

June 24, 1952

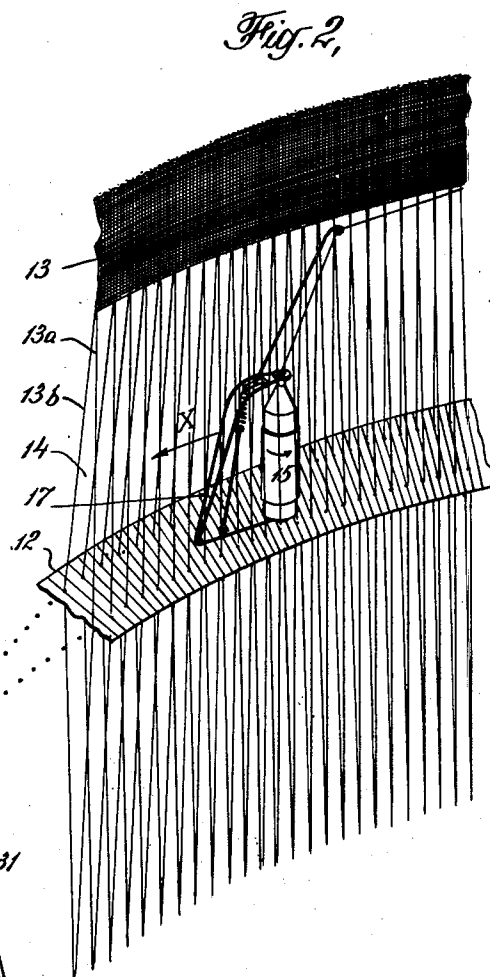
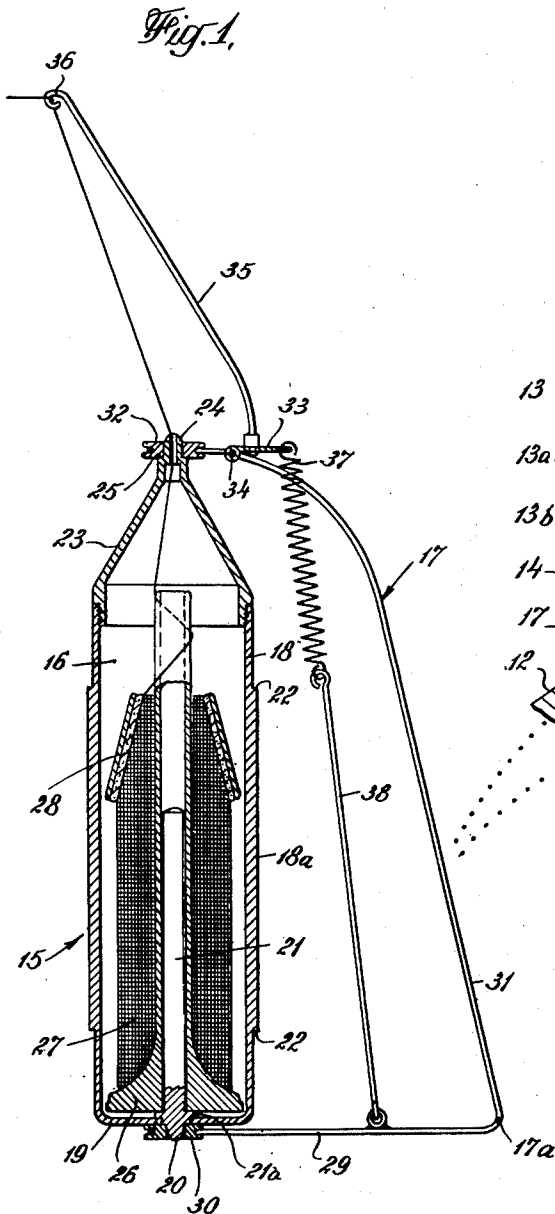
V. M. J. ANCET

2,601,358

CIRCULAR LOOM

Original Filed Dec. 27, 1948

4 Sheets-Sheet 1



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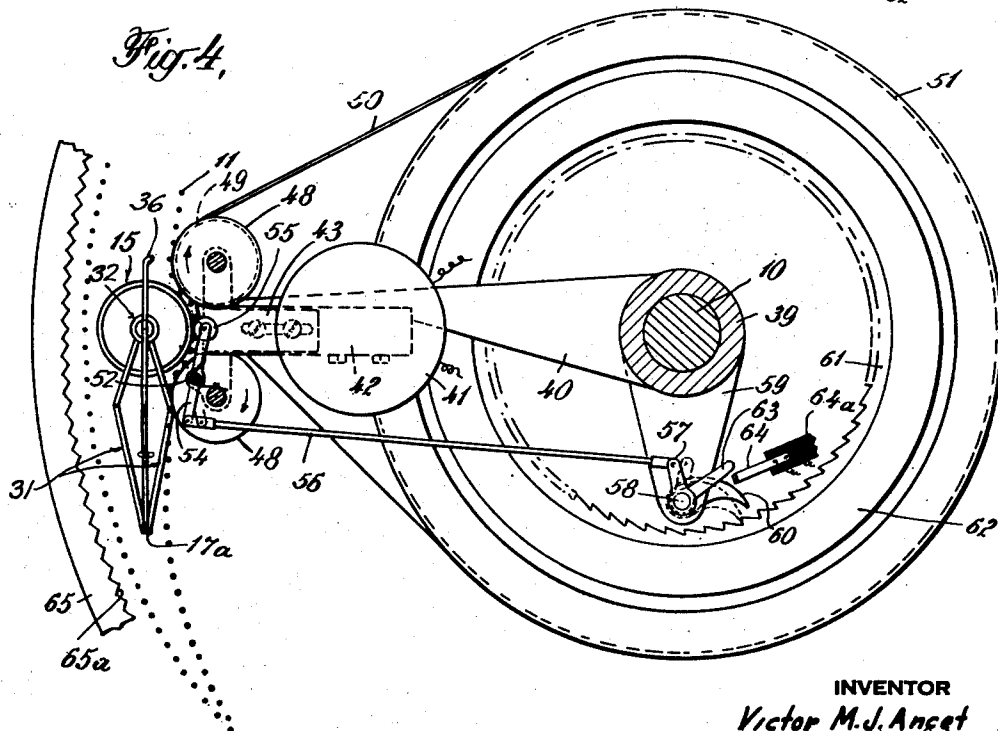
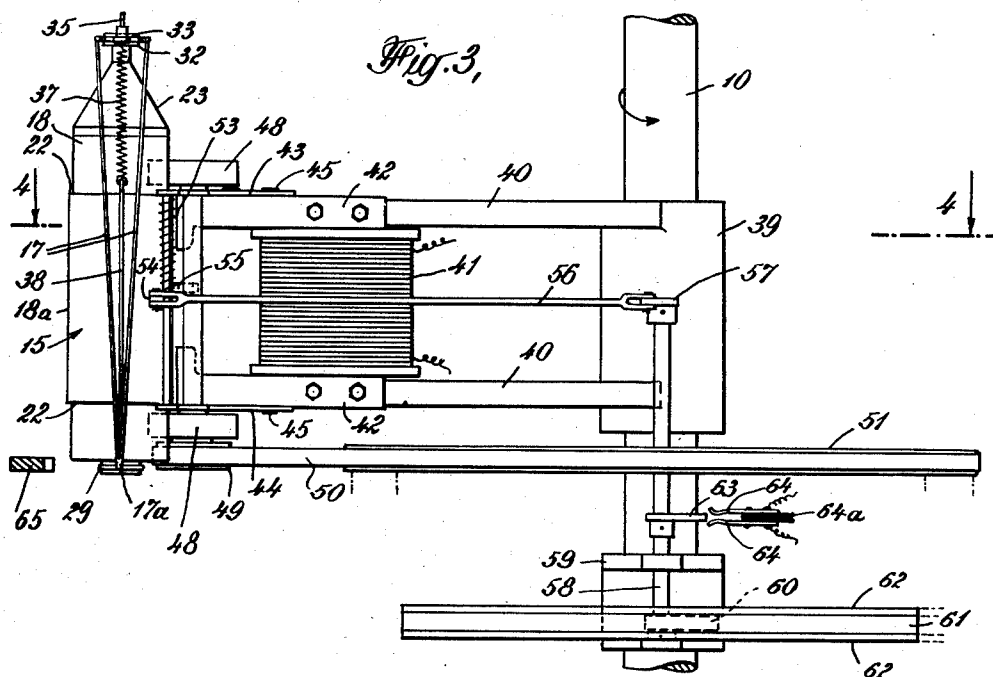
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CIRCULAR LOOM

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4 Sheets-Sheet 2



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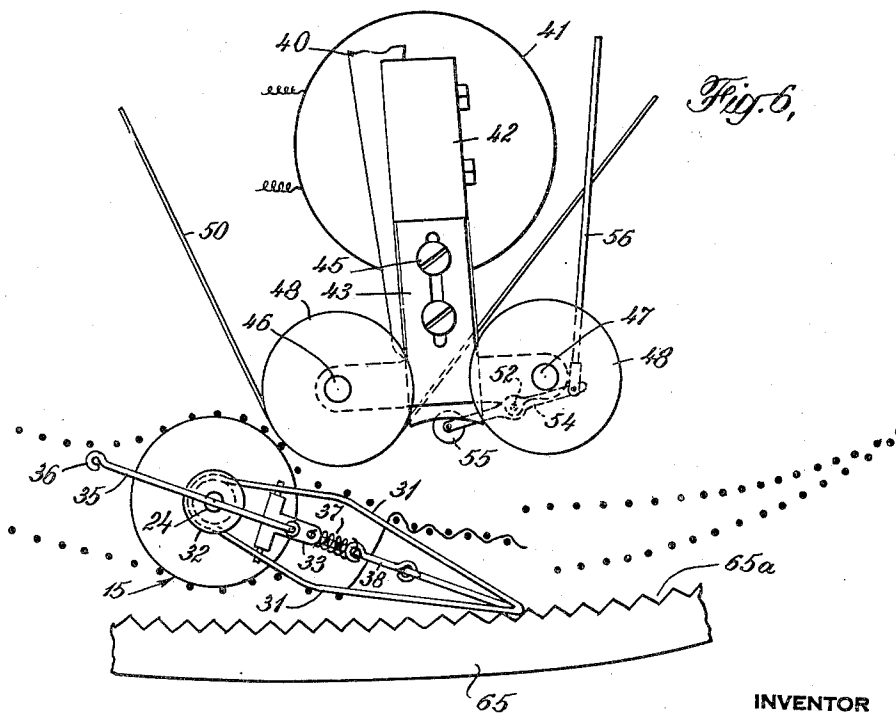
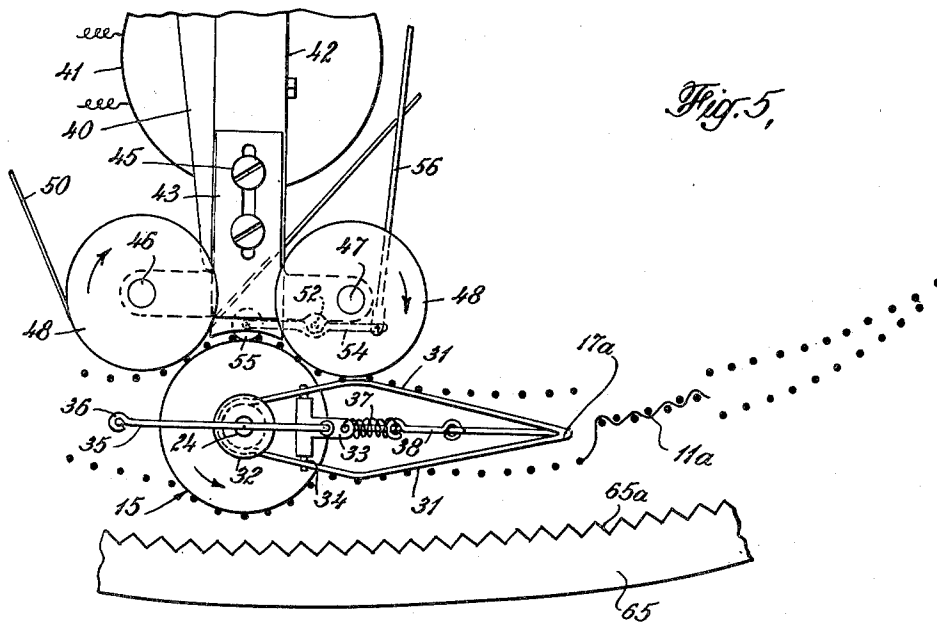
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CIRCULAR LOOM

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4 Sheets-Sheet 3



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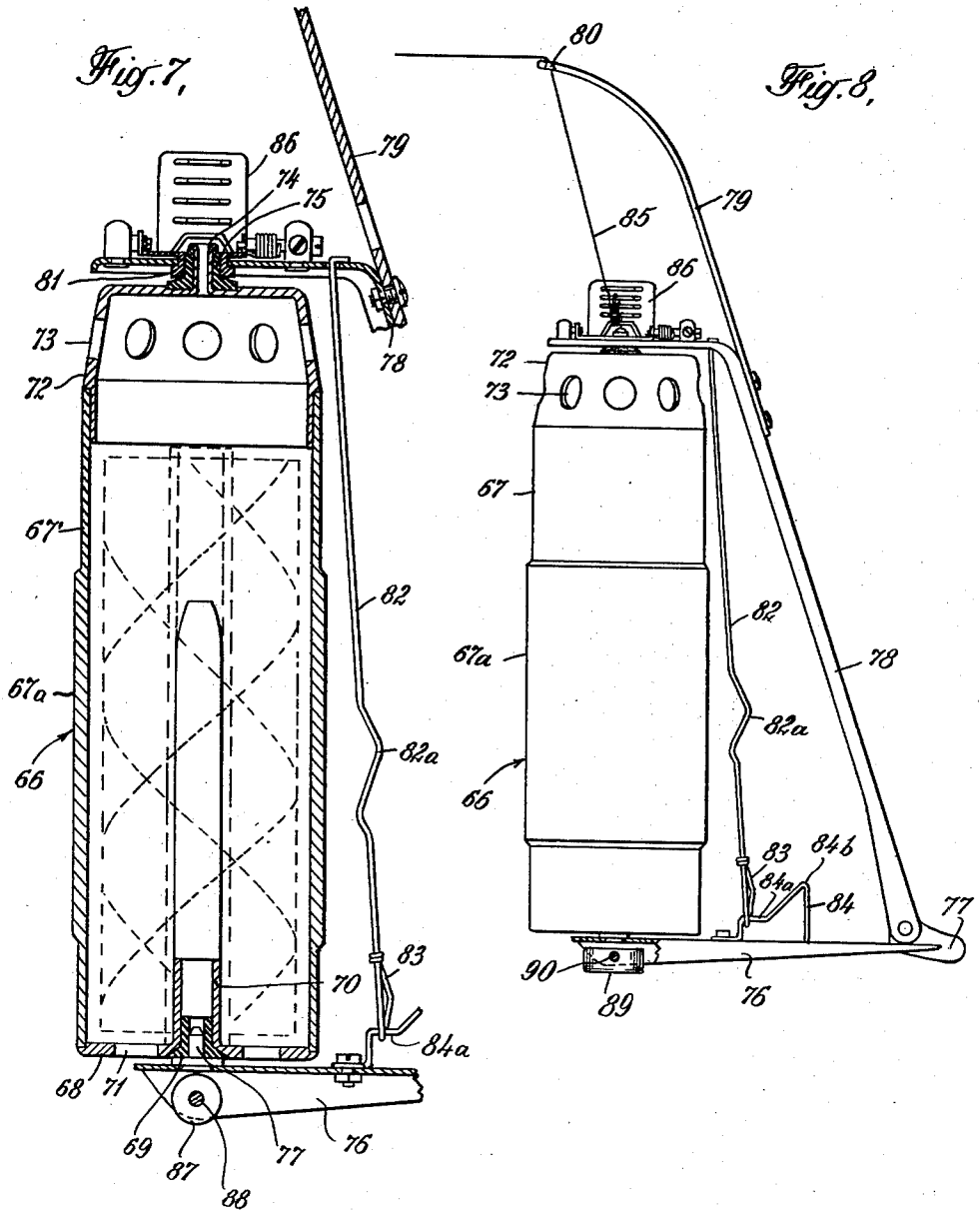
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,601,358

CIRCULAR LOOM

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Original application December 27, 1948, Serial No. 67,341. Divided and this application May 3, 1950, Serial No. 166,041. In France April 25, 1944

8 Claims. (Cl. 139—13)

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This invention relates to circular looms, which produce fabric in tubular form by means of a shuttle moved along a circular path within a shed made of sheets of warp threads. In such looms, the driving means for the shuttle necessarily lie outside the shed and, accordingly, act on the shuttle through one sheet of threads of the shed. Heretofore, the shuttle and driving means have been connected by mechanical means or else the shuttle has been made of magnetic material and held in place relative to the driving means, so as to be propelled thereby, by magnetic attraction. In prior circular looms, in which the shuttle and its driving means are connected mechanically, the warp threads in the sheet of the shed, through which the cooperating parts of the connection act, are subjected to abrasion, which is liable to do damage to the threads, particularly if they are of fine size. Also, in prior looms, in which the shuttles are driven either mechanically or magnetically, the shuttles are of complicated construction, so that they are expensive to produce and difficult to insert into and remove from the shed.

The present invention is directed to the provision of a novel circular loom, which includes, among other features, a new shuttle assembly and driving means therefor, the assembly comprising a shuttle and a frame, in which the shuttle is mounted and which includes a leading portion or nose preceding the shuttle and facilitating its movement through the shed and a trailing portion for guiding the weft thread issuing from the shuttle. The shuttle is formed at least in part of magnetic material, is hollow and has an external shape, which is that of a surface of revolution and is preferably generally cylindrical, and is supported with its axis extending toward the fell of the fabric in the same general direction as the warp threads in the shed. The weft thread package is carried within the interior of the shuttle and the thread is led through an axial opening in the top of the shuttle and through a guide eye in the trailing portion of the guide frame. The driving means for the shuttle assembly are mounted to rotate about the axis of the loom and include a plurality of rotary stops and an electromagnet, which attracts the shuttle and holds it against the stops. The drive means lie on one side of one sheet of warp threads in the shed and, preferably, the side nearer the loom axis in a vertical loom, and the shuttle and guide frame lie on the other side of the sheet. One or more of the stops are positively driven and, as a result, the shuttle

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is caused to rotate on its axis and thus rolls over the warp threads in the sheet of threads referred to.

In addition to the new features mentioned, the new loom includes novel means operating, in the event that the shuttle assembly encounters an obstruction in the shed, to free the assembly from its driving means, shut down the loom motor or other drive means, and apply a brake to stop rotation of the shuttle assembly drive means quickly.

This application is a division of my application Serial No. 67,341 filed December 27, 1948.

For a better understanding of the invention, reference may be had to the accompanying drawings, in which

Fig. 1 is a view, partly in side elevation and partly in vertical section, of a shuttle assembly used in the loom of the invention;

Fig. 2 is a diagrammatic perspective view showing the mode of operation of the shuttle assembly of Fig. 1;

Fig. 3 is a view in side elevation showing the shuttle assembly carrier of the loom;

Fig. 4 is a sectional view on the line 4—4 of Fig. 3;

Figs. 5 and 6 are plan views of the carrier and shuttle assembly showing, respectively, the normal position of the assembly and the deflection of the frame of the assembly, when it encounters an obstruction in the shed, and the dislodgment of the assembly from the carrier.

Fig. 7 is a fragmentary vertical sectional view through a modified form of shuttle assembly; and

Fig. 8 is a view of the modified form of shuttle assembly in side elevation.

The new circular loom comprises a central vertical shaft 10, which lies within a cylinder of warp threads 11 supplied from a pair of beams and passed upwardly through a reed 12. Below the fell of the finished fabric 13, the warp threads are separated by suitable heddle mechanism into inner and outer sheets 13a, 13b, defining a shed 14 within which operates a shuttle assembly 15.

The shuttle employed in the new loom is hollow and has an external shape, which is that of a surface of revolution. The shuttle has a central zone of magnetic material and is preferably made of such material throughout. The shuttle comprises a hollow body 18, illustrated as being of cylindrical form, and closed at one end by an integral closure plate 19, which is provided with a central pivot 20 on its outer face and with a spindle 21, which extends coaxially within the body. Preferably, the central zone

18a of the body is of heavier wall thickness than the ends and the thickened zone is defined at its ends by circumferential shoulders 22. The upper end of the body is closed by a removable cap 23 of generally conical form threaded into the end of the body. At its upper end, the cap is formed with a hollow boss 24, near the lower end of which there is a circumferential shoulder 25. When the shuttle is in use, it contains a bobbin 26, which is mounted on the spindle to rest on a circumferential enlargement 21a at the lower end thereof and slightly above the inner face of closure 19. A supply of weft thread 27 is wound on the bobbin. A frustoconical sleeve 28 lined with felt or like material may be placed to rest upon the thread wound upon the bobbin to act as a brake. The weft thread from the bobbin passes upwardly through the opening in the hollow boss 24.

The frame, which forms part of the shuttle assembly in the construction illustrated in Fig. 1, comprises a base 29, which may be a straight length of wire having a loop at one end, within which is mounted an annular bearing disc 30. The shuttle rests on the disc with its pivot 20 entering the opening through the disc. The base 29 extends forwardly from the shuttle a substantial distance and a pair of elements 31, which may be wires, extend upwardly and rearwardly from the forward end of the base and over the top of the shuttle. For convenience, the elements 31 may be a continuous length of wire, which is formed with a loop, the bight of which lies above the shuttle and carries an annular bearing disc 32. The disc rests upon the shoulder 25 at the top of the cap of the shuttle and the hollow boss 24 extends through the opening in the disc. A plate 33 is mounted for swinging movement on a crossbar 34 extending between the elements 31 and a trolley 35 extends upwardly and rearwardly from the plate and is provided with a weft thread guide 36 at its free end. A spring 37 is connected at one end to the plate and at the other end to a wire 38, which is connected to the base 29. The spring tends to hold plate 33 with the trolley 34 in erect position, as shown in Fig. 1, and counterclockwise swinging movement of the trolley is permitted but is resisted by the spring. When the shuttle is to be inserted in or removed from the frame, the base 29 and members 31 are sprung apart sufficiently to free disc 30 on the base from pivot pin 20 on the shuttle, after which the shuttle may be moved endwise to withdraw boss 24 from disc 32.

The shuttle assembly is moved by a carrier in a circular path through a shed of warp threads, which is opened ahead of the assembly and closed behind it by the heddle mechanism. The carrier comprises a sleeve 39 fast on the shaft and provided with upper and lower radial arms 40, between which is mounted an electromagnet 41 having a U-shaped core 42. The legs of the core extend radially outward beyond the ends of arms 40 and lie one above the other, their outer faces being concave. A pair of brackets 43, 44 are mounted on the upper and lower surfaces of arms 40, the brackets being longitudinally slotted and held in place by screws 45 passing through the slots, so that the brackets may be moved to different positions of adjustment lengthwise of arms 40. Each bracket has extensions projecting beyond opposite sides of its arm 40 and a pair of spindles 46, 47 are mounted in corresponding extensions on opposite sides of arms 40. Each spindle carries rollers 48 at its upper and lower

ends and spindle 46 projects through its lower roller 48 and carries another roller 49, which is connected by a belt 50 to a pulley 51 loose on shaft 10 and held stationary by appropriate means. Accordingly, as the shaft rotates and swings the carrier with it, roller 49 is rotated by the belt and rotates its spindle 46 and the rollers 48 mounted fast thereon.

In the operation of the loom, the shuttle assembly is placed in position with the shuttle bearing against rollers 48 on spindles 46, 47 of the carrier, the brackets 43, 44 being so adjusted that the surface of the shuttle lies close to but spaced from the outer ends of the core of the electromagnet. The energization of the electromagnet causes it to attract and hold the shuttle in position, so that it is advanced with the carrier, and the increased wall thickness of the central zone 18a of the shuttle increases the attractive effect. The distance lengthwise of the shuttle between shoulders 22 thereon is slightly less than the distance between the opposed faces of the rollers on spindles 46, 47, and when the shuttle assembly is placed in position, the thickened zone 18a of the shuttle lies between the upper and lower pairs of rollers. The assembly is then prevented from dropping downwardly by engagement of the lower shoulder 22 with the tops of the rollers of the lower pair and the shuttle assembly is advanced without being supported on the reed.

A shaft 52 mounted in brackets 43, 44 is encircled by a spring 53 connected to bracket 43 and the shaft and acting to swing the shaft counterclockwise, when it is viewed from the top. Between its ends, the shaft carries a lever 54, on which a small roller 55 is mounted at one end. The other end of the lever is connected by a rod 56 to an arm 57 on a shaft 58 mounted on an arm 59 fast on shaft 10. The shaft carries a pawl 60, which may be swung by rocking of shaft 58 into contact with teeth on the inner face of a flat ring 61, which lies between upper and lower friction rings 62 held stationary and pressed against ring 61 by suitable means. Shaft 58 also carries a contact blade 63, which, upon swinging of the shaft, is moved between spring contact members 64 on a block of insulation 64a suitably supported so as to move with shaft 10. The contact members are in a circuit which, when established by insertion of blade 63 between them, operates conventional loom stopping means. Normally, when the shuttle assembly is in place on the carrier with the shuttle engaging rollers 48, the surface of the shuttle bears against roller 55 and forces it backwardly, so that shaft 58 is held in a position with its pawl 60 free of the teeth of ring 61 and contact blade 63 out of contact with the spring terminal member 64. If the shuttle assembly is displaced from the carrier, the shaft 52 is swung by its spring and swings shaft 58, so that the pawl 60 engages the teeth of ring 61 and the circuit through the loom stopping means is closed by insertion of blade 63 between terminal members 64. The engagement of the pawl with ring 61 causes the carrier and loom shaft to be braked, so that the moving parts of the loom will promptly come to a stop.

When the shuttle assembly is in operating position in the shed, the longitudinal axis of the shuttle extends toward the fell of the goods in the same general direction as the warp threads in the shed. The base of frame 17 extends forwardly from the shuttle and the forward end of the base and the ends of elements 31 connected thereto form a nose, which leads the shuttle in

its movement. The trolley 35 extends rearwardly from the shuttle and the weft thread passing through the guide eye 36 lies close to the fell of the goods in position to be beaten up. The shuttle is free to rotate on its longitudinal axis in the frame and the shuttle assembly and the carrier lie on opposite sides of the warp threads in the inner sheet 13a of the shed. During the rotation of the carrier with shaft 10, the rollers 48 on spindle 46 are caused to rotate and this movement is imparted to the shuttle, so that it has a planetary motion, in which it travels along a circular path concentric with the loom shaft 10, and, at the same time, rolls over the threads in the inner sheet of the shed. By making the shuttle in the form of a hollow body, the external shape of which is that of a surface of revolution, the shuttle is of simple construction and it may be readily caused to roll over the warp threads so that abrasion of those threads is avoided.

In the normal operation of the loom, the frame, which is free to pivot on the shuttle, is so held that it leads the shuttle, because of the drag of the inserted weft thread on trolley 35. If a warp thread, such as that designated 11a (Fig. 5), becomes broken, for example at the top of the shed, and drops down to become entangled across the other warp threads as though it were a weft laid by the preceding shuttle at the bottom of the shed, it produces an obstruction in the shed, which is first encountered by the nose 17a of the frame of the shuttle assembly. When such a shed obstruction occurs, it is desirable to have the loom stopped at once and, when the nose of the assembly meets the obstruction, it is forced outwardly thereby and penetrates the warp threads of the outer sheet 13b of the shed. A stationary ring 65 having teeth 65a on its inner surface is mounted outside the shed in such position that, when the nose 17a of the frame of the shuttle assembly is forced outwardly as described, the nose engages one of the teeth on the ring. The shuttle assembly is thereby arrested and, as the carrier continues to move, the assembly is dislodged from the carrier. As soon as the shuttle moves away from rollers 48, shaft 52 is free to be swung by its spring 53 and this results in the stopping of the loom and the braking of the moving parts thereof, as previously explained.

The shuttle assembly, shown in Figs. 7 and 8, comprises a shuttle 66, which includes a body 67, which has the normal external shape of a surface of revolution and is illustrated as being generally cylindrical in form. The body has a central zone of magnetic material and preferably is made throughout of such material and has a central zone 67a of increased wall thickness. The lower end of the body is closed by a plate 68, formed with a central opening, in which is seated a flanged bushing 69 of non-metallic material, such as impregnated fibrous material. A tubular spindle 70 extends upwardly from the closure within and coaxially of the body, the tubular portion of the bushing extending through the closure plate and into the spindle. The closure plate is formed with a circular row of openings 71. The top of the body is closed by a cap 72, which may be frusto-conical in form and is constructed to telescope into the open end of the body. The cap has openings 73 in its inclined surface, which lie outwardly from the axis of the body a greater distance than the openings 71. The cap is formed with a hollow boss 74, which is encircled by a flanged bushing 75 of non-metallic material and is held in place by a turned-over bead at the outer end of neck 74. The bushing is

formed with a flange at its lower end, which may be seated in a depression in the top of the cap around neck 74 and preferably has a conical upper bearing surface.

The frame of the shuttle assembly, shown in Figs. 7 and 8, includes a base 76, which may be of sheet metal of channel section and is provided adjacent one end with a pivot pin 77 rising from a flat disc on top of the base and receivable into the bushing 69 at the lower end of the shuttle. At its other end, the base carries a thin vertical plate 77', to which is pivotally attached an element 78 extending upwardly and rearwardly to overlie the top of the shuttle. The element carries a trolley 79 extending upwardly and rearwardly therefrom and provided at its free end with a weft thread guide 80. The free end of element 78 lies parallel to the base and has a central opening containing a bearing bushing 81, into which the neck 74 of the shuttle with its bushing 75 may be received. The base 76 and element 78 are connected by releasable means, which are illustrated as including a wire 82 attached to the upper end of element 78 and terminating in a loop 83. The base 76 of the frame carries a wire loop 84 interconnected with loop 83, loop 84 being formed with portions 84a, 84b of different height. Wire 82 is formed with a kink 82a, so that its length may be increased by the flattening of the kink. When loop 83 of wire 82 is engaged with the lower part 84a of loop 84, the base and element 78 are held in engagement with the ends of the shuttle. When wire 82 is swung to bring its loop 83 within the higher portion 84b of loop 84, the base and element may be swung apart on their pivotal connection, so that the shuttle may be readily removed from the frame.

The weft thread 83 issuing from the shuttle through the opening in the hollow neck 74 passes through tensioning means 86 of conventional construction mounted on the top of element 78.

The shuttle assembly shown in Figs. 7 and 8 is intended to be supported in its movement along its circular path on the reed 12 of the loom and, to facilitate the movement of the assembly along the reed, the base 76 of the frame may be provided with a roller 87, which is mounted on a horizontal pivot 88 lying transverse to the base and in the axis of rotation of the shuttle in the frame. In an alternative construction, the base is provided with a shoe in the form of a flat disc 89 of non-metallic material, such as impregnated fabric. The disc may be mounted on base 76 by a ball and socket connection lying in the axis of rotation of the shuttle or on a horizontal pin 90, which extends transverse to the base and lies in the axis of shuttle rotation.

The shuttle assembly shown in Figs. 7 and 8 is moved about the axis of the loom in the same manner as the assembly shown in Fig. 1, that is, the assembly is held by magnetic attraction with the shuttle engaging the rollers 48 at the outer end of the carrier. The frame leads the shuttle in the movement of the assembly and the plate 77' forms a nose which, upon encountering an obstruction in the shed, is forced outwardly between the threads of the outer sheet of the shed into engagement with the teeth of stop ring 61. As the assembly is moved along with the carrier, the shuttle rolls on its longitudinal axis and the disposition of the openings 71 and 73 is such that, in the rotation of the shuttle, a current of air is caused to pass through the shuttle by centrifugal action. The air current tends to keep the interior of the shuttle free from lint, which other-

wise might be carried into the cloth with the weft thread.

I claim:

1. In a circular loom, in which warp threads are separated into spaced sheets to form a shed, the combination of a carrier movable in a path about the axis of the loom, a shuttle movable through the shed and made at least in part of magnetic material, the external shape of the shuttle being that of a surface of revolution, an electromagnet on the carrier acting on the shuttle to hold it against part of the carrier with one sheet of the shed therebetween whereby the shuttle rolls on the said sheet as the carrier moves along said path, a member carried by and extending ahead of the shuttle, the member being deflected from its normal path upon encountering an obstruction in the shed, and means extending adjacent the path of travel of the shuttle and engageable by the member when deflected thereby to arrest the shuttle and cause its disengagement from the carrier.

2. In a circular loom, in which warp threads are separated into spaced sheets to form a shed, the combination of a carrier movable in a path about the axis of the loom, a shuttle movable through the shed and made at least in part of magnetic material, the external shape of the shuttle being that of a surface of revolution, an electromagnet on the carrier acting on the shuttle to hold it against part of the carrier with one sheet of the shed therebetween whereby the shuttle rolls on the said sheet as the carrier moves along said path, a member carried by and extending ahead of the shuttle, the member being deflected from its normal path upon encountering an obstruction in the shed, means extending adjacent the path of travel of the shuttle and engageable by the member when deflected thereby to arrest the shuttle and cause its disengagement from the carrier, and a loom stopping means actuator comprising means held inoperative by the shuttle when in place against the carrier and rendered operative upon disengagement of the shuttle from the carrier.

3. In a circular loom, in which warp threads are separated into spaced sheets to form a shed, the combination of a carrier movable in a path about the axis of the loom, a shuttle movable through the shed and made at least in part of magnetic material, the external shape of the shuttle being that of a surface of revolution, an electromagnet on the carrier acting on the shuttle to hold it against part of the carrier with one sheet of the shed therebetween whereby the shuttle rolls on the said sheet as the carrier moves along said path, a member carried by and extending ahead of the shuttle, the member being deflected from its normal path upon encountering an obstruction in the shed, stationary means extending adjacent the path of travel of the shuttle and engageable by the member when deflected thereby to arrest the shuttle and cause its disengagement from the carrier, and a loom stopping means actuator comprising means held inoperative by the shuttle when in place against the carrier and rendered operative upon disengagement of the shuttle from the carrier.

4. In a circular loom, in which warp threads are separated into spaced sheets to form a shed, the combination of a carrier movable in a path about the axis of the loom, a shuttle movable through the shed and made at least in part of magnetic material, an electromagnet on the carrier acting on the shuttle to hold it against part

of the carrier as the latter moves along said path, a member carried by and extending ahead of the shuttle, the member being deflected from its normal path upon encountering an obstruction in the shed, a curved toothed element extending adjacent the path of travel of the shuttle, the member, upon being deflected, engaging a tooth of the element and being held thereby against further forward movement, whereby the shuttle is disengaged from the carrier, and a loom stopping means actuator comprising means held inoperative by the shuttle when in place against the carrier and rendered operative upon disengagement of the shuttle from the carrier.

5. In a circular loom, in which warp threads are separated into spaced sheets to form a shed, the combination of a carrier movable in a path about the axis of the loom, a shuttle movable through the shed and made at least in part of magnetic material, an electromagnet on the carrier acting on the shuttle to hold it against part of the carrier as the latter moves along said path, a frame mounted on the shuttle for swinging movement, the frame having a nose projecting forwardly ahead of the shuttle, the said frame and nose being deflected from the normal path upon encountering an obstruction in the shed, and means extending adjacent the path of travel of the shuttle and engageable by the nose of the frame when deflected thereby to arrest the shuttle and cause its disengagement from the carrier.

6. In a circular loom, in which warp threads are separated into spaced sheets to form a shed, the combination of a carrier movable in a path about the axis of the loom, a shuttle movable through the shed and made at least in part of magnetic material, an electromagnet on the carrier acting on the shuttle to hold it against part of the carrier as the latter moves along said path, a frame mounted on the shuttle for swinging movement, the frame having a nose projecting forwardly ahead of the shuttle, the said frame and nose being deflected from the normal path upon encountering an obstruction in the shed, means extending adjacent the path of travel of the shuttle and engageable by the nose of the frame when deflected thereby to arrest the shuttle and cause its disengagement from the carrier, and a loom stopping means actuator comprising means held inoperative by the shuttle when in place against the carrier and rendered operative upon disengagement of the shuttle from the carrier.

7. In a circular loom, in which warp threads are separated into spaced sheets to form a shed, the combination of a carrier movable in a path about the axis of the loom, a shuttle movable through the shed and made at least in part of magnetic material, an electromagnet on the carrier acting on the shuttle to hold it against part of the carrier as the latter moves along said path, a frame mounted on the shuttle for swinging movement, the frame having a nose projecting forwardly ahead of the shuttle, the said frame and nose being deflected from the normal path upon encountering an obstruction in the shed, stationary means extending adjacent the path of travel of the shuttle and engageable by the nose of the frame when deflected, thereby to arrest the shuttle and cause its disengagement from the carrier, and a loom stopping means actuator comprising means held inoperative by the shuttle when in place against the carrier and rendered operative upon disengagement of the shuttle from the carrier.

8. In a circular loom, in which warp threads

are separated into spaced sheets to form a shed, the combination of a carrier movable in a path about the axis of the loom, a shuttle movable through the shed and made at least in part of magnetic material, an electromagnet on the carrier acting on the shuttle to hold it against part of the carrier as the latter moves along said path, a frame mounted on the shuttle for swinging movement, the frame having a nose projecting forwardly ahead of the shuttle, the said frame and nose being deflected from the normal path upon encountering an obstruction in the shed, a curved toothed element extending alongside the path of travel of the shuttle, the nose of the frame, upon being deflected, engaging a tooth of the element and being held thereby against further forward movement, whereby the shuttle is disengaged from the carrier, and a loom stopping means actuator comprising means held in-

operative by the shuttle when in place against the carrier and rendered operative upon disengagement of the shuttle from the carrier.

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