June 2, 1936. H. DREYFUS ET AL 2,042,703

CIRCULAR LOOM

Filed July 13, 1934 2 Sheets-Sheet 1

FIG. 1

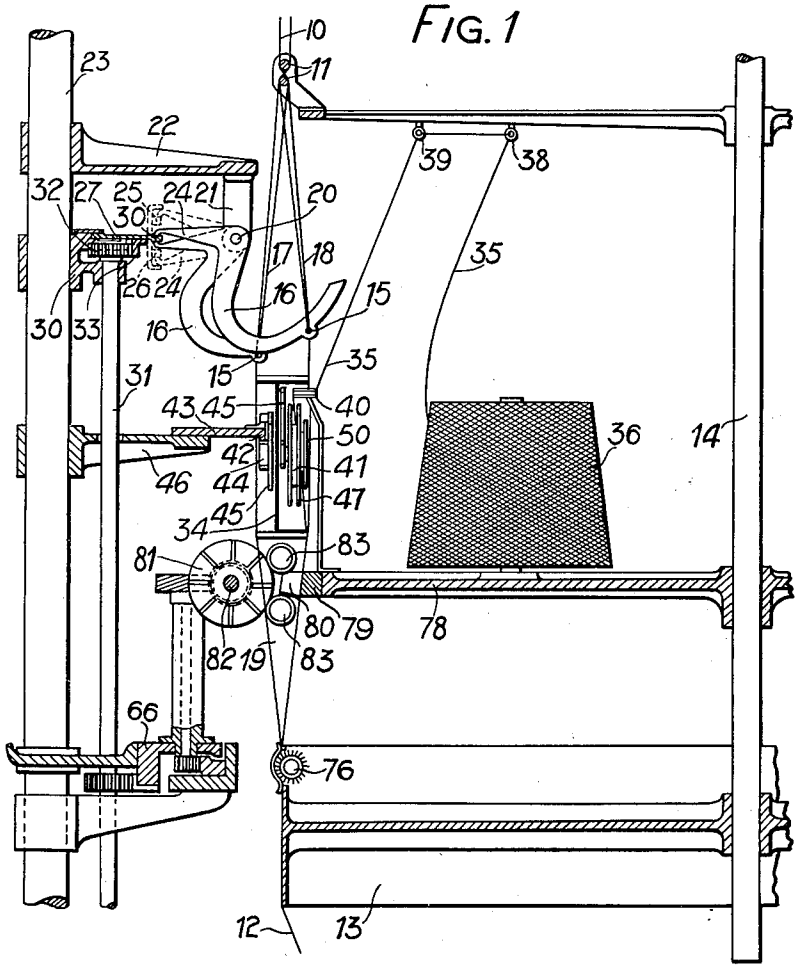


FIG. 6

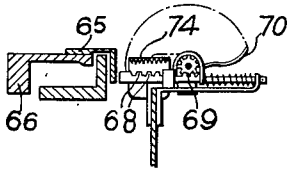
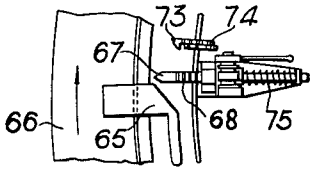


FIG. 7



HENRY DREYFUS
WILLIAM POOL
INVENTORS

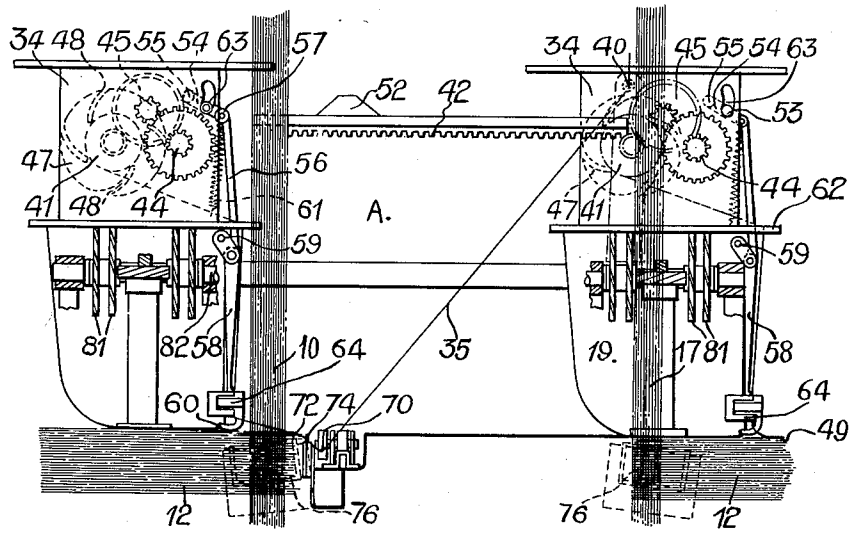
BY Dalton & Adkinson
ATTORNEYS

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CIRCULAR LOOM

Filed July 13, 1934 2 Sheets-Sheet 2

FIG. 2.



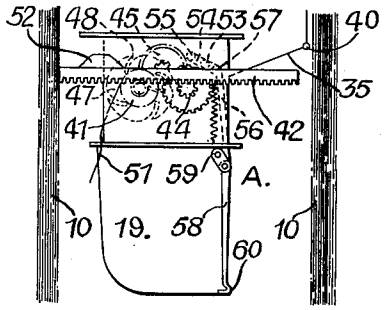


FIG. 3.

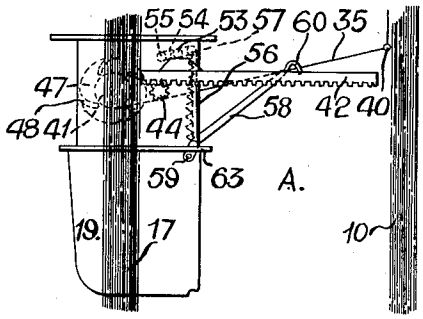


FIG. 4.

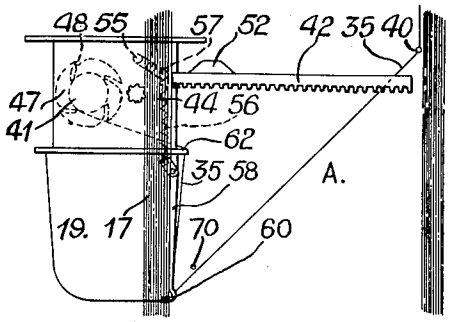


FIG. 5.

INVENTORS
HENRY DREYFUS
WILLIAM POOL
BY
Wilkinson & Wilkinson
ATTORNEYS

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CIRCULAR LOOM

Henry Dreyfus, London, and William Pool, Spondon, near Derby, England, assignors to Celanese Corporation of America, a corporation of Delaware

Application July 13, 1934, Serial No. 734,908
In Great Britain July 21, 1933

16 Claims. (Cl. 139—224)

This invention relates to circular looms, and is concerned with means for supplying weft in such looms.

The principal object of the invention is to enable circular looms to operate with a continuous weft supply, this being effected according to the invention by replenishing the or each shuttle with weft automatically on weft exhaustion. This arrangement is advantageous in that a loom can run for considerable periods without attention, it merely being necessary that an adequate supply of weft is maintained in the loom for replenishment of the shuttles. In a loom employing a plurality of shuttles any particular shuttle can be replenished without interfering in any way with the weaving operations of the remaining shuttles, the replenishment of an exhausted shuttle being effected in the course of the normal operation of the loom.

Any convenient length of weft may be supplied to a shuttle at appropriate intervals, a fresh length being furnished immediately on exhaustion of the spool or other weft package carried by the shuttle. Conveniently the replenishment takes place at a gap provided in the warp threads arranged round the loom, the loom weaving edged fabric the width of which is less than the weaving circumference of the loom by the number of warps omitted to provide access to the shuttle.

In the particular form of weft replenishing mechanism according to the invention, means are provided to rewind the spool in the shuttle with a length of weft upon exhaustion of the weft on the spool. With such arrangement it suffices to supply the spool with a length of weft sufficient to extend across the width of the fabric traversed by the shuttle between consecutive weft replenishments. Thus, with one gap only, as is sufficient in most practical sizes of circular looms, the length of weft supplied to the shuttle is sufficient to extend round the loom until the shuttle again reaches the gap. That is to say, in a circular loom in which the fabric is woven at or near the periphery of the loom, the length of weft to be supplied to the shuttle must be at least equal in length to the distance round the loom periphery less the distance across the gap between the edges of the fabric, a small excess, however, preferably being provided, which excess may be trimmed away afterwards.

Advantageously the shuttle takes up the weft length while crossing the gap without stoppage of its progress around the loom, the spool winding the weft rapidly during the progress of the shuttle across the gap.

Since each length of weft is contained within the shuttle during weaving, the shuttle may be employed in a loom using progressive shedding, and containing as many shuttles round its periphery as the number of sheds into which it is possible to divide the warps round that periphery. At the same time, weft replenishment taking place automatically, it is not necessary, in order to obtain high efficiency, to use spools of large dimensions. On the other hand, the spools may be of relatively small size with the consequent advantage that the shuttle dimensions may be reduced also, with the result that a large number of shuttles can be accommodated round the loom. Therefore a large number of picks may be laid at each revolution, resulting in a high output of the loom, which output need be only very slightly reduced by the necessity for a short non-weaving period at the replenishing gap or gaps.

Apart from the advantages of substantial continuity of operation and high efficiency resulting from the invention, the lighter and smaller shuttles which may be used are of service in enabling a high rate of weaving to be attained and also rapidly operating weft- and warp-stop mechanism to be employed. Thus, when such mechanisms operate to clutch the shuttles and warps together to bring weaving to an end, the lightness of the shuttles enables this to be done in a very short time, thus minimizing the risk of the warp being stretched or broken by the shuttles engaging the jam in the warps resulting from an end breaking and preventing change of shed.

One form of apparatus according to the invention will now be described in greater detail with reference to the accompanying drawings in which,

Fig. 1 is a part-sectional elevation showing the invention applied to a loom of the type described in U. S. application S. No. 655,560 filed 7th February, 1933, and having a plurality of shuttles rotating about its axis;

Fig. 2 is a side elevation of consecutive shuttles near the position in the loom at which weft replenishment is effected;

Figs. 3, 4 and 5 illustrate diagrammatically the weft replenishing operation, while

Figs. 6 and 7 are part-sectional elevation, and plan views, respectively, of a detail of Fig. 2.

Referring to Fig. 1 a sheet of warp threads 10 unwinding from overhead warp beams or like packages, (not shown), proceeds downwardly in cylindrical form over lease rods 11 to the fabric 12, which is held firmly against a supporting ring 13 borne by the central shaft 14 of the loom. The fabric 12 is wound by take-up mechanism

(not shown) situated at the bottom of the loom.

Between the lease rods 11 and the fabric 12 the warp threads pass through the eyes 15 of shedding members 16 which divide the warp threads into two sheets 17, 18 at intervals round the loom, for the reception between them of shuttles 19 (one shown). The members 16 pivot about a rod 20 which extends around the loom and is supported at suitable intervals by brackets 21 (one shown) which depend from arms 22 outstanding from pillars 23 of the loom frame, which pillars are spaced at intervals around the loom. Each member 16 is formed with an outstanding arm 24, the extremity of which rides against one of two cams 25, 26 formed along the inner edge of a rotatable ring 27 which extends continuously round the loom.

The ring 27 is supported by stationary brackets 30 borne by the pillars 23, and is driven from a vertical shaft 31 by a pinion 32 which engages an annular rack 33 secured to, and depending from, the ring 27. On rotation of the ring 27, the cams 25, 26 slide against the extremities of the arms 24 of the shedding members 16, and cause the shedding members to oscillate about the rod 20, as indicated in dotted lines in Fig. 1, and so to shed the warp threads. The shape and rate of rotation of the cams are such as to shed the warp threads progressively round the loom, each shed commencing at a point immediately in advance of each shuttle 19, and finishing immediately behind each shuttle.

The extremities of the arms 24 are disposed on the cams 25, 26 in accordance with the pattern to be woven. Thus, in the case of a plain weave, alternate arms will be placed on opposite cams, while in the case of a 2 and 2 weave e. g. alternate pairs of arms will be placed on opposite cams, in a manner which will readily be understood by those skilled in the art. If desired, more than one warp thread may be threaded through each eye 15.

Weft thread 35 is supplied to the shuttles 19 from a large package 36 situated near a gap A (see Figs. 2–5), formed in the warp threads. The weft 35 is led from the package 36 through guides 38, 39 and to a guide 40 from which the thread is caused to extend diagonally downwards across the path of the spool 41 of an approaching shuttle 19 (see Fig. 2) for engagement thereby in a manner to be explained later.

Extending across the gap A is a toothed rack 42 formed along the edge of a segmental plate 43 which is supported by a bracket 46 outstanding from an adjacent pillar 23 of the loom frame. As the shuttles 19 proceed across the gap A on their passage around the loom, a pinion 44 outstanding from each shuttle and comprising the leader of a train of gears 45 in engagement with the spool, is engaged by the rack 42, and because of the relative movement between the shuttle and the rack, the train of gears is set into motion and causes the spool 41 to rotate rapidly in a clockwise direction, as viewed in Figs. 2–5. The pinion 44 is so disposed that while it is accessible to the rack 42 at the rack side of the shuttle, it lies clear of the warp sheet 17 as the shuttle proceeds through the shed.

The inner flange 47 of the rotatable spool 41 is formed with a number of spiral slots 48, any one of which catches the weft thread 35 extending across the path of the spool from the guide 40, as shown in Fig. 2, and draws the weft thread across the flange and on to the body of the spool, the rotation of which causes the thread to be wound thereon from the supply package (see Fig. 3). Outstanding from the inner side of the spool 41 and fixed thereto is an auxiliary spool 50 (see Fig. 1) on to which the loose end of weft originally extending diagonally downward, and indicated at 51 in Fig. 3, is drawn by the flange 47 and wound by rotation of the spool. The weft thread thus extends from the auxiliary spool 50 across the flange 47 to the main spool 41.

The spool 41 is rotated continuously until the pinion 44 leaves the rack 42, sufficient weft thread 35 being wound on to the spool to last until the next replenishing operation. Thus, in a loom having one gap only in the warps, the length of weft supplied to the shuttle will be sufficient to extend round the loom from the commencement to the finish of the warp threads, or, with reference to Figs. 2–5, from the left-hand side of the gap A, through the warps and to the right-hand side of the gap. Each weft length preferably is such as to leave a short end or "tail" at each selvedge of the fabric. The rate of rotation of the spool may be varied in accordance with the length of weft it is required to wind, simply by varying the ratio of the train of gears 45.

As shown in Figs. 3 and 4, the weft thread 35 extends directly from the spool 41 to the guide 40, on completion of weft winding. In order to depress the weft thread to a point near the fell 49 of the fabric, a cam 52 secured to the top of the rack 42 at a point near the left-hand extremity thereof is positioned so as to engage a bowl 53 projecting from a lever 54 which is pivoted at 55 to a vertical plate 34 comprising a part of the shuttle. A depending link 56 pivotally connected at 57 to the lever 54, pivotally connects the lever to an arm 58 which is adapted to swing about a pivot 59 on the body of the shuttle. As the travelling shuttle brings the bowl 53 into contact with the cam 52, the bowl mounts the incline of the cam and in so doing swings the lever 54 about its pivot 55. The link 56 is thus lifted and the arm 58 is caused to swing upwardly about its pivot 59, as shown in Fig. 4.

The end of the arm 58 is formed as a hook 60 which is carried above the level of the weft thread 35 extending between the spool 41 and the guide 40, the weft thread being brought directly beneath the hook by continued forward motion of the shuttle 19. The continued forward motion of the shuttle carries the bowl 53 of the lever 54 past the high point of the cam 52, and the lever descends under the influence of a tension spring 61 which is secured at one end to the body of the shuttle and at the other to the pivot 57 at the extremity of the lever 54.

The lever 54 thus assumes its normal position and in doing so swings the arm 58 downwardly about its pivot 59 to the position shown in Fig. 5, with the weft thread 35 engaged within the hook 60. In descending from the position shown in Fig. 4 to that of Fig. 5, the arm 58 brings the weft thread 35 into a guide slot 62 cut in the rear of the shuttle body and into a spring tension device 64 disposed along the length of the arm 58. The weft thread is thus guided from the spool 41 to the fell 49 of the fabric 12 by the slot 62 and the hook 60. The bowl 53 of the arm 54 is guided in a slot 63 formed in the plate 34.

As shown in Figs. 4 and 5, the shuttle 19 has by this time left the gap A and has entered the warp shed. At this point, in the operation of the loom, a cam 65 (Figs. 6 and 7) projecting from a travelling ring 66 (to be referred to later) is brought into contact with a relatively sta-

tionary plunger 67 situated near the selvedge of the fabric 12. The plunger 67 is formed with upstanding teeth 68 which engage a pinion 69, to which is attached a finger 70. On recession of the plunger 67 under the influence of the cam 65 the rotation of the pinion 69 causes the finger 70 to be swung through a semi-circle, (indicated in dotted lines in Fig. 6). The finger 70 engages on its way the weft thread 35 extending from the hook 60 to the guide 40 (see Figs. 2 and 5), and depresses the weft thread to a point below the level of the fell 49 of the fabric 12.

The cam 65 is of such length as to cause the weft thread 35 to be held by the finger 70 in the position shown in Fig. 2 until the leading shuttle 19 has travelled some distance into the warp shed, where the weft thread wound on the spools 41 and 50 is unwound, the spools being rotated in an anti-clockwise direction by the pull of the weft thread. The warp sheets 17, 18 behind the shuttle 19 now change over to form another shed for the succeeding shuttle, and in doing so lock the newly laid weft thread securely in the fabric. The length of weft being laid in the fabric is maintained under tension during unwinding by the resistance to rotation of the train of gears 45, and the spring tension device 62. This latter device is particularly of use when the last few inches of weft have left the spool and are proceeding to the fell of the fabric.

In the meantime the continued movement of the shuttles has brought the next succeeding shuttle into weft-engaging position, as shown in Fig. 2, where the length of weft thread 35 extending from the finger 70 to the guide 40 across the path of the next spool 41 is engaged by the slots 48 of the flange 47, as explained with reference to the leading shuttle 19.

Substantially simultaneously with the engagement of the weft thread 35 by the spool 41 the moving cam 65 strikes the operating head 73 of a toothed weft cutter 74 situated adjacent the finger 70 and into the teeth of which the weft thread has been depressed by the movement of the finger. The weft thread is thus severed and the loose end 51 (see Fig. 3), is wound on the spool 50 in the manner described above. On passage of the cam 65 past the plunger 67 a compression spring 75, which encircles an extension of the plunger, forces the plunger outwardly again with the result that the finger 70 is returned to its normal position in readiness for further actuation. Since the fabric woven is not completely tubular, temples 76 are provided and support the selvedges of the fabric 12 adjacent the finger 70 and the weft cutter 74.

As will be understood, the operation described above is continuous, the actuation of each shuttle being similar to that of the one immediately preceding it. The large weft package 36 (conveniently a cone) enables the loom to run continuously for considerable periods at once, stoppage being effected only for weft replenishment or adjustment.

The shuttles 19 are supported in their vertical position by a ring 78 which also supports the weft package 36. The edge 79 of the ring 78 is inclined and provides a race-way for a roller 80 which is freely rotatable about an axle fixed within the shuttle body. Vane wheels 81, 81 fixed to a rotatable shaft 82, which is driven indirectly from the rotatable ring 66, engage flanged rollers 83 within the body of each shuttle, and while allowing of free passage of the warp sheet 17, propel the shuttle along its path around the loom. The opposing warp sheet 18 passes between the edge 79 of the ring 78 and the roller 80 within the shuttle body. For details of the propulsion of the shuttles reference may be had to U. S. application S. No. 706,322 filed 12th January, 1934.

While the invention has been described with reference to a loom in which the shuttles rotate, it is to be understood that similar mechanism may be employed where the shuttles are stationary while the warps rotate, or where both shuttles and warps rotate, e. g. in opposite directions.

What we claim and desire to secure by Letters Patent is:—

1. In a circular loom adapted for the insertion of weft round part only of the periphery of the loom, a shuttle, means for imparting relative circular motion between said shuttle and the warps with respect to the loom axis, a weft spool in said shuttle, weft-replenishing means disposed at a point of the periphery of the loom not occupied by the warps, and means to operate said weft-replenishing means on exhaustion of the length of weft carried by the shuttle so as to present to said shuttle a further length of weft sufficient for the part of the periphery of the loom that is occupied by the warps, without interrupting said relative circular motion between the shuttle and the warps.

2. In a circular loom, a shuttle between which and the warps there is relative circular motion with respect to the loom axis, a rotatable weft spool disposed in said shuttle and adapted to contain a length of weft, means for presenting weft to said spool on exhaustion thereof, and means for rotating said spool to wind thereon a fresh length of weft without interrupting said relative circular motion between the shuttle and the warps.

3. In a circular loom, a shuttle between which and the warps there is relative circular motion with respect to the loom axis, a rotatable weft spool disposed in said shuttle, means for presenting weft to said spool on exhaustion thereof, said presenting means being encountered by the shuttle in each weaving revolution of the loom, and means for rotating said spool so as to wind thereon weft presented to the shuttle at each such encounter without interrupting said relative circular motion between the shuttle and the warps.

4. In a circular loom, a shuttle, a rotatable weft spool in said shuttle, a pinion in driving connection with said spool, a segmental rack between which and said shuttle there is relative motion, said rack being so disposed as to come into engagement with said pinion by reason of such relative motion, and thereby to rotate said spool, and means for presenting weft to said spool during engagement of the pinion with the rack, so that a weft length is wound on said spool.

5. In a circular loom, a shuttle, a rotatable weft spool in said shuttle, a pinion in driving connection with said spool, a segmental rack between which and said shuttle there is relative motion, said rack being so disposed as to come into engagement with said pinion by reason of such relative motion, and thereby to rotate said spool, a weft supply, means for presenting weft from said supply to said spool, means on said spool adapted to engage weft presented thereto so that on rotation of said spool by said rack a length of weft is wound on said spool, a guide on said shuttle adapted to engage the weft extending

from said spool to said supply, and means to depress said guide to bring said weft to a point near the fell of the fabric.

6. In a circular loom, a shuttle, a rotatable flanged weft-spool disposed in said shuttle and adapted to contain a length of weft, means for presenting a fresh length of weft to said spool on exhaustion thereof, means for rotating said spool, and at least one slot in a flange of said spool adapted to engage said weft length and to enable a weft length to be wound on to the spool by the rotation thereof.

7. In a circular loom, a plurality of shuttles between which and the warps there is relative circular motion with respect to the loom axis, a weft spool disposed in each shuttle and adapted to contain a length of weft, a weft-supply, means for presenting the end of weft from said supply to each spool in turn on exhaustion thereof, means for rotating each spool upon weft presentation to wind thereon a fresh length of weft without interrupting said relative circular motion between the shuttles and the warps, and a weft-severing device adapted to sever from the supply the length of weft so wound.

8. Apparatus according to claim 7, comprising means to actuate the weft-severing device as the weft is engaged by the spool of the succeeding shuttle.

9. In a circular loom, a shuttle, a rotatable weft spool in said shuttle, a weft supply, means to present weft from said supply to said spool on exhaustion thereof, means to rotate said spool so as to wind weft thereon from said supply, guide means on said shuttle adapted to engage the length of weft extending from said spool to said supply after the commencement of the winding operation, means to depress said guide means so as to deflect the weft from said spool to a point near the fell of the fabric, a weft-severing device disposed near the path of said deflected weft, and a finger adapted to depress said deflected weft into engagement with the weft-severing device.

10. In a circular loom, a shuttle, a rotatable weft spool in said shuttle, a pinion, a train of gears connecting said pinion to said spool, a segmental rack between which and said shuttle there is relative motion, said rack being so disposed as to come into engagement with said pinion by reason of such relative motion and thereby to rotate said spool through said train of gears, and means for presenting weft to said spool during engagement of the pinion with the rack so that a weft length is wound on said spool.

11. In a circular loom, a plurality of shuttles, means to rotate said shuttles progressively about the axis of the loom, a rotatable weft spool disposed in each shuttle and adapted to contain a length of weft, a weft-supply, means for presenting the end of weft from said supply to each spool in turn on exhaustion thereof, means for rotating each spool upon weft presentation to wind thereon a fresh length of weft without interrupting the progressive rotation of the shuttles about the axis of the loom, and a weft-severing device adapted to sever the weft extending between the supply and each spool after replenishment.

12. In a circular loom, a plurality of shuttles adapted to rotate about the axis of the loom, a weft supply, a rotatable weft spool in each shuttle, a pinion in driving connection with each spool, a segmental rack between which and said shuttles there is relative motion, said rack being so disposed as to engage said pinions in turn when said shuttles pass along the rack and thereby to rotate said spools, at least one slot in a flange of each spool adapted to engage weft extending from said supply and to enable a weft length to be wound on to the spool by the rotation thereof, guide means on each shuttle adapted to engage the length of weft extending from said spool to said supply after the commencement of the winding operation, means to depress said guide means so as to deflect the weft downwardly to a point near the fell of the fabric across the path of the succeeding shuttle, a weft severing device disposed near the path of said deflected weft, a finger adapted to depress said deflected weft into the severing device, and means for operating said severing device to sever the weft as the downwardly extending portion thereof is engaged by the spool of the succeeding shuttle.

13. Apparatus according to claim 12, comprising an auxiliary spool secured to and rotatable with the main spool to receive the length of weft extending between the main spool and the severing device.

14. Apparatus according to claim 5, wherein the means on the shuttle for guiding weft to a point near the fell of the fabric is provided with a tensioning device, said tensioning device being adapted to apply tension to the weft unwinding from the shuttle during the weaving operation.

15. In a circular loom, a shuttle, a rotatable weft spool in said shuttle, a pinion, a train of gears connecting said pinion to said spool, a segmental rack between which and said shuttle there is relative motion, said rack being so disposed as to come into engagement with said pinion by reason of such relative motion, and thereby to rotate said spool through said train of gears, means for presenting weft to said spool during engagement by the pinion with the rack, so that a weft length is wound on said spool, and a weft-severing device adapted to sever weft from the supply after winding, said pinion disengaging from said rack on completion of said winding, and freeing said train of gears to act as a thread tensioning device on unwinding of the spool during the subsequent weaving operation.

16. In a circular loom, a shuttle, means to rotate said shuttle progressively about the axis of the loom, a rotatable weft spool in said shuttle, a pinion in driving engagement with said spool, a segmental rack disposed adjacent the path of said shuttle in such a position as to come into engagement with said pinion as the shuttle proceeds round the loom, and thereby to rotate said spool, a weft supply, means for presenting weft from said supply to said spool during engagement of the pinion with the rack so that a weft length is wound on said spool, and means for severing the weft length from the supply.

HENRY DREYFUS.
WILLIAM POOL.