C. WHALLEY.

CIRCULAR LOOM.

APPLICATION FILED MAR. 6, 1911.

1,017,192.

Patented Feb. 13, 1912.

7 SHEETS—SHEET 1.

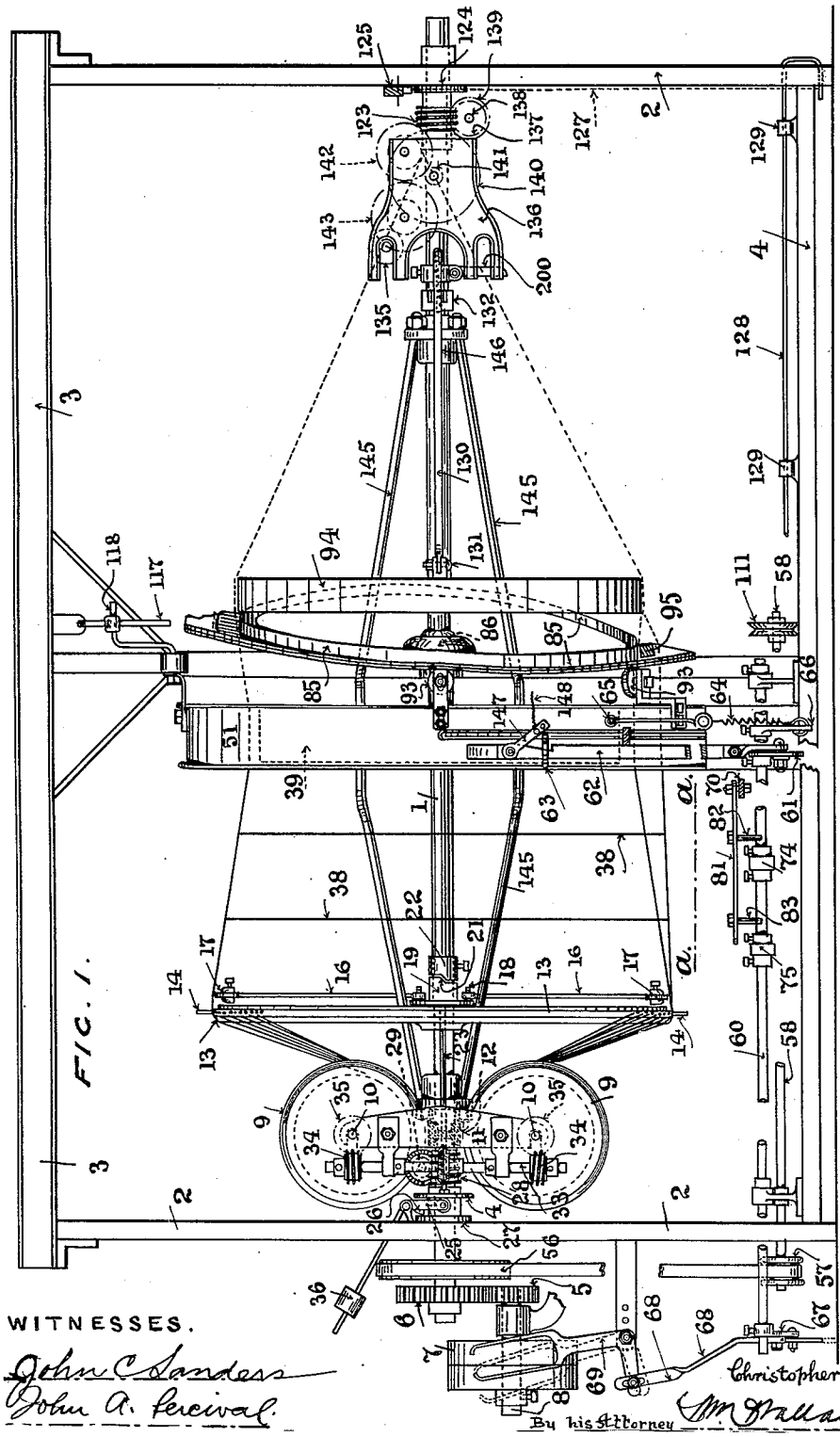

FIG. 1.

WITNESSES.

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7 SHEETS—SHEET 2.

FIG. 5.

FIG. 10.

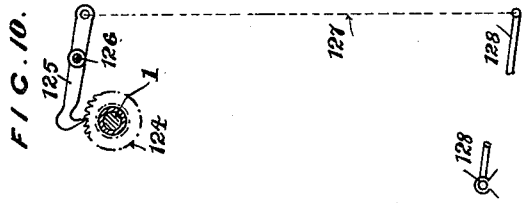


FIG. 4.

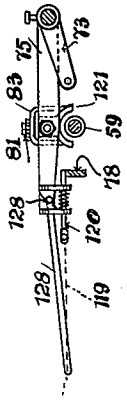


FIG. 9.

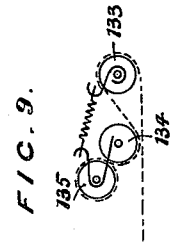


FIG. 2.

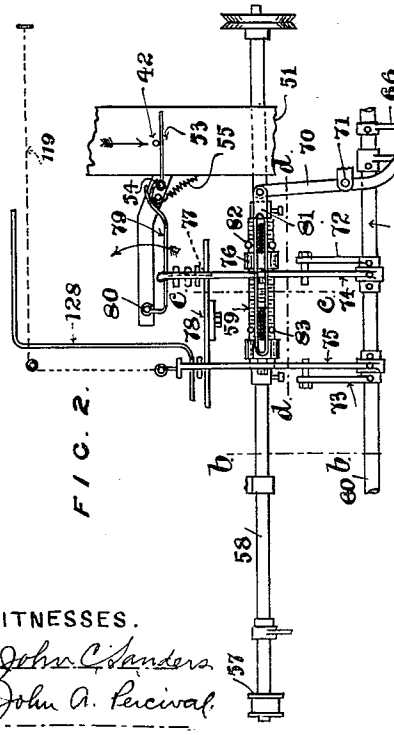


FIG. 3.

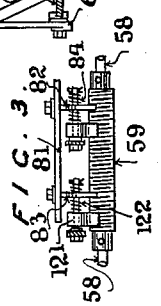


FIG. 8.

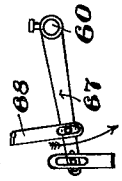
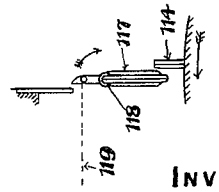


FIG. 7.

FIG. 6.



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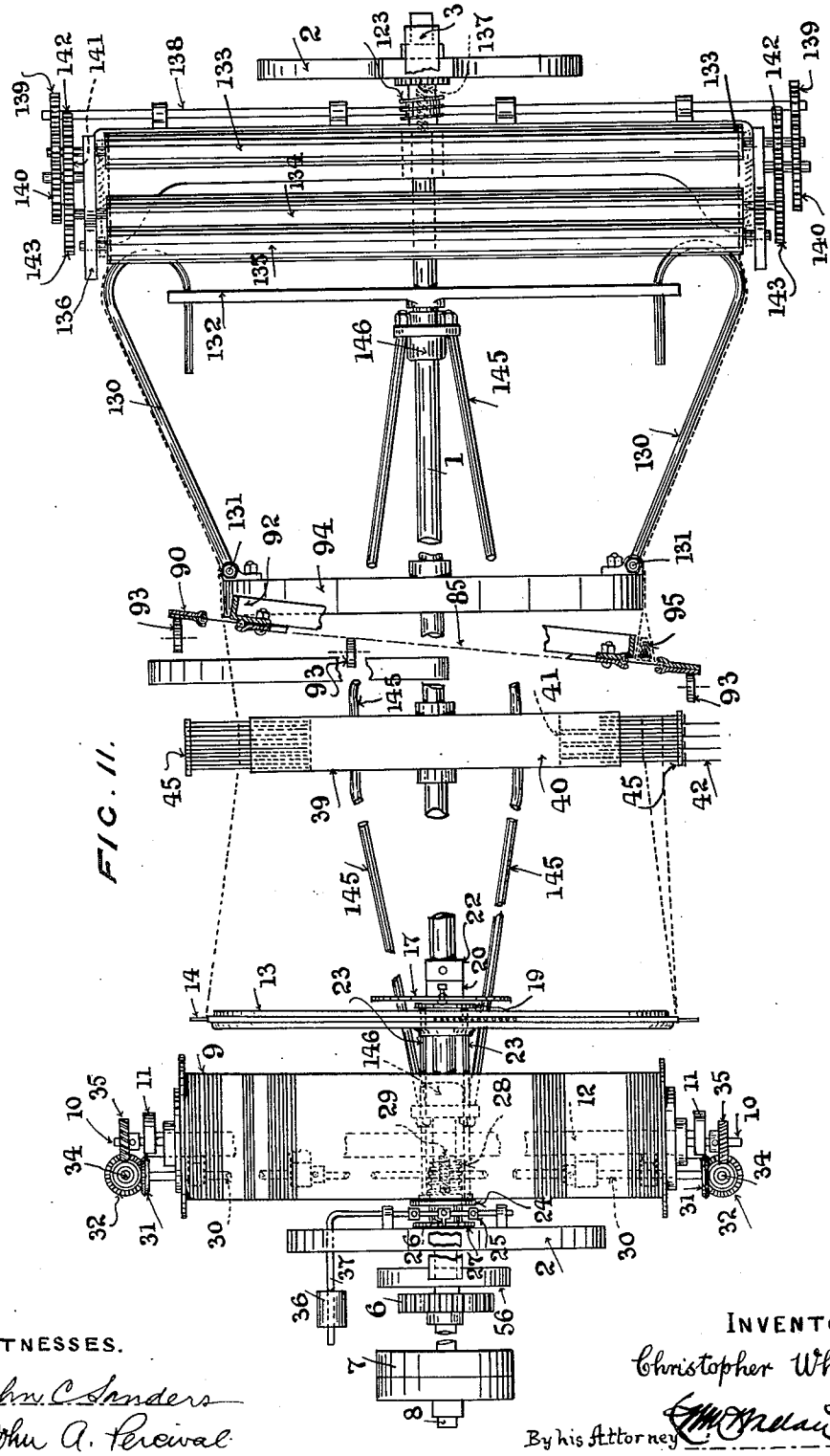

FIG. 11.

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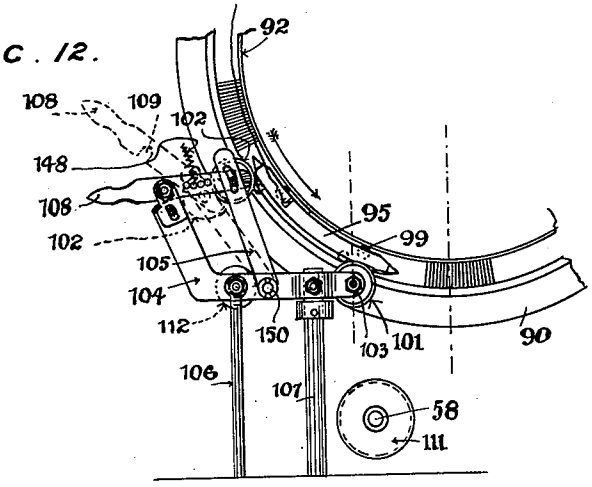
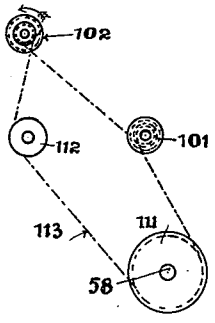
7 SHEETS—SHEET 4.

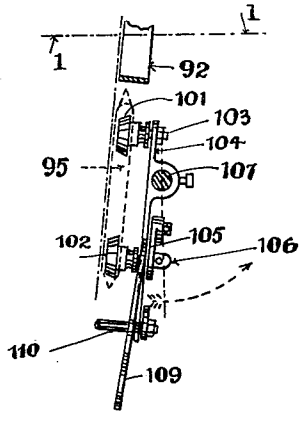
F I C. 12.



F I C. 12a.



F I C. 13.



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7 SHEETS—SHEET 5.

FIG. 21.

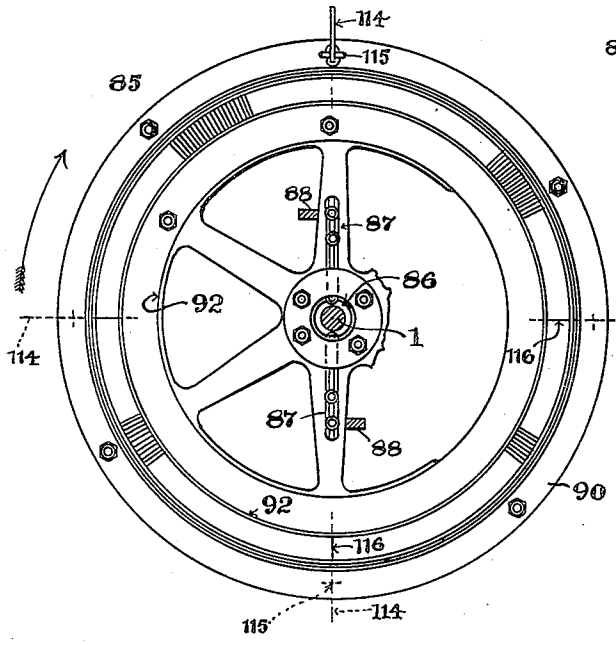


FIG. 22.

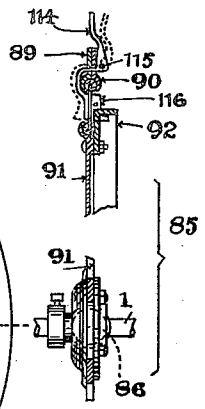


FIG. 23.

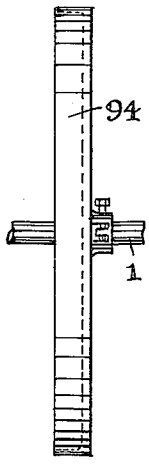
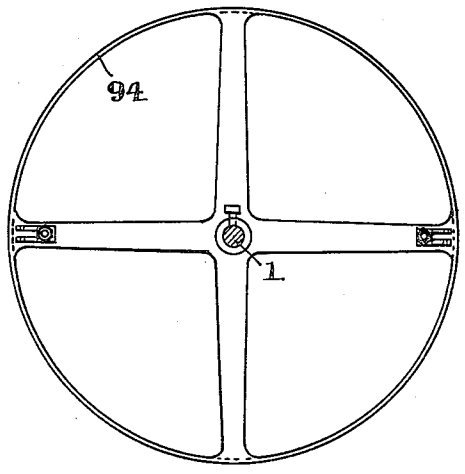


FIG. 24.



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7 SHEETS—SHEET 6.

FIG. 14.

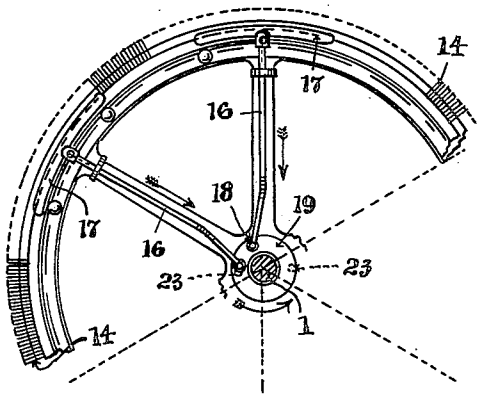

FIG. 15.

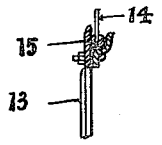

FIG. 16.

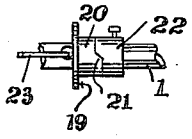

FIG. 17.

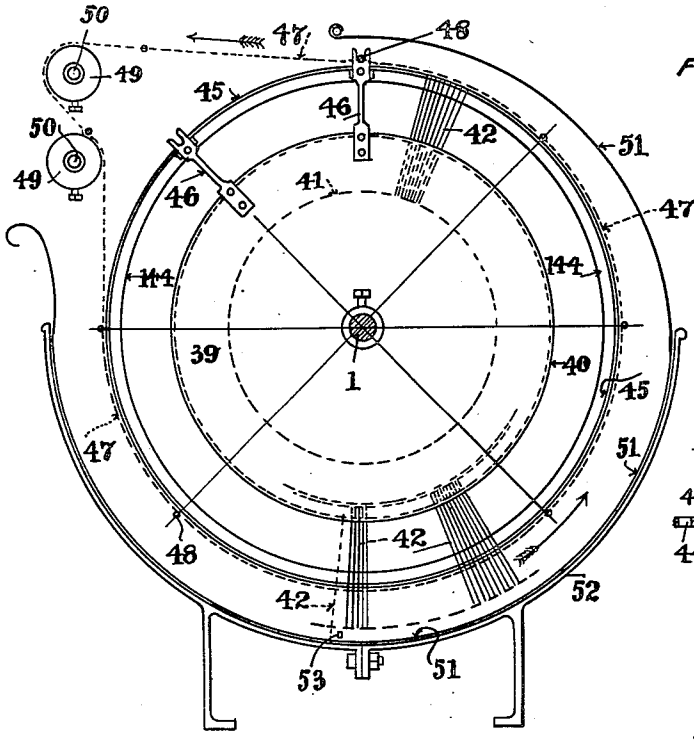

FIG. 18.

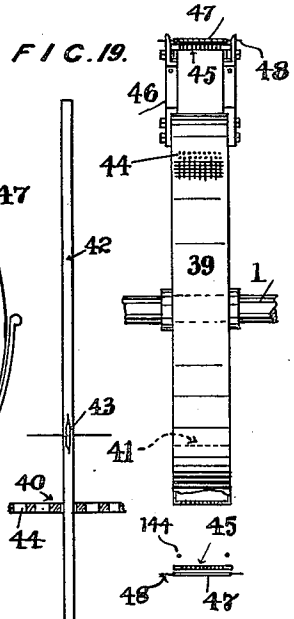

FIG. 19.

FIG. 20.

WITNESSES

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1,017,192.

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7 SHEETS—SHEET 7.

FIG. 25.

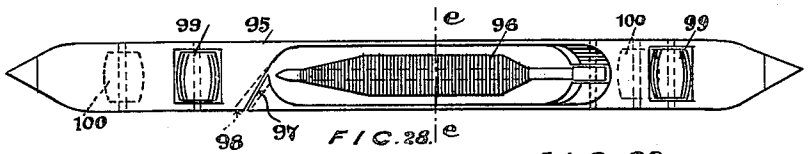


FIG. 28.

FIG. 27.

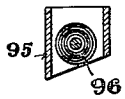
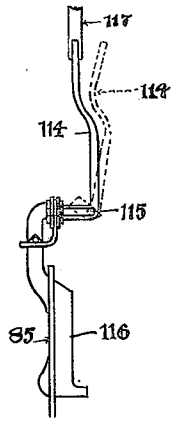
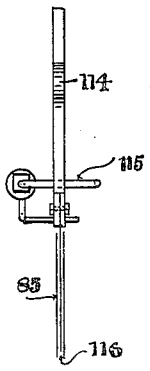


FIG. 29.





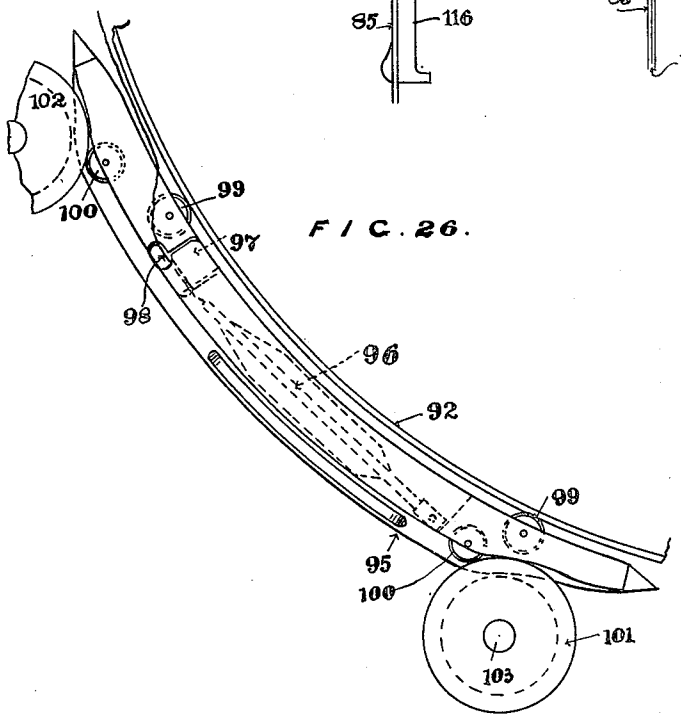


FIG. 26.

WITNESSES.

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UNITED STATES PATENT OFFICE.

CHRISTOPHER WHALLEY, OF CLITHEROE, ENGLAND.

CIRCULAR LOOM.

1,017,192. Specification of Letters Patent. Patented Feb. 13, 1912.

Application filed March 6, 1911. Serial No. 612,463.

To all whom it may concern:

Be it known that I, CHRISTOPHER WHALLEY, a subject of the King of Great Britain and Ireland, residing at 6 Salthill Terrace, Clitheroe, in the county of Lancaster, England, cotton-mill manager, have invented new and useful Improvements in and Connected with Circular Looms, of which the following is a specification.

This invention relates to a circular or revolving loom for weaving tubular fabrics or textile material into tube form for various purposes and which woven tube may be cut in the loom.

My loom marks a considerable departure from existing looms and is a rotary or revolving apparatus, the various moving and other parts being distributed around a central shaft or axle which is actuated to accomplish the driving. I combine automatic warp and weft stop motions.

I use warp beams from which the warps are taken and these rotate about the central shaft, and I have a circular back rest and if necessary other supports for the warps as they pass to an annular cumber-board or heddle frame containing heddles or needles. This cumber-board or heddle frame has heddles or needles which move to control the shedding and will be more fully dealt with hereafter.

Means are provided to carry cards, perforated sheets, or other appliances, to control the needles or heddles. Likewise warp and weft stop motions are provided. I use a circular reed disposed at an angle, which reed is caused to revolve and coöperates with an annular rotating temple. The revolving reed, which as stated, is disposed at an angle, has an annular ledge, face or "race" for the shuttle to contact with. I use a fixed shuttle. After the temple, one or more flatteners or stretching appliances are used, and the flattened tube is preferably cut and then passes to a batching roll, which is rotated, just as the warp beams are rotated.

The above brief outline suggests the lines upon which I construct my loom.

I shall now proceed to describe my loom in detail and with the aid of the attached sheets of illustrative drawings.

Figure 1 shows a general elevation of the loom with certain of the parts omitted for the sake of clearness. Fig. 2 is a plan view of what would be seen looking down on the line *a*—*a* Fig. 1, and illustrates mechanism in connection with the warp and weft stop motions. Fig. 3 shows a sectional elevation on the line *d*—*d* Fig. 2. Fig. 4 is a sectional elevation, on the line *c*—*c*, Fig. 2, of parts connected with the weft stop motion. Fig. 5 is a similar view, on the line *b*—*b* Fig. 2, of parts connected with the warp stop motion. Figs. 6, 7, 8, 9 and 10 are detached detail views illustrating more clearly parts seen in Fig. 1. Fig. 11 indicates, partly in section, a general plan view of the loom. Fig. 12 is a broken detail elevation showing the shuttle box and rotating reed. Fig. 12[a] shows one way of driving the bowls in the shuttle box. Fig. 13 is a plan view of the shuttle box, &c. Fig. 14 illustrates a rear view of the annular revolving back rest for the warp threads, and certain features in connection with the automatic warp let off or warp tension mechanism. Figs. 15 and 16 are detail views in connection with Fig. 14. Figs. 17 and 18 are respectively front elevation and side view of the annular revolving cumber-board or heddle frame which supports the heddles or needles. Figs. 19 and 20 show elevation and section of one heddle or needle. Figs. 21 and 22 are respectively back view and broken section of the annular revolving reed, &c. Figs. 23 and 24 show side view and back view of the annular rotating temple. Figs. 25 and 26 show plan and side view of a suitable form of shuttle for use in my loom. Fig. 27 is a cross-section of the shuttle on the line *e*—*e* Fig. 25. Figs. 28 and 29 indicate in side and front elevation the weft fork or finger used in connection with the revolving reed.

My circular or revolving loom comprises a main driving shaft 1 supported in suitable bearings carried in vertical end frames 2 2, or other standards, which end frames are stayed or stiffened by girders 3 and bottom framework 4, or otherwise, and such shaft is driven by spur gear 5 6 from a fast pulley 7 on the driven shaft 8. Any other convenient plan may be adopted to drive or rotate the shaft 1.

The warp beams 9 9 are arranged transversely with respect to the driving shaft 1 and are turned around thereby. They are carried on shafts 10 10 supported in side brackets 11 11 attached to the cross girder 12 which is fixed on the main shaft 1. The warps from the two beams 9 9 are led over

and distributed around an annular back rest 13 which has pins 14 distributed over its periphery, said pins being fixed in clamped balks 15, the pins 14 forming divisions for one or several ends. I arrange for the warp distribution or "let off" to be automatically controlled according to the tension of the warp passing over the back rest 13, in the following manner: In connection with the back rest 13 are arranged a number of cranked rods 16, which carry segmental pieces or crutches 17, and are, by their opposite ends, jointed at 18 to a loose disk 19 which has a cam or tooth 21, formed on the boss 20, this cam or toothed boss engaging a toothed collar or cam 22 fixed on the main shaft 1. With ordinary tension on the warp, the disk 19 is not affected, but, with increased tension, the crutches 17 press the rods 16 toward the center and the disk 19 is slightly rotated, and, by the action of the cam 22 pushed slightly back. This movement of the disk 19 acts on the spindles 23 attached to the rotating plate 24, which, in turn, acts on lever arms 25 and forces a tooth 26 carried by a pivoted bar in fixed brackets into gear with a notched wheel 27 formed with or attached to the worm 28 (see Figs. 1, 7 and 11) and so fixes the worm 28. The worm 28 drives a worm wheel 29 on the suitably supported cross shaft 30, and this shaft has a bevel wheel 31 at each end which bevel wheels actuate the bevel pinions 32 and so the upright shafts 33. Said upright shafts 33 have worms 34 gearing with worm wheels 35 on the warp beam shafts 10. Thus the warp beams 9 are rotated to let off warp as required. On the tension being relieved, the rods 23 cease to be acted on by the disk 19, and the worm wheel is released and becomes free on the shaft, and so the warp beams merely rotate around without letting off as will be clear. A weight 36 on the lever arm 37 tends to take the tooth 26 out of gear. The brackets supporting the warp beam shafts are suitably slotted or designed for facility in removing said beams. The warp let-off motion can be varied and I may employ other types of warp let-off and automatic tension motion.

From the back rest 13, the warps are led to an annular device in the nature of a cumber board or heddle frame, marked 39, and the warps may be guided or sustained by inside wire rings 38, 38, or otherwise. The cumber board or heddle frame is an annular drum with a perforated periphery 40, and a wooden or other boss 41, the inclosed space between the boss 41 and periphery 40 forming an annular housing space for a portion of the length of the needles 42. These needles 42 are of stout wire, and have eyes 43, each warp being threaded through an eye. The periphery 40 is drilled with holes 44, closely pitched, so that the needles are distributed at close intervals all around and in ranks laterally, the drawings indicating ranks of 12 needles at closely pitched intervals. To further guide the needles, a perforated shell 45 is sustained by brackets 46, arranged at regular intervals, and attaching the perforated shell to the cumber board or heddle frame 39. Thus the needles 42 are accurately guided at two points viz. by each passing through a hole in the periphery 40 and the shell 45. The cumber-board or heddle frame is fixed on the main shaft, and, as it rotates, the unchecked needles fall by gravity once they pass below the horizontal center, just as they begin to regain their positions once they rise above the horizontal center. The movements of the needles provide for the formation of the shed, the shed being entirely closed when the outer extremities of the needles lie flush with the outer face of the shell 45, while the shed is opened when the needles move outward by gravity on passing below the horizontal center. With the very considerable number of needles which can be disposed around the cumber-board or heddle frame it is apparent that the shedding capacity is very great for weaving figured cloth.

The checking of the needles 42 in the ranks, is done by providing a chain of perforated metallic bands, or perforated cards, or the like, such as the chain of perforated bands 47, which are jointed on pivot rods or spindles 48, the extremities of said spindles gearing into the slotted heads of the brackets 46 whereby the chain of perforated bands is driven or carried around as the cumber-board or heddle frame rotates. It is clear that the chain of perforated bands 47 contacts with the periphery of the shell 45 of the cumber-board or heddle frame, and, according as the holes or slots are cut or disposed, so the needles are selected and allowed to fall. The chain of perforated bands 47 is shown as of greater length than the circumference of the cumber-board or heddle frame and the extra stretch is guided on adjustable drums 49, which turn on axles 50. Where the chain would be of considerable length, the excess amount may be supported in any convenient way, or allowed to fall into a cradle or carrier. A smooth sheet metal liner 51 is fitted to the semi-circular cast iron guard 52, which limits the possible descent or drop of the needles, and this liner is so shaped, as shown, to assist the action of gravity and compel the thrusting back of all the needles into the proper position as they pass above the horizontal center.

The inner half of the shed, corresponding to the depressed needles, is the tightest, as this half of the shed operates or controls the positive let-off.

The shed is not equally divided as the back rest 13 is larger in diameter than the center of the shed and larger than the

cumber-board 45. It has been explained that the inner half of the shed is the tightest half and that the outer half of the shed is formed by the needles dropping out where holes are punched in the metal card 47. These needles can only drop out so far as the slackness of the ends will allow. Obviously this being the slackest half of the shed, they can so drop out. The ends only need to move a little to open the shed, for they but require to pass the tapered point of a fixed shuttle. The needles that do not emerge externally keep the warps held down tighter and render the inner half of the shed the tighter as already stated.

Normally, the presence of the warp passing through the eye limits the drop of any needle, and the maximum amount of drop for forming the shed is indicated in full lines at the bottom of Fig. 17, but, should a warp break, then the needle drops to a greater extent (see the dotted lines on the left) and encounters the liner 51. This excess of drop is made to control a warp stop motion which is fitted. Annular wires 144 may be fitted in any suitable position, to the cumber-board or heddle frame, for the warps to bear against or pass over.

A suitable warp stop motion, is, as follows, and the reader is referred to Figs. 1, 17, 2, 3 and 5. As stated, the excess movement due to breakage of a warp can be utilized, and, when this occurs, the needle falls (see Fig. 17), as the cumber-board or heddle frame revolves, encounters the finger 53, pivoted at 54, which finger it moves angularly against the action of a spring 55. To turn away from this pivoted finger 53 and examine Figs. 1, 2, 3 and 5, it is noticed, that a pulley 56 on the main shaft 1 drives a pulley 57 on a shaft 58 below the center of the loom. This shaft has fixed to it a worm 59 which is constantly rotated, as is apparent. Toward the near side of the loom is journaled a rocking shaft 60, to the foot treadle 61 of which is jointed the notched starting lever 62, which, when the loom is "on," latches below a slotted bracket 63. The latching of the starting lever 62 is against the tension of a spring 64, anchored at 65, and attached to the lever arm 66. On the end of the shaft 60, is a lever 67, which, by a cranked arm 68, is jointed to the pivoted belt fork 69 (see Figs. 1 and 8). When the starting lever 62 is latched below the bracket 63, the belt fork 69 holds the strap on the fast pulley, but, when the starting lever is unlatched by the pivoted knock-off bar 70, and rises, the shaft 60 is rocked, by the spring 64, and the belt fork 69 moves into the dotted position and shifts the strap onto the loose pulley thereby stopping the loom. It now remains to explain how the knock-off bar 70, pivoted at 71, is operated.

On the shaft 60 are pinned lifters 72, 73, which, when the shaft is rocked to re-start the loom by strong foot pressure on the foot treadle 61, would tend by their short spindles to lift the drop levers 74, 75, which are loose on the shaft 60. At present, the reader is only concerned with the lifter 72 and the drop lever 74, and this drop lever carries a half-nut 76 the same being normally held out of gear with the worm 59 by a spring pressed spindle 77 resting on a fixed bar 78. The spring-pressed spindle 77 is bent into a loop, and its bifurcated end slides on the drop lever 74, the loop surrounding the lever arm 79 pivoted at 80 and on this lever arm 79 the finger 53 acts. Attached to the knock-off lever 70, pivoted at 71, is a slotted bar 81 which carries adjustable forks 82, 83. Should a warp break, the finger 53 is acted on by the fallen needle and moves the lever arm 79, which pulls back the spindle 77 clear away from the bar 78. On this occurring, the drop lever 74 allows the half nut 76 to fall into gear with the worm 59 and the half-nut is moved endwise (against a spring 84) until it encounters the fork 82, and so moves the slotted bar 81 and acts on the knock off lever 70 which unlatches the starting lever and so effects the shifting of the belt and stoppage of the loom. This is the warp stop motion shown.

The warps pass through and are distributed around a circular revolving reed 85, carried on a ball joint 86, or otherwise supported. Such revolving reed is driven by attached drivers 87 fitting in slots in the fixed ball 86 and, also by driving bars 88 attached to the wall of the cumber-board or heddle frame. The reed dents are fixed in balks and can be applied in segments, the outer balks being clamped between plates 89, 90, and the inner balks between the flanged arms 91 and the back of an annular plate, or ledge, or "race" 92 which is bolted to the reed. The complete reed is disposed at a suitable angle, or skewed, and is held in the desired position by small bowls 93 which can be adjusted to give the desired inclination or cant to the revolving reed for the purpose of setting same to the annular revolving temple 94. To this temple, the revolving reed beats up, and the dents force the weft with any desired degree of force into the "fell" of the cloth, the annular revolving temple 94 being fixed on the main shaft 1. I arrange that the reed shall reach and beat into the fell of the cloth as said reed approaches the top or moves downward from a vertical line coincident with the loom center, the reed gradually approaching and receding from the fell of the cloth as I endeavor to indicate in Figs. 1 and 11.

The weft is preferably supplied from a

curved shuttle 95, which shuttle is fixed, and lies against the annular face of the ledge or race 92, and this shuttle is shown more clearly in Figs. 25, 26 and 27. The use of a fixed shuttle is a most important point. The shuttle carries a cop 96 on a plain pivoted tongue, and threads through the slot 97, the weft paying off through the eye 98. The shuttle has bowls 99 at the top to contact with the ledge or race, and bowls 100 at the bottom. Said shuttle is inclined or beveled at the bottom, and rests on two inclined retaining bowls 101, and 102, which keep the shuttle in place and prevent same moving while the ledge or "race" slips past easily, along with the reed. One of these retaining bowls revolves on a stud 103 and is carried in a frame 104, and the other bowl 102 is carried on a stud attached to a pivoted arm 105 jointed at 150 to the frame 104, the frame being angularly adjustable about a support 107 to conform with the inclination, adjustment, or setting of the reed. To the lever arm 105, is jointed a hand lever 108, having a notch 109 which engages the stud 110 to keep the shuttle box closed and the shuttle in position, while, by elevating the hand lever 108, the bowl 102 is moved to permit opening of the shuttle box and allow of the shuttle being removed from the box (see the dotted lines Fig. 12). The part marked 106 is a support or strut from the shuttle box. For preference, I drive the shuttle retaining bowls 101 and 102 to reduce friction on the warps, and one way of accomplishing this is shown, in Fig. 14, where a band 113 encircles the grooved bosses of said bowls 101 and 102 and is driven from a pulley 111 on the shaft 58. The pulley 112 is a band tension device. The way of holding the shuttle in place may vary considerably, the means shown are however very simple.

It will be appreciated, from the foregoing, that the shed moves past the shuttle fully open with warp threads above and below, and closes as the cumber-board or heddle frame revolves. I fit a weft stop motion and this preferably takes the form of a weft fork or finger 114 (four or any number being fitted), pivoted at 115, and having a thin plate 116 which passes between the reed dents. With weft being delivered around the ledge or "race," the weft holds back such thin plates 116, and the outer end of the fork or finger 114 misses the lever 117 pivoted at 118. Should however the weft break, the thin plate 116 emerges (see Fig. 22) and the fork or finger encounters the lever 117 to which is attached a flexible wire 119, guided through eyes and over small pulleys, and pulls upon this wire. The wire 119 is attached to a pin 120 fitted in bearings in the drop lever 75 (see Figs. 2 and 4). When the wire 119 pulls the pin off the bar 78 the half nut 121 is lowered into gear with the worm 59 and shifted (against the action of spring 122), so that it ultimately actuates the fork 83 and slotted bar 81 and moves the knock off lever 70 to release the setting-on lever 62. Consequently the shaft 60 is rocked, the belt fork is shifted, and the loom stopped in similar manner to what has been already described in connection with the warp stop motion. It is clear, that, when the foot treadle 61 is actuated, it moves the lifters 73, 72 causing same to raise the drop levers 75 74, allowing the coiled springs shown to re-set the parts 120 and 77.

In order to prevent any take-up and the production of faulty places when the weft fails, I arrange to stop the take up immediately the weft fails and before arrestation of the loom, and this is done in the following simple manner. The take-up depends upon the fixing of a worm 123, and this worm is compounded with a ratchet wheel 124 normally locked by a weighted pawl 125 pivoted at 126. To this pawl is connected a flexible tie 127 also attached to a cranked rod 128 which is bent back and journaled in bearings 129, and extends longitudinally on the rear side of the loom toward the weft stop motion gear, where it is bent and is passed freely through a hole in the drop lever 75. Now, immediately the pin 120 is pulled and the drop lever falls, the rod 128 is acted upon, allowed to fall slightly and pulling on the flexible tie 127, takes the pawl 125 out of gear and frees the worm 123. Thus the take-up is stopped before the worm 59 has traversed the half-nut to act on the fork 83. The reëngagement of the pawl 125 takes place when the drop lever 75 is raised and re-set.

From the annular temple 94, the circular fabric is flattened and gradually assumes a stretch suitable for the taking-up roller, and it may be drawn past flatteners, or distenders such as the rounded flattening bars 130 pivoted at 131 and supported by a bar 132 fixed on the main shaft 1. The doubled or flattened tube of fabric which may be woven with "doup" ends (as well known) or with a "split" or absence of several warps, is now cut to pass the main shaft and thus permit the severed and flattened tube to pass to the take-up means. The cutting may be done in any well known or suitable manner as by a knife 200 on the shaft 1. The take up means may consist of a sand roller 133 partly around which the fabric passes, a second sand roller 134, and a taking up roller 135, the taking up roller winding-up the fabric. The taking-up roller is made readily removable and its axle may fit in simple slots, Such taking-up roller 135 may be held in position by spring tension on its axle, and rotated by friction from the sand roller 134. All the roller shafts are supported in bear-

ings in side brackets 136, 136, attached to a cross girder from the main shaft 1, and so the taking-up rollers are rotated around like the warp beams.

The manner of actuating the take-up may vary, and, in the drawings, I have shown simple means consisting of the worm 123, which, for taking-up is fixed by the pawl 125. Said worm 123 gears with the worm wheel 137 fixed on the cross-shaft 138. This cross-shaft 138 carries spur pinions 139, which gear into carrier wheels 140 having small pinions 141, which latter drive the pinions 142 fixed on the sand roller 133, and the pinions 142 gear with pinions 143 on the second sand roller 134, all as is clear from the drawings.

The cumber-board or heddle frame 39 is held by stays 145 fixed to the cross-heads 146 keyed or fixed on the main shaft 1.

The frame-work of the loom is properly stayed and the main shaft carried in roller bearings if desired. The whole loom can be made very compact, occupying a lateral space very little in excess of the diameter of the cumber-board or heddle frame.

By using a stationary shuttle I dispense with all shuttle driving and picking difficulties and the weft always comes off the same way.

The cumber-board or heddle frame can take a very great number of needles and the shedding power of my circular or revolving loom is very considerable.

The whole system being rotary and the loom employing a rotating reed, and a fixed shuttle, the loom runs with an entire absence of vibration and little noise.

The new loom is very simple in construction and can be run at a high speed with little attention.

Cloth of very considerable width can be woven in it, say from 100 to 200 inches, and I may omit warps or weave a "split" to facilitate cutting of the tubular woven fabric.

To prevent the weaver starting without shuttle or leaving the lever handle 108 up, and the shuttle box open, I may provide means, which, after elevation or unlatching of the starting lever 62, prevent said starting lever being pressed down or latched until the shuttle box is closed. This can be simply done, by having a pivoted catch 147 on the starting lever 62 which catch is connected to the lever handle 108 by a flexible tie 148. Should the weaver leave the lever handle 108 up, the catch 147 drops into a vertical position and stops the starting lever from latching by encountering the bracket 63. When the shuttle box is closed however, the pull of the flexible tie 148 moves the catch 147 sidewise out of the way of the bracket 63 and the starting lever 62 can be at once latched.

I declare that what I claim is,

1. A revolving loom comprising revolving warp supporting devices, a back-rest for the warps, warp let-off mechanism, tension controlled means working said warp let-off mechanism, revolving automatic shedding mechanism, radial needles and cards controlling the shedding, a rotating reed, cooperating with a stationary shuttle, means for driving the reed and means for supporting said shuttle, and fabric take-up mechanism, carried about the central shaft.

2. A revolving loom having in combination a rotating warp supply, rotating warp tension controlling mechanism, warp let-off mechanism controlled thereby, means governing the shedding and consisting of a revolving cumber-board, radially movable needles, and a traveling metal card, a rotating reed, driven from the main shaft, and acting with a stationary shuttle, rotating take-up mechanism about the main shaft, all as described.

3. The combination in a revolving loom, revolving warp carrying means, a back rest, an automatic tension device comprising movable sections, guide spindles, a rotatable plate, and push spindles, and warp let-off mechanism, revolving shedding mechanism, revolving beat-up mechanism, stationary shuttles, rotating temples and take-up gear as described.

4. In combination in a revolving loom, a main revolving shaft, revolving warp beams, gear to drive said warp beams, a rotating back-rest, radially movable devices on said back-rest acted on by the warp tension, a rotatable plate, means for insuring driving connection for the warp beams on movement of the plate, a revolving cumber-board, with radially movable needles, a movable card, a revolving reed, a stationary shuttle, a revolving temple, and rotating take-up rollers, and gear driven from the main revolving shaft to take-up the cloth as woven substantially as described.

5. In revolving looms, and in combination, a main driving shaft, a warp supply, a back-rest and means for controlling warp delivery, a revolving cumber-board or heddle frame, needles or heddles in the same and revolving therewith, and a pattern device, moving with the cumber-board, a revolving reed, a stationary shuttle, a revolving temple, and rotating take-up rollers, and gear driven from the main driving shaft to take-up the cloth as woven substantially as described.

6. In revolving looms, and in combination with a warp supply, a warp supply, a main revolving shaft, a back-rest thereon, and means for controlling warp delivery, a revolving cumber-board or heddle frame, needles or heddles in same and revolving therewith, and a pattern device with engag-

ing attachments, a cumber board, means on the cumber-board engaging the attachments on the pattern device, the pattern device moving with the cumber-board, said pattern device controlling the movement of the needles, said needles controlling the shedding, and revolving beat-up means, and take-up means for batching the cloth woven, as set forth.

7. In revolving looms and in combination a rotating warp supply, revolving gear for driving same, a back rest warp tension mechanism, a revolving cumber-board, needles therein, means for guiding the needles, a traveling pattern card in connection with the cumber-board, means to insure return of the needles, the whole coöperating with a revolving temple, revolving take-up means, and gear for driving said take-up means, as set forth.

8. In revolving looms of the indicated type and having revolving warp delivery rollers, driving gear, warp tension devices, the combination therewith of a revolving reed and revolving temple, a main revolving shaft carrying the reed said reed having provided means to permit adjustment of the angle, a stationary shuttle and stationary means to support same, and revolving batching and take-up gear which receive the woven cloth from the temple as described.

9. In revolving looms of the indicated type and in combination with revolving warp supply means, revolving driving gear, revolving back rest, cumber board and revolving reed with a ledge, of a stationary shuttle adjacent to said ledge, and a box for said shuttle, anti-friction means for supporting the shuttle, and means permitting the box to be opened and closed, a temple for the woven cloth and revolving take-up rollers and gear all as described.

10. In revolving looms and in combination a revolving shaft, revolving warp beams, driving and warp tension gear, a revolving cumber-board, radially movable needles, a pattern card, a revolving reed having a shuttle ledge, and a stationary shuttle carried in a shuttle box, said box having anti-friction bowls, driving means for such bowls, a revolving temple, and revolving take-up means as described.

11. In revolving looms with revolving warp supply, revolving back-rest and automatic warp tension gear, and including a revolving cumber-board with radially movable needles, and revolving reed with shuttle ledge, a stationary shuttle, anti-friction bowls thereon, and a collapsible shuttle box, bowls therein supporting the shuttle, driving means for the bowls, a revolving temple and revolving take-up means as set forth.

12. A revolving loom comprising a central driving shaft and supports thereon for warp beams, revolving warp beams and gear therefor, and revolving warp tension mechanism, and a revolving cumber-board on the central shaft with radially movable needles, a trigger lever operated by the needles and a warp stop motion actuated by said trigger lever, fixed means for returning the needles, a revolving reed and a ledge thereon, a weft furnishing device, and a rotating temple co-acting with the revolving reed, and revolving cloth batching means, as described.

13. A revolving loom comprising a central revolving shaft, driving gear for said shaft, a revolving warp supply carried from the shaft, warp tension devices and gear controlled therefrom for liberating warp, a revolving shedding device having radially movable needles, means for returning the needles, a revolving circular reed with radially disposed dents, a weft finger, a movable trigger operated thereby, weft stop motion mechanism actuated by said trigger, a revolving temple and batching means for the cloth leaving the temple, and take-up gear on the revolving shaft all as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHRISTOPHER WHALLEY.

Witnesses:

RICHARD WEBSTER IBBERSON,

ALFRED STUART YATES.