

July 9, 1929.

C. SÉRY  
CIRCULAR WEAVING LOOM

1,720,151

Filed April 14, 1927

8 Sheets-Sheet 1

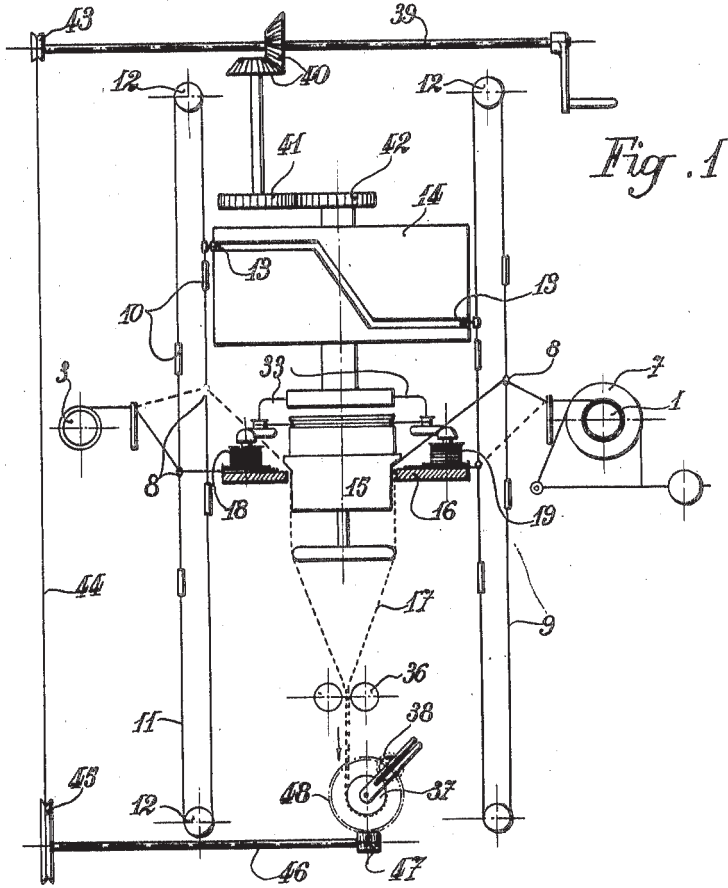


Fig. 1

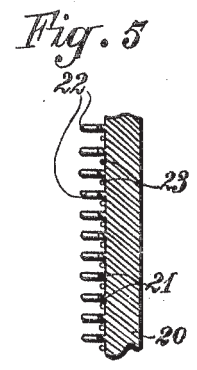


Fig. 5

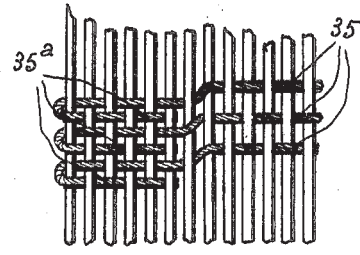


Fig. 14

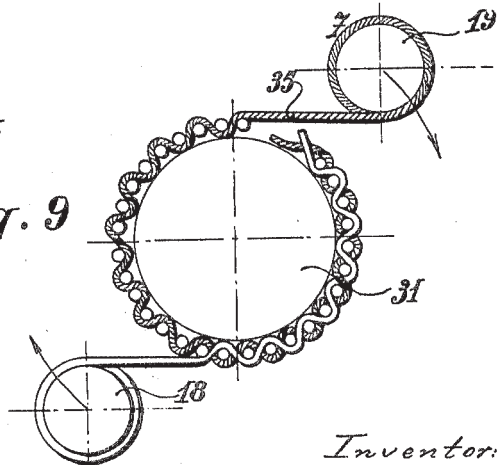


Fig. 9

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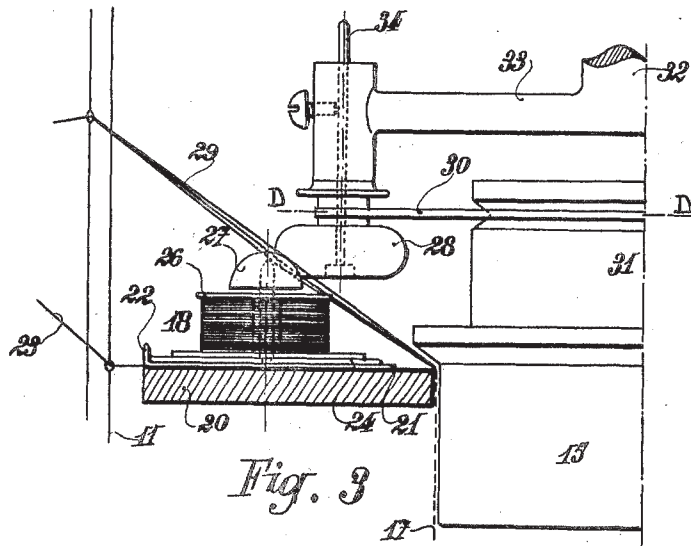
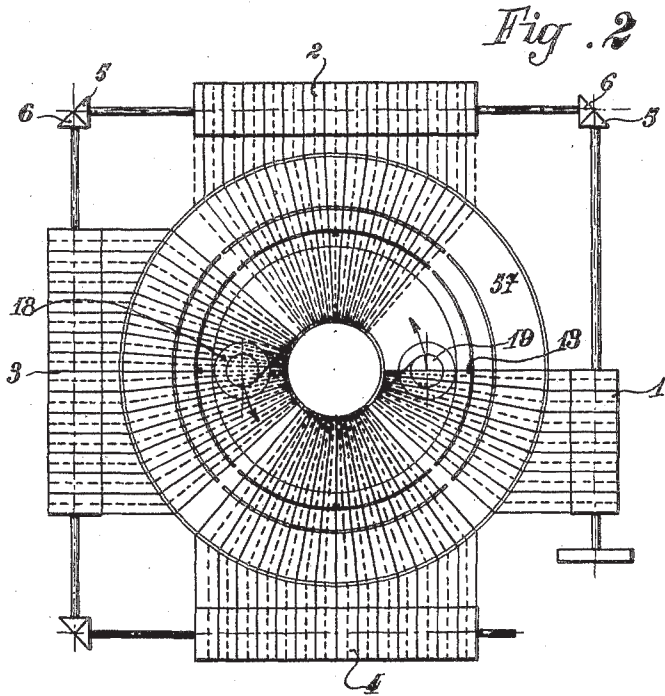
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8 Sheets-Sheet 2



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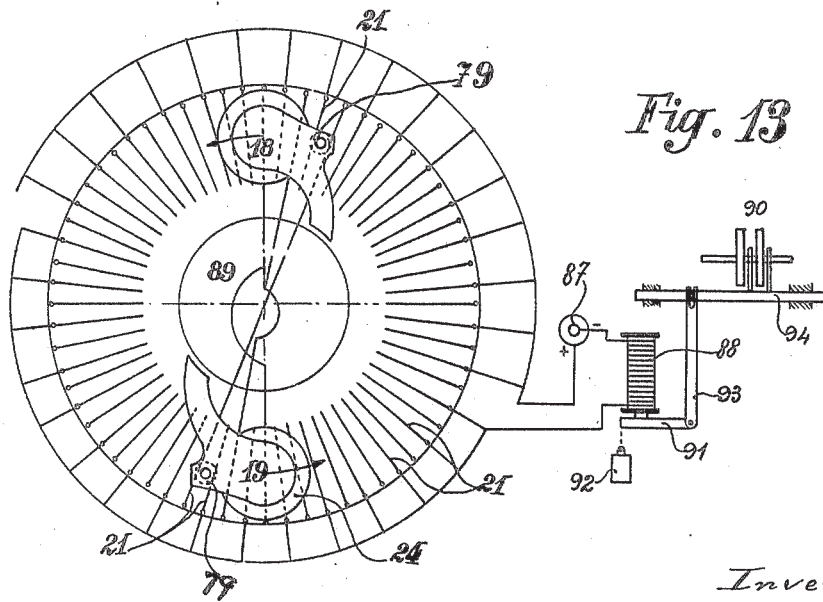
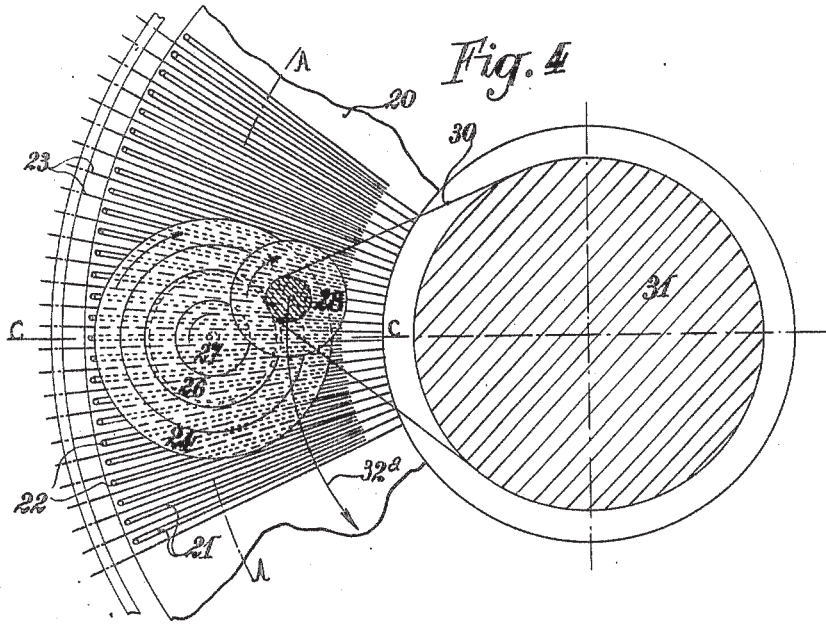
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CIRCULAR WEAVING LOOM

Filed April 14, 1927

8 Sheets-Sheet 3



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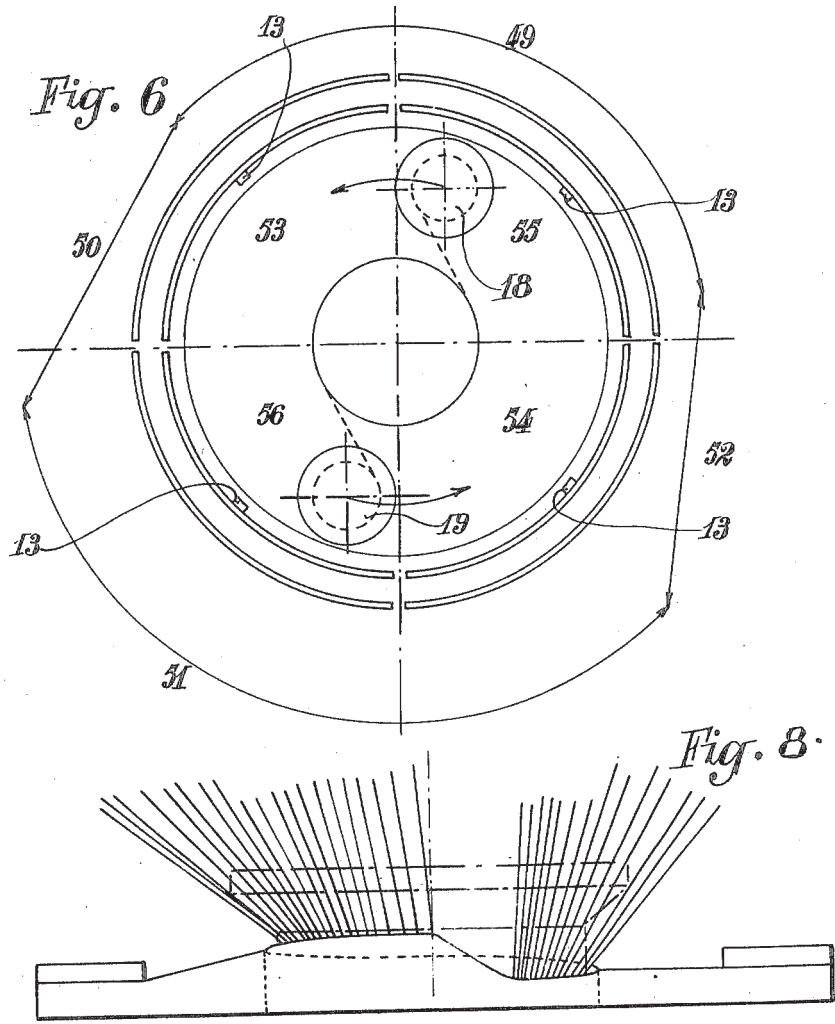
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CIRCULAR WEAVING LOOM

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8 Sheets-Sheet 4



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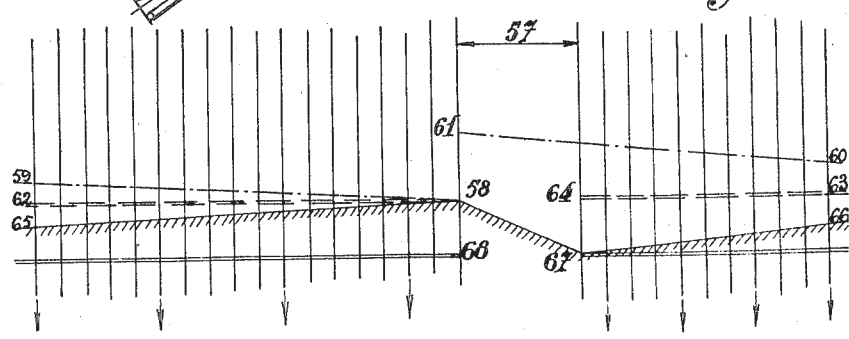
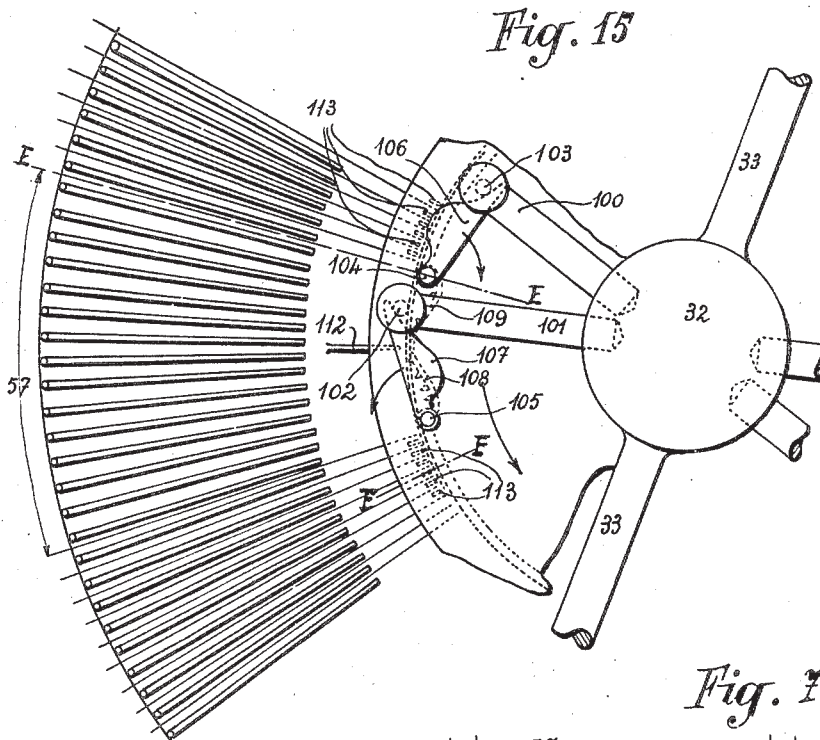
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CIRCULAR WEAVING LOOM

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8 Sheets-Sheet 5



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CIRCULAR WEAVING LOOM

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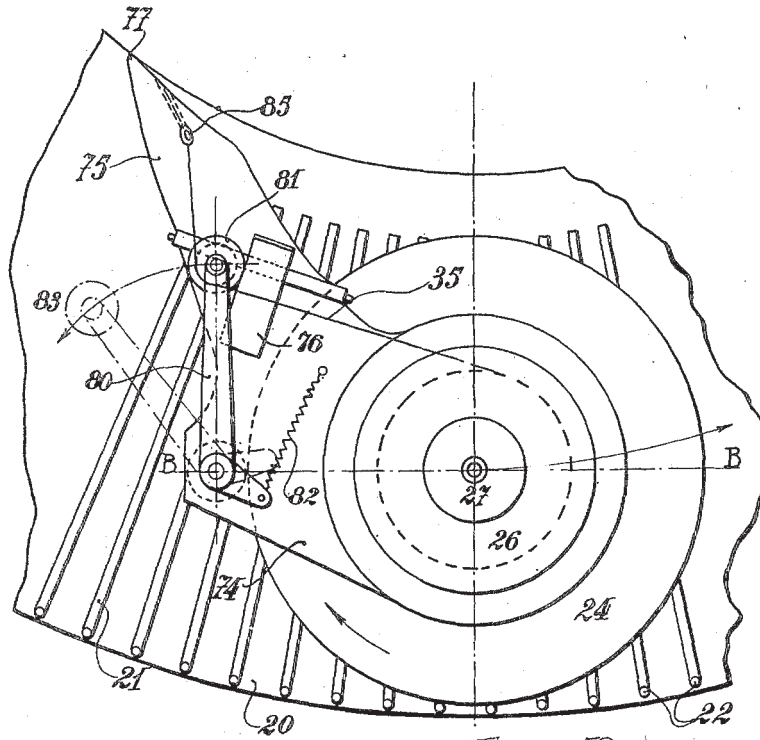


Fig. 10

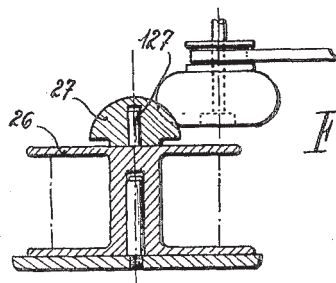


Fig. 19

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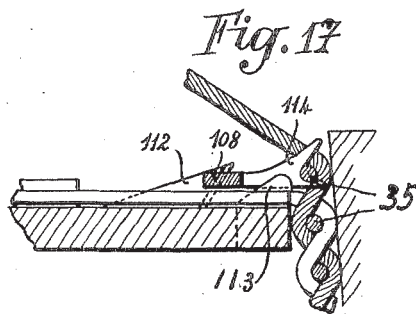
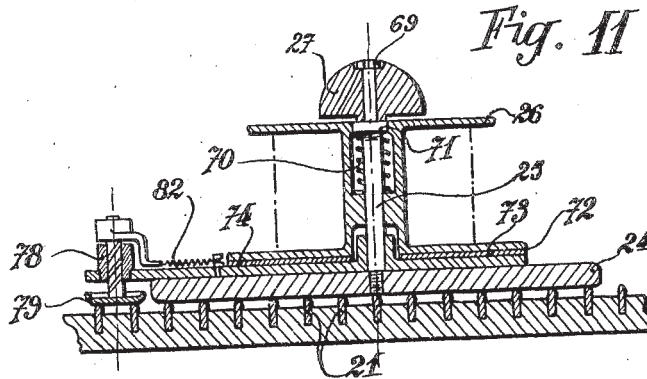
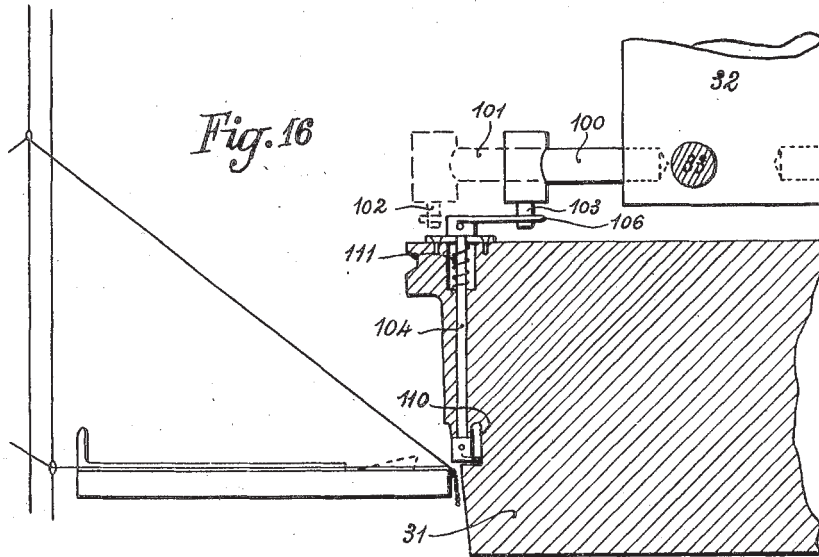
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CIRCULAR WEAVING LOOM

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8 Sheets-Sheet 7



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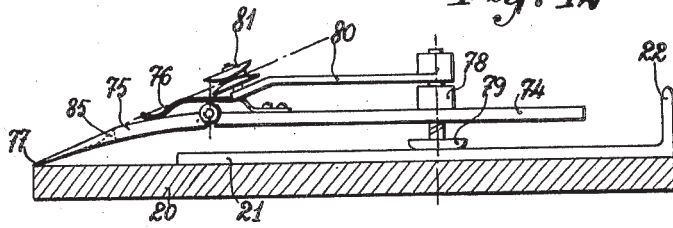
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CIRCULAR WEAVING LOOM

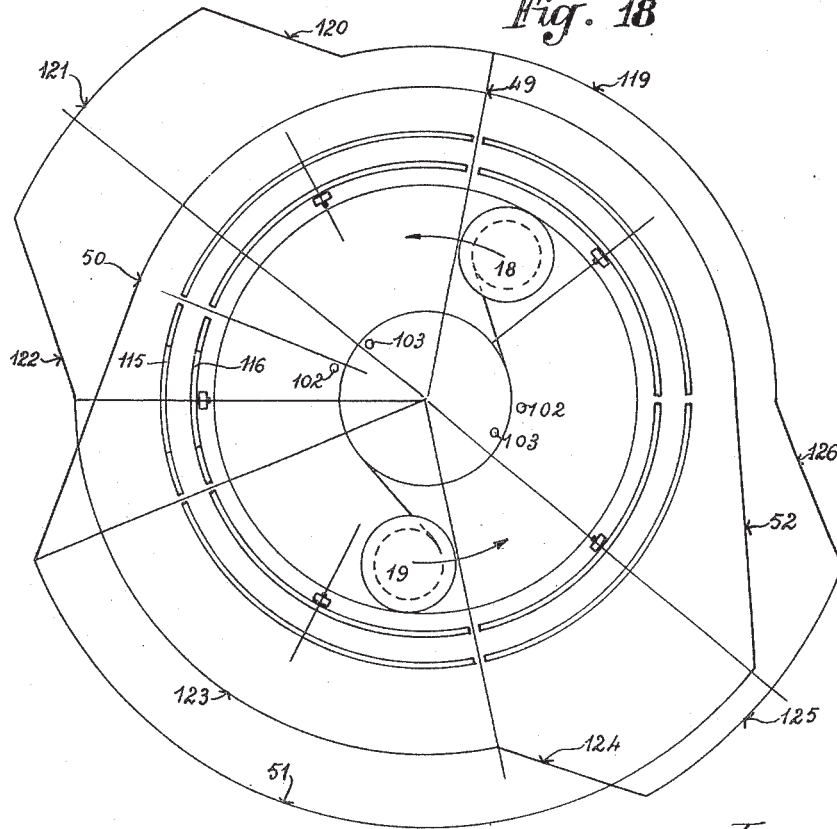
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8 Sheets-Sheet 8

*Fig. 12*



*Fig. 18*



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# UNITED STATES PATENT OFFICE.

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CIRCULAR-WEAVING LOOM.

Application filed April 14, 1927, Serial No. 183,853, and in France April 24, 1926.

This invention refers to a circular weaving loom in which the warp threads are arranged radially. The shuttles slide on a circular plate provided with channels in which the warp threads of the lower shed are located and they simultaneously rotate on projections located around the periphery of said circular plate, substantially as an hypocycloidal gear. Each shuttle is driven by a pulley having a rounded edge acting through the upper warp shed, on an idler supported by the shuttle. This driving pulley is itself positively rotated.

The circular loom according to the invention is provided with means whereby the weft is made strictly perpendicular to the warp, and with an electric stop motion. It comprises also a device for forming selvages if desired when non-tubular fabrics are to be manufactured.

Such a loom is diagrammatically represented in the annexed drawings:

Fig. 1 is a side view.

Fig. 2 is a plan view, the upper parts of the loom being omitted.

Figs. 3 and 4 show the drive of the shuttles; Fig. 3 being an enlarged side view with parts in vertical section on line C—C of Fig. 4, and Fig. 4 a horizontal section on line D—D, Fig. 3.

Fig. 5 is a cross section on line A—A (Fig. 4) of the circular plate on which the shuttles slide.

Fig. 6 is a diagram showing the movements of the heddles.

Figs. 7 and 8 show the results obtained by giving the weft thread a helical motion.

Fig. 9 shows the arrangement of the weft threads in the fabric.

Fig. 10 is a plan view of a shuttle.

Fig. 11 is a cross-section of the same on line B—B, Fig. 10.

Fig. 12 is a side view of the thread-guiding arm.

Fig. 13 shows the electric connections for stopping the loom when a weft thread is broken.

Fig. 14 represents the selvage which may be obtained.

Fig. 15 is a partial plan view of the loom provided with the selvage forming means (these means being not shown in Figs. 1 to 14 for the sake of simplicity).

Fig. 16 is a cross section on line E—E (Fig. 15).

Fig. 17 is an enlarged cross section of a folding reed on line F—F (Fig. 15), the reed being in its folded position.

Fig. 18 is a diagram of the double drive of the warp threads, the heddles of the selvage threads being driven by a special cam.

Fig. 19 is a cross section of a shuttle with frictionally driven idler.

The loom as represented is arranged for manufacturing calico weave and it has only two shuttles. It comprises four beams 1, 2, 3 and 4, at right angles to each other and connected through bevel gears 5, 6, in such a way as to require only a single beam brake 7. The warp comprises the even numbered threads (which are represented in dash lines, Fig. 2) and the odd numbered threads (represented in full lines). These threads are directed by a circular reed and they pass through the eyelets 8, the even numbered threads passing through the outer eyelets (Fig. 1) and the odd numbered threads through the inner eyelets.

These eyelets are carried by the heddles 9 and the heddle laths 10 which are connected together by ropes 11 passing over pulleys 12. (These pulleys are not represented in Fig. 2 and Fig. 1 only shows the threads which are substantially in a plane parallel to the plane of the drawings). The heddles are thus distributed in four sectors each comprising even and odd numbered heddles, the movement of the even numbered heddles and the movement of the odd numbered heddles being always inverted. Each inner upper lath 10 is provided with an idler 13 cooperating with the channel of a cylindrical cam 14 for giving the heddles the necessary movements.

When the fabric must have selvages, a separate driving mechanism is preferably provided for the warp threads near the selvage. This mechanism will be described separately.

The warp threads, after passing through eyelets 8, are passed through an annular way between a central guide 15 and the edge of a central aperture provided in a circular plate 16. In Fig. 1, this plate 16 is represented in cross section. In Fig. 2, the cam 14 has not been represented.

The shuttles 18 and 19 are placed on plate 16, between the upper and the lower sheds.

The circular plate 16 (Figs. 3, 4 and 5), is made up of a circular plate proper 20

provided with radial projections 21 with rounded edges, and, around its periphery, with higher projections 22. The warp threads 23 of the lower shed are located  
5 in the channels formed between the projections; and the peripheral projections 22 are used as gear teeth for retaining and rotating the circular base 24 of the shuttle.

The aforesaid circular base 24 is provided with a vertical spindle 25 on which the cop 26 rotates freely. A semi-spherical idler 27 rotates also freely on the upper end of shaft 25. This idler 27 is tangent with the upper warp shed (Fig. 3).

15 The drive of the shuttle will be explained with reference to Figs. 3 to 5.

Each shuttle is driven by a pulley 28 having a rounded edge and acting on the semi-spherical idler 27 of the shuttle through  
20 the upper warp shed 29. An endless belt 30, which is passed around the fixed central member 31 of the loom, drives these pulleys 28 when they are rotated around the axis of the loom at a speed which is such that the  
25 rounded edge of pulley 28 rolls on the warp threads without any slipping. The warp threads are not displaced by pulley 28 but are only pressed between said pulley and the idler 27.

30 The pulley 28 is supported by an arm 33 keyed on a central shaft 32. When shaft 32 is rotated in the direction of the arrow 32<sup>a</sup>, Fig. 4, the base 24 of the shuttle is pressed obliquely on the outer projections 22 and rotates as an hypocycloidal gear meshing  
35 with these projections, while sliding on the radial projections 21 of circular plate 20. (In Fig. 2, the shaft 32, the two arms 33 and the two pulleys 28 have been omitted.)

40 The fabric 17 is folded by rollers 36, Fig. 1; it is fed by a spiked roller 37 and is wound around roller 38. Cam 14 and shaft 32 are driven by a shaft 39 through bevel gears 40 and gears 41 and 42. Driving  
45 shaft 39 is provided with a pulley 43 which, by means of a belt 44, drives a pulley 45 keyed on a shaft 46. Shaft 46 drives the spiked roller 37 by means of a worm 47 acting on a gear 48. 39 is the driving shaft of the  
50 loom and it is provided with the necessary gears or pulleys not shown.

Fig. 6 illustrates the working of the loom.

The shuttles 18, 19 are driven in the direction of the arrows. Cam 14 is indicated by  
55 curve 49, 50, 51, 52 which represents in radii the distance from the channel of cam 14 (see Fig. 1) to a horizontal plane.

Cam 14 rotating at a speed equal to the speed of the shuttles, shuttle 19 always slides  
60 over odd numbered warp threads and shuttle 18 over even numbered warp threads. The fabric obtained (Fig. 9) is a weave with two alternate warp threads.

As shown in Fig. 2, a part 57 is preferably  
65 void of warp threads in order to per-

mit of a free access to the shuttles and also for insuring the correction of the obliquity of the weft threads as explained below with reference to Figs. 7 and 8.

Fig. 7 represents the warp threads of the  
70 tubular fabric 17 which is fed in the direction of the arrows by the spiked roller 37 (Fig. 1). The weft thread is guided by the inner edge of plate 20 (Fig. 3). If this  
75 inner edge were horizontal, the weft thread would be located in 58, 59, 60 and 61. Fig. 7, its winding around the central part 15 (Fig. 1) being helical as a consequence of the downward movement of fabric 17. For  
80 avoiding this obliquity, the inner edge is itself made helical in a direction opposite to the direction of 58, 59, 60 and 61. Said  
inner edge is indicated at 58, 65, 66 and 67 (Fig. 7) and the weft thread comes at 58,  
85 62, 63 and 64. An incline 67, 58 is provided in the part 57 (which has no warp threads) for connecting points 67 and 58. Of course,  
the obliquity of the weft threads in part 57 is not a drawback as these threads are intended to be cut for obtaining an ordinary  
90 flat fabric.

Fig. 8 shows the inner edge of plate 20.

It is to be understood that when the diameter of the fabric is great, the obliquity  
95 of the weft threads is not to be taken into account and there is no need of making the inner edge of plate 20 helical.

The shuttle comprises an adjustable brake for insuring a suitable tension of the weft  
100 threads, a thread guide for guiding the same, and a stop motion for stopping the loom when the thread is broken, (Figs. 10, 11 and 12).

As aforesaid, the base of the shuttle is a circular plate 24 preferably made of fiber  
105 or the like, provided with a spindle 25 on which the cop 26 rotates freely; the semi-spherical idler 27 is pivoted at the upper end of spindle 25, a nut 69 being provided for retaining said idler in axial position.  
110 Cop 26 is provided with an axial housing in which is located a braking spring 70 which is adjustable by means of nut 71. Spring 70 presses the lower face 72 of cop 26 against a  
115 piece of leather 73. Between the base 24 and the leather sheet 73 a member 74 is interposed, on which the thread guide 75 is articulated (Fig. 12). A spring 76 presses  
120 thread guide 75 against the inner edge of plate 20, the weft-thread being guided by the extreme end 77 of the guide which is rounded.

When the shuttle is driven, the circular  
125 base 24 rotates in the direction of the arrow (Fig. 10). The end 77 of guide 75 is maintained against the warp threads by the friction of member 74 on base 24, and the weft thread 35 is tensioned by the friction of cop 26 on the leather sheet 73. The articulation  
130 of the thread guide 75 permits of laying cor-



rectly the weft thread when the inner edge of plate 20 is made helical.

The stop-motion is an electromagnetic device which is operated by the opening of an electric circuit.

Member 74 is provided with a nut 78 having a quick or coarse pitch, which cooperates with a screw that passes through it and is provided with a circular shoe 79. This screw is rotated by a lever 80, Fig. 10, which is fixed to it and is provided with an idler 81. A spring 82 acts also on lever 80. The weft thread unwound from cop 26 passes around idler 81 and enters the thread guide through an aperture 85 in order to be guided to the extreme end 77. The tension of the weft thread maintains lever 80 in the position in full lines, Fig. 10, in which shoe 79 is in contact with the radial projections 21 of plate 20. When the weft thread breaks, lever 80 is brought to the position in dashed lines by spring 82, thereby rotating the screw that carries shoe 79, with the result that said shoe comes to its upper position in which it is no longer in contact with projections 21.

Projections 21 are metallic and they are insulated from each other; this is easily obtained by making plate 20 of an insulating substance in which projections 21 are embedded, as shown in Fig. 11.

Fig. 13 diagrammatically illustrates the working. The shoes 79 are intended for short-circuiting two consecutive projections 21 in any position of the shuttles. Every odd-numbered projection is connected with the opposite one (in Fig. 13, only three such connections have been represented); the even numbered projections are connected with two semi-circular connections, one of which is directly connected with a terminal of the source of current 87, the other one being connected with the other terminal through an electromagnet 88. When magnet 88 is energized, it attracts its armature 91 against the action of a weight 92. When the electric circuit is open, magnet 88 releases its armature 91 which, under the action of weight 92 drops, rocking lever 93 to the left and bringing the driving belt of the loom on to the loose pulley 90 through rod 94.

The electric circuit, as will be readily understood from Fig. 13, is closed through the two shoes 79 when the loom is in regular operation. When a weft thread is broken, the corresponding shoe 79 is lifted, as explained, and the circuit is opened. The loom is thus stopped through the release of armature 91.

The loom, as described, weaves a tubular fabric which is opened in the space 57 void of warp threads, giving a fringed plane fabric without selvages. A selvage is easily obtainable with some slight additions (Figs. 14 to 16).

The central shaft 32 is additionally provided with two pairs of radial arms 100 and 101, Figs. 15 and 16, having vertical projections 102 and 103 at their outer ends which may cooperate with two levers 106 and 107 keyed on two vertical shafts 104 and 105, rotating in the fixed axial member 31 of the loom. These shafts 104 and 105 are provided at their lower ends with folding reeds 108 and 109 which are normally located in a recess 110 of member 31 (see Fig. 16). Springs 111, located in housings in member 31, act on shafts 104 and 105 so as to bring reeds 108 and 109 inside recess 110.

As will be readily understood from Fig. 16, arm 100 acts on lever 106 and simultaneously arm 101 acts on lever 107 so as to rotate both reeds 108 and 109 in an outward direction. Shafts 104 and 105 are located at the edges of the space 57 void of warp threads.

A knife 112 is located in front of reeds 106 and 107 (Fig. 15); and triangular teeth 113 (Figs. 15 and 17) are interposed between the warp threads adjacent to space 57.

Each folding reed is made of a curved member (Fig. 17) provided with flat teeth 114 having a U-shaped recess.

The heddles of the warp threads located near the selvage are driven by special heddle laths 115—116 (Fig. 18) which are themselves driven by a special cam keyed on the same shaft as the main cam 14 and intended for imparting to the laths 115 and 116 a motion twice as rapid as the motion of the usual laths. This special or auxiliary cam has been represented, Fig. 18, by curve 119, 120, 121, 122, 123, 124, 125 and 126.

The special weave which must be obtained is represented in Fig. 14. The weft threads have been cut, folded at 35° and woven again with the adjacent warp threads.

The working is as follows:

Shuttle 19 (for instance), Fig. 18, passes across space 57, laying a weft thread. The special selvage cam then moves the warp threads adjacent to the selvage, weaving the last weft thread. Arms 100 and 101 then operate levers 106 and 107. Reeds 108 and 109 press this last weft thread on cutter 112 which cuts it midway, and they completely fold the two free ends. When levers 106 and 107 are released, the reeds are brought back into their recess by springs 111, but the ends of the weft thread are retained by the teeth 113 (Fig. 17). The selvage cam then again moves the selvage heddles and the free ends of the weft thread are woven as shown in Fig. 14.

The special selvage cam might be dispensed with, each free end 35° being simply woven with the next weft thread by the usual cam 14.

It may be found useful, for insuring a perfect drive of the shuttles with delicate warp

threads, to impart to the semispherical idler 27 a positive rotation in order to avoid any slip between said idler 27 and the driving pulley 28 (Figs. 3 and 4). This is easily obtainable by pivoting the idler 27, Fig. 19, on a special spindle 127 fixed on the top of the cop 26. With this arrangement, the friction between idler 27 and spindle 127 helps the driving pulley 28 to rotate idler 27.

15 The loom, as described, is arranged for weaving calico, but it will be readily understood that, by a suitable drive of the heddles, any complex weave could be manufactured.

15 It must be pointed out that the loom according to the invention may be used for weaving a textile tubular covering directly on a rope or cable, for instance on an electric cable, this cable being employed in lieu of the axial member 31 and, of course, being driven by a suitable drum together with its woven covering.

What I claim is:

25 1. A circular weaving loom comprising a circular way for the shuttles; radial channels in said way for the warp threads of the lower shed; and projections between which the warp threads of the lower shed are located distributed around the periphery of said circular way, and arranged substantially perpendicular to said way at the ends of the channels, said projections forming teeth for rotating the shuttles and for retaining them radially on said way.

35 2. A circular weaving loom comprising in combination a circular way for the shuttles; radial channels in said way; projections around the periphery of said way; and rotating shuttles sliding on said way, said shuttles having a circular base which rolls on said peripheral projections as an hypocycloidal gear.

45 3. A circular weaving loom with warp threads arranged radially around a central guide, said loom comprising in combination a circular way for the shuttles; radial channels in said way for the warp threads of the lower shed; projections on the periphery of said way; rotating shuttles sliding on said way, said shuttles having a circular base which rolls on said projections as an hypocycloidal gear; and driving means acting on said shuttles through the upper warp shed.

55 4. A circular weaving loom with warp threads arranged radially around a central guide, said loom comprising in combination a circular way for the shuttles; radial channels in said way; projections on the periphery of said way; driving means for the shuttles; and rotating shuttles, each comprising a circular base, a vertical spindle fixed to said base co-axially with the same, a cop rotatable on said spindle, an adjustable spring brake for said cop, and a semi-spherical idler loosely pivoted on said

spindle, said idler being substantially tangent to the warp threads of the upper shed and being actuated, through said shed, by the driving means for the shuttles.

70 5. A circular weaving loom as claimed in claim 4, wherein the driving means for the shuttles comprise a rotating shaft co-axial with the loom, radial arms on said shaft, driving pulleys pivoted at the outer ends of said arms, with their axes of rotation substantially parallel with the spindles of the shuttles, said driving pulleys having rounded edges adapted to act on the spherical idlers of the shuttles through the upper shed, said pulleys being positively rotated at such a speed that there is no sliding between their edge and the warp threads of said upper shed.

85 6. A circular weaving loom with warp threads arranged radially around a central guide, said loom comprising in combination a circular way for the shuttles; radial channels in said way; projections on the periphery of said way; driving means for the shuttles; and rotating shuttles each comprising a circular base, a vertical co-axial spindle fixed to said base, a cop rotatable around said spindle, adjustable braking means for said cop, a trunnion fixed on said cop co-axially with the same, and a substantially semi-spherical idler loosely pivoted on said trunnion, said idler being tangent to the warp threads of the upper shed and being adapted to receive the action of the driving means through said shed.

100 7. A circular weaving loom in which the warp threads are arranged radially around a central guide, said loom comprising in combination a circular shuttle way having a central aperture through which said guide extends with an annular space for the fabric; shuttles on said way; articulated thread guides on said shuttles, said guides being adapted to lay the weft thread on the edge of said aperture; and means whereby said thread guides are kept in permanent contact with said edge and with said central guide.

115 8. A circular weaving loom as claimed in claim 7, in which a sector is void of warp threads.

120 9. A circular weaving loom comprising in combination a circular shuttle way having a central aperture; a central guide extending therethrough; radial channels in said way for the warp threads of the lower shed; projections on the periphery of said way, substantially perpendicular to the same; and shuttles sliding on said way, each shuttle comprising a circular base, a co-axial spindle on said base, a cop rotatably mounted on said spindle, a flat member interposed between said base and the lower face of said cop, friction members between said cop and said flat member, spring means pressing said cop against said friction members, and an articu-



lated thread guide supported by said flat member; whereby the rotation of said cop under the action of the weft thread tends to keep said thread guide in permanent contact with said central guide.

10. A circular weaving loom in which the warp threads are arranged radially around a central guide, except for a sector which is void of warp threads, said loom comprising in combination a circular shuttle way having a central aperture for said central guide; shuttles sliding on said way; and articulated thread guides on said shuttles, said guides being adapted to lay the weft thread on the edge of said aperture; said edge being made helical in the part in which warp threads are provided.

11. A circular weaving loom comprising in combination a circular way for the shuttles; electrically insulated radial projections on said way, said projections forming channels for the warp threads of the lower shed; shuttles sliding on said way, the base of said shuttles being made of insulating material; electrical contact means carried by said shuttles, said means being adapted to permanently connect two successive radial projections with each other during the normal working of the shuttles; means whereby said contact means are rendered inoperative when the weft thread is broken; an electromagnetic stopping device; and electrical connections whereby the loom is stopped when the contact means of one of said shuttles are put out of operation.

12. A circular weaving loom as claimed in claim 11, wherein the shuttles comprise in combination a circular base; a spindle on said base; a cop rotatable on said spindle; a flat member interposed between said cop and said base; means whereby said flat member does not rotate when said base and said cop rotate; a quick pitch screw in said flat member; a contact shoe at the lower end of said screw; an arm at the upper end of the same; spring means whereby said arm is rotated in such a direction that said shoe is lifted; and an idler at the end of said arm, said idler being adapted to receive the weft thread and to be maintained by the tension of said thread, against the action of said spring means, in a position such that said contact shoe slides on the radial projections of the circular base of the shuttles.

13. A circular weaving loom comprising in combination a circular way for the shuttles; insulated radial projections on said way; shuttles sliding on said way; electrical contact means on said shuttles, said means being adapted to normally connect two successive radial projections; means whereby said contact means are rendered inoperative when the weft thread is broken; electrical connections connecting together each two opposite odd-numbered radial projections; an

electrical connection connecting the even-numbered projections of one-half of said way with one terminal of a source of electric current; an electrical connection connecting the even-numbered projections of the other half of said way with the other terminal; and electro-magnetic means inserted in the electric circuit, said means being adapted to stop the loom when the circuit is opened.

14. A circular weaving loom with the warp threads arranged radially around a central guide, except for a sector which is void of warp threads, said loom comprising means whereby the last laid weft thread is cut substantially midway in the space void of warp threads, and its ends completely folded between the two sheds, for being woven with the adjacent warp threads, for the purpose of making selvages on the fabric.

15. A circular weaving loom as claimed in claim 14 wherein the warp threads adjacent to the selvages are given a special motion for insuring a correct weave of the folded ends of the weft thread.

16. A circular loom with the warp threads arranged radially around a central guide, except for a sector which is void of warp threads, said loom comprising in combination a circular way for the shuttles; two folding reeds for folding the last laid weft thread, said reeds being located in said sector void of warp threads; a cutter in the middle of said sector and near said central guide; and means for actuating said reeds; whereby the last laid weft thread is pressed by said reeds against said cutter and cut by the same, the two ends being then freely folded in the sheds on both sides of said sector.

17. A circular weaving loom as claimed in claim 16 wherein means are provided for maintaining the folded ends of the last laid weft thread in the sheds before their weaving with the adjacent warp threads; said means comprising ratchet teeth located on the circular way for the shuttles between the successive warp threads of the lower shed; said teeth permitting the folding of the ends of the weft thread under the action of the folding reeds, but retaining said ends when said reeds return to their normal position.

18. A circular weaving loom in which the warp threads are arranged radially around a central guide, except for a sector which is void of warp threads, said loom comprising in combination a circular way for the shuttles; a cutter on said way substantially in the middle of said sector and near said central guide, said cutter being adapted to cut the last laid weft thread when said thread is pressed against said cutter; folding reeds disposed in a recess in said central guide, said reeds being pivoted on axes sub-

stantially parallel with the axis of the loom; operating levers for operating said reeds; two arms on the central shaft of the loom; actuating rods at the end of said arms, said  
5 rods being adapted to operate said levers respectively and simultaneously and to rotate said reeds for pressing the last laid weft thread against said cutter which cuts  
10 it, and for folding the ends in the sheds on the sides of said sector; and spring means for returning said reeds and levers to their normal position.

19. A circular weaving loom as claimed in claim 18, wherein ratchet teeth are provided  
15 for maintaining the folded ends of the last laid weft thread in the sheds before their weaving with the adjacent warp threads when the folding reeds return to their normal position; said reeds embodying a curved  
20 back and flat U shaped teeth which are

adapted to pass between said ratchet teeth and fold the weft thread thereover.

20. A circular weaving loom in which the warp threads are arranged radially, except for a sector which is void of warp threads, 25 comprising a cam coaxial with the loom for driving the heddles, means for cutting the weft threads in the portion void of warp threads and for making selvages by folding the ends of the last laid weft thread 30 after it has been cut and weaving it with the adjacent warp threads by a special drive of the latter, said drive comprising a special cam keyed on the shaft of the first-named cam and imparting to the heddles of 35 the selvedge warp threads a movement twice as rapid as the movement of the other warp threads.

In testimony whereof I affix my signature.

CLAUDE SÉRY.