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[54] METHOD OF AND APPARATUS FOR FILLING THE SHUTTLES WITH WEFT ON PROGRESSIVE SHED WEAVING LOOMS

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[30] **Foreign Application Priority Data**

Apr. 28, 1970 Czechoslovakia 293370

[52] **U.S. Cl.** ..... **139/12**, 139/224 R

[51] **Int. Cl.** **D03d 47/26**, D03d 45/00

[58] **Field of Search** 139/12, 13, 126, 224, 122

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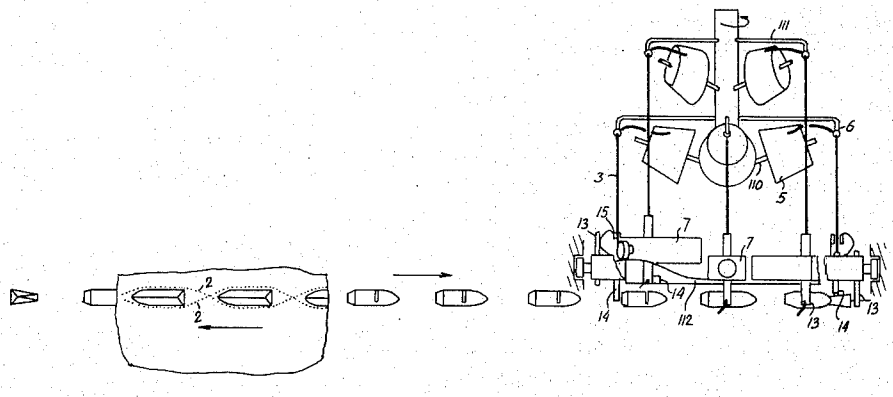
[57] **ABSTRACT**

Method of and apparatus for filling the shuttles with weft on progressive shed weaving looms with continuous movement of shuttles along a closed path by means of supply units on a part of a common rotary path along which the supply units and the shuttles move in the same direction with the same speed and at conforming spacings. In the section where the path of the shuttle and that of the supply unit coincide the weft thread is withdrawn from the supply of weft thread and deposited in the form of windings created irrespectively of the running of the weaving loom in a plane identical with the rotary plane of the shuttles in a length proportional to the total multiple of coils on a standing selectively rotatable bobbin disposed in a recess of the shuttle. After the shuttle and the supply unit have parted, the coils on the shuttle are separated from the supply, while at least one end of the supply of weft thread is already held.

10 Claims, 12 Drawing Figures



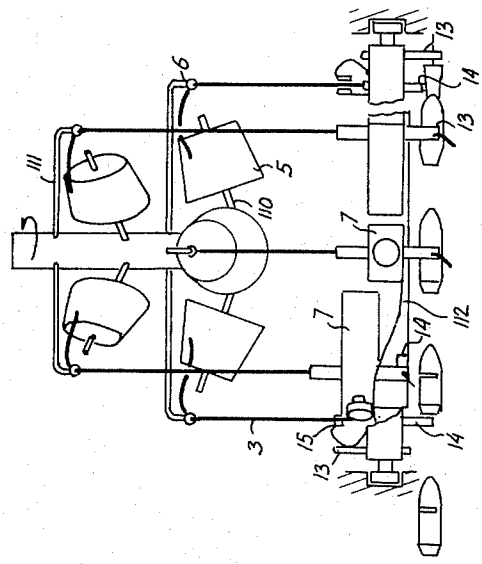


Fig. 1

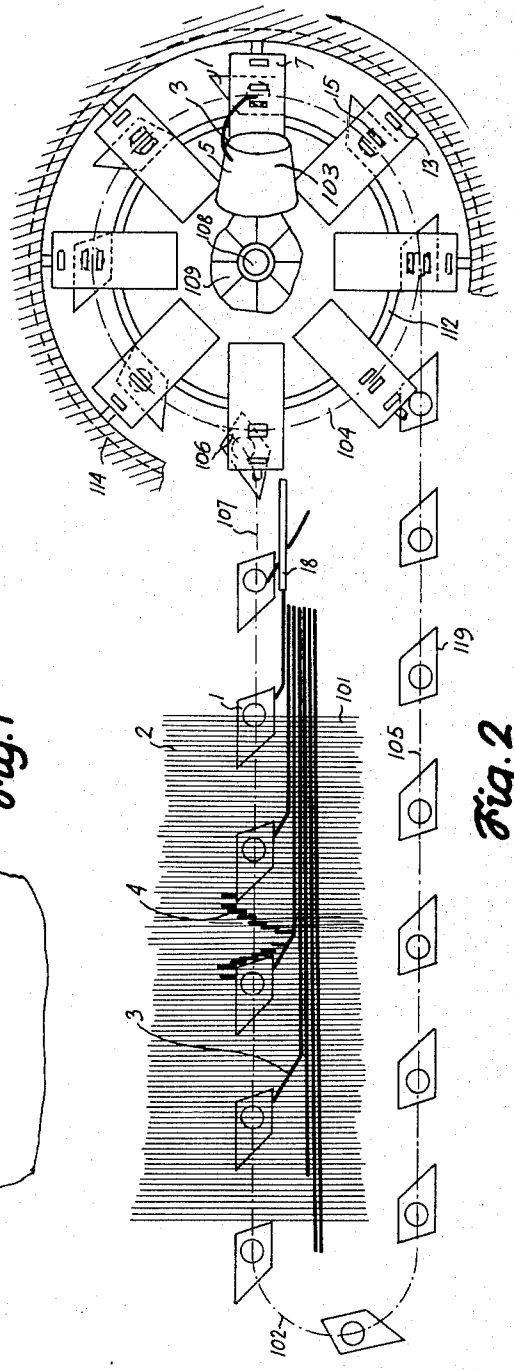


Fig. 2

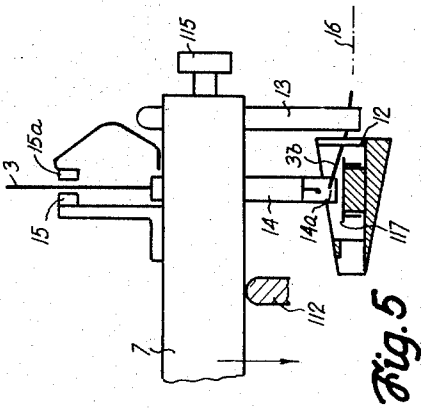


Fig. 5

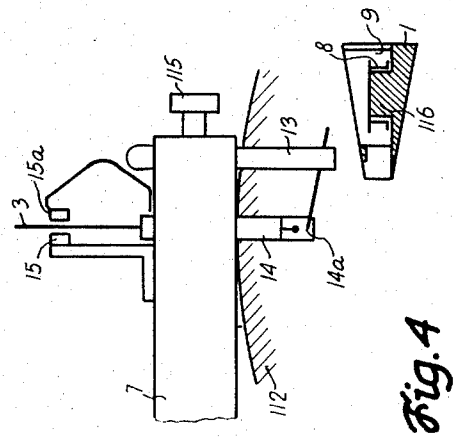


Fig. 4

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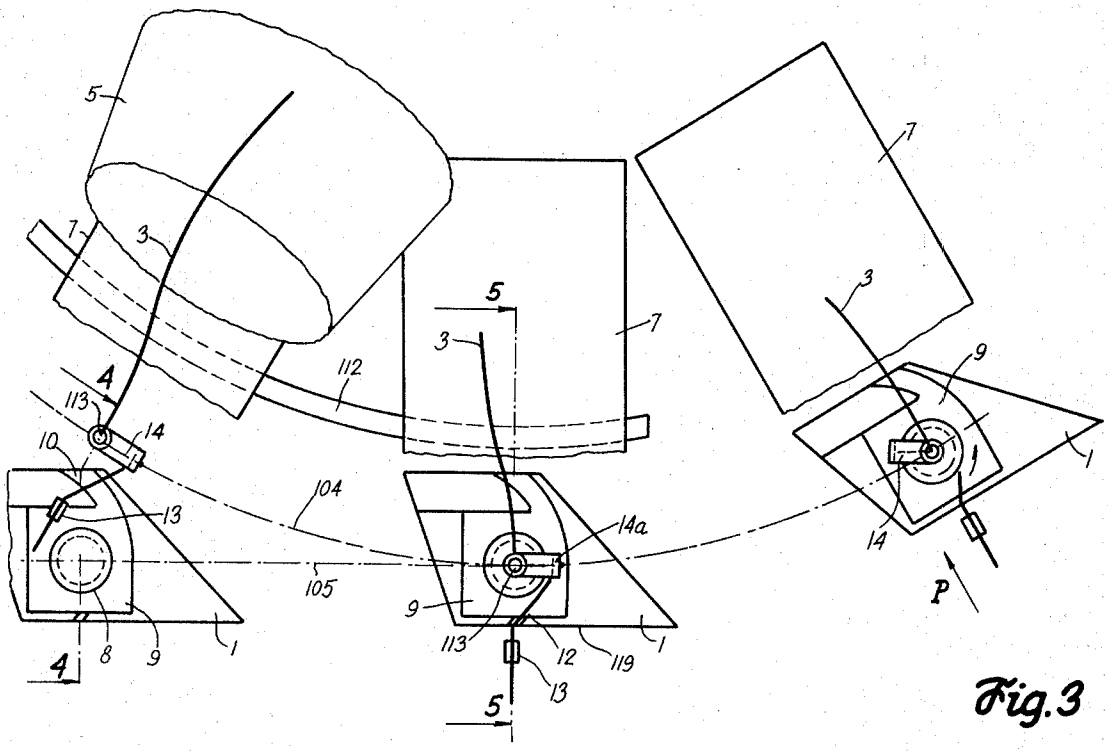

Fig.3

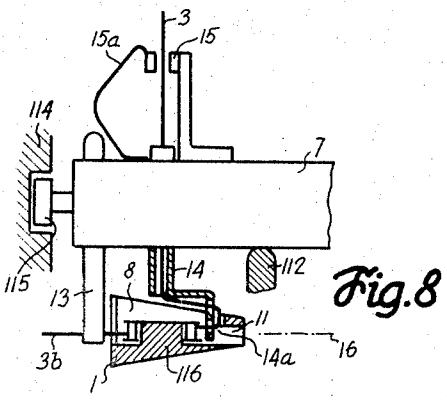

Fig.8

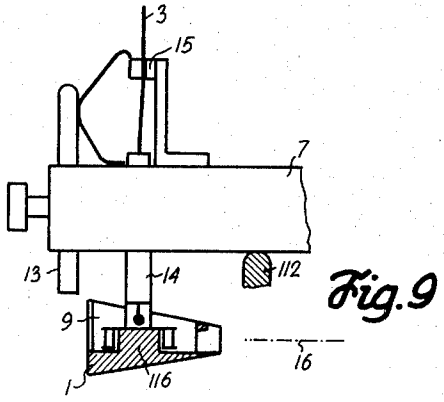

Fig.9

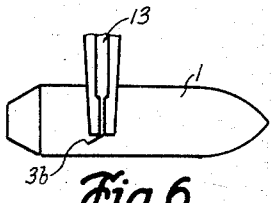

Fig.6

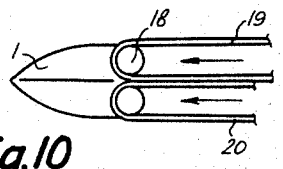

Fig.10

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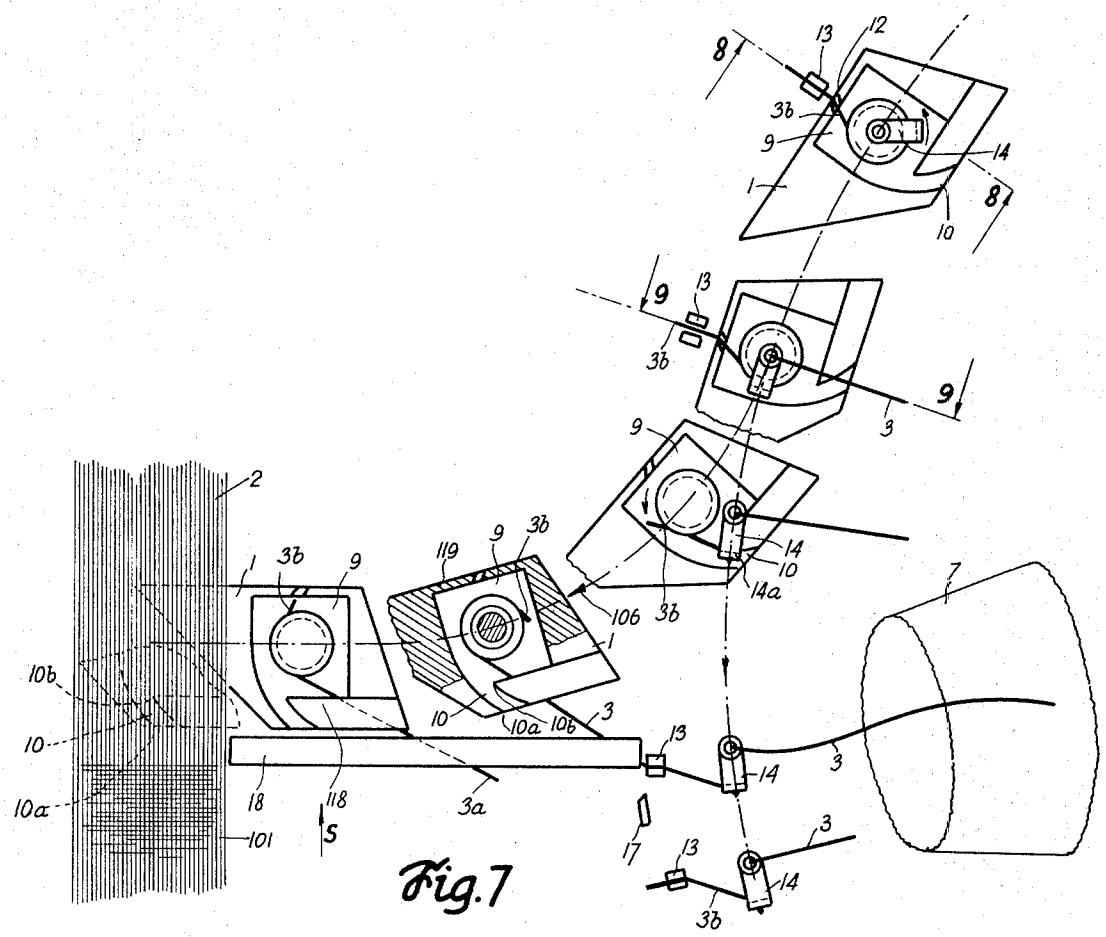

Fig.7

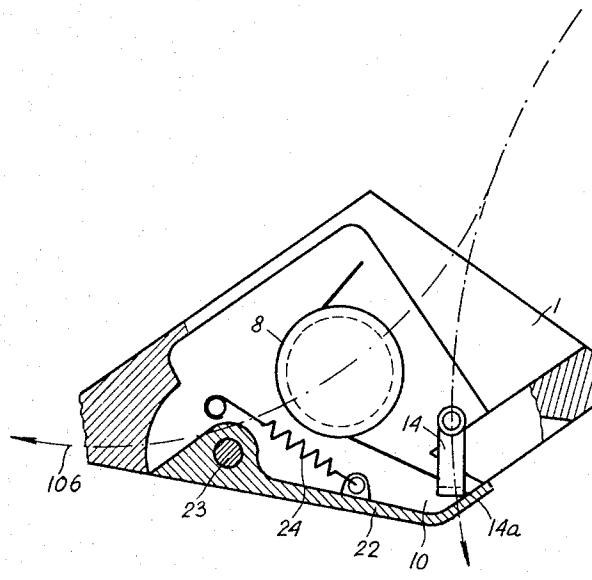

Fig.12

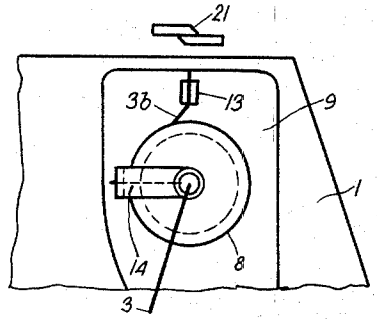

Fig.11

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METHOD OF AND APPARATUS FOR FILLING THE SHUTTLES WITH WEFT ON PROGRESSIVE SHED WEAVING LOOMS

The present invention relates to a method of filling shuttles on progressive shed weaving looms with weft, and to devices for performing the same.

Weaving looms performing a continuous weaving process taking place simultaneously at a plurality of spots along the weaving width are characterized by a high number of picked wefts which have usually been measured to a length somewhat exceeding the width of warp pass to the reed. In these weaving looms the prerequisite is to pick some thousand wefts a minute, and in them considerably greater widths can be envisaged than the maximum width of contemporary single shed weaving looms. Consequently, the method of obtaining a high number of lengths measured in a given time unit, of transferring these wefts into a shuttle, and of inserting them into the warp under constant tension presents a serious problem.

One of the existing devices fills the shuttles of a weaving loom with weft consecutively, that is, one after the other. The supply of weft is prepared in one single stationary place in the form of loops lying one next to the other which are formed by a flyer rotating on a flat mandrel. The mandrel under the rotating flyer is bevelled or tapered so that the loops can slide themselves to the straight part of the mandrel along which a rack feeding device shifts a certain number of loops, corresponding with the length of the weft, to the end of the mandrel. The weft prepared in such a way is taken over by the shuttles which are slipped on the mandrel within the intervals of the progressing shed, wiping by their resilient inner walls the separated charge of loops, that is, the picks, during their motion towards the shed. The weft has the same form inside the shuttle as that in which it has been prepared, i.e., it is deposited in the cavity of the shuttle in the form of coils.

A disadvantage of this method resides in the limited amount of measured cut weft in length per minute, and in the complicated handling of shuttles caused by interrupting their continuous flow in the metering station. Moreover, the loose arrangement of weft in the form of coils within the cavity of the shuttle requires more careful handling of the shuttle, while causing a certain danger of irregular unwinding of the weft from the shuttle.

Another known device with measured out weft loosely deposited in the shuttle uses a plurality of metering stations working simultaneously. The device feeds the metered out weft into the shuttle by means of air pressure, said weft being deposited in the shuttle in the form of loops created at random. A drawback of this device consists in the disarranged form of deposited weft that does not permit its regular unwinding during the picking movement. Another drawback will be seen in the effect of pressure air upon the weft. It affects the weft at least twice, fraying out its ends that must be cut away.

Further known devices meter the weft thread on a bobbin inserted into the shuttle, or on a central core, or wind the weft thread directly on a bobbin carried by the shuttle.

A device is known, e.g., wherein the measured out weft is deposited in the shape of coils on a central core

that is partially or totally taken out of the shuttle during the winding operation. The central core is handled by a device of considerable complexity, which is a handicap. Besides that, the arrangement of weft on a central core from which it is withdrawn during picking is disadvantageous because of the irregularity of such process, particularly owing to the last coils being slipped off all at one time and being thus woven with uneven tension.

Another device is known in which the empty bobbins are taken out of the shuttles and the weft is wound on them outside the weaving loom. After removal of the empty bobbin, a full bobbin is inserted. Similarly to the preceding solution, the clumsy handling represents a drawback when removing, and especially when inserting the bobbins into the shuttles, since during this operation the end of weft must be gripped and held throughout the time until it is inserted into the shed and fastened by the warp threads.

A further known device has shuttles which are simultaneously supplied with weft at a number of places. In such devices, the weft is wound on a bobbin which is transferred from a rotary belt to the metering device in which every bobbin takes up weft in the required length by reason of its own rotation. When the pick has been wound, the bobbin is transferred back to the rotary belt and serves as a shuttle in the weaving process as well; this is undesirable, since a bobbin is unable to fulfill some technological requirements, such as separating sticking threads or doing away with misplaced threads interlaced with warp. A further disadvantage lies in irregular unwinding of weft from the bobbin, particularly at the end of the picks when the last coils are on the bobbin. However, a major disadvantage resides in the fact that the end of the weft is not position-controlled while being fed by air pressure to the circumference of the bobbin before the winding starts.

Winding units arranged on a turret characterize a further known device which winds weft on a rotating bobbin. The device takes over the shuttles from a motion screw sand thrusts them into the respective recesses of the supplying turret where they are gripped and fixed by pairs of holding members, while the weft is fed to them by reciprocating shiftable needles. The disadvantages of such device include a complex shuttle handling, i.e., their transferring from a rotary equipment onto a special supplying turret.

A common disadvantage and lack of the above-described devices consists in the fact that the speed of metering depends upon the speed of weft picking. Consequently, the precision of the measured length of weft will be different under normal working conditions and different under conditions of switching on or of stopping the loom. Moreover, when the loom has been stopped, none of the described devices allows the shuttle to be filled with a correctly measured out length of weft by that supply unit which was to fill the shuttle yet did not do so for some reason before the machine stoppage.

The present invention has among its objects the elimination of the above disadvantages and drawbacks of the known solutions, to carry out the weft metering with more precision, to allow the shuttles to be supplied with weft irrespectively of the speed of the weaving loom, to make it easier to exchange a metering unit in case of defect, to allow repeated metering to be carried

out by the operator when the loom does not work, to ensure reliable gripping of the ends of weft thread before it is interrupted, to ensure the control of the weft which is being inserted into the shed, and to carry out the metering into the shuttle without any position handling of the shuttle or its parts.

In accordance with the present invention this can readily be attained by a method consisting particularly in that in the section where the path of the shuttles and that of the supply units coincide the weft thread is withdrawn from the supply of weft thread and deposited in the form of windings created irrespectively of the run of the weaving loom in a plane identical with the rotary plane of the shuttles at a length proportionate to the total multiple of coils on a freely rotatable but standing bobbin. The bobbin is disposed in a recess of the shuttle from which the weft thread is withdrawn, after the shuttle and the supply unit have parted, in the level of creating the coils, and separated from the supply, while at least one end of the supply of weft thread is already held. The principle of the apparatus for performing the method according to the invention is particularly characterized in that the metering device is provided with a drive independent from the running of the weaving loom; the exit member of the metering device is a winding element entering into the recess of the shuttle, and further is provided with pincers. The shuttle is provided with a freely rotatable bobbin accommodated in a recess, and at the selvedge of the fabric there is disposed means for separating weft thread from the supply, a device for nipping the weft thread and for the control of the end of the weft thread leaving the shuttle through a groove.

It is preferable, from the viewpoint of simplification of design, that in the section of the coinciding paths the shuttles and the metering devices, the exit of the winding element and the pincers assume the same position relative to the shuttle before and after the metering, in which position the weft thread between the said winding element and the pincers is in the area above the upper face of the bobbin outside its contour. In order to avoid the catching of the warp threads by the shuttle, it is advantageous to have the groove in the shuttle pass over into a slot, which is either curved in accordance with the path of the relative movement of the winding element with respect to the shuttle, or is protected by a rotatable cover provided with a spring. With the aim of assuring a smooth unwinding of weft thread from the shuttle, it is advantageous if the pincers are interlocked with the weft thread passage limiter which is arranged on the metering device.

For a safe passage of the pincers off the shuttle, it is advantageous if the pincers are lifted over the level of the shuttle by a guide bar in the section where the shuttle and the metering device paths part and returned back again to the place where the path of the pincers intersect the instantaneous position of the weft thread between the shuttle and the winding element.

It is also preferable, in order to assure that the shuttle passes off the metering device, that the metering device be lifted by a guide bar over the shuttle before the winding element meets the shuttle, after the weft thread has been interrupted between the pincers and the shuttle.

It is of advantage, for a simple design, that the means for interrupting the weft thread between the shuttle and the pincers form an edge arranged at the parting point of the shuttle and the metering device, or a part of scissors. For assuring a regular cut irrespective of the speed of the shuttle movement and of the metering device, it is advantageous if the means for interrupting the weft thread passing between the shuttle and the pincers are scissors coupled with pincers.

It is preferable, for correct feeding of the weft thread into the shuttle, to have the pincers placed on the metering device outside the shuttle; this allows the shuttle to be smaller in dimensions; if the pincers enter the recess of the shuttle, while the groove in the side of the shuttle is omitted, the beginning of the wound thread remains within the shuttle.

Further advantages and features of the present invention will be more fully explained in the following detailed description read with the accompanying drawings in which:

FIG. **1** is a plan view of the closed circulation of the shuttles and the supply units including a part of the weaving area of the loom;

FIG. **2** is a front view of the closed circulation of shuttles and supply units;

FIG. **3** is a plan view of the meeting of a metering device with the shuttle that is to be filled with weft;

FIG. **4** is a section taken along the line **4—4** in FIG. **3**;

FIG. **5** is a section taken along the line **5—5** in FIG. **3**;

FIG. **6** is a view taken in the direction P in FIG. **3**, the view depicting the holding of the end of weft in pincers outside the space of the shuttle;

FIG. **7** illustrates in plan view the characteristic phases for the parting of a shuttle from a supply unit;

FIG. **8** is a section taken along the line **8—8** in FIG. **7**;

FIG. **9** is a section taken along the line **9—9** in FIG. **7**;

FIG. **10** is a view taken in the direction S in FIG. **7** depicting the mechanical conveyor controlling the end of weft between the shuttle and the selvedge;

FIG. **11** is a plan view of an alternative embodiment with the recess of the shuttle with pincers inside and the scissors outside the shuttle; and

FIG. **12** shows a further alternative embodiment of the shuttle, such shuttle being provided with a swingable cover.

The weaving process on a progressive shed weaving loom is characterized by a plurality of shuttles **1**, as shown in FIG. **1**. During the process of weaving, each shuttle **1** passes through the weaving area limited by the width of drawn-in warp consisting of warp threads **2**. During the process of weaving, at least some of the shuttles are in the weaving area, inserting the measured-out weft threads **3** into the travelling sheds. The transport of shuttles **1** in the weaving area is carried out, in the illustrative embodiment, by laminae **4** controlled by known means (not shown). The laminae **4** also serve to beat up the weft **3** to the already formed fabric **101**. AFter having picked the weft **3**, i.e., after having left the weaving area, in the given example the shuttles change their direction along a circle **102**, returning in a known way to the other side of the

formed fabric **101** where they are refilled with weft thread by means of supply units **103**, which will be described later, the shuttles then returning to the weaving area.

In the illustrative embodiment, the supply units **103** move along a circular path **104**, which, however, does not represent a necessary prerequisite. The path **104**, e.g., can have the form of two straight lines and two half-circles, etc. A part of the path **105** of the shuttle **1** is common with the path **104** of supply units **103** of which, either tangentially or along a circular arch **106**, said path **105** passes over to a straight section **107** along which it enters the shed and moves through it.

Over this common part of path **104**, **105** the length of which depends upon the spacings of shuttles **1** and also upon the number of supply units **103** carrying out the weft supplying function, the shuttles **1** and the supply units **103** have the same spacings and the same speed. With respect to the fact that the shuttles **1** as well as the supply units **103** move along closed paths **104**, **105**, it is preferable, both from the viewpoint of the continuity of their travel and from the viewpoint of simplicity of production, to have this speed also maintained along the remaining parts of said parts **104**, **105**. The maintaining of the same speed and the same spacings of supply units **103** and of shuttles **1** depends especially upon the type of drive. In an example of the embodiment, outside the weaving width the shuttles **1** are driven, e.g., by means of a finger of an endless chain (not shown) which is guided and driven by driving means of which only a shaft **108** is represented at that side of the weaving loom at which the shuttles **1** are refilled with weft thread and enter the weaving area.

The shuttle **1** moves along the part of the common path **104**, **105** in one rotary plane in which the refilling of the shuttles with weft thread **3** takes place. It is preferable also to maintain the same rotary plane for the remaining part of path **105**, which represents the simplest solution.

On the driving shaft **108** over the respective guiding means of the chain carrying the shuttles **1**, a rotary guiding device is accommodated consisting of a turret carrying the supply units **103**, while in the case of applying a different rotary path **104** said turret can be replaced by some guiding means of an endless chain (not shown) carrying the supply units **103** along a guiding profile rail. The turret **109** is shown as carrying eight supply units **103**. This number is given only by way of example. The number of supply units **103** depends upon the output of the weaving loom, expressed in meters of measured-out weft thread **3** within a given time unit, and further upon the maximum metering speed, which is substantially limited by the strength of weft thread **3**. The number of supply units **103** can also be chosen from the viewpoint of the possibility of color pattern or of mixing the weft thread **3**.

Each supply unit **103** contains a minimum supply **5** of weft thread **3**, preferably in the form of a bobbin which, in the illustrative embodiment, is supported by a holder **110** of the frame **111** connected with the shaft **108** of the turret **109**, e.g., by a pin (not shown), or in the case of a different rotary path, it is supported by a holder of a driving rotary device which can consist of a profile guide rail (not shown) together with an endless chain fed around sprockets (not shown) of which one is accommodated on the shaft **108**. The supply unit **103** contains further guiding means of the weft thread **3** and a metering device **7** accommodated on the turret **109** in a vertically shiftable position and controlled by a template **112**.

The guiding means are accommodated on frame **111** between the supply **5** and the metering device **7** and consists, e.g., of a brake, a weft stop controlling at the same time the running of the weaving loom, and guide elements of known shape, or, solely by way of example, as an eye **6** directing the weft thread **3** into the metering device **7**.

The metering device **7** of the supply unit **103** serves to feed in, to measure out, and to deposit a required length of weft thread **3** on the bobbin **8** of the shuttle **1** (FIG. **3**). It consists of a winding member **14** which is the exit member of a metering device (not shown) driven by a drive (not shown) independent of the running of the weaving loom, and further, of pincers **13** arranged in a vertically slidable position with which the limiter **15** of the passage of weft thread **3** is coupled.

The winding element is hollow, e.g., in the shape of a flyer, and provided with an outlet **14*a*** through which passes the weft thread **3** fed from the supply **5** through the cavity **113** of the winding element **14**.

The pincers **13** and the limiter **15** are constructed and function in a known way and are controlled by a template or cam **114** (FIGS. **8** and **9**) the stroke of which is transferred to the pincers **13** by means of a roller **115**; said pincers open during the upward movement, and at the same time close, e.g., by means of a transfer member (not shown), the limiter **15** arranged on the metering device **7** by swinging out its swingable arm **15*a***.

The position of pincers **13** on the metering device **7** determines the embodiment of shuttle **1** which is placed under the metering device **7** throughout the whole part of the rotary paths **104**, **105** which is common with the respective supply unit **103**. The shuttle **1** is provided with a bobbin **8** accommodated rotatably on a pin **116** in a recess **9** of shuttle **1** (FIGS. **4**, **8**, and **9**). The dimensions of the recess **9** allow the weft thread **3** to be wound on the bobbin **8** by means of the winding member **14** which is arranged on the metering device **7** coaxially or at least parallel with the pin **116** so as to allow its outlet **14a** entering the recess **9** under the level of the upper face **117** of the bobbin **8a** to rotate freely around said bobbin. The winding level **16** is determined by the position of the outlet **14*a*** during the winding process. The recess **9** passes over into a groove **10** through which the winding element **14** projects when the supply unit **103** and the shuttle **1** part. With the aim of guiding the weft thread **3**, the groove **10** passes over into a slot **11** extending under the winding level **16** (FIG. **8**). In order to prevent loose or sticking warp threads **2** from falling into the groove **10**, said groove is either closed by a cover **22** rotatable on a pin **23** in an alternative embodiment (FIG. **12**) and held by a spring **24**, or is arched in accordance with the path of the relative movement of the winding element **14** with respect to the shuttle **1** at the parting point of their paths **104**, **105**. The paths **104**, **105** of the shuttles **1** (FIG. **7**) and of the supply units **103** in the place of parting must be chosen so as to insure the edge **10*a*** of the groove **10** in the recess **9** to be arranged behind the

edge **10***b* at the inner side wall **118** of the shuttle **1**, if viewed in the direction of the movement of the shuttle **1**. In case the pincers **13** are placed outside the shuttle **1** at the outer side **119**, the device is provided with a groove **12** through which the warp thread **3** is fed between the outlet **14***a* of the winding member **14** and the pincers **13**. The groove **12** is inclined and both its slope and its width prevent warp thread **2** from falling into it.

For separating the measured-out weft thread **3** deposited in the shuttle **1** from the supply **5** either scissors **21** (FIG. **1**) or an edge **17** (FIG. **17**) is arranged in the parting place of the supply unit and the shuttle, and that as near the pincers **13** as possible. The scissors **21** can form a part of every metering device **7** where they are placed at the outer side of the pincers **13** with which they are then coupled similarly as the limiter **15** (FIG. **11**). In such cases the edge **17** or any other means for interrupting the weft thread can be omitted.

In order to control the cut end of the weft thread **3***a* which projects from the shuttle, to provide for its correct drawing-in to the selvedge **101**, and holding it after the shuttle has entered the shed at least to the moment of interlacing by the second warp thread **2**, a thread controlling device is provided at the margin of the weaving area formed, e.g., by a conveyor **18** consisting of two rotary belts **19**, **20** travelling in opposite directions (FIGS. **7**, **10**).

For simplicity of illustration, some mechanisms taking part in the operation of the whole device have not been illustrated in the drawings, since they do not represent the object of the invention and can be replaced by various known mechanisms. This related particularly to the independent drive which can be either common to all metering devices **7**, or can be provided separately for every metering device **7**. In both cases, a mechanical stop is provided by way of example in the place where the metering device moves in the section of paths **104**, **105** common with the respective shuttle **1**, said stop connecting the metering device with the central drive in the first case, whereas in the second case it sends an impulse to switch on the motor of the metering device **7**. The number of revolutions of the winding member **14**, and consequently also the length of the weft thread **3** can be determined, by way of example, in turning a toothed segment (not shown) of the metering device **7**, said segment driving a gear accommodated on the winding member **14**. The dimensions of the segment determine the number of revolutions of the winding member **14**. This toothed segment can also serve for switching off the metering device **7** and for stopping the winding member **14**, e.g., by interrupting the transmission of turning force by means of a specially adapted stop and at the same time by stopping the winding member **14** in its initial position. In an illustrative embodiment, a counter can be used for determining the number of revolutions with an electric circuit for the control of the metering device driving motor.

The method of filling the shuttles **1** with weft **3** and the operation of a device according to the invention are as follows; such method can be divided, for better understanding, into these three basic phases:

1. The meeting of the shuttle **1** with the supply unit;
2. The metering of weft yarn **3**;
3. The parting of the shuttle from the supply unit.

THE MEETING OF THE SHUTTLE WITH THE SUPPLY UNIT

THe first phase, in which the shuttle meets with the supply unit, can be seen in FIGS. **2–6**, inclusive. Before the meeting of the rotary paths **104**, **105** of the supply units **103** and of the shuttles **1**, the metering device **7** guided by the template **112** is in its upper position over the rotary path of the shuttle, so that the pincers **13** and the winding member **14** may not prevent the shuttle **1** from passing the metering device **7** at different levels. The weft thread is fed from the supply **5** through the eye **6**, (possibly also through an unillustrated brake and a weft stop) over a winding member **14** to the outlet **14***a*, its end **3***b* being tightly held in pincers **13**. The limiter **15** of the passage of weft **3** does not prevent the weft thread from passing from the supply **5**. In this phase, the winding element **14** does not rotate, and its outlet **14***a* assumes the position in which the previous winding operation has stopped. As soon as the pincers **13** are placed outside the outline of the shuttle **1** during the next meeting of the shuttle **1** with the metering device **7**, the metering device **7** moves downward together with the pincers **13**, the winding member **14** enters the recess **9** of the shuttle **1**, and the end **3***b* of the weft thread **3** between the pincers **13** and the outlet **14***a* is fed through the groove **12** in the outer side **119** of the shuttle **1** substantially into the winding level **16** under the upper face of the bobbin **8** and assumes such position as not to intersect the outline of the bobbin **8**. This position of the winding member **14** and of the pincers **13** at the winding level **16** is shown in FIG. **8**. Thus the metering device **7** is brought into the position in which the winding of weft thread **3** on bobbin **8** takes place.

THE METERING OF WEFT YARN

THe second phase of metering is clearly visible in FIGS. **2**, **6**, **7**, and **8**. With respect to the bobbin **8** in the shuttle **1**, the metering device has assumed the position of winding into which it has been brought during the first phase of metering. An impulse for the connection of the metering device **7** with the metering drive mechanism (not shown) is given by a stop or is derived from the position of the metering device **7** on its rotary path. The winding member **14** starts rotating in the marked direction, while the end **3***b* of the weft thread **3** is held by pincers **13** and the limiter **15** of the weft thread **3** does not limit the passage of weft thread **3** from the supply **5**. This enables the winding member **14** to deposit the drawn-in weft thread **3***a* in the form of coils on the bobbin **8** which stands still during the whole process of winding. The weft thread **3** between the guide **6** and the metering device **7** can be braked and controlled in a known way (not shown), in order that the run of the rotating machine may be stopped in case of breakage.

The winding operation ends, at the latest, immediately before the shuttle **1** parts from the supply unit **103**. During the winding operation, the winding member **14** makes a full number of revolutions determined by the program of the measuring-out device (not shown) and consequently its outlet **14***a* stops in a suitable position in which it has started winding on. The drive of the metering device **7**, independent of the running of the weaving loom, results in the independence of the speed

of winding the weft thread 3 from the speed of picking the weft thread 3 in the weaving area. This also results in winding under equal tension, which effects the precision of the measured-out length of the weft thread 3.

In the case of weaving loom stoppage, e.g., as the result of a breakage of warp 2 or of the drawn-in weft thread 3, or the direct stopping of the loom by the operator, the metering process which is being performed is not interrupted for the shuttles in which the metering has already started. In such cases, the metering process in these shuttles 1 end even sooner than before the shuttle 1 parts from the metering device 7. When the weaving loom is running, the metering devices 7 are brought into winding operation in one position only due to the action of a trip (not shown) at the beginning of the common rotary path of the shuttles 1 and the supply units. When the weaving loom stands still, and consequently the circulation of shuttles 1 and of supply units 103 has also been stopped, the metering device 7 can be brought into operation by hand instead of by the trip in any place of the common rotary path so that it begins winding. The operator has the possibility of removing a defect of the supply unit 103, to tie up a broken weft thread 3, possibly to exchange the whole metering device 7, and to refill the respective shuttle 1 with the correct length of weft thread.

THE PARTING OF THE SHUTTLE FROM THE SUPPLY UNIT

The third phase, in which the shuttle and the supply unit part, can be readily seen in FIGS. 7, 8, 9, and 10. The metering is finished shortly before the shuttle 1 and the respective supply unit part. The outlet 14*a* of the flyer 14 assumes the same position as before the metering. The pincers 13 guided by the template 114 slide over the rotary plane of the shuttles 1 and open at the same time. Thus the end 3*b* of the weft thread is loosened. At the same time, the weft thread passage limiter 15 cooperating with the pincers 13 is brought into operation, preventing the weft thread 3 from passing out of the supply 5. Besides the pincers 13, the metering device 7 is also guided by the template 112 and remains in the metering position, while the outlet of the flyer 14*a* leaves the shuttle 1 through the groove 10 when a smooth parting from the shuttle takes place.

As the rotary paths of the metering device 7 and of the shuttle 1 diverge, the weft thread 3 is unwound from the bobbin 8 of the shuttle 1, since the limiter 15 of the passage of weft thread 3 does not allow the passage of weft thread from the supply 5. The bobbin 8 rotates in the same direction in which it will rotate in the weaving area during the picking of the weft thread 3, so that the end 3*b* of weft thread 3 is automatically drawn-in into the space 9 of the shuttle 1 before the shuttle 1 enters the weaving area. The weft thread 3 between the supply in the shuttle and the metering device 7 has not yet been cut, and is fed between the shuttle 1 and the metering device 7.

Meanwhile, the pincers 13 have passed the path of shuttle 1 at a different level in a position over the rotary level of the shuttles 1. Approximately in the place where said pincers get over the instantaneous position of the weft thread 3 between the shuttle 1 and the metering device 7, they start their downward travel again, guided by the template 114, to the winding level 16, tightly gripping the weft thread 3 between the flyer 14 and the shutter 1, while the limiter 15 cooperating with them gives free passage to the weft thread 3 from the supply 5, which is already a part of the preparation of the supply unit 7 for the next winding. The weft thread 3 between the pincers 13 and the shuttle 1 is drawn from the groove 10 into the slot 11 as the unwinding from the bobbin 8 continues, and is fed into the conveying unit 18. In that moment, the edge 17 or the scissors 21, which are stationarily arranged as near the rotary path of the pincers 13 as possible, interrupt the weft thread 3 between the pincers 13 and the shuttle 1. Thus the end 3*b* is created as the beginning of the next winding of weft thread 3.

The end 3*a* of weft thread 3 leading to the shuttle 1 is taken over by the conveying unit 18 and transported, under simultaneous control, to the end of the weaving area where it is caught by the selvedge warp threads 2 preparing for the shed change. After the weft thread 3 has been interrupted, the metering device 7 is prepared for the following metering. Before the metering device meets with the shuttle 1 that should be refilled with weft thread 3, the metering device 7 guided by the template 112 moves out, and at the same time also the pincers 13 get over the rotary level of the shuttles 1 and the whole metering cycle is repeated.

With respect to the correct length of the weft thread 3 in the shuttle 1, the weft thread 3 must quite clearly be unwound either from the yarn supply 5 or from the shuttle 1 when the shuttle 1 and the supply unit part, while it is preferable to insure the unwinding from the shuttle 1 as has been described, since the rotary movement of the bobbin 8 causes the end 3*b* of the weft thread 3 to be automatically drawn into the recess 9 of the shuttle 1.

In the alternative embodiment according to FIG. 11 where the pincers project into the recess of the shuttle 1, the manner of operation is the same as in the above-described one. The advantage of such arrangement consists in that the end 3*b* of the weft thread 3 remains all the time in the space of the shuttle 1, thus avoiding the danger that it might fail, for any reason, to be drawn-in into the cavity of the shuttle 1. In such case it might be caught by warp threads going over to a shed change. The warp thread 3 from the bobbin 8 would have the tendency to unwind in the wrong direction and through the wrong outlet, i.e., through the groove 12.

In case the path of the parting of shuttle 1 is not chosen with respect to the suitable curvature of path 10, the shuttle 1 must be used with a cover 22, as shown in FIG. 12. Then the flyer 14 or some other member of the metering device 7 (e.g., a peg) swings the cover 22 out, thereby closing the groove 10 around the pin 23 and thus creating the necessary space for the exit of the outlet 14*a* of the flyer 14 out of the shuttle 1. After the cover 2 has returned by means of the action of the spring 24, the shuttle 1 has no interruption of its outline in the form of an open groove 10.

In the alternative embodiment in which each metering device 7 has its own scissors 21 which project either in the recess 9 of the shuttle 1 or outside the shuttle 1, the operation is as follows: At the moment of the parting, the template 114 is guided in accordance with the pincers 13, assuming a position over the rotary plane of

the shuttles 1 and the jaws of the scissors, as well as the pincers 13, are open. After the pincers 13 and the scissors 21 have passed the shuttle 1 at different levels, the scissors 21 move downwards together with the pincers 13 into the winding level 16, and similarly to the pincers 13 the weft thread 3 between the shuttle 1 and the flyer 14 is fed automatically to the open jaws of scissors 21. After the weft thread 3 has been gripped by he pincers 13, which takes place when the weft thread 3 has been drawn-in to the conveying unit 18, the weft thread 3 is at the same time interrupted by scissors 21. The advantage of such embodiment resides in the fact that a better quality of cut and a higher precision of the length of the pick 3 are insured, the process of cutting being independent from the rotary speed of the shuttle 1.

Although the invention is illustrated and described with reference to a plurality of preferred embodiments thereof, it is to be expressly understood that it is in no way limited to the disclosure of such a plurality of embodiments, but is capable of numerous modifications within the scope of the appended claims.

What is claimed is:

1. In a progressive shed weaving loom having a plurality of shuttles with bobbins moving along a closed path, and an apparatus for filling the shuttles with weft on the bobbins, said bobbins being pivotable in the plane of said closed path, the improvement comprising a weft supply, a plurality of metering devices moving along a closed path a part of which is parallel to the closed path of the shuttles, rotatable winding elements arranged on the metering devices, a drive for the winding elements which is independent of the running of the weaving loom, independent of the moving of the shuttles, and independent of the moving of metering devices, means for moving the winding elements near the bobbins of the shuttles when filling the bobbins, pincers to hold the weft when filling the bobbins, the pincers being arranged on the metering devices, means for separating the filled weft from the supply, the weft leaving the shuttle through a groove, and a device for nipping the weft and for the control of the end of the weft leaving the shuttle through the groove.

2. Apparatus as defined in claim 1, comprising a controllable weft limiter, said limiter being arranged on each metering device between the winding element and the weft supply.

3. Apparatus as defined in claim 2, wherein the pincers are shiftable parallel to the axis of rotation of the winding elements and are interlocked with the weft limiter.

4. Apparatus as defined in claim 1, wherein the device for nipping the weft and for the control of the end of the weft is arranged between the means for separating the filled weft and the shed of the loom.

5. Apparatus as defined in claim 4, wherein the device for nipping the weft and for the control of the end of the weft comprises two contracting rotary belts travelling in opposite directions.

6. Apparatus as defined in claim 1, wherein the groove in the shuttle is disposed at the same level as the winding elements, the groove merging with and passing over into a slot which is curved in accordance with the path of the relative movement of the winding element with respect to the shuttles when the winding element and the shuttle part.

7. Apparatus as defined in claim 6, comprising a swingably arranged cover provided with a spring for selectively covering the groove in the shuttle.

8. Apparatus as defined in claim 1, wherein the means for separating the filled weft are scissors coupled with the pincers.

9. Apparatus as defined in claim 1, wherein the pincers are placed outside the shuttle, and the outer side of the shuttle is provided with a recess.

10. A method of filling the shuttles on progressive shed weaving looms with weft, said shuttles continuously moving in a closed path comprising moving weft supply units and the shuttles in the same direction with the same speed and at conforming spacing, in the section where the path of the shuttle and that of the supply unit coincide withdrawing the weft from the supply of weft and depositing it in the form of windings created irrespective of the running of the weaving loom in a plane identical with the rotary plane of the shuttles, and with a length proportional to the total multiple of windings on a standing bobbin disposed selectively rotatably in a recess of the shuttle, and, after the shuttle and the supply unit have parted, holding at least one end of the supply of weft and separating the weft from the supply unit.

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