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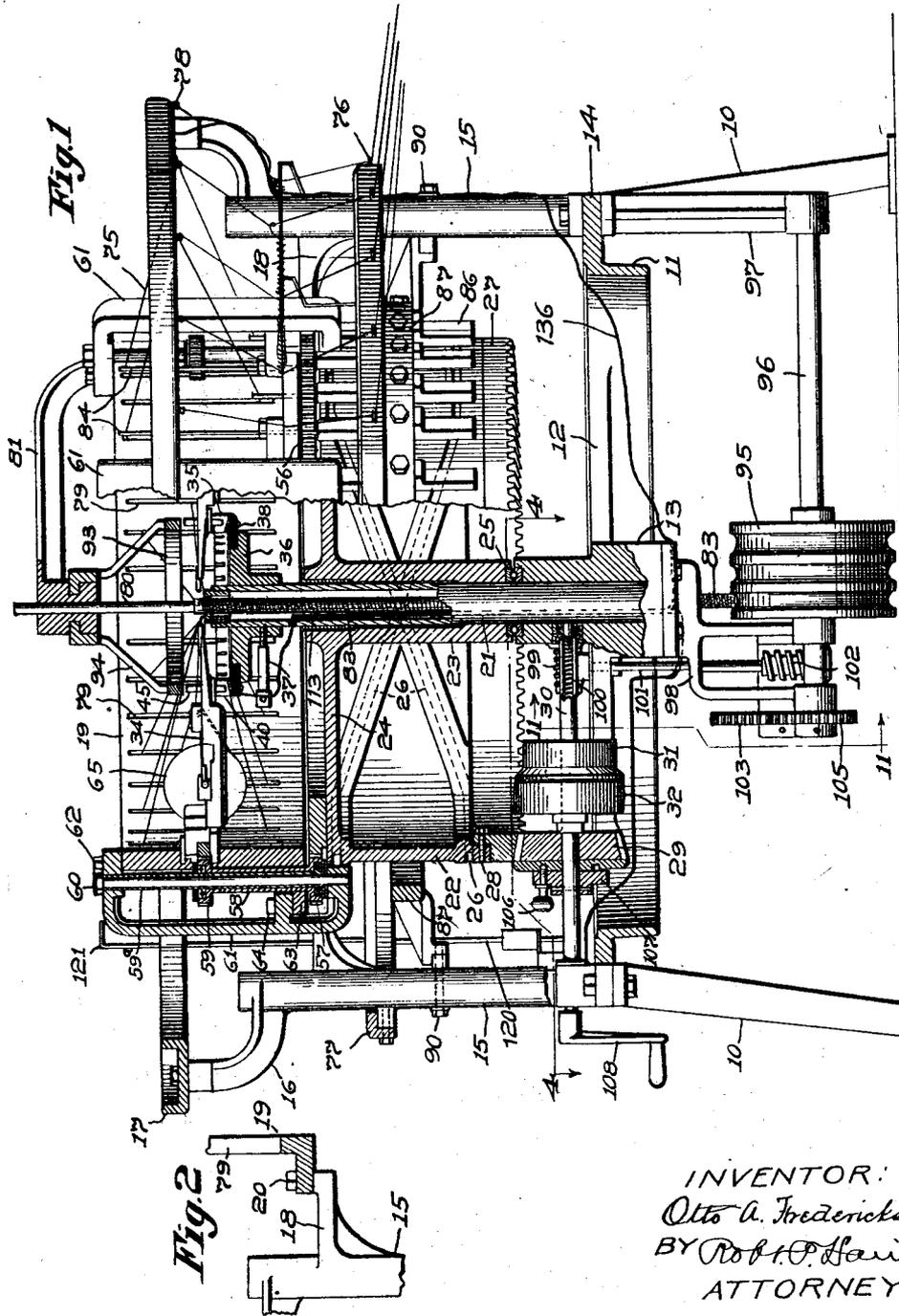
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O. A. FREDERICKSON

CIRCULAR LOOM

Original Filed March 3, 1924

4 Sheets-Sheet 1



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Fig. 3

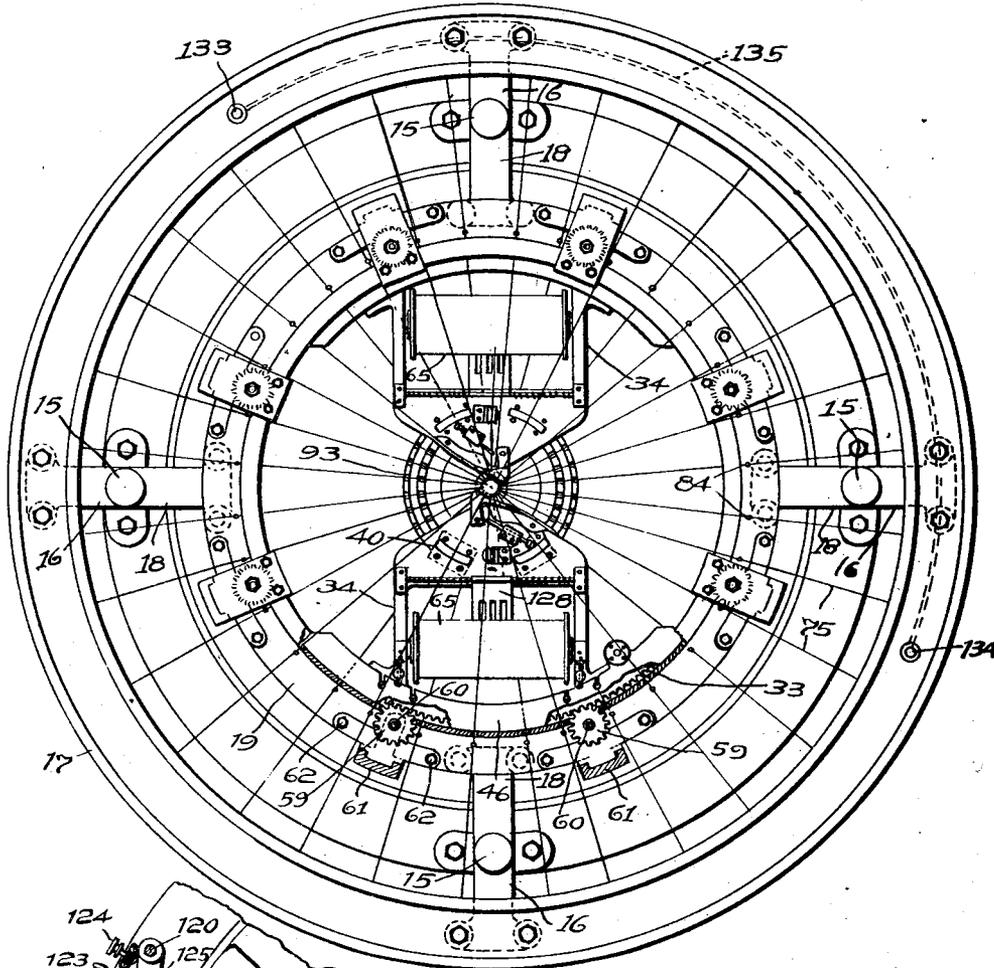
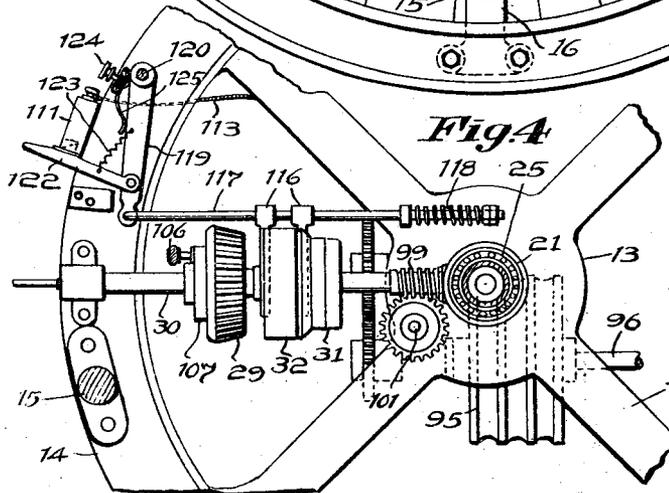


Fig. 4



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Fig. 5

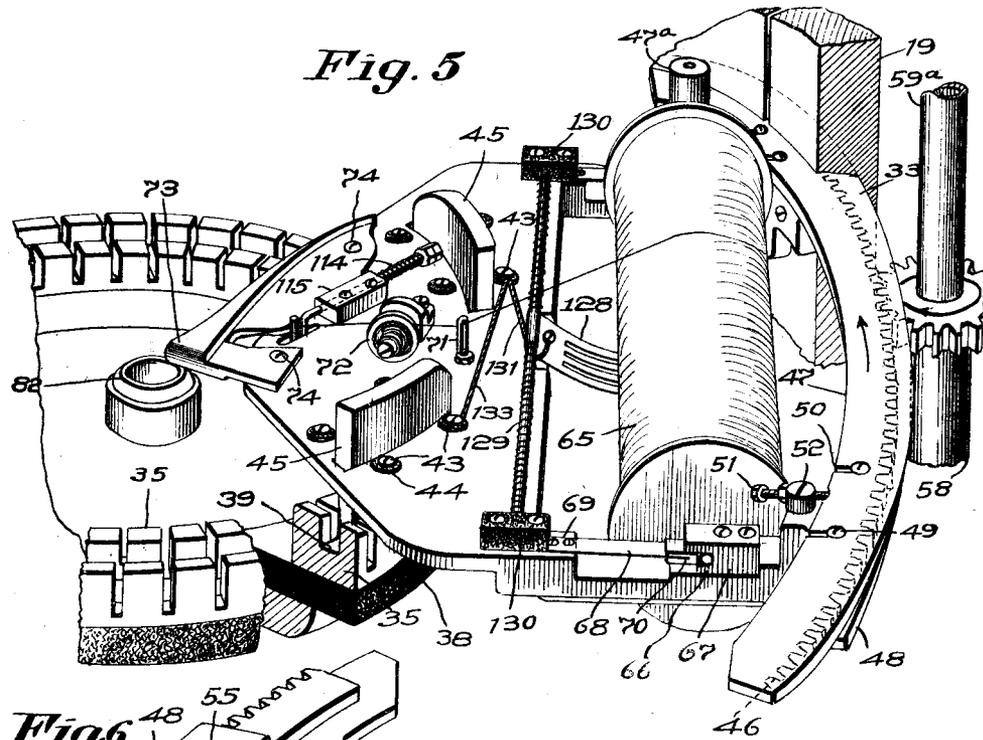


Fig. 6

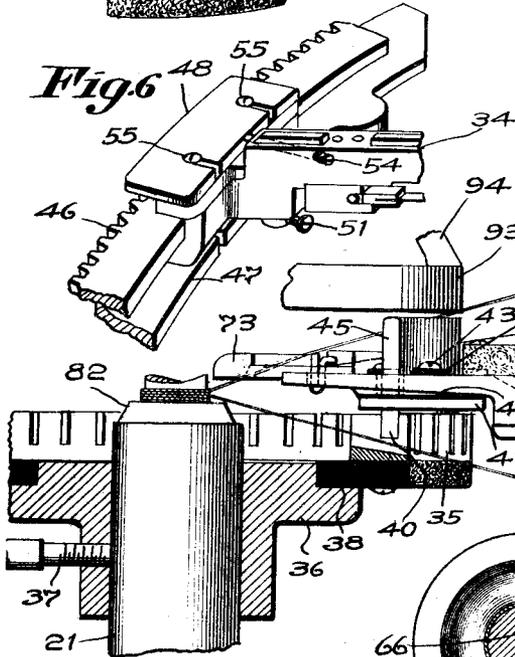


Fig. 7

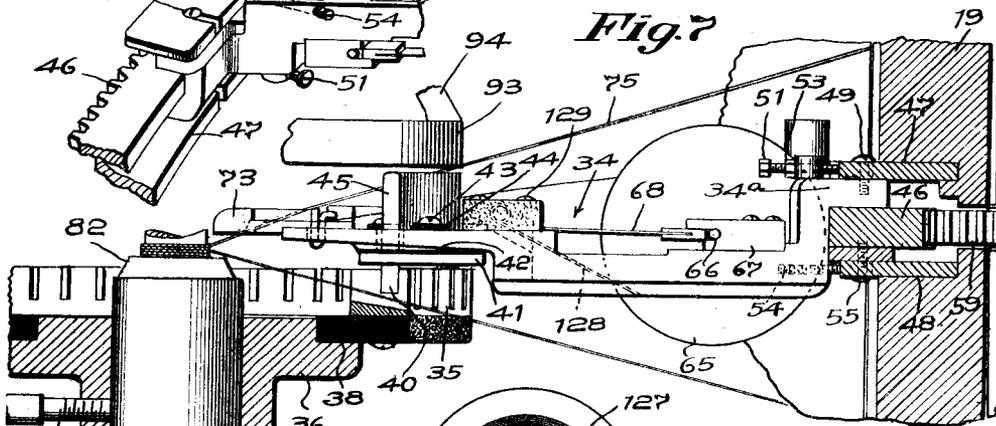
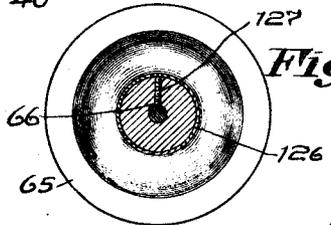


Fig. 8



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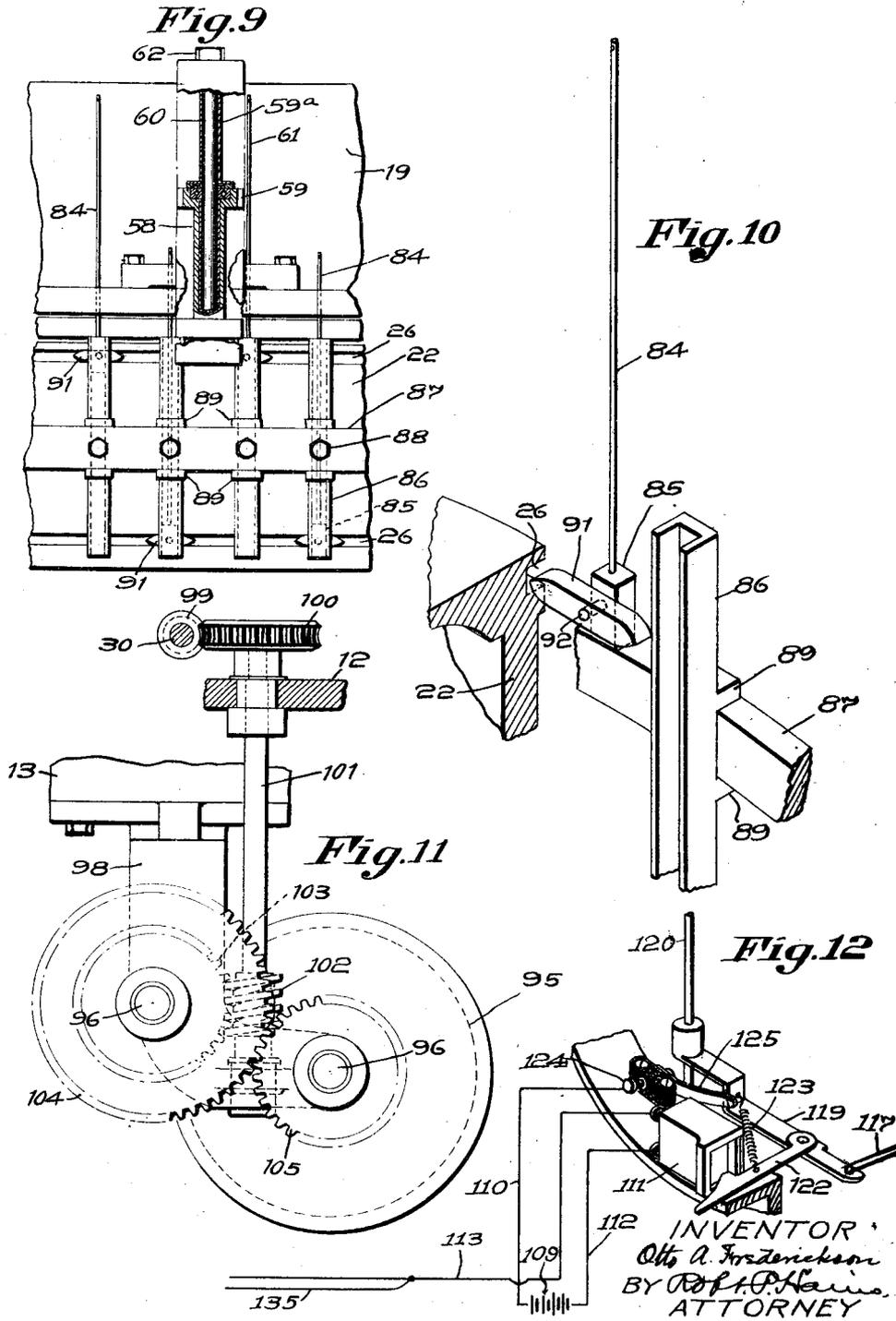
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CIRCULAR LOOM

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4 Sheets-Sheet 4



# UNITED STATES PATENT OFFICE.

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## CIRCULAR LOOM.

Application filed March 3, 1924, Serial No. 696,458. Renewed July 7, 1928.

This invention relates to circular looms, and more particularly to the type in which the shuttle travels in a horizontal plane.

One of the main objects of the present invention is to provide a strong and serviceable circular loom that may be operated at high speed with a minimum amount of vibration. The circular looms provided heretofore have been open to the objection that they vibrate excessively when operated at high speed and the present invention contemplates a strong compact loom construction which is practically free from vibration.

In circular looms of the type to which the present invention relates one or more shuttles are supported to travel about a circular race-way, and an important feature of the present invention resides in wear plates upon the shuttles that engage the race-way and which are adjustably secured to the shuttles so that they may be adjusted to take up wear.

Heretofore circular looms have been provided with a warp ring which supports the inner portion of the shuttle, and another feature of the present invention resides in means cooperating with the warp ring for positively maintaining the shuttle in place so that all danger of the shuttle escaping from its path of travel is avoided.

Another feature of the invention resides in means by which the take-up means for the woven tube may be operated either by hand or by power without operating the entire loom.

Another feature of the invention resides in improved means for operating the shuttle or shuttles.

Still another feature of the invention resides in electric means controlled by the tension of the weft thread and also by the amount of weft thread carried by a shuttle, and constructed to stop the loom when the weft thread becomes too slack and also when the supply of weft thread carried by a shuttle becomes substantially exhausted.

Other features of the invention and novel combination of parts in addition to the above will be hereinafter described in connection with the accompanying drawings, which illustrate one good practical form thereof.

In the drawings:—

Fig. 1 is a vertical sectional view thru a circular loom constructed in accordance with the present invention.

Fig. 2 is a fragmentary sectional view

showing the supporting means for the fixed drum.

Fig. 3 is a top plan view of Fig. 1.

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 1.

Fig. 5, on an enlarged scale, is a perspective view of one of the shuttles and the associated parts of the loom.

Fig. 6 is a perspective view of a portion of the under face of the shuttle.

Fig. 7 is a vertical sectional view thru the shuttle and associated parts shown in Fig. 5.

Fig. 8 is a transverse sectional view thru the weft supporting spool of Fig. 5.

Fig. 9, on an enlarged scale, is a face view of a portion of the fixed drum and of several of the heddle supporting guides.

Fig. 10 is a perspective view showing a heddle and one of the heddle guides in disassembled relation.

Fig. 11 is an enlarged sectional view taken on the line 11—11 of Fig. 1, and;

Fig. 12 is a perspective view of electrical means for stopping the loom, the electrical connections being shown diagrammatically.

In the embodiment of the invention illustrated in the drawings the supporting frame of the circular loom is provided with legs 10 which are bolted or otherwise secured to a lower ring 11 having spokes or inwardly extending arms 12 which support a hub 13. In the construction shown the legs 10 are secured to a laterally extending flange 14 of the ring 11, and secured to the upper face of this flange and extending upwardly therefrom are posts 15, four being shown in the present case. These posts are provided near their upper end with outwardly extending brackets 16 which support an upper ring 17. The posts 15 are also provided with inwardly extending brackets 18 which support the fixed drum 19 and which is secured to the brackets 18 by bolts 20, as clearly shown in Fig. 2.

The central hub 13 supported by the lower ring 11 is provided with an upwardly extending hollow post or shaft 21 and rotatably mounted upon this post is the cam drum 22. The cam drum 22 is supported by a hub 23 connected to the drum by the laterally extending web 24 disposed at the upper portion of the drum 22. The hub 23 rests upon a roller bearing 25 and a bearing surface is provided between the hub 23 and fixed shaft 21 at the opposite ends of said hub. The cam drum 22

is provided with the cam slots 26, each of which extends part way around the upper portion of the cam drum and then extends downwardly along an inclined path and extends part way around the lower portion of the cam drum in a well known manner, and as will be apparent from Fig. 1. The lower portion of the cam drum 22 in the construction shown is provided with a ring gear 27 which is secured to the cam drum by bolts 28 and this gear and drum are driven by a pinion 29 mounted upon the shaft 30. The shaft 30 is provided with a loose pulley 31 and a fixed pulley 32 and the shaft 30 is driven in the usual manner by shifting a driving belt from the loose pulley 31 to the fixed pulley 32 to thereby drive the pinion 29 and cam drum 22 operated thereby.

The fixed drum 19 is provided with a race-way 33, in the present case comprising an annular slot formed in the inner face of the drum 19 and the shuttle or shuttles 34 travel in this race-way. The race-way 33 serves to support the outer portion of the shuttles 34 and in the present case these shuttles are further supported by a warp ring 35 mounted upon a flange plate or head 36 rigidly secured to the upper end of the post 21 by a set screw 37. In the construction shown the warp ring 35 is electrically insulated from the head 36 and to this end a ring of fibre or other insulating material 38 is disposed between the ring 35 and head 36. The warp ring has an annular slot or recess 39 formed in its upper face which is adapted to receive a downwardly extending shoe 40 secured to the lower face of the shuttle 34. In the present case, and as best shown in Fig. 7, the shoe 40 is electrically insulated from the shuttle 34 and this is accomplished by providing the shoe with a laterally extending flange 41 disposed at the under face of the shuttle and spaced therefrom by insulating material 42. The flange 41 is rigidly secured to the shuttle by bolts 43 which bolts are electrically insulated from the shuttle by fibre or the like 44. In the construction shown the shoes 40 are provided with an upwardly extending portion 45 which extends thru an enlarged slot or opening in the shuttle, as shown in Fig. 5, the arrangement being such that the upwardly extending portion 45 does not touch the metal of the shuttle. In the construction shown each shuttle is provided with two shoes 40 supported in spaced relation to each other, as clearly shown in Fig. 5. The arrangement is such that as the shuttles travel around the race-way 33 they will be supported by the shoes 40 sliding in the annular groove or recess 39.

In the embodiment of the invention illustrated the shuttles 34 are driven by spaced pinions to be described, and each shuttle is therefore provided with a toothed rack 46 secured to the shuttle so that the toothed por-

tion of the rack will extend into the race-way 33. It is obviously necessary to provide the shuttle with means that extend into the race-way to support the shuttle and in the present case wear plates are provided to this end. A relatively long wear plate 47 is provided above the rack 46 and two spaced wear plates 48 are provided below the rack. It is desirable that means be provided for adjusting the wear plates upon the shuttle to take up wear and to this end the plate 47 is secured to an outwardly extending portion 34<sup>a</sup> of the shuttle by bolts 49 that extend thru slots 50, the arrangement being such that the wear plates may be secured upon the shuttle in any desired position of adjustment by tightening the bolts 49.

It may be desirable to provide means for forcing the wear plates outwardly upon the shuttle and to this end the wear plate 47 is provided with adjusting screws 51 which have threaded engagement with posts 52 extending upwardly from the shuttle, and each screw may be secured in the desired position of adjustment by a lock nut 53. The under wear plates 48 are adjustably secured to the shuttle in a similar manner, and as clearly shown in Fig. 6 the wear plates 48 may be adjusted outwardly by a set screw 54 and these plates may be secured in the desired position of adjustment by screws 55. Due to the construction just described the desired adjustment between the shuttles 34 and the race-way 33 may be at all times maintained and lubricant may be supplied to the wear plates by one or more oil cups 47<sup>a</sup>, and since the shoes 40 travel in the annular slot 39 these shoes prevent the shuttles from moving inwardly sufficiently to permit the wear plates 47 and 48 to move out of the race-way.

In order to drive the shuttles the rotating cam drum 22 is provided at its upper end with a ring gear 56 and this ring gear is adapted to drive pinions 57 secured at the lower end of hollow shafts 58, which shafts are provided at their upper ends with pinions 59 that mesh with the teeth of the rack 46 secured to the shuttles. In the construction shown the hollow shaft 58 provided with the pinions is rotatably mounted upon a sleeve 59<sup>a</sup> which surrounds a bolt 60 and the sleeves 59<sup>a</sup> and bolts 60 are rigidly supported by vertically extending flanges 61 having laterally extending flanges at their opposite ends, which flanges receive the opposite ends of the bolts 60. The upper flange of the bracket 61 is rigidly secured to the upper face of the fixed drum 19 by bolts 62 and an intermediate portion of the bracket 61 is secured to a flange 63 of the fixed drum by bolts 64. The number of pinions 59 provided to drive the shuttles may be varied as desired and in the construction shown eight of these pinions are provided, each of which is supported in the manner just described by a bracket 61.

In the present construction the rack 46 of each shuttle is made relatively long so that this rack will at all times remain in engagement with at least two pinions 59 and the construction is such that while the rack is moving into engagement with one pinion an intermediate portion will be engaged by a second pinion, while the rear end portion of the rack will be in engagement with a third pinion. The arrangement of parts whereby a shuttle is always acted upon by at least two driving pinions is desirable, as this construction tends to steady the action of the shuttle and drives the same in a much more satisfactory manner than where only one driving pinion is normally in active engagement with the shuttle rack.

Each shuttle 34 is provided with a source of weft thread supply, in the present case comprising a spool 65. The spool 65 is provided with a central pin 66, the ends of which protrude from the opposite ends of the spool and are rotatably supported in blocks 67 secured to the shuttle. Each block 67 is provided with a laterally extending notch adapted to receive the pin 66 and the pin is held within each notch by a flexible blade 68 rigidly secured to the shuttle at 69 and having a head 70 at its outer end which is normally held by the blade in position to close the pin-receiving slot. When it is desired to remove the spool 65 from the shuttle this is readily done by forcing the head 70 downwardly sufficiently to permit the pin 66 to escape from the supporting slots.

The weft thread is led from the spool 65 under a guide 71 and then thru a tension device 72 which may consist of two discs yieldingly held in contact with each other, and the weft thread passes from this tension device to the weaving point. The inner end of each shuttle 34 is preferably provided with a warp guiding plate 73 which is secured to the shuttle by bolts 74 and the weft thread passes under the warp guiding plate 73.

The warp threads 75 supplied to the circular loom may be drawn from a suitable source of supply and these threads are shown as passing thru guides 76 secured to an intermediate ring 77 fastened to the upright posts 15. The warp threads pass from the guides 76 upwardly to guides 78 carried by the upper ring 17 and then pass from these guides thru vertical slots 79 formed in the wall of the fixed drum 19, and the warp threads extend from these slots to the weaving point. The loom illustrated is constructed to weave tubular fabric of a relatively small diameter such as used for insulating wire, and in the construction shown the warp and weft threads are woven about a mandrel or forming bar 80 which is supported by a bracket 81 secured to the fixed drum and extending inwardly to the central axis of the machine. The mandrel 80 extends downwardly into a ring or

form 82 mounted in the upper end of the fixed shaft 21 and the woven fabric passes downwardly in the form of a tube 83 between the mandrel 80 and ring 82.

During the weaving operation it is necessary to provide means for raising and lowering the warp thread 75 so that the shuttles will pass alternately over and under these threads, and means to this end in the construction shown consists of heddles 84 having blocks 85 at their lower ends which slide vertically in heddle guides 86. In the present case the heddle guides are constructed in the form of independent castings which are rigidly secured to a supporting ring 87 by bolts 88, and each heddle guide is provided with spaced ears 89 adapted to engage the upper and lower faces of the ring 87 which ring is supported by the posts 15 to which it is secured by bolts 90. The construction of the heddle guides just described is desirable because it permits any heddle guide to be removed when desired, for renewal or other purposes, without disturbing the position of the other heddle guides. In order to impart reciprocal movement to the heddles each is provided with a shoe 91 secured to the block 85 by a pin 92 and adapted to slide in one of the cam slots 26. In most cases the arrangement will be such that while one heddle is in its uppermost position the next adjacent heddle will be in its lowermost position and this is accomplished by mounting the shoes 91 of the heddles alternately in one groove 26 or the other, and each heddle will be held in its uppermost position during part of one complete rotation of the cam drum 22 and then will pass downwardly along the inclined portion of the slot 26 to remain in its lowermost position during a short interval of time, it being understood that the movement imparted to the heddles is so timed that the warp threads at all times clear the traveling shuttles. Since the shuttles pass over the warp threads that are depressed, notches are formed in the warp ring 35 to receive these warp threads so that they will not be injured by the shoes 40 of the shuttles sliding in the recess formed in the upper face of this ring. As stated the shoes 40 cooperate with the annular groove of the warp ring 35 to prevent the shuttles from moving inwardly sufficiently to disengage the wear plates from the race-way 33. It is desirable to provide means for preventing the shuttles from lifting upwardly sufficiently to disengage the shoes 40 from the annular recess in which they travel, and to this end a ring 93 is provided which is supported from the bracket 81 by arms 94 and this ring is held in spaced relation to the upwardly extending portions 45 of the shoes 40. The position of the ring 93 is such that it is normally out of engagement with the portions 45 but prevents the shoes from

escaping from the annular groove in which they travel. The ring 93 serves also as a warp thread depressor to depress the warp threads extending from the upper portion of the slots 79 to the weaving point as will be apparent from Figs. 1 and 7.

As the tube 83 is woven it passes downwardly thru the hollow shaft 21 and passes several times about the grooved take-up drum 95 which is secured to a horizontally extending shaft 96 having one end journaled in a downwardly extending bracket 97 and its opposite end rotatably supported by a bracket 98 fastened to the hub 13. Provision is made for driving the take-up drum from the shaft 30 and to this end the shaft 30 is provided with a worm 99 which drives a worm gear 100 secured to the upper end of a vertical shaft 101 and the lower end of the shaft 101 is provided with a worm 102 which imparts movement to the take-up drum thru a worm wheel 103 and gears 104 and 105.

In some cases it may be desirable to rotate the take-up drum 95 either by hand or by power without driving the entire loom and this is accomplished by mounting the pinion 29 loosely upon the shaft 30 and driving movement is imparted to the pinion from the shaft by a sliding pin 106 carried by a disc 107 rigidly secured to the shaft 30, the arrangement being such that the pinion 29 may be released from driving engagement with the shaft by pulling the pin 106 out, and may be driven by this shaft by inserting the pin 106. The outer end of the shaft 30 is provided with a crank 108 by which the entire loom or the take-up alone may be operated by hand.

It is desirable to provide means for automatically stopping the loom if a weft thread drawn from the spool 65 becomes too slack and electrical means to this end will now be described. As above pointed out the shoes 40 are insulated from the shuttle to which they are secured and the warp ring 35 is insulated from the loom frame. The current for operating the electrical mechanism to be described is furnished by a battery or other source of supply 109 (see Fig. 12) and one terminal of this battery or other source of supply is grounded to the loom frame by a wire 110. The other terminal of the source of supply 109 is connected to one terminal of a solenoid 111 by a wire 112. A second terminal of the solenoid 111 is connected to the insulated warp ring 35 by a wire 113 which wire is shown in Fig. 1 as extending from the ring 35 downwardly thru the hollow post 21 and then along one of the arms 12 of the lower ring to the solenoid. From the construction just described it will be seen that if a contact is provided between the metal frame of one of the shuttles 34 and one of the insulated shoes 40 the electric circuit will be completed to excite the solenoid 111. A

means for completing this electric circuit and controlled by the tension of the weft thread 65 consists of a sliding pin 114 the rear end of which is adapted to contact with the upwardly extending portion 45 of a shoe 40 and the opposite end of this pin is provided with a hook portion which engages the weft thread. The pin 114 is slidably mounted in a block 115 secured to the shuttle and the pin is urged towards its contact position by a coiled spring. The arrangement is such that the tension of the weft thread extending from the tension device 72 to the weaving point normally holds the pin 114 out of contact with the element 45 but when this tension becomes too slack the pin moves rearwardly under the action of its spring and completes the electric circuit.

The loom is stopped by shifting the driving belt from the fixed pulley 32 to the loose pulley 31 and the belt is shifted from one pulley to the other by a belt shifter consisting of spaced fingers 116 rigidly secured to a sliding bar 117 which bar is urged in a direction to shift the belt from the fixed pulley to the loose pulley by a spring 118.

The belt shifter is moved to the loom driving position by a rocking arm 119 rigidly secured to the lower end of a vertical rod 120 and the outer end of the arm 119 is secured to the sliding bar 117, the arrangement being such that the rod 120 may be rotated by hand to move the belt from the loose to the fixed pulley and to this end the rod 120 is provided with a handle 121 at its upper end. The belt shifter is held in the loom driving position by a latch 122 pivotally secured to the arm 119 and adapted to engage a sliding bolt within the solenoid 111. The latch 122 is urged toward the solenoid by a spring 123. When the solenoid is excited by completing the electric circuit the sliding bolt within the solenoid is retracted to release the latch 122 whereupon the belt shifter is moved in a right-hand direction, viewing Fig. 4, to shift the belt to the loose pulley. The wire 110 forming a ground between one terminal of the source of electric supply and the loom frame is preferably secured to the contact 124 which is insulated from the machine frame and a flexible blade 125 extending from this contact and resting against the rocking arm 119 completes the circuit between the contact 124 and loom frame.

It is desirable that the loom be provided with means for stopping the same, not only when the weft thread becomes too slack, but also when the weft thread upon either spool 65 becomes substantially exhausted. In the present case this is accomplished by providing each spool 65 with a contact surface or ring 126 which is electrically connected to the central pin 66 of the spool by a screw 127. A contact member 128 is secured to a transversely extending bar 129, the opposite ends

of which are supported by blocks 130 formed of fibre or other insulating material, and the outer end of the contact member 128 rests against the weft thread wound upon the spool 5 65 and is urged against the same by coiled springs wound about the bar 129. As long as there is a working supply of weft thread upon the spool 65 the outer end of the contact member 128 is held out of electrical contact with the ring 126, but when the weft 10 thread is unwound sufficiently to uncover this ring the contact member 128 engages the same and completes the electric circuit. The circuit between the contact member 128 and 15 one or both of the shoes 40 is completed by a wire 131 which may extend from the contact member to one of the bolts 43. A wire 132 preferably is provided extending from a securing bolt 43 of one shoe to a securing bolt 20 43 of the other shoe. This is desirable in order to complete the electric circuit thru either shoe, so that the loom stopping mechanism will not fail to work if one of the shoes should become insulated from the warp ring 25 by dirt or from other causes. From the electrical construction described it will be seen that the loom will be brought to rest automatically by the weft thread becoming substantially exhausted upon either spool and 30 also by the weft thread on either spool becoming too slack.

It is desirable that means be provided by which the machine attendant may readily stop the circular loom and in the present case 35 this is accomplished by providing push buttons 133 and 134 which may be mounted upon the upper ring 17 at opposite sides of the loom, so that the loom may be stopped from either side of the same. The push buttons 40 133 and 134 may be connected with the wire 113 by a conductor 135, the arrangement being such that the operation of either push button will excite the solenoid and effect loom stoppage in the manner above described.

45 What is claimed is:

1. A circular loom, comprising in combination, a supporting frame, a fixed drum supported by the frame and having a shuttle race-way formed as a groove in the inner wall 50 of the drum, a warp ring within the drum and positioned below the inner portion of the shuttle, a shuttle supported by the warp ring, means for driving the shuttle, and a wear plate extending radially from the shuttle into the groove of the race-way and 55 adjustably secured to the shuttle for adjustment thereupon to take up wear.

2. A circular loom, comprising in combination, a supporting frame, a drum supported by the frame and having a shuttle race-way formed at the inner face of the drum, a warp ring within the drum and positioned below the inner portion of the shuttle, a shuttle supported by the warp ring, means 60 for driving the shuttle, a wear plate extend-

ing radially from the shuttle into the race-way, and means for adjusting the wear plate relative to the shuttle to take up wear.

3. A circular loom, comprising in combination, a supporting frame, a drum supported 70 by the frame and having a shuttle race-way formed as an annular groove at the inner face of the drum, a shuttle supported to travel about said race-way and having a gear segment adjacent the race-way, spaced pinions 75 for operatively engaging the segment to drive the shuttle, and wear plates supported on the opposite sides of the segment and extending radially from the shuttle into the annular groove of the race-way. 80

4. A circular loom, comprising in combination, a supporting frame, a drum supported by the frame and having a shuttle race-way formed as an annular groove at the inner face 85 of the drum, a shuttle, means for supporting the shuttle to travel about said race-way, wear plates secured to the opposite faces of the shuttle and extending radially outward into the groove of the race-way, and means for 90 adjusting the wear plates independently to take up wear.

5. A circular loom, comprising in combination, a supporting frame, a drum supported by the frame and having a shuttle race-way formed as an annular groove at the inner face 95 of the drum, a shuttle, means for supporting the shuttle to travel about said race-way, a wear plate extending radially from the shuttle into the annular groove of the race-way so that its outer curved face slides against the 100 inner curved wall of the groove, means for adjusting the wear plate on the shuttle to take up wear, and means for securing the wear plate in different positions of adjustment. 105

6. A circular loom comprising in combination, a supporting frame, a drum supported by the frame and having a shuttle race-way in the form of an annular groove formed in its inner face, a warp ring supported centrally 110 within the fixed drum in spaced relation thereto so that it lies under the inner portion of the shuttle and formed with an up-standing annular portion against which a shoe may slide, a shuttle having a shoe near its inner 115 end adapted to slide upon the warp ring against the shouldered portion to prevent the shuttle from moving inward toward the axis of the loom, a wear plate extending radially outward from the outer end of the shuttle 120 into said annular groove to hold the shuttle from moving radially outward, and means for adjustably securing the wear plates to the shuttle to vary the distance between said shoe and the outer bearing face of the wear plate. 125

7. A circular loom, comprising in combination, a supporting frame, a drum supported by the frame and having a shuttle race-way disposed in a horizontal plane, a warp ring within the drum below the inner portion of 130

- the shuttle and having an annular recess formed in its upper face, a shuttle having a shoe extending downwardly into said recess to slide therein, means for driving the shuttle, and a wear plate extending from the outer portion of the shuttle into engagement with the race-way.
8. A circular loom, comprising in combination, a supporting frame, a drum supported by the frame and having a shuttle race-way disposed in a horizontal plane, a warp ring within the drum below the inner portion of the shuttle and having an annular slot formed in its upper face, a shuttle having a shoe extending into said slot to slide therein and adapted to limit movement of the shuttle in a radial direction toward the axis of the loom, means for driving the shuttle, and a wear plate extending radially from the shuttle into engagement with the race-way and constituting a thrust bearing for limiting the outward movement of the shuttle.
9. A circular loom, comprising in combination, a supporting frame, means upon the frame providing a shuttle race-way in the form of an annular groove, a warp ring over which the inner portion of the shuttle travels and having an annular slot formed in its upper face, a shuttle having shoes secured there-to in spaced relation and extending downwardly into said slot to slide therein and adapted to limit movement of the shuttle inwardly toward its axis of rotation, means projecting radially from the outer end of the shuttle into said groove of the race-way, and means for driving the shuttle.
10. A circular loom, comprising in combination, a supporting frame, means upon the frame providing a shuttle race-way, a shuttle provided with an arcuate rack, driving pinions disposed in spaced relation around the race-way and positioned to operatively engage said rack to drive the shuttle, and the rack being of sufficient length to be engaged at all times by at least two pinions.
11. A circular loom, comprising in combination, a supporting frame, a drum supported by the frame and having a shuttle race-way, a shuttle provided with an arcuate rack, driving pinions disposed in spaced relation around the race-way and positioned to operatively engage said rack to drive the shuttle, and the rack being of sufficient length to operatively engage three of said pinions at the instant the rack moves out of engagement with one pinion and into engagement with another.
12. A circular loom, comprising in combination, a supporting frame, a fixed drum supported by the frame and having a shuttle race-way, a warp ring within the drum, a shuttle supported by the warp ring and race-way and having a rack, a cam drum rotatably mounted below the fixed drum and having cam slots and an operating gear, pinions rotated by the operating gear and positioned to engage said rack and drive the shuttle, heddles for shifting the warp threads, a fixed ring surrounding the cam drum, separate heddle guides independently secured to said ring and provided with vertical slide-ways for the heddles, means for rotating the cam drum, and shoes within the cam slots and secured to the heddles to reciprocate them.
13. A circular loom, comprising in combination, a supporting frame, a fixed drum supported by the frame and having a shuttle race-way, a shuttle supported to travel around said race-way and having a rack, a cam drum rotatably mounted below the fixed drum and having cam slots and an operating gear, pinions rotated by the operating gear and positioned to engage said rack and drive the shuttle, heddles for shifting the warp threads, a fixed ring surrounding the cam drum, separate heddle guides independently secured to said ring and provided with vertical slide-ways for the heddles, and means extending into the cam slots to reciprocate the heddles.
14. A circular loom, comprising in combination, a supporting frame, a fixed drum supported by the frame and having a shuttle race-way, a shuttle supported to travel around said race-way, a rotating drum that drives the shuttle, take-up means for advancing the woven product, a main shaft for operating the rotating drum and take-up means, power means for driving said shaft, hand operated means for rotating the shaft, and means for releasing the rotating drum from the action of said shaft so that the take-up means may be operated either manually or by power without operating the rotating drum.
15. A circular loom, comprising in combination, a supporting frame, a drum supported by the frame and having a shuttle race-way, a warp ring supported within the drum below the inner end portion of the shuttle and having a diameter substantially greater than the diameter of the woven fabric and having an annular recess formed in its upper face, a shuttle supported by the warp ring and race-way, a shoe upon the shuttle engaging said recess, driving means for the shuttle, and a depressor ring of approximately the same diameter as the warp ring supported over the shuttle in position to engage the shuttle and prevent the shoe from rising out of the recess.
16. A circular loom comprising in combination, a supporting frame, a drum supported by the frame and having a shuttle race-way, a warp ring supported within the drum below the inner portion of the shuttle, a shuttle supported by the warp ring and race-way, driving means for the shuttle, and a depressor ring supported above the warp ring and of sufficient diameter to lie over a portion of the shuttle that is disposed a sub-

stantial distance from the inner end of the shuttle and adapted to hold the shuttle from moving upwardly out of engagement with the warp ring.

5 17. A circular loom, comprising in combination, a supporting frame, a drum supported by the frame and having a shuttle race-way, a warp ring supported within the drum below the inner portion of the shuttle,  
10 a shuttle supported by the warp ring and race-way, driving means for the shuttle, a shoe extending upward from the shuttle at a substantial distance from the inner end of the shuttle, and a depressor ring supported above  
15 the warp ring to depress the weft thread and disposed over said shoe to prevent the shuttle from moving upwardly out of engagement with the warp ring.

18. A circular loom, comprising in combination, a supporting frame provided with  
20 a shuttle race-way, a shuttle supported by the race-way to travel in a circular path about the axis of the circular loom, means for driving the shuttle, a weft thread spool  
25 adapted to be mounted upon the shuttle and

having a supporting shaft the ends of which project from the ends of the spool, shaft supporting blocks secured to the shuttle and having laterally extending openings to receive the ends of said shaft, and heads yieldingly  
30 held in the entrance to said openings to retain the ends of the shaft therein and depressable to permit the insertion and removal of said shaft.

19. A circular loom, comprising in combination, a supporting frame having a shuttle  
35 race-way, means for advancing the shuttle around its race-way, a cam drum rotatably supported below the shuttle and having cam slots, heddles for shifting the warp threads,  
40 a fixed ring surrounding the cam drum, separate heddle guides independently secured to said ring and provided with vertical slide-ways for the heddles, means for rotating the cam drum, and shoes within the cam slots and  
45 secured to the heddles to reciprocate them.

In testimony whereof, I have signed my name to this specification.

OTTO A. FREDERICKSON.