being communicated to the upper gear on said shaft, and thence to the carrier. Upon each of these shafts, immediately above each of the gear-wheels, is a plane disk or wheel, represented in Fig. 7 by the circles around the gear *v''' 1 2 3*, and designated 45, 46, 47, and 48 in Figs. 2 and 7. These disks extend over the upper ends of the gear-teeth on the ring G and segment I, with their peripheries against shoulders on the said plate and segment. They serve to hold the plate and segment in position concentric to the axial center of the hollow post D, and to prevent the gears being too deeply engaged. Upon this carrier is mounted the spool 10, which carries the woof-thread. It also carries the shuttle-arm 12, the woof-thread, and a suitable tension device, the woof-thread being delivered from the spool 10 into the web at the end of the shuttle-arm, this shuttle-arm consisting of a strong bar attached to the carrier I, and braced, as shown in Fig. 7, having a hole in its inner end, through which the woof-thread passes into the web. To this carrier is also attached the separator 13, which is an arm formed of an iron or steel rod attached to the carrier, extending inward to the rim of the upper end of the hollow post D, and looped, as shown in Figs. 1, 2, and 7, so as to pass between the upper and lower threads of the web-shed and separate them just around the rim of said hollow post, to give free opportunity for the delivery and forcing into the web of the woof-thread.

The inner end of arm 12 works between the branches of the looped end of the separator,

as seen in Fig. 7, and a pin, 28, in the said arm keeps the inner end of the separator in its proper position.

J is a thread lifter or guard, consisting of a curved metal rod, fixed upon the carrier I above the upper surface, its forward end J′ being inclined downward, and extending to just a little above the upper surface B′, and over the pick-up cams *o o′ n n′*, by which arrangement such warp-threads, as they are carried up one after another by the pick-ups, will slide up the incline J′ and along the guard J until they drop off from it at its opposite end J″, which is also inclined downward to permit them to do so. The arm 12 is made to also act, in connection with the separator, as a packer, to force the woof-thread into the web, or, as it is termed, to "beat up" the web.

L L′ are two reverse cams or inclines, whose office is to draw down the pick-ups if, when passing off from the cams *o n*, they should chance not to drop down by their own weight. (Fig. 6.)

A series of tension devices is provided, there being one for each warp-strand. Each consists of a small hub, N, in which is fixed a wire or rod, 52, extending downward, to which is attached a weight, 54. Another wire, 50, having a loop at the outer end, extends from the hub at, or nearly at, right angles to the first. A third shorter wire, 51, looped at the outer end, is fixed in the hub midway between the two longer ones. The thread from the spool passes through the loop in the short wire, then is wound several times spirally around the upper wire, then passes through the loop at its end, and thence into the loom between the partition-wires *h*, to the tube D. By these means a yielding tension is given to the warp-threads, which will permit them to be carried up onto the guard J, and draw them tight again when dropped onto the plate B′. These hubs are strung onto a rod or wire, which surrounds the frame, and is held in arms or brackets attached to the posts of the frame.

There are three rods running around the loom, the center one, 14, supporting the tension-wires, the lower one, 15, furnishing a rest for the upper tension-arms, the upper one, 16, acting to regulate the yielding tension upon the warp-threads where they pass up onto the guard J, and the threads are separated by the separator 13, the operation being as follows: As the strands are raised by the pick-ups *e*, the guard J, and the separator 13, the tension device yields until the strain brings the upper wire or arm 50 in contact with the rod 16, where it is stopped, when, the strain being continued, the strand will be drawn off from the spool to the extent it is taken up into the web. Thus the tension device yields to a certain limit, that limit being the rod 16, when the yielding ceases, and then additional strain on the strand unwinds it from the spool.

The operation of this loom is as follows: The warp-threads being provided, wound on the spools E, and severally carried into the loom through the loops of the tension-wires 50, 51, and 52, between the wires *h*, and over the looped or bent ends of the arms *i*, all converging to and passing down over the circular rim of the upper open end of the hollow post D, down through the same, and so on out of the loom, the woof-thread being provided on the spool 10, and passed through a hole in the inner end of the arm 12, ready to be wound into the web; then suppose that the plate *p* is pushed outward, so that the cam *n′* ranges under the short pick-ups whose bent ends turn inward, and the loom is set in motion. The carrier G being thereby started on its revolution, with the cam *n′* entering under the series of short pick-ups, those of this series whose ends turn inward will be raised up one after another, carrying up with them the arms on whose looped ends lie the warp-threads. The said threads, one after another, are thereby thrown up above the lower point of the inclined end J′ of the lifter or guard J, and as the said guard moves around they will slide up onto and along the said guard until they drop off at the opposite end. While the said cam *n′* is thus operating through one half of the circle upon short pick-ups whose ends turn inward, the cams on plate *p′* will be shifted or set in position by the eccentric *r′*, so that the cam *o′* will range under the long pick-ups whose ends turn inward through the other half of the circle, carrying up in like manner the warp-threads lying on the looped ends of the arms in such pick-ups onto the guard J. Thus a complete revolution of the carrier will have been made, and every alternate thread around the entire circle will have been thrown up onto the guard and held in that position while the said guard has been passing under it. While the said threads have been assuming this position the woof-thread has been delivered from the arm 12 (which has revolved with said carrier) into the angle between the upper and lower threads of the web, the same being carried in a circle just at the upper edge of the open end of the tube D, full opportunity to do so having been secured by the separator 13, which, attached to the carrier, has been carried between the sheds of warp, spreading them wide apart to allow the arm 12 to pass between them.

Now, while the cam *o′* has been operating upon the long pick-ups, the plate *p* has been shifted by its eccentric, so as to bring the cam *n′* to range under the short pick-up whose ends turn outward, so that the warp-threads that were left down during the first half of the revolution will now be picked up and carried onto the guard.

While this last operation is going on the plate *p′* will be shifted by its eccentric, so as to bring the cam *o* to range under the long pick-ups whose ends turn outward, and thus the warp-threads of the other half the circle will be carried. Meantime the woof-thread has been delivered and wound into the web from

the shuttle-arm 12, and by the same forcibly "beaten up." The separator forcibly separates the strands, so as to enable the web to be laid close up to the weaving-point, and at the same time the arm or blade 12 applies a pressure against the web already woven. Then the next revolution of the separator again forces the strands apart, which have just passed behind the weft already woven, and so on. Thus the forcing the strands apart, in connection with the tension on the strands caused by the weights on the tension-wires and pressure applied by arm or blade 12, forces the weft close to that previously laid in, or "beats it up." Thus at each revolution of the loom the warp-threads are crossed over the filling-threads, and the operation of weaving a tubular web is thereby accomplished. As fast as the web is formed it passes down through the hollow tube D, and so out of the loom. The requisite tension may be given to the completed web by any suitable means.

In order to hold the eccentrics still in position after each quarter-revolution, a yielding stop-pin, 25 26, is provided for each, which engages a notch in the periphery of a disk-wheel fixed in the shaft of each eccentric, as seen in Fig. 4, the said disk and notches being shown in dotted lines and the yielding stop-pins in full lines.

The shafts of these eccentrics, to which the arms *t u* are attached, are of different lengths. Thereby the said arms on the one will move around the circle in a different plane from those on the other, so that the arms *t* will encounter and be revolved by the stops *x* and *x'*. each stop giving to the shaft a quarter-turn, and the arms *u* will encounter the stops *x''* and *x'''* on the opposite side of the circle, and be similarly thereby operated on.

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

1. In a circular loom for weaving a web of indefinite length, the combination of the pick-ups *e*, actuated by mechanism substantially as specified, for opening thereby the shed of the warp, the devices described for giving to the warp-strands the requisite tension, and arm 12, for delivering and packing the woof-thread into the web, all constructed and arranged to operate as shown and described.

2. In a circular loom, the combination of the segmental carrier I, the separator 13, and the arm 12, all being constructed to operate as shown and described.

3. In a circular loom, the combination of the cams *n n' o o'* and mechanism, substantially as described, for shifting the position of the same at each revolution around the loom, whereby the pick-ups *e* are actuated to open the shed of the warp, all being constructed to operate as shown and described.

4. In a circular loom for weaving a cylindrical web of indefinite length, the combination of the separator 13, the pick-ups *e*, and the devices described for giving to the warp-threads a yielding tension, all being constructed to operate as shown and described.

5. In a circular loom for weaving a tubular web of indefinite length, the combination of a separator, 13, for separating the warp-shed near the point of weaving, and mechanism, substantially as described, for giving to the warp-thread the requisite tension, all being constructed to operate as shown and described.

6. The combination, in a circular loom, of the toothed carrier I, the pinions *v'''* 1 2 3, the rollers *v v'*, &c., the disks 45 46 47 48, whereby the said carrier, while in motion, is supported and maintained in position concentric to the tube D, all being constructed to operate as shown and described.

7. In a circular loom for weaving a tubular web of indefinite length, the tension devices described, consisting of the hub N, the wires 50, 51, and 52, and the weight 54, for regulating the tension of the warp-threads, all being constructed to operate as shown and described.

8. In a circular loom for weaving a cylindrical web, the combination of the hollow tube D, through which passes the completed web, and around the open end of which the web is formed, with the segmental carrier I and separator 13, substantially as described.

Witness my hand this 10th day of August, 1877.

BENJAMIN L. STOWE.

Witnesses:
THEODORE G. HOSTER,
B. S. CLARK.