C. O. BERG.

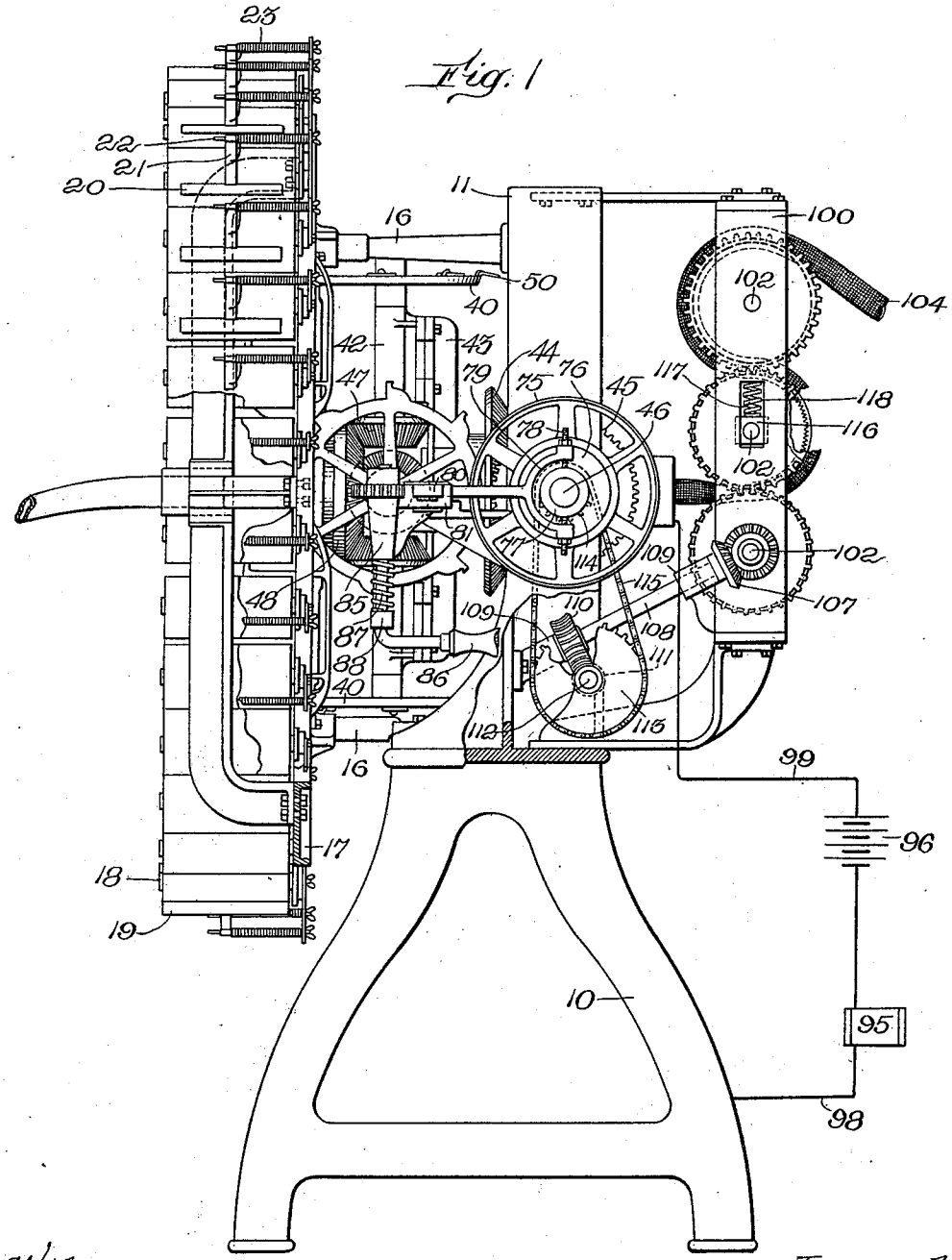
CIRCULAR LOOM.

APPLICATION FILED DEC. 27, 1909.

1,000,576. **Patented Aug. 15, 1911.**

4 SHEETS—SHEET 1.

Fig. 1



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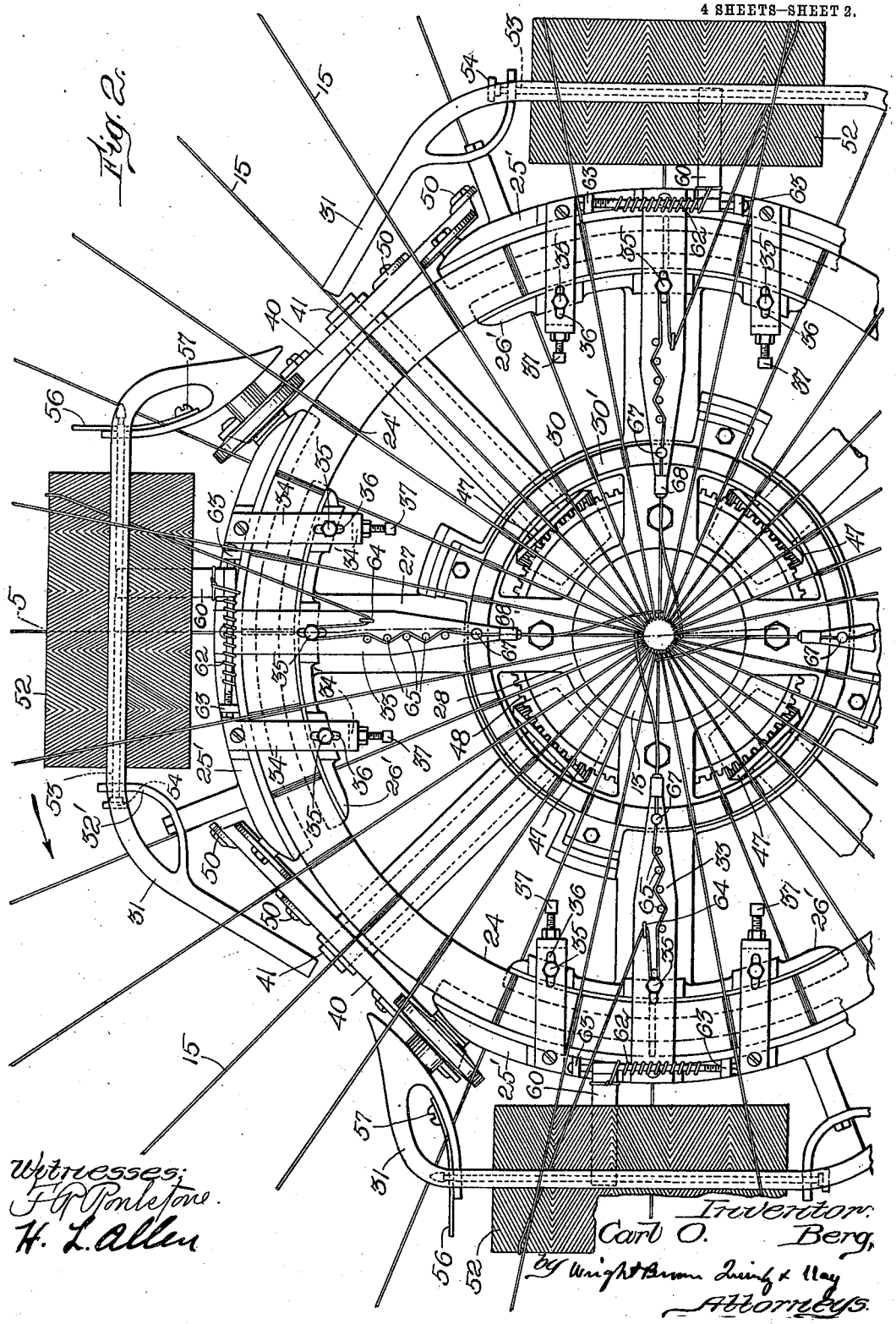
4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

Fig. 3.

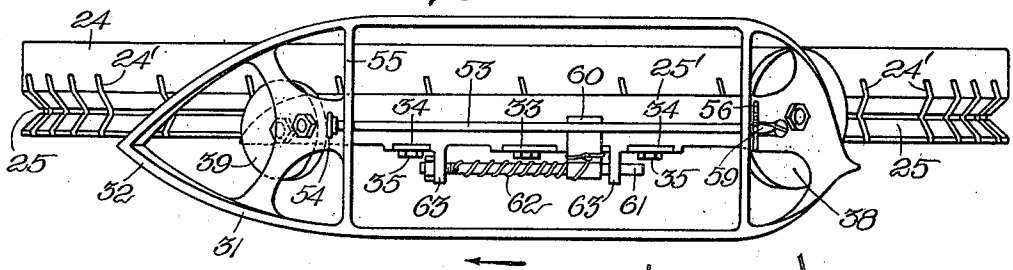


Fig. 4.

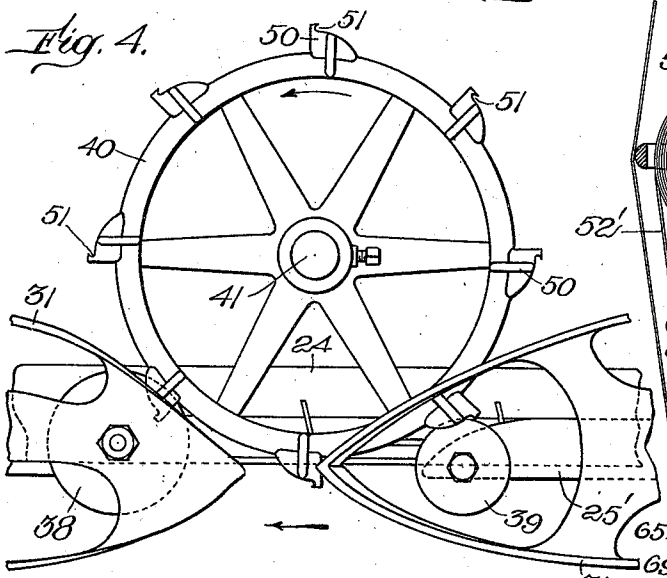


Fig. 5.

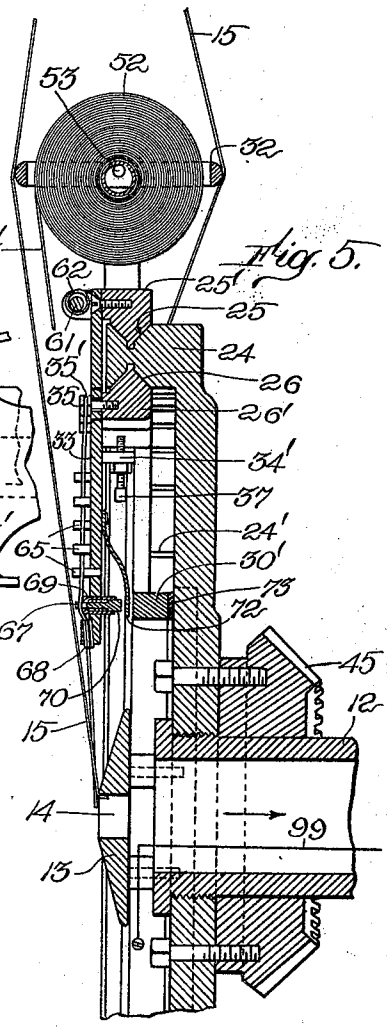
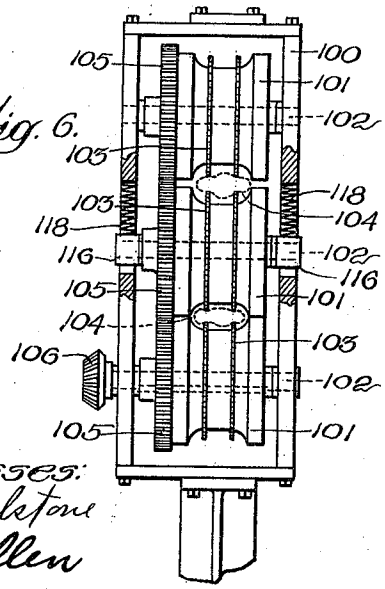


Fig. 6.



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4 SHEETS—SHEET 4.

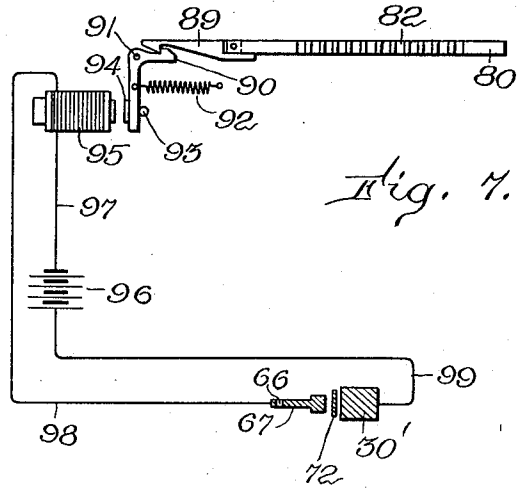

Fig. 7.

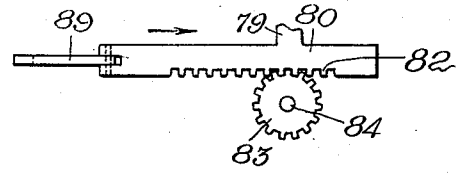

Fig. 8.

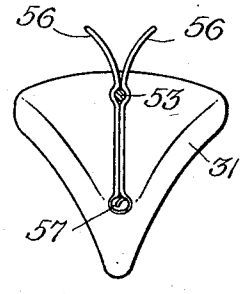

Fig. 9.

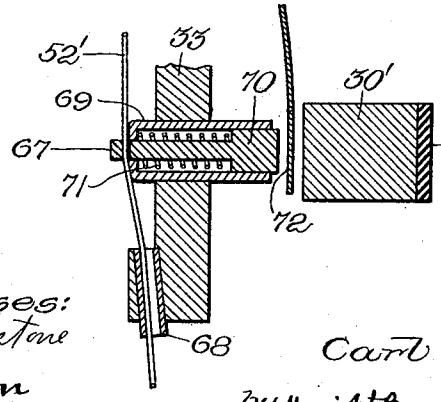

Fig. 10.

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UNITED STATES PATENT OFFICE.

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CIRCULAR LOOM.

1,000,576. Specification of Letters Patent. **Patented Aug. 15, 1911.**

Application filed December 27, 1909. Serial No. 535,001.

To all whom it may concern:

Be it known that I, CARL O. BERG, of Everett, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Circular Looms, of which the following is a specification.

This invention relates to circular looms such as those employed for weaving textile covering for electrical insulating conduits, rubber hose, and other articles of similar nature.

The invention herein embodied is similar in general to the machines illustrated and described in the patent to Thibodeau and Harris, No. 895,512, granted August 11, 1908.

The present invention, however, embodies shuttle mechanism of improved construction by which it is sought to improve the ease of operation in driving the shuttle and to reduce the size of the shuttle whereby it may pass through the shed of the warp without displacing the warp threads to so great an extent as that required by the shuttle of the aforesaid patent.

The first of these objects is attained by providing the shuttle with relatively long segmental shoes which slide in grooves of an annular shuttle race instead of rolls with which the shuttle in the former patent is provided. By reason of providing the segmental shoes, the shuttle has a relatively great surface bearing upon the shuttle race and it is therefore adapted to slide with less vibration and with less friction than is the case when the shuttle is provided with rolls.

The second object is attained by arranging the shuttle bobbin in the plane of the shuttle race instead of mounting the bobbin at one side of the plane of the shuttle race. By reason of mounting the bobbin in this manner, the depth of the shuttle may be materially reduced and the displacement of the warp threads of the shed is correspondingly reduced. The resistance to the shuttle is therefore reduced in proportion to the reduction of displacement of the warp threads. As a natural consequence of arranging the shuttle bobbin in the plane of the shuttle race, the diameter of the bobbin may be increased, thereby providing for a greater quantity of shuttle thread without increasing the displacement of the warp threads. It has been found by actual practice that the amount of shuttle thread which may be carried by a shuttle constructed in accordance with the present invention may be increased three-fold and that the necessary displacement of the warp threads is not increased.

In addition to the features above mentioned, the present invention embodies electrical controlling means whereby the operation of the machine is stopped when a shuttle thread breaks. In connection with this mechanism, the shuttle comprises an automatic device of improved character, said device being engaged by the shuttle thread and adapted to be moved by a spring when the shuttle thread breaks to thereby close the electrical circuit for disconnecting power transmitting mechanism. This automatic thread device which is hereinafter termed a detector is constructed in such manner as to provide ample surface for making electrical contact with another part of the machine through which the circuit is closed.

Of the accompanying drawings, which illustrate one form in which the invention may be embodied,—Figure 1 represents a side elevation of a loom for weaving tubular fabric. Fig. 2 represents a front elevation of a portion of the machine including the shuttles and their race together with driving mechanism for the shuttles and the warp threads radiating from the point of weaving. Fig. 3 represents a top edge view of the shuttle race and one of the shuttles. Fig. 4 represents a view similar to Fig. 3 of various members, including the adjacent ends of two shuttles and a driving member in one of the shuttles. Fig. 5 represents a transverse section on line 5, 5 of Fig. 2. Fig. 6 represents a rear elevation of feeding means by which the woven fabric is drawn from the machine. Fig. 7 represents the various members included in the electrical circuit by which the power transmitting mechanism is controlled. Fig. 8 represents a top plan view of a part of the mechanism shown by Fig. 7. Fig. 9 represents an end elevation of a shuttle. Fig. 10 represents a section of a spring detector on a relatively large scale.

The same reference letters indicate the same parts wherever they occur.

Referring first to Fig. 1, a base is indicated at 10 and supports a frame 11 in which the various parts and mechanisms hereinafter described are mounted. A central sleeve 12 (see Fig. 5) is affixed in the frame 11 and extends from front to rear. A ring or form 13 is affixed at the forward end of the sleeve 12 and is formed with an aperture 14 into which the warp threads 15 are introduced. The fabric is woven in tubular form as hereinafter described, against the inner face of the ring 13 which therefore determines the diameter of the work. In practice, a plurality of rings 13 having apertures of various sizes are provided with the machine and any one of the rings may be attached in the position shown by Fig. 5, to adapt the machine to the particular size of work required.

As the weaving operation progresses, the work is drawn through the sleeve 12 in the direction of the arrow in Fig. 5 by suitable feeding mechanism arranged at the rear of the machine as shown by Fig. 1 and hereinafter described. The frame 11 is provided with a plurality of stationary arms 16 which project forwardly and which support a ring 17 in which are mounted a plurality of spindles 18 which support the warp bobbins 19. The spindles 18 are arranged in a circle and their threads 15 are extended radially toward the ring 13 as hereinbefore explained. Each bobbin 19 is provided with a tension plate 20 and the plates are affixed upon arms 21 which are pivotally mounted upon spindles 22. Helical springs 23 are coiled about the spindles and engaged with the arms 21 in such manner as to exert their tension to hold the plates 20 against the bobbins.

Within the ring 17 and approximately in the same vertical plane is another ring indicated at 24 in Figs. 2 to 5 inclusive. The ring 24 is formed with an external groove 25 and an internal groove 26, said grooves constituting a shuttle race. The ring is stationary and is supported by a plurality of spokes 27 which extend radially from a hub 28. The hub is mounted upon a sleeve 12 as shown by Fig. 5 and may be connected with the sleeve by screw threads 29. In the form shown by the drawings, the ring 24, the hub 28 and the spokes 27 are formed as a single casting and in addition to these members, there is an inner ring 30 which is hereinafter explained. The ring 24 is formed with radial slots 24′ through which the warp threads 15 pass and by which the threads are guided.

In the present embodiment of the invention, there are four shuttles indicated at 31. Each shuttle is of the outline shown best by Fig. 3 and comprises the pointed frame 32 which is arranged outside the shuttle race but in the vertical plane thereof. The frame 32 is formed with ears 32′ which are affixed to a segmental shoe 25′ arranged in the groove 25 of the shuttle race. The shoe 25′ is connected to a shoe 26′ which is likewise segmental and which is arranged in the groove 26 of the shuttle race. The two shoes 25′ and 26′ are connected by a radial arm 33 of the shuttle and by straps 34. The radial portion 33 and the straps 34 are permanently affixed to the shoe 25′ but are adjustably connected to the shoe 26′ by means of bolts 35 which extend through elongated slots 36 in the part 33 and in the straps. The straps are formed with ears 34′ (see Fig. 5) which are bored and adapted to receive adjusting screws 37 which bear against the shoe 26′ and which are therefore adapted to adjust the shoe to the desired position to fit the shuttle race.

Each of the shuttles is provided with a roll 38 at its rear end and with a roll 39 at its forward end. The shuttles are driven individually by wheels 40 of which there is one wheel for each shuttle, said wheels being affixed upon radial shafts 41 mounted in bearings 42, carried by arms or spokes 43 which are all connected rigidly together and mounted to rotate upon the central sleeve 12. A beveled gear 44 is affixed to the spokes 43 and may be driven by a beveled gear 45 on a power shaft 46. In this way, the wheels 40, together with their shafts and bearings, are rotated bodily about the central sleeve 12 and the shafts 41 are otherwise rotated about their individual axes. For this purpose, the inner end of each shaft 41 is provided with the beveled gear 47 and the hub 28 is provided with a beveled gear 48 which is fixed and intermeshes with all of the gears 47. By this form of gearing, the wheels 40 are rotated in the direction indicated by the arrow in Fig. 4 while they move about the sleeve 12 in the direction also indicated by an arrow in Figs. 2, 3 and 4. Each of the wheels 40 engages the roll 38 of one shuttle and the roll 39 of the next shuttle as shown by Fig. 4 and thereby drives the shuttle in advance and prevents the succeeding shuttle from racing ahead of its driving wheel 40. The wheels 40 in addition to driving the shuttles are employed for opening and changing the shed of the warp. For this purpose, each wheel 40 is provided with a plurality of ears 50, said ears being formed with indentations 51 adapted to receive the warp threads 15. The number of warp threads, as well as the number of shuttles and the number of ears 50, may be varied according to the requirements of the desired fabric and it is therefore unnecessary to define their particular number in this case. The ears 50 are so arranged as to engage alternate warp threads and to thereby displace those warp threads from their normal position.

Referring to Figs. 3 and 4 it will be seen

that the nose of the shuttle is approximately in the vertical plane of the front face of the ring 24 and that the slots 24′ extend comparatively deep in the ring. The normal position of the warp threads is at the base of the slots, or in other words, at the rear of the nose of the shuttle. As the wheels 40 move around the race, the alternate warp threads engaged by the ears 50, are moved into a vertical plane at the front of the vertical plane of the nose of the shuttle and the shed of the warp is thereby opened. The shed is further opened by the frame 32 of the shuttle as the nose of the shuttle advances between the separated warp threads. By reference to Figs. 3, 4 and 5 it will be observed that the frame 32 is in the vertical plane of the shuttle race and that a shuttle bobbin 52 is supported by the shuttle in the vertical plane of the race and between the front and rear bars of the frame 32.

The means here shown for supporting the bobbin 52 comprises a spindle 53 adapted to be passed through the cop of the bobbin. The spindle may be provided with a head 54 at one end and may be pointed at the other end as shown by Fig. 3. The shuttle frame 32 is formed with cross bars 55 which are adapted to receive the spindle 54 and between which the bobbin 52 is arranged. Fig. 9 shows a spring device adapted to lock the spindle 54 in the shuttle. Said device comprises a pair of spring arms 56 formed by a member which is affixed by a screw 57 to the rear end of the frame 32. The spring arms are formed with crooks 58 which are adapted to snap into a groove 59, formed in the spindle 53 near the pointed end thereof. The spring arms are therefore adapted to prevent longitudinal movement and displacement of the spindle but they may be readily separated to permit removal of the spindle. By reason of supporting the shuttle bobbin in the manner described, the bobbin is carried about the shuttle race in the plane of the normal position of the warp and the displacement of the warp necessary to form the shed is thereby reduced to a minimum.

The shuttle is provided with a tension device including a plate 60, a spindle 61 and a helical spring 62. (See Figs. 3 and 5). The spindle 61 is affixed in ears 63 on the shuttle and the plate 60 is adapted to turn upon the spindle and to engage the bobbin as shown by Fig. 5. The spring 62 is coiled about the spindle and one end is inserted through the spindle and the other end is engaged with the plate and tends to press the plate against the bobbin. The thread 52′ from the bobbin 52 is passed through an eye 64 affixed upon the part 33 of the shuttle and is then passed through a groove 35′ in the screw 35 and then over a series of pins 65 projecting from the part 33 whereby additional tension is imposed upon the thread. From the series of tension pins, the thread passes through an eye 66 formed in the outer end of a spring plunger 67 and then passes through a throat 68 at the inner end of the shuttle part 33 and thence to the forming ring 13.

The plunger 67, as shown by the Fig. 19, is mounted to slide in a holder 69 and has a head 70 at its inner end. A helical spring 71 coiled about the shank of the plunger between the head and the closed end of the holder exerts its tension tending to force the plunger toward the ring 30′. The tension of the thread 52′, however, is sufficient to hold the plunger forward against the tension of the spring 71. A thin flexible metal strip 72 is affixed by one end to the inner surface of the shuttle portion 33 and its free end lies between the head 70 and the ring 30′ and normally is separated from both the plunger and the ring. If the thread 52′ breaks or is entirely used, the spring plunger is thereby released and is moved toward the ring 30′ thereby pressing the free end of the plate 72 against the ring. This device is employed as hereinafter explained for closing an electrical circuit by which the operation of the machine may be stopped. The ring 30′ is attached to the ring 30 but is electrically insulated therefrom by insulating material indicated at 73 in Fig. 5. The ring 30′, like the ring 24, is provided with grooves for the reception of the warp threads 15, and the spring plate 73 is therefore adapted to engage the front face of the ring 30′ without engaging the warp threads.

The power transmitting mechanism, for which the electrical controlling device is provided, is shown by Figs. 1, 7 and 8. Referring first to Fig. 1, it will be seen that the power shaft 46 supports a driving pulley 75. The driving pulley is loosely mounted upon the shaft and is equipped with a clutch of any desired form and construction and indicated as a whole at 76. A sleeve 77 loosely mounted on the driving shaft and adapted to slide longitudinally thereof is provided for the purpose of setting and releasing the clutch in the well-known manner and is engaged by studs 78 affixed in a yoke or shipper 79. The shipper is carried by a slide 80 mounted in a guide and support 81. The slide is formed with rack teeth 82 as shown by Fig. 8 and is engaged by a pinion 83 affixed upon a shaft 84. The shaft is journaled in a bracket 85 and its lower end is provided with a crank or handle 86 by which it may be turned to move the shipper and consequently the sleeve 77 toward and from the clutch pulley. A spring 87 coiled about the shaft 84 and attached to the bracket 85 and to a collar 88 affixed upon the shaft exerts its tension to normally move the slide in the direction indicated by an arrow in

Fig. 8. The slide when moved in this direction retracts the sleeve 77 from the clutch thereby releasing the clutch so that the pulley may rotate freely upon the shaft. Referring now to Fig. 7 it will be seen that the slide 80 is provided with a pivoted latch 89 which is adapted to engage a complemental latch 90 mounted upon the stationary pin 91. When the slide is moved to set the clutch in driving position, the latch 89 engages the latch 90 as shown by Fig. 7 and the clutch is thereby maintained in driving relation. The latch 90 is normally held in the position shown by a spring 92, and a back stop 93 is provided for limiting movement in one direction of the latch. The latch carries an electro-magnetic armature 94 which is arranged to coöperate with the electro-magnet 95 by which the latch 90 may be retracted from the latch 89 to release the latter. When the latch 89 is released, the slide 80 is retracted by its spring 87 to release the clutch.

Fig. 7 includes a diagram of electric wiring by which the electro-magnet is connected with the plunger or detector 67 shown in Fig. 10. According to this diagram, 96 represents a source of current and 97 represents a conductor connecting the source of current and the magnet 95. A conductor 98 connecting the other side of the magnet and the detector 67 may be grounded on the frame of the machine at any desired point. A conductor 99 connecting the source of current with the insulated ring 30′ may be carried through the central sleeve 12 of the machine and attached to the ring as shown by Fig. 5. By reason of so connecting the detector and the ring with the magnet 95, the power mechanism may be disconnected whenever the detector is released by its shuttle thread 52′.

The fabric is drawn through the central sleeve 12 by the feeding mechanism shown by Figs. 1 and 6. Said mechanism is mounted in a frame 100 at the rear of the machine and comprises a series of rolls 101 affixed upon shafts 102 journaled in the frame 100. Each of the rolls 101 is provided with toothed disks 103 adapted to engage the tubular fabric 104 and the fabric may be passed over the rolls in the manner shown by Fig. 1. The rolls are provided with intermeshing gears 105 by which they are caused to revolve in unison, and one of the shafts 102 is provided with a beveled gear 106 which is driven by a gear 107. The gear 107 is affixed at one end of the shaft 108 mounted in bearings 109 on the frame. At the other end of the shaft is a worm gear 110 which intermeshes with a worm 111 on a transverse shaft 112. The shaft 112 is also mounted in bearings in the frame and is provided with a sprocket 113 connected to a sprocket 114 by a chain 115. The sprocket 114 is affixed on the shaft 46 and therefore drives the feed rolls whenever the clutch 76 is operatively engaged. As shown by Fig. 1, the bearings for one of the shafts 102 consist of sliding blocks 116, mounted to slide in slots 117 in the frame 100. Springs 118 are provided for forcing the blocks 116 toward the adjacent roll for the purpose of causing the coöperative rolls to engage the fabric 104 with yielding tension.

It is to be understood that the feed mechanism forms no part of the present invention and may be varied at will. The clutch 76 forms no part of the present invention and a detailed description thereof is omitted. The features to be regarded as essential to the present invention are the shuttle, the means of mounting the shuttle upon the shuttle race, the means for mounting the shuttle bobbin by which the passage of the shuttle through the shed is facilitated and the herein described detector 67 and the adjacent parts for closing the electrical circuit.

An advantage of constructing the detector in the manner described is that the contacting members by which the electrical circuit may be closed are formed with relatively broad faces which insure sufficient contact to conduct the current without liability of failure to do so. In a similar way an advantage is provided by mounting the shuttles upon shoes which have relatively broad bearings upon the shuttle race as distinguished from the theoretical line contacts of rolls, such as those hitherto commonly employed for mounting the shuttles upon the shuttle race. The electric current by which the power transmitting means is controlled passes from the race to the shuttle and is therefore essential to provide sufficient bearing of the shuttle upon the race to insure passage of sufficient current to energize the controlling magnet. The shoes formed as illustrated on the drawings are adapted to have enough bearing upon the race to insure the passage of the current for this purpose.

Having thus explained the nature of my said invention, and described a way of constructing and using the same, although without attempting to set forth all of the forms in which it may be made or all of the modes of its use, I declare that what I claim is:—

1. In a machine for weaving tubular fabric, a circular shuttle race, complemental shoes arranged to slide on said race, a shuttle supported by said shoes, said shuttle being arranged outside the periphery of the race, means on said shuttle for supporting a bobbin so that its axis will be in a plane transverse to the axis of the race and intersecting the race, and means for driving the shuttle.

2. In a machine for weaving tubular fabric, a shuttle race having opposed faces, sliding shoes arranged on said faces, adjustable means connecting the shoes whereby

said shoes may be adjusted to fit the race, and a shuttle attached to and supported by said shoes.

3. In a machine for weaving tubular fabric, a race, a shuttle movable thereon, a driver, a member movable in advance of the driver, means on the shuttle adapted to be engaged and driven by the driver, and means on the shuttle adapted to abut against the member in advance.

4. In a machine for weaving tubular fabric, an endless shuttle race, a plurality of shed-forming members movable about the race, a plurality of shuttles movable on said race, means on the shuttles adapted to be engaged respectively by the shed-forming members for driving the shuttles, and means on the shuttles adapted to abut against the respective shed-forming members next in advance.

5. In a machine for weaving tubular fabric, an endless shuttle race, a plurality of shed-forming wheels movable about the race, a plurality of shuttles movable on the race, driving rolls mounted on the shuttles to be engaged respectively by said wheels, and rolls on said shuttles adapted to respectively engage the wheels in advance of the respective driving wheels.

6. In a machine for weaving tubular fabric, a shuttle race, a shuttle movable thereon, shuttle driving means, a continuously driven member for driving said means, means for locking said means in driving relation, an electromagnet for releasing said locking means, an insulated member, a flexible member carried by said shuttle and having a relatively broad face adapted to engage said insulated member, said flexible member normally standing away from said insulated member, a yielding thread-engaging member carried by said shuttle and adapted when released to press said flexible member against said insulated member, and conductors connecting in series said shuttle race, said magnet, a source of current, and said insulated member.

In testimony whereof I have affixed my signature, in presence of two witnesses.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."