S. B. CRESPI.

WEAVING PROCESS AND LOOM THEREFOR.

APPLICATION FILED MAR. 21, 1918.

1,418,239. Patented May 30, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

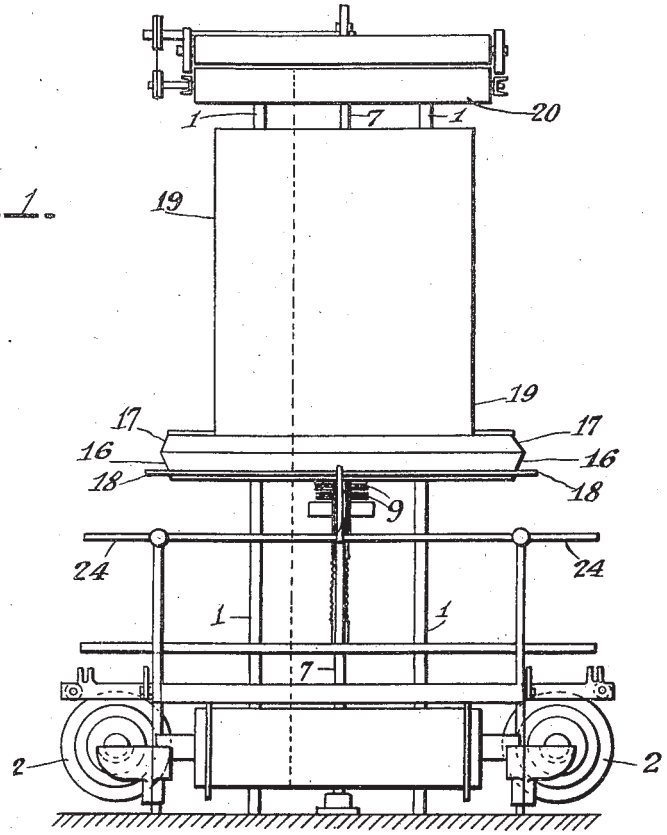
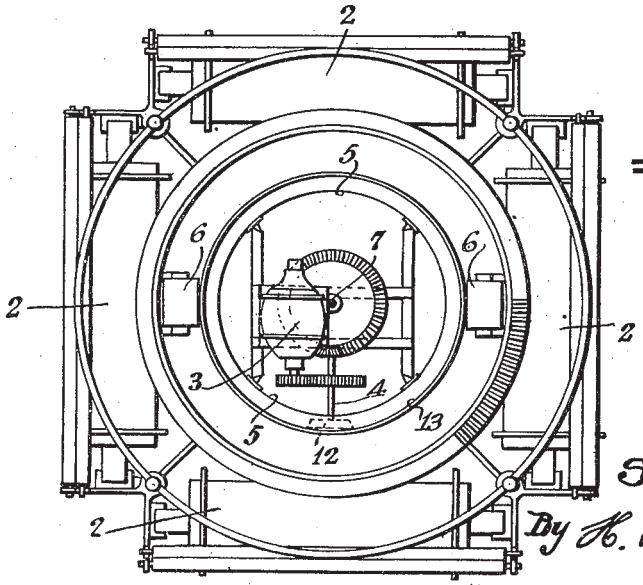


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

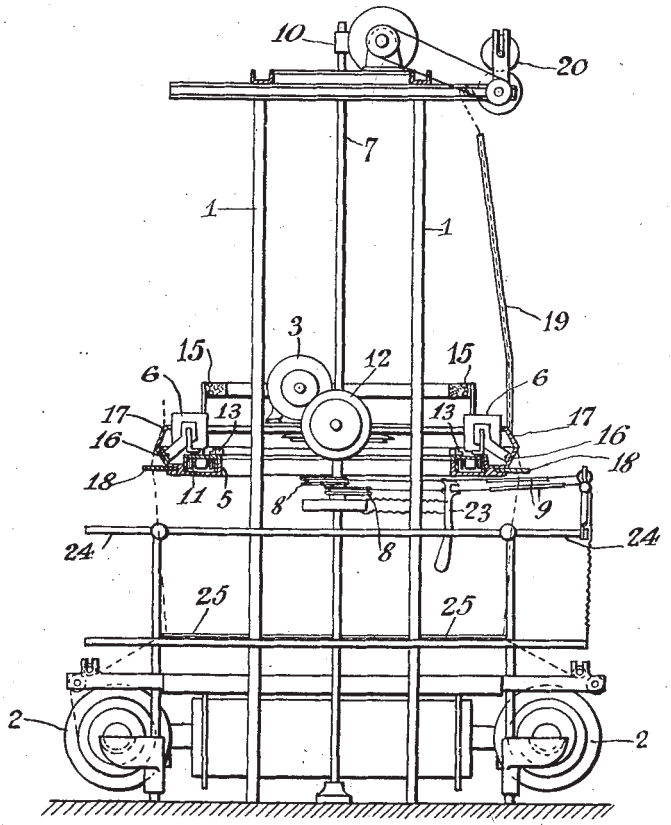


Fig. 6.

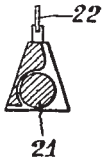


Fig. 5.

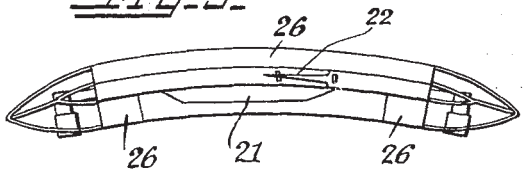
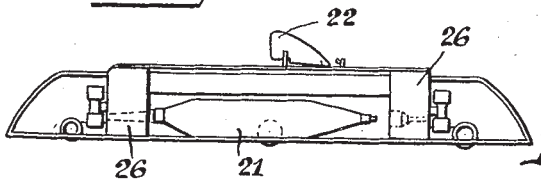


Fig. 4.



Inventor:
S. B. Crespi,
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Atty

UNITED STATES PATENT OFFICE.

SILVIO BENIGNO CRESPI, OF MILAN, ITALY.

WEAVING PROCESS AND LOOM THEREFOR.

1,418,239. Specification of Letters Patent. Patented May 30, 1922.

Application filed March 21, 1918. Serial No. 223,861.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, SILVIO BENIGNO CRESPI, manufacturer, a subject of the King of Italy, and residing at Milan, Italy, have invented certain new and useful Improvements in Weaving Processes and Loom Therefor, of which the following is a specification.

As is well known, in the ordinary multiple heddle loom, the weaving of webs and cloths of vegetable fibres (silk, wool, cotton, flax, hemp, jute, etc.) is done by throwing a weft yarn across a series of warp yarns that open and close alternately, webs and cloths with different kinds of interwisting and patterns being thus formed. In old times the throwing in of the weft yarn was effected by hand by means of the shuttle, and later through mechanical agency by means of the fly-shuttle. The characteristic feature of the weaving proper (exclusive of the hosiery manufacture) always is the alternating or reciprocating motion, which is resorted to for the throwing of the shuttle, that is suddenly stopped at the end of its short flight.

This involves an abnormous waste of "vis viva" and a considerable wear and tear of the shuttle, of the bobbin therein and of the shuttle picking and stopping gear; and of the reed, that beats up the weft yarn after its entwisting with the warp yarns. The sharp motion of the reed puts a considerable wear on the warp threads and on the reed as well as on all the loom gears which, when the reed is stopped in case of the weft yarn breaking or the shuttle sticking or any of the warp threads (in the latest looms) breaking, are subjected to heavy shocks often attended with serious breakdowns; and of the heddles, which too rise and fall with a sharp motion causing jerks in the warp, in the heddles themselves and in the gears by which they are actuated.

The said feature of a sharp and jerky alternating motion makes the loom an imperfect, antiquated machine and reduces the attainable output, the latter being limited, by the stress that can be withstood by the loom when beating up the weft and by number of motion reversals that can be performed in the time unit. With a fabric of very strong cotton yarn and being one meter in breadth a number of flights of 200 per minute cannot be conveniently exceeded, so that the picks inserted cannot practically exceed a total of 200 to 250 flights per minute even with yarns having the highest strength and elasticity. With wool, silk, hemp and even cotton fabric less easy than calico, satin or "croisé" only lower outputs are reached with a mechanical process always necessarily attended with numerous breakages of the weft and warp threads, entailing the use of a shuttle (and therewith also of a spool) of small dimensions, causing a considerable wear and tear in the loom, and involving a great waste of energy inasmuch as considerable force has to be spent in moving the shuttle from one shuttle box to the other at high speed and the energy stored up in the shuttle has got to be absorbed by the stopping gears at the two ends of the short shuttle flight.

The object of the present weaving process and loom is to do away with the disadvantages of the reciprocating loom, no matter what may be the kind of the woven fabric or the quality of the textile fibres employed.

Characteristic features of the invention are the absence of the shuttle's to and fro motion and of its stoppage at each end of its short travel, the suppression of the reed beat and motion altogether, and the adoption for the heddles of a motion which, though still reciprocating yet is far gentler, not being hindered by the reed shock.

According to the present invention the shuttle never stops except when the weft on the shuttle spool is exhausted (apart of course from casual weft breakages). Instead of two and fro, the shuttle runs continuously in a single direction over or below or sideways of a reed through which the warp threads are led and guided. The shuttle always runs inside of the warp shedding, which is formed in sections in front of the running shuttle and closes behind it with a soft and easy alternating motion and without any interruptions or jerks. Accordingly the loom is circular in form—the shuttle runs round at a high speed, the value of which depends on the nature of the fabric, the possibility being thus obviously afforded of

a far greater number of picks in the time unit than has been the case heretofore, and all this being attained with a lower power consumption, fewer yarn breakages and less wear and tear of the loom parts and with better ultimate results in the weaving of any kind of fabric. The resulting tubular fabric can afterwards be cut by suitable means the number and mutual spacing of which can be conveniety arranged according to the desired piece-breadth.

The shuttle is not thrown, but drawn inside of the warp threads by an external force, which may be electro-magnetic attraction. This force is conveniently displaced and displaces the shuttle along with it, thus imparting to the shuttle the desired velocity.

The shuttle performs two duties, namely the old one of allowing the weft thread to unwind from the spool guiding it and laying it down between the warp threads, and a new one which consists in pressing the weft within the warp threads without the help of the sudden rough stroke from the reed, the latter duty being performed, not by a single stroke, over the whole piece breadth as heretofore, but gradually and gently within each pair or set of warp threads, the required power being accordingly smaller and the result the same as with the method used heretofore.

The annexed drawing shows a circular loom embodying the invention by way of example.

Fig. 1 is a view from the outside;

Fig. 2 is a cross section through the shuttle racepath plane.

Fig. 3 is an elevated cross section;

Figs. 4, 5, and 6, are an inside view; a plan view and a cross section respectively of the shuttle.

Of course the constructional det ils and those concerning the form of the various parts may be varied from those shown and described without departing from the spirit and scope of the invention.

The loom comprises a centre frame with uprights 1 of suitable height, the said framing being surrounded by several beams —2— over which the warp threads are wound.

The threads, unwinding from the straight warp beams —2—, rise up along the generating lines of a vertical cylinder, and gradually pass from the cylindrical to the flat-form and build the warp.

Inside of the said loom frame the electric motor —3—, (or the belt pulley, or the gear wheel driven from a shafting) actuating the loom is accommodated. The whole drive is effected across a single horizontal shaft —4—; shaft —4— actuates a large revolving rack ring —5— to which a magnet or magnets —6— (two in the drawing) are secured, as well as a vertical center shaft —7—. The vertical center shaft —7— is fitted with eccentrics —8— operating the heddles —9— and with a worm gear —10— through which it actuates the cloth beams, for the purpose of winding up or eventually unwinding the cloth and keeping the warp taut.

At a convenient height, viz close beneath the rack ring —5—, a circular box —11— is secured to the frame. In this box several circular rows of balls or rollers are lodged forming a race path for the frictionless rotation of the ring —5—. This ring which can be made of cast iron or other material, is caused to revolve by a toothed wheel —12— keyed on the shaft —4— and engaging the rack —13— of the ring.

An electric current of convenient intensity energizes the magnets —6—, to which it is led through brushes —14— and contact rings —15— secured to the frame, from which latter, however they are carefully insulated.

The circular box —11— and revolving rack ring —5— carrying the magnet —6— are surrounded by a circular stationary guard —16— of antimagnetic, non-conducting metal, which does not intercept the magnetic flux issuing from the magnets. The guard is trunk-shaped with the larger base upward, its tapering angle being the same which it is intended to give to the warp threads when forming the shed for the passage of the shuttle.

On top of the anti-magnetic guard —16— a further circular guard —17— is provided, which is trunk-shaped too, but with the larger base at the bottom. The outer circular edge where the two trunks meet serves as a support to the warp threads on their way from the warp beams to the top of the loom, and and forms a circle equal in diameter to the circle formed by the centers of the sheds, the center points of the two circles lying on the same vertical line.

Beneath the anti-magnetic guard —16— the stationary circular reed —18— is arranged, on which the shuttles —21— are run.

Over the guard —17— metal sheets —19— are secured to the frames; at the bottom they form a circle equal to that of the common upper base of guard 17, but upwardly they gradually pass over through all intermediate curvatures from the circular to the polygonal form, so that at the top they are transformed, into a system of polygonal section and, in the case of a tubular fabric divided into four breadths, they are transformed into a system of square section.

Above the upper end of the metal sheets —19— the cloth beams —20— are arranged. These beams are driven from the center shaft —7— through worm —10—, driving a worm gear 10^a fixed to a shaft 10^b. The shaft 10^b carries a fixed sprocket 10^c and

the beam shaft 10^d has a fixed sprocket 10^e, said shafts being connected by a chain 10^f.

The shuttle or shuttles —21— are of metal and constitute the armature —26— of the magnets —6—, from which they are separated by the guard —16—. The shuttle consists of a solid, block, or of metal parts connected together, or of laminations bolted together, forming a circular segment having the same curvature as the guard —16—.

A suitable hollow space is left inside the shuttle to accommodate the spindle and the cap —21—. The weft thread unwinds from the spindle end, passes to the front portion of shuttle and thence up to a guide —22— projecting from the top of the shuttle. The piece —22— serves to guide the weft through the warp threads and press it therein first when the weft thread is wedged in between the warp threads and successively when the shuttle, in its circular race, passes over the same point again, or when the next shuttle passes over the same point in the case of two or more shuttles working in the same way.

The guide —22— thus performs two duties that is to say in addition to guiding and wedging the weft in the warp threads; it replaces the beating-up reed, which is thus abolished.

The heddles —9—, stretched between frames having the form of circle, segments or the like, are held on one side by ropes radiating from the eccentrics —8— and on the other side by weighted ropes carried around pulleys supported by a circular rod —24—, this rod extending all around the loom as if it were a railing. The eccentrics —8— impart the heddles an alternating motion synchronous with the passage of the shuttles and in a plane perpendicular to the travel of the warp threads; levers —23— for the purpose of magnifying or reducing the imparted motion are arranged between the eccentrics —8— and the heddle frames.

The weaving is performed in the following manner:

The warp threads unwind from the warp beams —2— either by traction or by positive drive. From the beams —2— they are led to a stationary ring secured to the loom frame and carrying a circular guide-reed —25—, through the teeth of which they pass up vertically. The ring carrying the reed —25— is so dimensioned and arranged that the margin of the reed is a circle of the cylinder perpendicular to the reed over which the shuttle runs and containing the circular midline of the shedding and the maximal circle of the trunk-shaped guard —17—.

On its way upward the warp thread crosses the heddles —9—, radially arranged in a circle and secured in frames shaped in the form of segments of a circle or the like. The heddles operated by the eccentrics, springs or weights arranged outside of the loom frame with ropes and pulleys, are moved gently from the centre towards the periphery and backwards, thus gradually opening and closing the shed in such a way that the shed is fully open when the shuttle must pass through, and then is closed, reversed and fully opened again in opposite direction on the next passage of the shuttle or of the second shuttle.

The warp thread then passes up through the reed —18—, that is to say each warp thread or pair of threads (or bundle of three or more threads according to the kind of fabric concerned) is led through each slit of the reed over which the shuttle is running. The warp thread then passes up to the bottom edge of the top guard —17—, against which it leans for the crossing. After the crossing it leans on the tapering side of —17— and rises up the plates —19— and thence it passes to the cloth beams —20—.

When the warp is ready in place, the attendant presses two heddle frames inwardly so as to cause all the threads thereof to lay against the inclined surface of the anti-magnetic guard —16—, behind which the magnets are revolving. Care should be taken to select the two frames preceding (in the direction of the shuttle's travel) those which, owing to the maximum opposition of the eccentrics, give the maximum shedding.

A fully open shed being thus formed, the shuttle should be inserted therein. The same should be done for the other shuttle or shuttles. After the shuttle has been set in place and a magnet opposite thereto, the magnet will cause the shuttle to travel along with it when current is switched into the magnet. While travelling, the weft thread will unwind from the shuttle cop, pass through the guide —22— and be wedged in between the warp threads. As soon as the shuttle has passed by, the heddles move back and cause the warp threads to cross each other; the weft is thus closed up and the next shuttle passage completes the pressing in.

The shuttle will put in a further pick and so on. The picks will be laid in, closed up and pressed just as in an ordinary loom, but a tubular woven fabric will be obtained.

At predetermined intervals, by suitably arranging the warp threads and the heddle motion, longitudinal selvedges are obtained; here the tubular tissue is cut and three, four or five pieces will be obtained out of the tube, these pieces having been woven simultaneously and winding on separate cloth beams.

Having now particularly described and ascertained the nature of my said invention and the manner in which the same is to be performed, I declare that what I claim is:

1. A circular loom comprising a center

framing having warp beams arranged at the bottom and take-up beams for the finished cloth arranged at the top, devices for collecting the warp threads unwinding from the different warp beams into a single tube, a reed having the same perimeter as the section of the warp tube and designed to form the race for the shuttles, heddle sets, eccentrics for imparting continuous reciprocating motion to said heddle sets, a circular box having a revolving cover as a support for shuttle driving magnets, metal sheets arranged above the cloth formation level and gradually changing from a curved shape at the bottom to a flat shape at the top, and means for cutting the woven fabric into a predetermined number of longitudinal pieces, substantially as and to the purpose set forth.

2. A circular loom comprising a center framing having warp beams arranged at the bottom and take-up beams for the finished cloth arranged at the top, devices for collecting the warp threads unwinding from the different warp beams into a single tube, a reed having the same perimeter as the section of the warp tube and designed to form the race for the shuttles, heddle sets, eccentrics for imparting continuous reciprocating motion to said heddle sets, a circular box having a revolving cover as a support for shuttle driving magnets, metal sheets arranged above the cloth formation level and gradually changing from a curved to flat shape, means for cutting the woven fabric into a predetermined number of longitudinal pieces, an electric motor arranged in the center of the loom, means to transmit motion from the motor to the cover of the circular box, the warp and cloth beams, and to the eccentrics, two trunk-shaped guard rings of antimagnetic material facing in contact with their larger bases to form a body interposed between the shuttle driving magnets and the shuttles as well as a resting surface for the inner warp threads of the shed, substantially as and to the purpose set forth.

In testimony whereof I have hereunto signed my name in the presence of two witnesses.

SILVIO BENIGNO CRESPI.

Witnesses:

G. B. ZANARDO,

GUY CAMELLE PERRON.