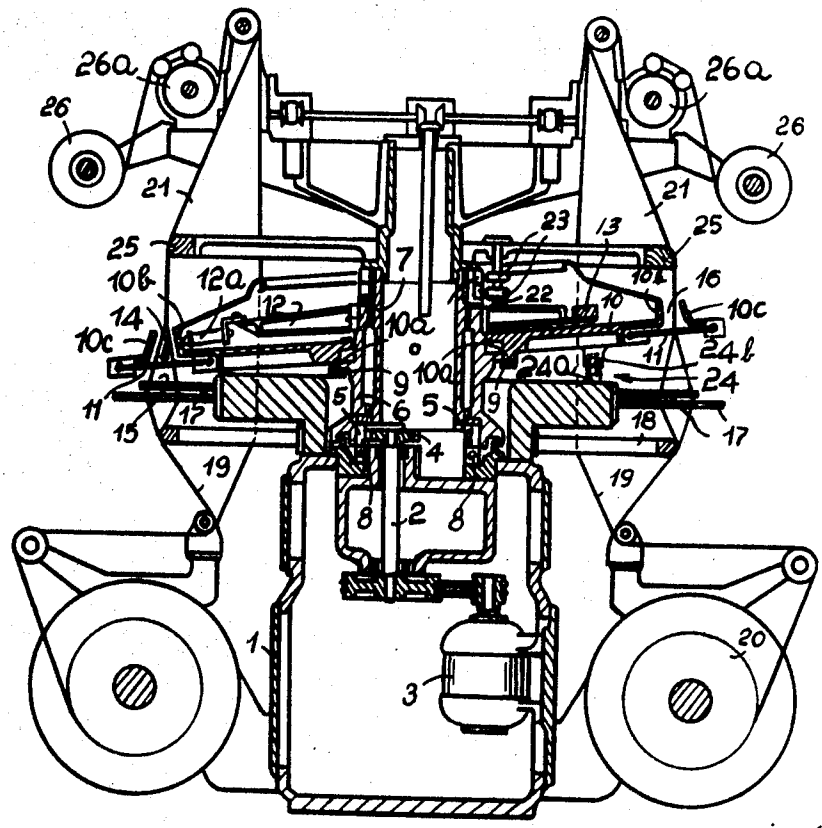
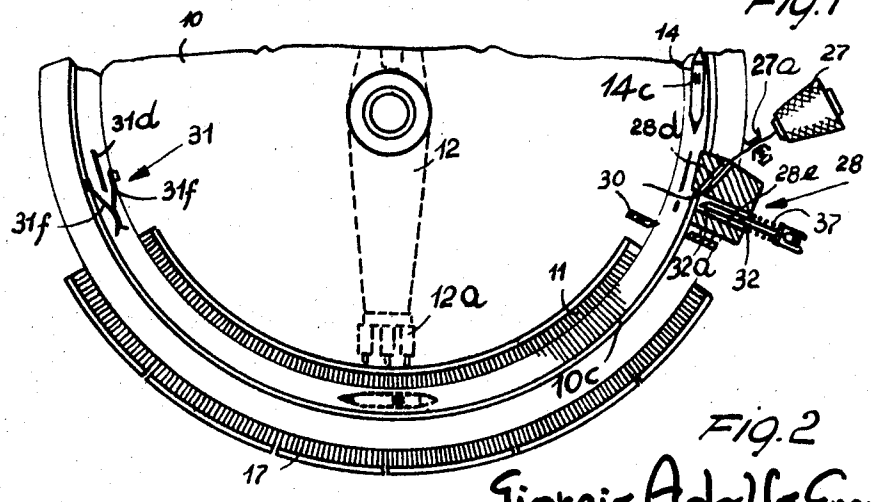
Oct. 7, 1969 G. A. GRANDI 3,470,919

DEVICE FOR THE FORMATION OF THE WEFT IN BOBBINLESS SHUTTLE LOOMS

Filed Oct. 9, 1967 3 Sheets-Sheet 1



F19.1



F19.2

Giorgio Adolfo Grandi
INVENTOR.

BY

Agent

Oct. 7, 1969 G. A. GRANDI 3,470,919

DEVICE FOR THE FORMATION OF THE WEFT IN BOBBINLESS SHUTTLE LOOMS

Filed Oct. 9, 1967 3 Sheets-Sheet 2

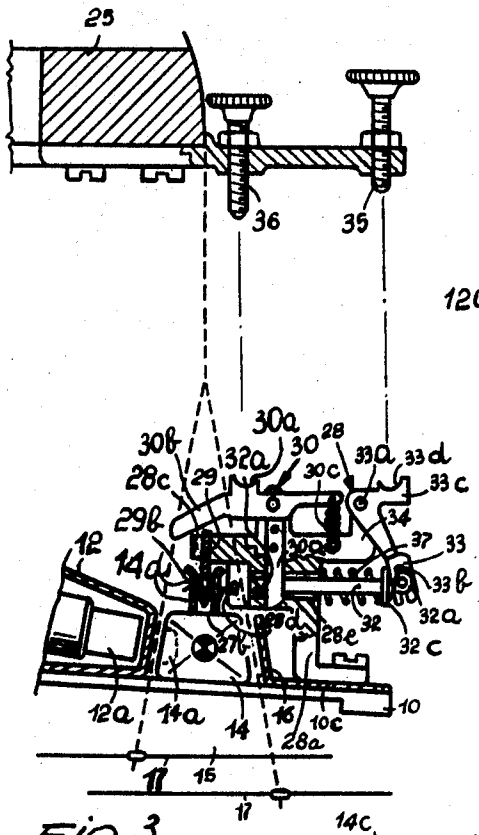


Fig. 3

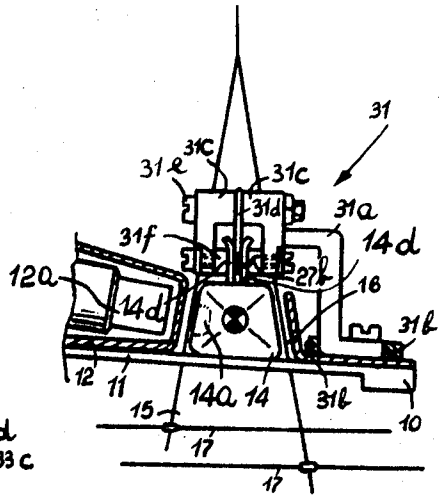


Fig. 4

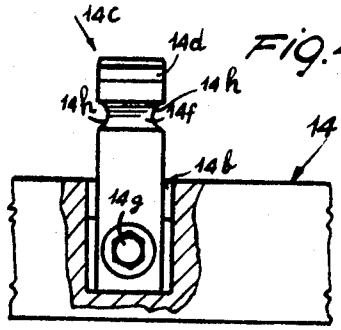


Fig. 7

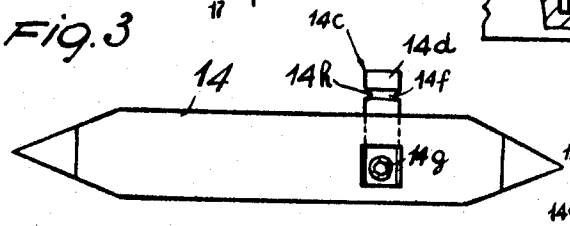


Fig. 5

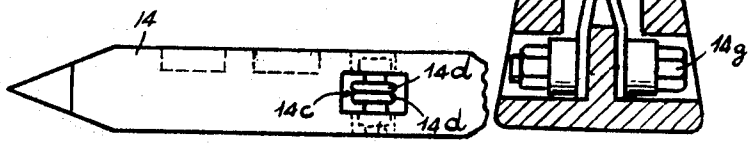


Fig. 8

Fig. 6

Giorgio Adolfo Grandi
INVENTOR.

BY

Agent

Oct. 7, 1969 G. A. GRANDI 3,470,919

DEVICE FOR THE FORMATION OF THE WEFT IN BOBBINLESS SHUTTLE LOOMS

Filed Oct. 9, 1967 3 Sheets-Sheet 3

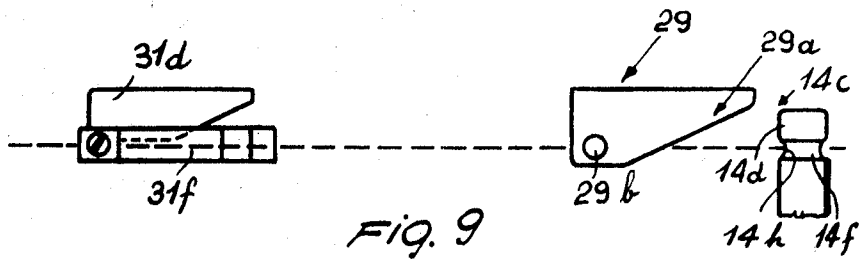


Fig. 9

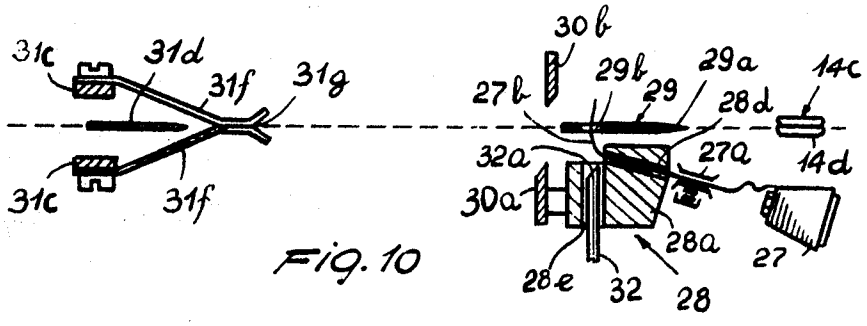


Fig. 10

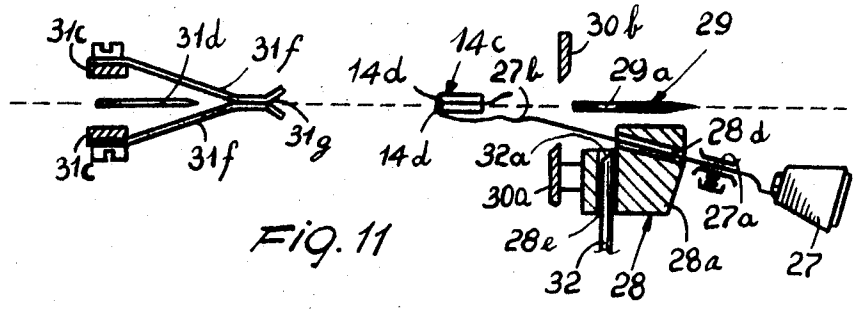


Fig. 11

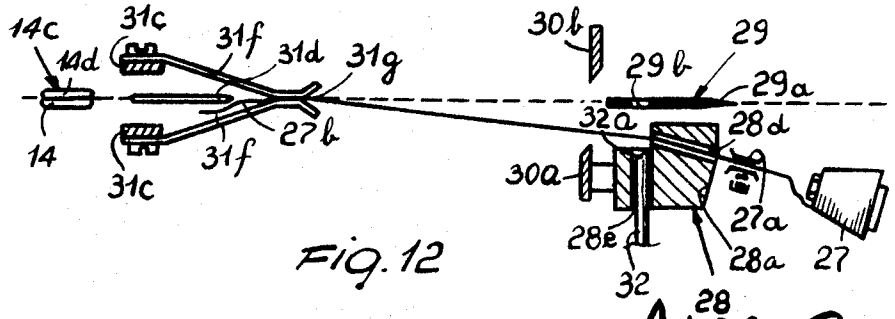


Fig. 12

Giorgio Adolfo Grandi
INVENTOR.

BY

Agent

United States Patent Office 3,470,919 Patented Oct. 7, 1969

3,470,919

DEVICE FOR THE FORMATION OF THE WEFT IN BOBBINLESS SHUTTLE LOOMS

Giorgio Adolfo Grandi, Via Muratori 5/3, Bologna, Italy

Filed Oct. 9, 1967, Ser. No. 673,635
Claims priority, application Italy, Oct. 15, 1966, 28,906/66
Int. Cl. D03d *39/00, 47/00*
U.S. Cl. 139—16 6 Claims

ABSTRACT OF THE DISCLOSURE

A device for weft insertion applicable in a circular loom operating with a bobbin-less gripping shuttle and comprising gripping means on the shuttle for gripping the weft yarn at the entrance into the shed, first clamping means at the entrance of the shed for clamping the free end of the weft yarn before it is gripped by that gripping means, second clamping means for clamping the free end of the weft yarn entrained by said gripping shuttle at the exit from said shed, means for releasing said clamping means in pre-established periods and cutting means for cutting the weft yarn at the entrance of said shed.

This invention relates to a device for the formation of weft in bobbin-less shuttle looms.

The main object of this invention is that of resolving the problem of the formation of the weft in bobbin-less shuttle looms by providing a device with an extremely high shuttle speed and without operational interruptions of the shuttle, so that high fabric production may be obtained.

Another object of the invention is that of using members of especially reduced size and weight so that the movement of said members involves minimum inertias and their operative rapidity may consequently be extremely high.

A further object of the invention is that of providing a device which may be used with looms adapted to a simultaneous loom production of a plurality of fabrics, even fabrics of different weft aligned along the guide run of the shuttle.

A further object of the invention is that of providing a device for the formation of the weft which may be adapted to the production of fabrics of different width on a single loom and a plurality of fabrics on a single loom, so that the range of its use on a single loom is notably increased.

These and further objects, which will better appear hereinafter are achieved by a device according to the invention for the formation of the weft, characterized in that it comprises, in a weaving loom with a shuttle guide, a shuttle sliding in said guide and provided with a pincer adapted to entrain and carry an end of a weft thread, a distributor member fast with said guide and situated, along the guide run of the shuttle, in an upstream zone with respect to the direction of advance of the shuttle, of the entrance section of the warp shed, a wedge-like retractor for the jaws of the pincer carried by said distributor, clamp means carried by said distributor member and adapted to cause the clamping of an end of a weft thread between the jaws of said pincer when said jaws are opened by said wedge so that the end of the weft thread is clamped between the jaws when the shuttle passes said wedge, and cutting means situated adjacent to said distributor member and adapted to cut the thread gripped and entrained by said pincers after said thread exits from the warp shed, a clamp member for the end of the thread carried by the shuttle pincer and situated along the shuttle guide, downstream, with respect to the direction of advance of said shuttle, from the exit section of the warp shed, a wedge-like diverger for the jaws of said pincer and rigid with said clamp member, entraining means adapted to entrain the end of the thread freed as a result of the diverging of the clamp jaws, said entraining means being rigid with said guide.

Further characteristics and advantages will appear more clearly from the following detailed description of an embodiment of the device according to the invention illustrated by way of non-limiting example in the accompanying drawings in which:

FIG. 1 shows a vertical section of a circular loom provided with a device according to the invention for the formation of weft, in which are shown the main members of a loom adapted to the simultaneous weaving of two independent cloths;

FIG. 2 shows a diagrammatic plan view of a portion of a loom reed-holder disc in which the positions of the characteristic members forming the device according to the invention are indicated;

FIG. 3 shows a partial section view of a detail of a distributor member at the moment at which a shuttle is adjacent thereto;

FIG. 4 shows a view of a gripper member for the end of the weft, when a shuttle is adjacent thereto;

FIG. 5 shows a lateral view of a shuttle cooperating with the device according to the invention;

FIG. 6 shows a plan view of the same shuttle;

FIG. 7 shows a lateral view of a detail of a pincer fast with the shuttle;

FIG. 8 shows the same detail in a cross-section of the shuttle;

FIG. 9 shows wedges mounted on the distributor and members in their alignment with the pincer of the shuttle;

FIGS. 10, 11 and 12 show a diagrammatic plan view of the sequence of turning operations of the device according to the invention.

With reference to said figures, the loom comprises a base **1**, a vertical driving shaft **2** actuated by a motor **3** and engaged, through a cog wheel **4**, with an internally toothed cog wheel **5** situated in the lower part of a sleeve member **6**; said sleeve member **6** is positioned with its axis vertical and is associated to a co-axial support column **7** so as to cause the rotation of said sleeve.

Reference numeral **8** indicates a thrust bearing which supports the weight of the sleeve **6**. Said sleeve **6** is peripherally provided with an annular step **9**, situated in an inclined plane with respect to the horizontal, in manner such as to form an inclined support. A reed-holder disc **10** rests, by means of its annular flange **10***a*, on said inclined support and is substantially co-axial to said rotating sleeve. Said reed-holder disc is provided along at least a circular arc and, in the case shown, on two distinct successive circular sectors, each less than a semi-circle, with radical reeds **11**. An arm **12**, fast with said rotating sleeve **6**, carries at one of its ends an electro-magnet **12***a* and is counter-weighted in **13**. The electro-magnet rotates rigidly with the sleeve **6**, entrained by said shaft **2**, and is maintained facing a shuttle **14** arranged in a shed **15**, whence said shuttle is caused to rotate.

Said shuttle **14** runs in an annular guide **16**. Reference numeral **17** indicates healds, **18** indicates a lower ring with reeds aligning warp threads **19**, **20** indicates warp beams, **21** indicates the woven fabric, **22** indicates the rings for the electrical connection with relative brushes **23**; **24** indicates a device for preventing the rotation of the reed-holding disc **10** but which however allows said disc to undulate; **25** indicates an upper ring, **26** indicates the beam rollers, **26***a* indicates take up rollers; **27**

indicates the external reels, **27***a* indicates a known thread braking device, said device **27***a* being positioned between the reel **27** and the thread distributor device **28**; **30** a pair of cutters, **31** indicates a weft retaining clamp.

Passing to the details of the above-described members, it may be noted that rigid with the fixed framework is a substantially vertical guide **24***a* against which rolls a roll **24***b* supported by the reed-holder disc **10** and free to rotate about an axis passing through the centre of undulation. Said guide **24***a* co-operates with the roller **24***b* preventing the disc **10** from rotating but not from effecting vertical undulational movements.

The annular external edge **10***b* of the disc forms an internal edge of annular channel guide **16** whose external edge **10***c* is formed by an angled profile of circular perimeter and secured by known means to the reed-holder disc **10** in the peripheral zone of the latter. In such manner the upper plane of the teeth of the reed **11** forms the base of the guide **16** for said shuttle **14**.

The shuttle **14** has a form analogous to that of the known bobbin type of shuttle. Advantageously the shuttle is light in weight and has transverse dimensions such as to enable free sliding along the rotary path of the guide **16**. Said shuttle **14** carries, at the side thereof facing the inner wall of the annular guide **16** a magnetizable core indicated in broken lines with **14***a*. On the upper side of said shuttle **14** is provided a vertical grooving **14***b* in which a pincer is secured by known means **14***g*. Said pincer or gripping means **14***c* is formed by two elastic vertical plates or jaws **14***d* in mutual contact in a zone external to the grooving **14***b* and forming the gripping part of the pincer. The upper edges or free ends of the plates **14***d* are mutually separated so as to define a gap **14***e* adapted to facilitate the introduction between the two plates of a diverging means.

A horizontal grooving **14***f* is provided on the outer side of the one of said two plates **14***d* which is external with respect to guide **16**. Said grooving **14***f* is provided at the level of the zone of mutual contact between said plates **14***d*. Said plates **14***d* are provided in front and rear with a rest **14***h* for the positioning of the thread as will be seen hereinafter.

There now follows a detailed description of all those members which directly co-operate with the shuttle **14**, during its movement, in the automatic formation of the weft. Such members have been previously mentioned and, more precisely are: the thread distributor device **28**, the cutters **30** and the weft retaining clamp **31**.

The distributor device **28** is situated, along the annular **16** and in the direction of rotation of the shuttle **14**, in a zone slightly in advance of the zone where the beginning part of the thread-carrying healds **17** are arranged. Said healds **17** form in known manner, the shed of the warp **15**. Said distributor comprises a bracket block **28***a* carried by a vertical support **28***b* secured by known means to the section **10***c* forming the outer wall of the guide **16**; by means of this arrangement the distributor **28** is rendered fast with the reed-holder disc **10**.

The upper part of the block **28***a* extends horizontally to the central lane of the guide **16** and overhangs the latter (FIG. 3). In this zone supported from above by known means **28***c*, is a vertical blade member **29** with a wedge-like profile. Said blade **29** is tapered in its bottom section **29***a* thereby providing an inclined edge allowing gradual engagement with the gripping means **14***c*. Said blade **29** is provided with a hole **29***b* in an intermediate position of its length. The blade **29** is situated above the plane of the guide **16** at a height such that when the shuttle **14** passes below the blade **29** the latter may be progressively inserted (tapered end first) between the two elastic plates **14***d* forming the jaws of the pincer **14***c* carried by said shuttle; the blade **29** thus diverges said plates **14***d*, this operation being facilitated by the shape of the mouth **14***e*. Further the hole **29** is situated at the same level, with respect to the plane of the guide **16**, as the zone of mutual contact of the two blades **14***d* and the rests **14***h*.

In the lower part of the block or rack **28***a* two tubes **28***d* and **28***e* are provided; said tubes **28***d* and **28***e* converge towards the guide **16** and lie in a plane parallel to the plane of the guide **16**, at the same level as the zone of contact between the two blades **14***d* and the hole **29***d*. The oblique pipe **28***d* forms a guide for the thread **27***b* coming from the reel **27**, the pipe **28***e* has a radical development with respect to the circular guide and is designed to coincide with the hole **29***b* when the shuttle passes; said pipe **28***a* forms a seat in which a rod **32** slides longitudinally. The exit holes of the pipes **28***d* and **28***e* (on the side facing the annular guide **16**) are as near as possible to one another. Said rod **32** is suitably shaped at the end facing the blade **29**, for example, in the form of a fork or groove **32***a*. It will be understood that the rod and the blade **29** provide a clamping means for the free end of the weft yarn. The opposite end of the rod **32** projecting from the block **28** is pivoted to an angled lever **33** engaged in **33***a* to a cantilever support **34**, the upper end of which is secured to the block **28**. Such pivoting is achieved by the engagement of a bolt **32***a*, associated in known manner to the end of the rod **32**, inside a slot **33***b* situated at the end of the lever **33**. A spiral spring **37**, co-axial with said rod **32** and situated between the block **28***a* and a ferrule or annular stop **32***c* of the rod **32** maintains the latter in a normally retracted position within the pipe **28***e*. The lever **33** extends beyond the fulcrum **33***a* with an appendage **33***c*. Said appendage **33***c* is angled with respect to the lever **33** and is upwardly provided, at its free end, with a seat **33***d* designed to engage a stop or check **35** carried by said ring **25**. Said stop **35** is of adjustable level by known means. Also in the warp shed, immediately before the healds **17**, for example slightly downstream of the distributor **28** in the direction of rotation of the shuttle, is situated the cutting device **30** for the inserted weft pick. Said cutting device **30** comprises a first blade **30***a* rigidly secured to the body of the distributor **28**, in vertical position, and a counter-blade **30***b* hinged to the blade **30***a*. Said counter-blade **30***b* is subjected to the pulling action of a spring **30***c* anchored to the body of the distributor and which maintains the blade **30***b* diverged from the blade **30***a*. The counter-blade **30***b* is further provided with a seat **30***d* designed to engage, due to the rising of the reed-holder disc (and analogously to what has been described for the lever **33***c*), a stop **36** rigid with the ring **25**. The level of said stop **36** which may be adjusted by known means, is such that its contact with the counter-blade occurs, during the rise of the reed-holder rim, before the contact between the appendage **33***e* and the corresponding stop **35**.

The weft retaining clamp **31** is situated, along the guide run of the shuttle, slightly downstream of the healds **17** and comprises a bracket **31***a* overhanging the guide **16** cantilever-wise and secured by known means to the angled profile **10***c* forming the external wall of the guide **16**. The position of said bracket along the guide may be adjusted in known manner, by making it slide between the pair of parallel guides **31***b* and stopping it in the desired position, so as to be able to displace the weft retaining clamp **31** into the position above indicated according to the width of cloth to be woven.

At the end of said bracket a U-shaped stirrup **31***c* is secured by known means; the stirrup is formed of two symmetrical parts associated to one another, along the plane of symmetry and on the perpendicular to the central lane of said guide **16**, by screw means; said parts lock between each other a vertical wedge-like blade **31***d* having a profile substantially similar to that of the wedge **29**. The blade **31** has a tapered lower section and projects downwardly between the U-shaped prongs. Secured at the end of the prongs of said stirrup **31***c*

are clamping means made of two horizontal elastic plates **31***f* defining a nip between their free extremities and extending backwardly with respect to the stirrup, that is in the opposite direction to the direction of motion of said shuttle, and converging in such direction until making mutual contact in a zone behind the wedge-like blade member **31***d*, at the trajectory of the pincer **14**.

Blade member **31***d* has an inclined edge to allow gradual engagement with gripping means **14**.

Said plates **31***f* diverge at their end section, beyond the zone of mutual contact and form a mouth or opening **31***g*.

Said plates **31***f* are at the same level, with respect to the plane of the guide **16**, as the zone of mutual contact of the plates **14***d* forming the pincer **14***c* of the shuttle **14***a*. The projecting portion of the wedge **31***d* is designed to enter only the upper part of the zone of mutual contact of the plates **14***d*. This is in order to avoid damaging the end of the weft pick in the opening phase of the pincer **14***c*.

The working is as follows:

When the driving shaft **2** rotates it entrains into rotation, by means of gear coupling **4** and **5**, the sleeve **6**. The reed-holder disc **10** slides on the inclined guide **9**, and prevented from rotating together with the sleeve **6** by the device **24**, will be actuated with a motion which may be defined as a circular rocking. That is, considering any tooth of the comb, said tooth will periodically rise and lower between two fixed limited. The shuttle is situated in the guide **16** actuated by such rocking motion but is entrained in circular rotation by the electromagnet **12***a*, in synchronism with such undulations, whence said shuttle is not affected by the latter movement and it travels with substantially uniform speed along a track lying in a horizontal plane almost corresponding to the lowest position of the guide **16**.

At the end of the cycle which precedes that now described the free end of the thread emanating from the spool **27** exits freely from the pipe **28***d*. In the case of the machine considered, provided with two arcs of reeds and such as to simultaneously weave two cloths, the shuttle, in the considered moment, is in a diametrically opposite position to the distributor **28** along the guide run, while the reed-holder disc **10** is raised by the part of the distributor taken into consideration, so as to obtain the commencement of the locking of the weft of the reeds **11** against the fabric. Slightly earlier, the fixed stop **35** engages the rest **33***d* determining the advance of the rod **32** in the pipe **28***e*. Said rod **32** with its fork-shaped end **32***a* pushes the thread **27***b* immediately after its discharge from the pipe **28***d* and until said thread **27***b* is inserted in the hole **29***b* of the wedge **29**.

At the re-lowering of the reed-holder disc **10**, and while the shuttle is approaching, the rod **32** retracts in the pipe **28***a*, under the action of the spring **37**, ready to repeat the setting-up operation of the thread in the following cycle.

When the shuttle arrives at the distributor **28** the wedge-like blade **29** is progressively inserted between the plates **14***d* of the pincer **14***c* of the shuttle and divides the plates.

As the shuttle advances the two plates **14***d* slide against the two opposite surfaces of the wedge to the hole **29***b*. At this point the path of the plates of the pincer **14***c* is intersected by the thread which, exiting from the pipe **28***d*, has been positioned with its end in the hole **29***b* as previously described. Then, since the elastic pressure exerted by the internal plate of the pincer **14***c* does not allow the end of the thread, compressed between said internal plate and said wedge, to come out of the hole **29***b*, and due to the advance of the shuttle, the front edge of the external plate advances and pushes the thread in front of it and causes the thread to be wound about it, dragging other thread from the spool **27**.

When wedge has passed through zone of contact of the two plates **14***d* they lock the thread near its end allowing the now freed thread to leave the hole **29***b*. The thread thus remains firmly held since the end of the thread is turned in the direction opposite to the direction of advance of the shuttle. The thread becomes positioned in the rest **14***h* and partially lies in the protection groove **14***f* of the external plate of the pincer **14***c*. The shuttle advances in the warp shed, and, when it exits from the shed, the weft thread becomes held by the clamp **31**. Successively at the entrance zone of the shed the thread must be cut. For this operation the clamp **31** and the cutters **30** are provided.

With regard to the cutters **30**, since from the entrance side the reed-holder disc has been re-raised, the seat **30***d* of the counter-blade **30***b* engages the fixed stop **36** whence said counter-blade is caused to downwardly rotate, against the action of the spring **30***c*, closing against the fixed blade **30***a* and cutting the thread. The final part of the rising stroke of the reed-holder disc initiates a new cycle with the setting up of the thread in the hole **29***b* by the rod **32**.

Simultaneously, on the exit side of the shed, when the shuttle arrives at the clamp **31** carrying, held between its pincer **14***c*, the end of the thread, the pincer becomes wedged, through the mouth **31***g*, between the two plates **31***f*, entraining behind the thread. The shuttle thus arrives at the wedge-like blade **31***d* which is then inserted between the plates **14***d* forming the pincer **14***c*. The plates **14***d* diverge freeing the end of the thread which is however retained by the elastic plates **31***f* which have returned into mutual contact after the passage of the pincer of said shuttle. Then the shuttle, by this time freed from the entrained thread, continues it run without pauses for the successive operations of insertion of the weft. In the case of the described machine, there being two cloths, for such operations a further distributor and clamp analogous and diametrically opposite to those described.

With the object of avoiding excessive stressing of the weft thread, wound about the external plate of the pincer **14***c*, when said pincer **14***c*, meets the receiving pincer formed by the plates **31***f*, the horizontal groove **14***f* is provided to protect the thread.

The invention as thus conceived may be subjected to numerous modifications and variations within the scope of the appended claims. Thus, for example, the device according to the invention may not only be used in circular looms but also rectilinear looms, parallel looms and the like. Moreover all the members may be replaced by other technically equivalent means.

I claim:

1. In a loom operating with a bobbin-less gripping shuttle including means for the formation of at least one shed of warp threads, means defining a guide for the shuttle and passing through said shed, and means for imparting motion to said shuttle, a device for weft insertion comprising gripping means on said shuttle for gripping the weft yarn at the entrance into the shed, first clamping means at the entrance of said shed for clamping the free end of weft yarn before it is gripped by said gripping means, second clamping means for clamping the free end of said weft yarn entrained by said gripping shuttle at the exit from said shed, means for releasing said clamping means in pre-established periods and cutting means for cutting the weft yarn at the entrance of said shed and wherein, according to the improvement,

said gripping means comprise two plate elements having contacting free end portions projecting from the body of said shuttle and resilient portions urging said free end portions against each other,

said first clamping means comprises a first blade member, in the path of said plate elements said first blade member having a through opening in the path of said plate elements, a pusher member in front of said opening, a distributor duct for guiding a free end of the weft thread in a position between said opening and said pusher member allowing said pusher mem-

ber to insert said free end of the weft yarn into said opening, said second clamping means comprises two plate members having contacting free extremity portions defining a nip therebetween, said nip being located in the path of said free end portions of said gripping means, said plate members having further resilient portions urging said free extremity portions against each other, a second blade member arranged in the path of said free end portions and near said free extremity portions to spread apart said free end portions when said gripping means reach said second blade member and enter the nip defined by said free extremity portions to spread apart said free extremity portions.

2. A device for weft insertion according to claim 1, wherein at least one of said plate elements has a groove at an outside surface thereof for receiving a weft thread portion therein.

3. A device according to claim 1, wherein said first blade member has an edge inclined with respect to the path of said plate elements and said free end portions have their tips outwardly bent to diverge from one another thereby to allow a gradual engagement with said inclined edge.

4. A device according to claim 1, wherein said second blade member has an edge inclined with respect of the path of said plate elements and extending above said nip, and said free end portions have their tips outwardly bent to diverge from one another thereby to allow a gradual engagement with said inclined edge.

5. A device according to claim 1, wherein said loom is a circular loom.

6. A device according to claim 1, wherein said means for imparting motion to said shuttle is a rotating magnet.

References Cited

UNITED STATES PATENTS

3,105,523	10/1963	Borrell	139—13

FOREIGN PATENTS

672,554	10/1963	Canada.
1,488,508	6/1967	France.

HENRY S. JAUDON, Primary Examiner

U.S. Cl. X.R.

139—125