3 Sheets—Sheet 1.

B. L. STOWE.

CIRCULAR-LOOMS.

No. 194,741. Patented Aug. 28, 1877.

Fig. 1

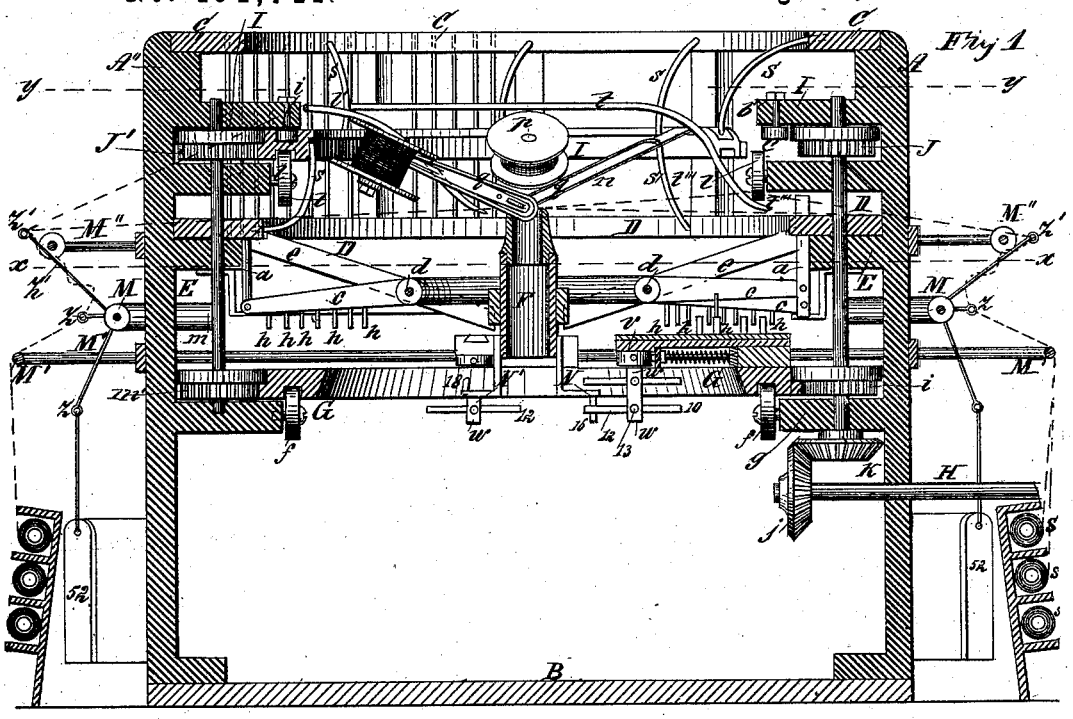
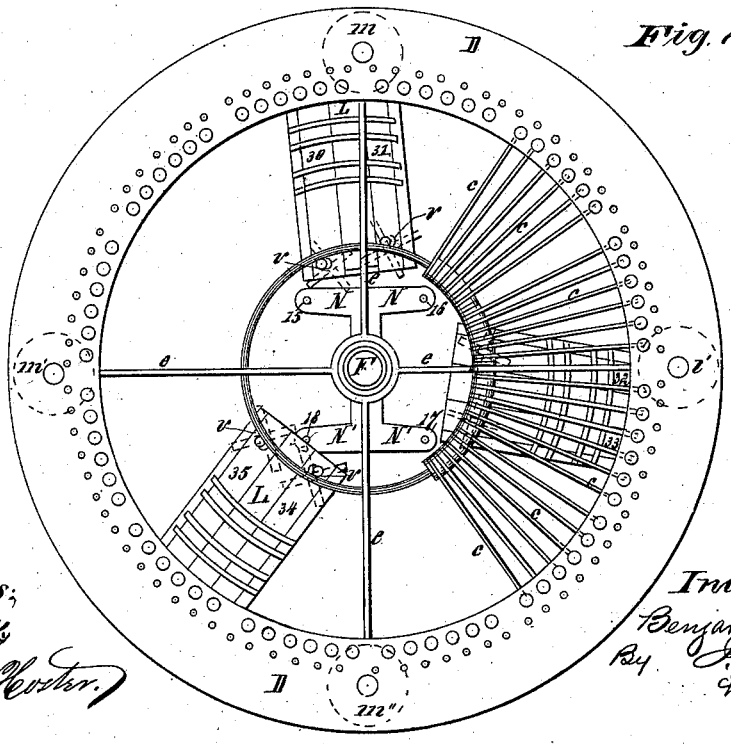


Fig. 2



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Theodore G. Hoster.

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3 Sheets—Sheet 2.

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CIRCULAR-LOOMS.

No. 194,741. Patented Aug. 28, 1877.

Fig. 4.

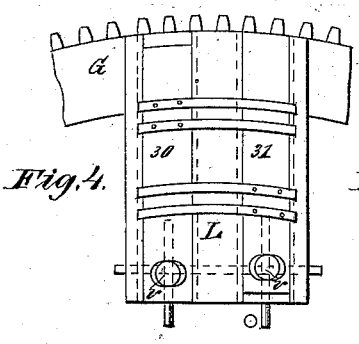


Fig. 5

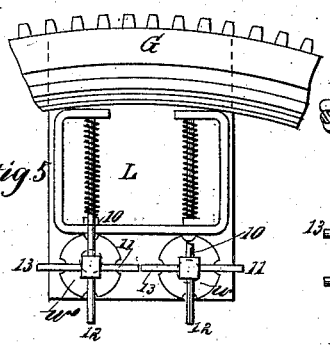


Fig. 6

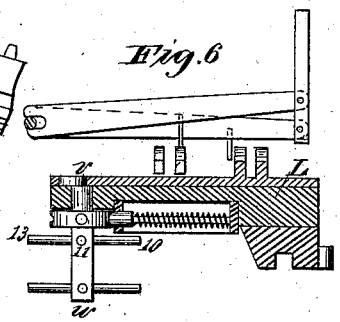


Fig. 7.

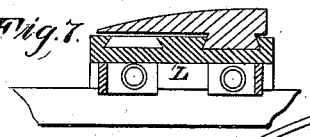
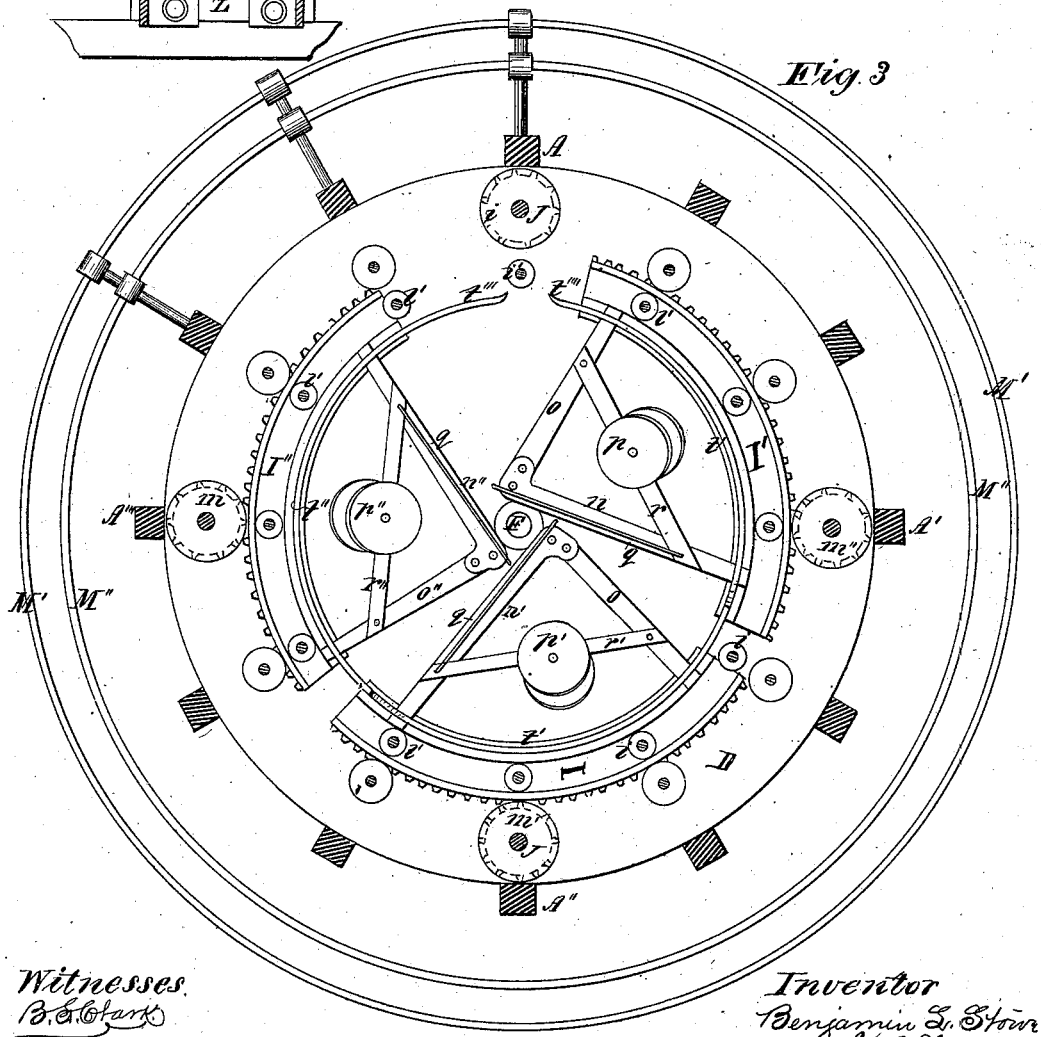


Fig. 3



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3 Sheets—Sheet 3.

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CIRCULAR-LOOMS.

No. 194,741. Patented Aug. 28, 1877.

Fig. 9.

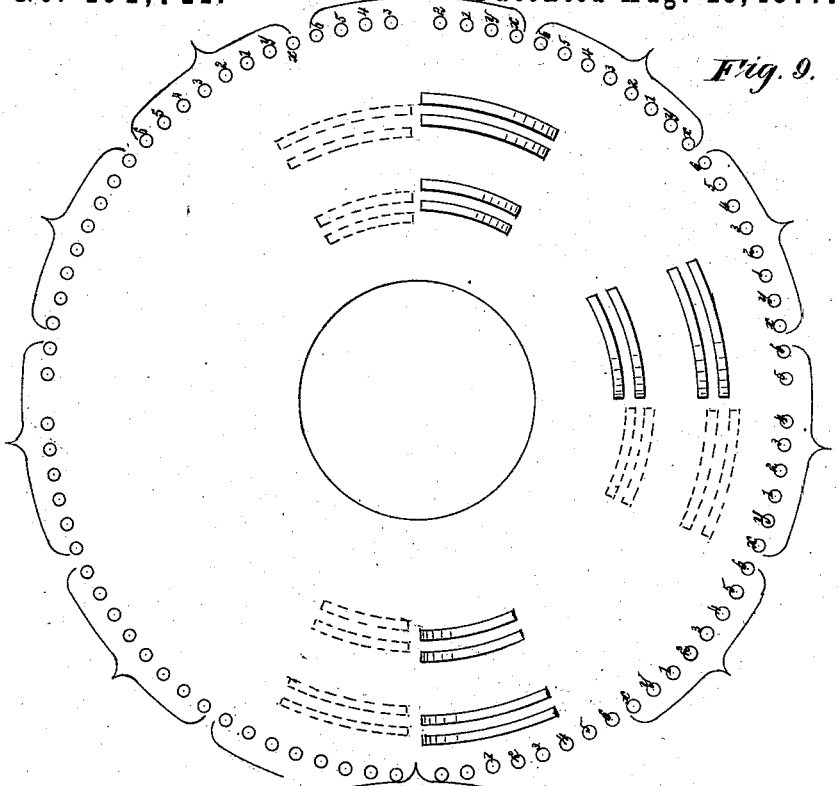
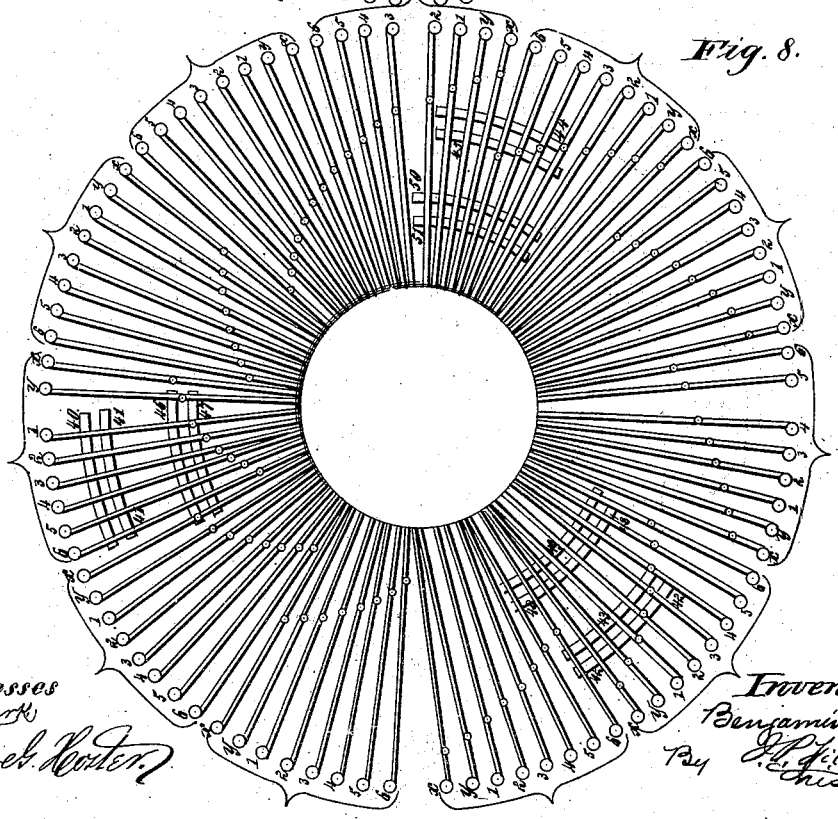


Fig. 8.



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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. **194,741**, 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, county, and State of New York, am the inventor of an Improvement in Circular Looms for Weaving Fire-Hose and other fabrics of more than one ply, of which this is the specification, reference being had to the accompanying drawings, forming part of the same, in which—

Figure 1 is a central vertical section of a circular loom containing my improvement. Fig. 2 is a top face view of the portion of the loom immediately in sight when the part above the dotted line *x x* in Fig. 1 is removed. Fig. 3 is a similar view taken on the dotted line *y y* of Fig. 1. Figs. 4 to 7 are detailed views of the cams and their accessories, by which the pick-up levers, hereinafter described, are actuated, Fig. 4 being an upper face view of the said cams with the sliding bars to which they are attached, and the base-plate in which they are held and slide, and a broken piece of the ring to which said base-plate is attached; Fig. 5 being an under face view of the same; Fig. 6, a central section of the same, with two of the pick-up levers in position to be operated upon by the said cams, and Fig. 7 is a cross-section of the same. Fig. 8 is a detached upper face view of the pick-up levers and pick-ups, and the aforesaid cams. Fig. 9 is a similar view without the levers, showing the said cams in different positions.

I am the inventor of certain improvements in circular looms whereby a continuous single-ply web in the form of a tube, used chiefly for fire-hose, may be woven, and for which application for a patent was made August 15, 1877.

My present invention relates to certain improvements upon said looms, whereby such continuous tubular webs of more than one ply may be woven; and consists of the devices and combination of devices for that purpose hereinafter described and claimed.

The working parts of my many-ply circular loom, as of my single-ply loom, are mounted upon a suitable circular frame, consisting, preferably, of four posts, A A′ A″ A‴, tied together at the bottom by cross-beams B, and at the top by the flat ring or annular plate C. D is a second flat ring or annular plate, which lies upon and is secured to brackets or arms designated by the letter E. The warp-threads, held on and delivered from spools S, disposed in suitable racks arranged around the outside of the loom, all pass into the loom, over the upper face of the ring D, and converge to and pass down into the hollow post or cylinder F set in the center of the loom. They thus arrange themselves around the upper rim of this cylinder, and it is on this circle at the top of said cylinder that the weaving of the woof-thread into the web takes place.

The apparatus by which the warp-threads are thrown in the process of weaving consists of the following devices: A series of pick-up pins, indicated by the letter *a* in Fig. 1, (two only, however, being shown, one on either side of the figure, as to have attempted to represent the whole series would have confused the view,) and by the larger of the series of small circles in Fig. 2. These pick-ups are fitted to work up and down in holes made through the ring D. Their lower ends are jointed to a series of levers, *c*, each pick-up having its separate lever, and all the levers being, at the opposite end, pivoted on a wire, *d*, in the form of a ring, which is supported by the arms *e*. Each of these levers is provided with a pin or lug, which projects downward from its under edge, designated by the letter *h*. The upper ends of the pick-up are forked slightly, and in each one of these forks lies one of the warp-threads as it runs from its spool over the ring or annular plate D to the cylinder F.

G is an annular gear, which runs upon rollers *f*, which revolve on axes fixed in brackets on arms *g*, there being several of these rollers and brackets attached to the frame of the loom. An annular groove is made in the under face of this gear, in which the said rollers *f* run. Motion is given to this gear from a driving-shaft through any suitable intermediate mechanism.

I I′ I″ are three segments of an annular gear, fitted similarly to the gear G, to run on rollers *l*, which work in annular grooves on their under faces. There are also grooves on the upper faces of these segments, in which work the rollers *l′* upon axes at right angles

to the axes of the rollers *l*. There is a large number of these rollers around the loom, mounted on brackets attached to the frame, so that the said segments, although separated some distance apart, will make a continuous circuit around the loom, supported from one bracket to another.

These segments are provided with gear-teeth on their outer edges, and motion is given to them by several pinions, two of which are shown in Fig. 1, and designated by the letter J and J′. Another two are on opposite sides of the loom, midway between those shown in said figure; and these pinions receive their motion, the pinion J directly from the driving-shaft H through the gears *j k*, and the other three from the annular gear G, and pinions on the lower end of the shafts *m m′ m″*, two of which only are shown in the drawing. These separate segments do not fill the circle, there being a small space between I and I′ and between I′ and I″, and a larger space between I and I″, for a purpose to be presently explained.

Upon each of these segments is fixed an arm, *n n′ n″*, which projects inward and downward to the edge of the rim of the open upper end of the tube F, as shown in Fig. 3. These arms are stayed and strengthened by the braces *o o′ o″*.

Three spools, *p p′ p″*, are provided for three woof-threads, the design being to weave a three-ply hose. These spools are set on axes fixed in the cross-bars *r r′ r″*. A woof-thread running from each of these spools passes through a hole in the end of the arm with which its spool is connected, and thence into the web. As the said arms revolve around the said tube with the segments I I′ I″, each one winds into the web a woof-strand. The inner ends of the arms *n n′ n″* are so arranged in relation to each other and to the web that each acts as a shuttle to deliver into the web a woof-thread of one of the plies, *n*, for example, delivering the threads for the inner ply, *n′* that for the next outer ply, thus forming a coil around outside of the coil formed by *n*, and *n″* (when a fabric of more than two plies is woven) for that which is coiled into the exterior ply, around outside of the coil formed by *n′*. Upon each of these segments is also fixed a guard or thread-lifter, *t t′ t″*, being a rod or wire curved to conform to the shape of the segment, and raised a few inches above its upper face. The rear end of the guard on segment I″ extends over onto segment I′, as does that of the latter onto segment I. The forward ends of the several guards are curved downward, as seen at *t‴*, Fig. 1, so that the extreme ends range just above the plane of the warp-threads when they are not thrown up. The rear end *t⁗* of the guard in segment I also drops down to the same plane. *s* and *s* are stationary wire guards attached, one to the plate C and the other to the plate D, the lower end of the former terminating in the groove in the upper face of the segments I I′ I″, and the upper end of the latter extending upward on the inner edge of the segments to near the upper face of the same.

There are similar guards before each one of the brackets, and posts around the loom, which carry the friction-rollers, on which the said segments run. Their office is to prevent the warp-threads, as they pass up onto the guard *t*, from becoming caught in the rollers *l* or *l′*. Attached to each shuttle-arm is a separator, *q*, formed of a rod or wire, looped over the inner end of the arm, and the ends carried back and fastened to the arm near its outer end. It ranges along the upper and lower surfaces of the arms a little distance from them. The office of each is to separate the sheds of the web, and give free opportunity to the ends of the shuttle-arm to deliver the woof-threads into the web.

It will be borne in mind that the design of the improvements herein intended to be claimed is the weaving of a web of more than a single ply. The loom represented by the drawings is constructed to weave a three-ply web. To understand the method and devices by which this is done, the entire number of the warp-threads may be considered as divided into series or sets of eight each, six of the eight comprising three pairs, each pair designed to form a single web, and the other two of the eight, which may be denominated the "tying-strands," being designed to pass entirely through the single webs, and tie them together. Thus every fourth pair will be tying-strands.

The operation of weaving this three-ply web may be accomplished by throwing the warp-threads up and carrying the woof-threads between them in the following order in each of the said series or sets, which, for convenience of description, we designate as follows: The tying-threads, the first two of the series, by the letters *x y*, and the remaining six by numbers 1 to 6, inclusive, Figs. 8 and 9.

To receive the three woof-threads in succession, the warp-threads are thrown up in the following order: First, strands *x* and 1; second, strands 2 and 4; and, third, strands 3 and 5. This operation will pass the first woof-thread between the tying-strands and strands 1 and 2; the second, between the tying-strands and strands 3 and 4, strand 2 being raised with strand 4, the pairs of strands 1 and 2 and 5 and 6 will be out of range of this second woof-thread, the one pair above and the other below it, and it will pass between only the tying threads and the strands 3 and 4. Then the third woof-thread will pass between the tying-strands and strands 5 and 6, as with strand 5, strand 3 is carried up, leaving only strands *y* and 6 down when the third woof-thread is passed in. It will be understood that the several warp-threads of the different series of eight, when thrown up, remain in that position until all the three woof-threads have been woven in. They then all fall back to their first position, resting on the

upper face of the annular ring D. The above movements are accomplished by one revolution of the loom. At the next revolution the warp-strands are thrown up in the following order: First, the tying-strand *y* and strand 2; second, strands 1 and 3; and, third, strands 4 and 6.

By these means it is obvious all three of the woof-strands will, at each revolution of the loom, be carried between the tying-strands, while only one will be carried between any other two of the series. I have found this to be the preferable order from its simplicity and effectiveness. I do not, however, intend to limit myself to it. Any other may be adopted that is preferred, it only being essential that a sufficient number of the warp-threads shall be employed as tying-strands to effectually tie the several plies of the web together. The necessary modifications of mechanism, herein described, for throwing the woof-strands in any desired order, any expert mechanic will be able to make upon the principle here explained.

Having thus described the movements of the strands or threads required in the operation of weaving a three-ply hose or web, the special mechanism by which the pick-ups *a* are actuated, so as to produce these movements, will be readily understood. It consists of three sets of cams or inclined planes, which are fixed upon and revolve with the annular gear G. They are shown in detail in Figs. 4, 5, 6, and 7, and an upper face view is given in Fig. 2. Each set consists of two pairs of cams or inclined planes, each pair being secured to a bar or plate, which is fitted to slide in a dovetailed groove in a base-plate attached at one end to the said gear G, the other end extending inward toward the center of the loom. These plates are designated L L′ L″.

The said sliding bars are designated by numbers 30 to 35, inclusive, in Fig. 2. Upon the bars 30, 32, and 34 are fixed the inner pairs of cams, or those nearest the center of the loom, and on the bars 31, 33, and 35 are fixed the outer pairs, or those farthest from the center of the loom. Near the inner end of each of the plates L are two short shafts, *w w′*, fitted to revolve in suitable bearings in said plate. They extend above the said plate into slotted openings in the sliding bars 30 to 35 and on the upper ends are fixed eccentrics V, which work in the said slotted openings, and as the shafts *w w′* are revolved, slide the bars 30 to 35 back and forth on the plate L. The shafts *w* extend below the plates L, and in each are fixed four arms, 10 11 12 13, Fig. 5. N N′ are two brackets or arms, one on each side of the hollow post F. In each of these arms is fixed a stop-pin, 15 to 18. The pins on the bracket N′ extend upward, and those on bracket N extend downward, as seen in Fig. 1. The shafts *w*, which actuate the sliding bars 30, 32, and 34, are longer than the other shafts which actuate the bars 31, 33, and 35, and the four arms in each range below the bracket N, so that they will, on their way, as they are carried around by the revolution of the gear G, encounter the stop-pins in said bracket N, while the arms in the short shafts which actuate the bars 31, 33, and 35, range above the bracket N′, and will therefore encounter the stop-pins in the said bracket N′. These arms and stop-pins are so arranged with reference to each other that each shaft as it passes a bracket, with the stop-pins of which its arms come in contact, will be caused thereby to revolve on its axis a half-revolution, and thus by the action of the eccentric on its upper end, shift the sliding bar with which it is connected inward or outward, as the case may be. The cams or inclined planes on the said bars are arranged to pass under the lugs or pins *h* on the under edge of the pick-up levers *c*, so as to throw up said levers in the order required to accomplish three-ply weaving, as hereinbefore described. This will be understood by reference to Fig. 8, representing the levers divided into groups of eight each, as indicated by the brackets surrounding the figure. The small circles on the levers represent the positions of the pins or lugs on the under edge of the levers, and the three sets of segmental lines, numbered from 40 to 51, inclusive, indicate the cams or inclined planes. The levers are lettered and numbered in groups *x y* 1 to 6, inclusive, corresponding to the letters and numbers applied to the warp-threads, as before described. Now, it is evident that upon these cams being carried round one-half of the circle, starting from the positions shown, cam 40, Fig. 8, will engage the pins on all the levers marked X, 41 on those marked 1, 42 on those marked 2, 43 on those marked 4, 44 on those marked 3, and 45 on those marked 5. The said cams 40 to 45 will act only through one-half of the circle, the cams 46, 47, 48, 49, 50, and 51 operating through the other half of the circle upon the pins arranged in a similar order, nearer the center of the loom in range of the last-named cams. This division of labor on the part of the cams is made in order to afford the opportunity of shifting their position when not engaged with lever-pins, the outer range of cams being shifted while passing through the half of the circle, where the pins are in range of the inner cams 46 to 51, and the latter cams are shifted while passing through the opposite half of the circles, where they will range within the lever-pins, and therefore be free to revolve.

One revolution having been made with the result before described, and the cams having been shifted in making it, the next revolution will take place with the cams in the position indicated by the dotted lines in Fig. 9, the result of which will be to throw up the levers intermediate with those that were raised by the first revolution. Then, the cams having been shifted back to their first position, the operation of the first revolution is repeated, fol-

lowed in turn by that of the second, and so on continuously.

M M′ M″ are wires or rods, which encircle the loom, supported in brackets attached to its frame, upon one of which, M, are placed the tension devices, consisting of small hubs or disks, in each of which are inserted three wires radiating outward. To the lower one is attached a weight, 52. The other two have loops in their outer ends, as seen at Z Z′, Fig. 1. There is one of these tension devices for each warp-strand, which, as it is wound off from its spool, passes over the rod M′, through the eye Z, then spirally around the wire Z′, through its eye, and into the loom over the rod M″. A series of partition-wires are fixed in the frame between the annular plates or rings C and D, between which the warp-threads pass, whereby the threads are kept from tangling, and are held in position in the forked ends of the pick-ups *a*.

The operation of this loom is as follows: It being understood that the spools containing the warp-threads are provided and in their places, and that the said threads have all been gathered in and carried down through the tube F, so as to arrange themselves in place around its rim, also that the woof-threads are supplied from the spools *p*, each being passed through the hole in its arm, and ready to move into the web, the loom is put in motion with the pick-up cams in the position shown in Figs. 2 and 8, and by the full lines in Fig. 9. The pick-up levers will thereby be thrown up in the order hereinbefore described, carrying up the warp-threads in the same order. The said threads, as they are one after another thrown up, will be received upon the forward inclined ends of the guards *t t′ t″*, and will be carried and supported on these guides during the entire revolution of the segments, until they fall back again to their first position at the rear end *t‴* of the guard on segment I. The shuttle-arms carrying the woof-threads weave the woof-threads into the web around the rim of the tube F, the three arms at each revolution weaving in three woof-threads, and forcing them up into the web. Each set of cams is situated with reference to one of the said segments, so that the warp-threads are thrown up by it just in front of the guard-wire *t* on such segment, and then remain up, the guard-wires sliding under them until they (the threads) fall back to their first position at the rear of the segment I, as before described.

By this joint action of the several shuttle-arms, pick-up levers, and cams, as described, a three-ply hose is produced. If a web of a greater or less number of plies is desired to be made, as it is evident may be done, it is only necessary to employ a greater or less number of sets of cams, and a corresponding number of woof-threads, shuttle-carriers, arms, and carrier-segments, arranging the pins in the pick-up levers upon the principles which I have fully explained.

It is intended in this specification to limit myself to the devices specially pointed out by the claims, having relation particularly to weaving more than one ply. In the general structure of the loom, as the same is used for the weaving of a single ply, there are, I believe, novel devices, for which I have filed a separate application for a patent, said application having been filed August 15, 1877.

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

1. In a circular loom for weaving a web of more than one ply, the combination of the pick-ups *a*, with their levers *c*, having pins or lugs, constructed and arranged to operate as shown and described.

2. In a circular loom for weaving a web of more than one ply, the combination of two or more sets of cams or inclined planes with the pick-ups *a* and levers *c*, provided with pins or lugs, with mechanism substantially as described, whereby said cams are shifted relatively to each other, all being constructed to operate as shown and described.

3. In a circular loom for weaving more than one ply, the combination of two or more segmental gears I with the guides *t t′*, &c., the pick-ups *a*, the levers *e*, and shifting-cams, all being constructed to operate as shown and described.

4. The combination, with the segmental carriers, of two or more guides *t*, constructed and adapted to receive upon themselves the warp-threads, as and where they are successively raised up by the pick-ups described, and conjointly acting, when said threads are once raised, to bear up the same until a revolution of the loom is completed, as shown and described.

5. The combination, in a circular loom for weaving a web of more than one ply, of two or more segmental carrriers, two or more shuttle-arms *n*, the pick-ups *a*, and two or more sets of shifting-cams or inclined planes, for actuating said pick-ups, all being constructed to operate as shown and described.

6. In a circular loom for weaving more than one ply, the combination of the segmental carriers I I′, &c., the guard-wires *s s′*, the guides *t t′*, &c., the rollers *l l′*, &c., and the pinions J J′, &c., all constructed to operate as shown and described.

7. In a circular loom for weaving a tubular web of more than one ply, the combination, with two or more shifting cams or inclines, 40 to 51, inclusive, of devices, substantially as described, actuated by said cams or inclines to throw the warp-threads to form the shed, the said cams or inclines being arranged to operate upon certain series or groups of said devices during a portion only of their revolution around the loom, and during the other portion of their revolution, and while free from engagement with said devices, to be shifted to engage with an alternate series of said devices, whereby the said warp-threads are during successive revolutions of the loom

thrown in proper alternation to form the web, as set forth.

8. In a circular loom, the combination, with mechanism for separating the warp into a multiple shed, of two or more segmental gears, I, severally carrying arms *n*, which bear spools of the woof-thread, the whole constructed and arranged as described, whereby two or more woof-threads are delivered into the web at each revolution in spiral coils, one within another, thereby producing a web of more than one ply, substantially as described.

In witness whereof I have hereto set my hand this 10th day of August, 1877.

BENJAMIN L. STOWE.

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