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Pfarrwaller

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[54] **WEAVING MACHINE HAVING A VARIABLE WEFT YARN PATH**

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[52] **U.S. Cl.** ..... **139/122 R,** 139/127 P

[51] **Int. Cl.** **D03d 47/34**

[58] **Field of Search** ..... 139/122 R, 122 H, 122 W, 139/127 R, 127 P; 226/118, 119

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[57] **ABSTRACT**

The movable guide element for forming the yarn reserve in the weft yarn path is provided with a driven guide roller over which the weft yarn moves. The guide roller is positively rotated in the direction of yarn movement at a speed at least equal to the yarn speed to reduce the tension in the weft yarn and, thus, to reduce the power needed for picking of the weft yarn into the shed.

10 Claims, 7 Drawing Figures

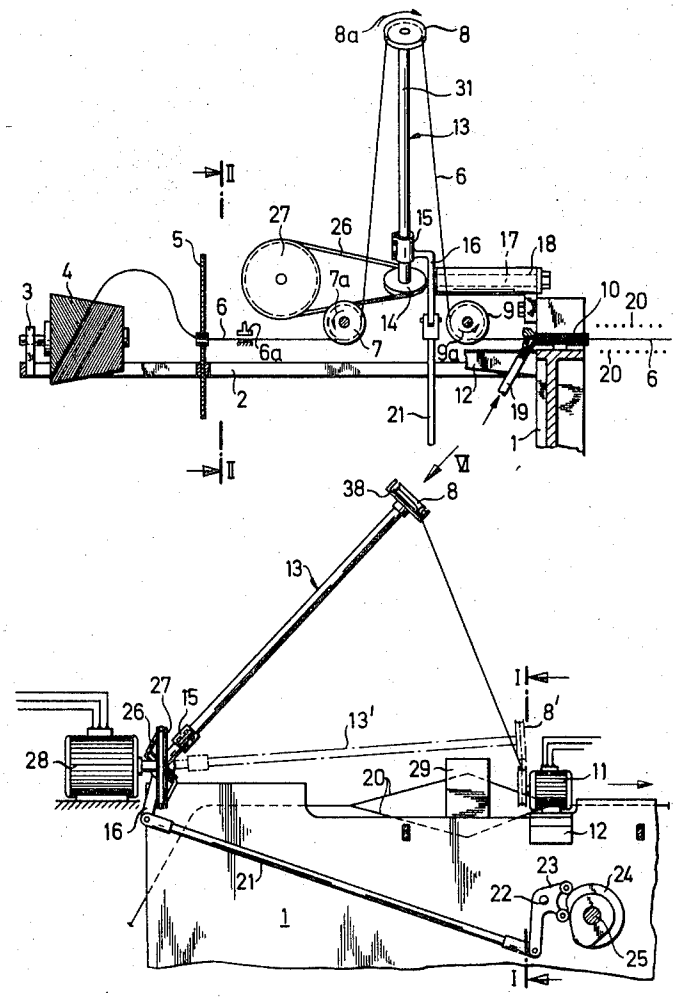

Fig.1

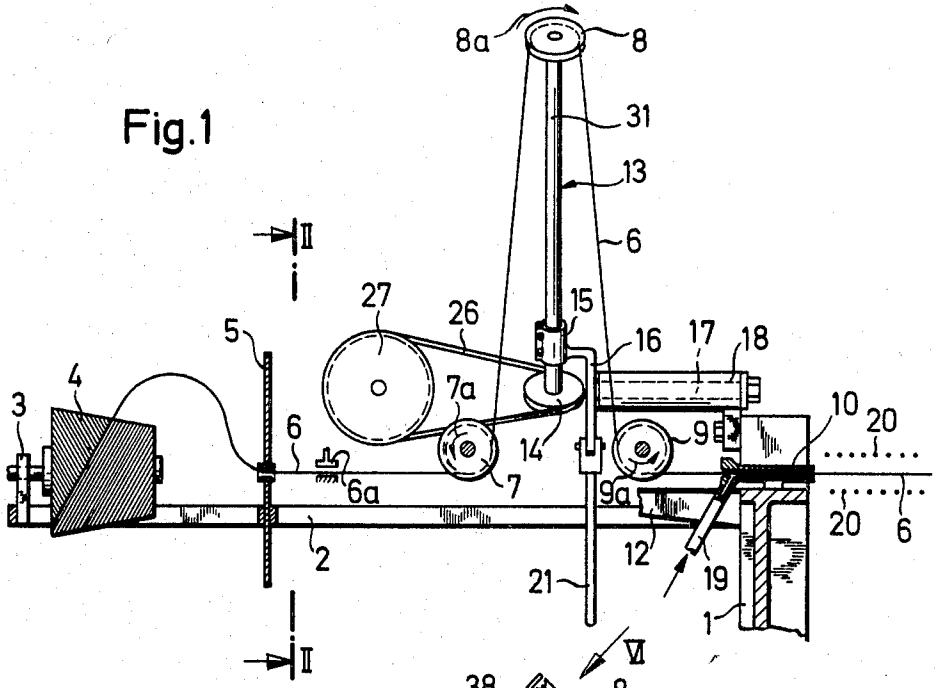
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Fig. 2

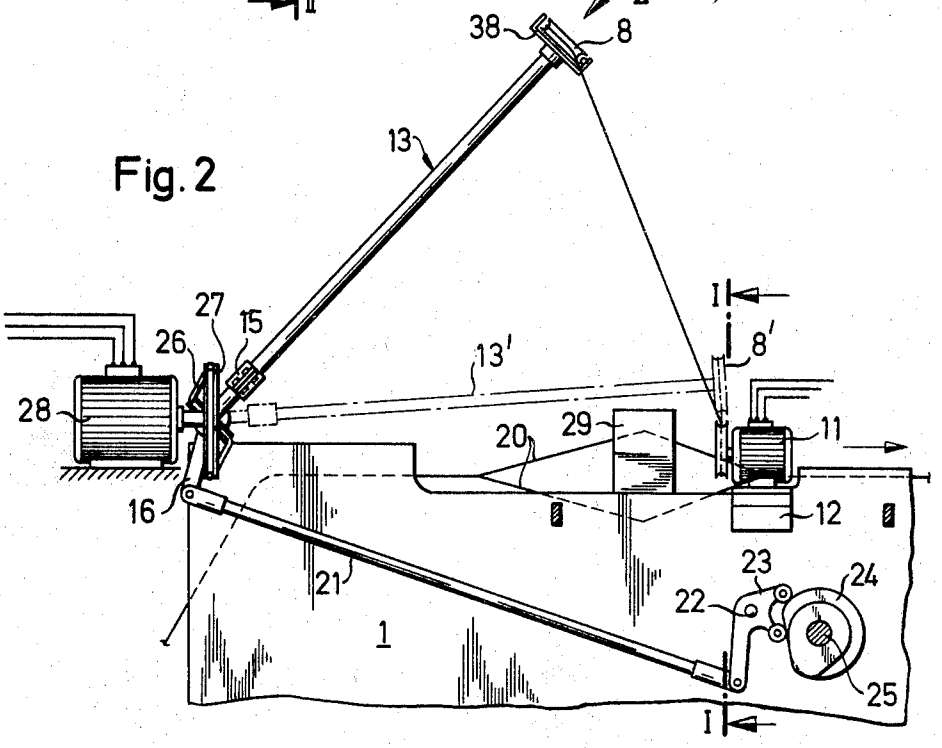
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Fig.3

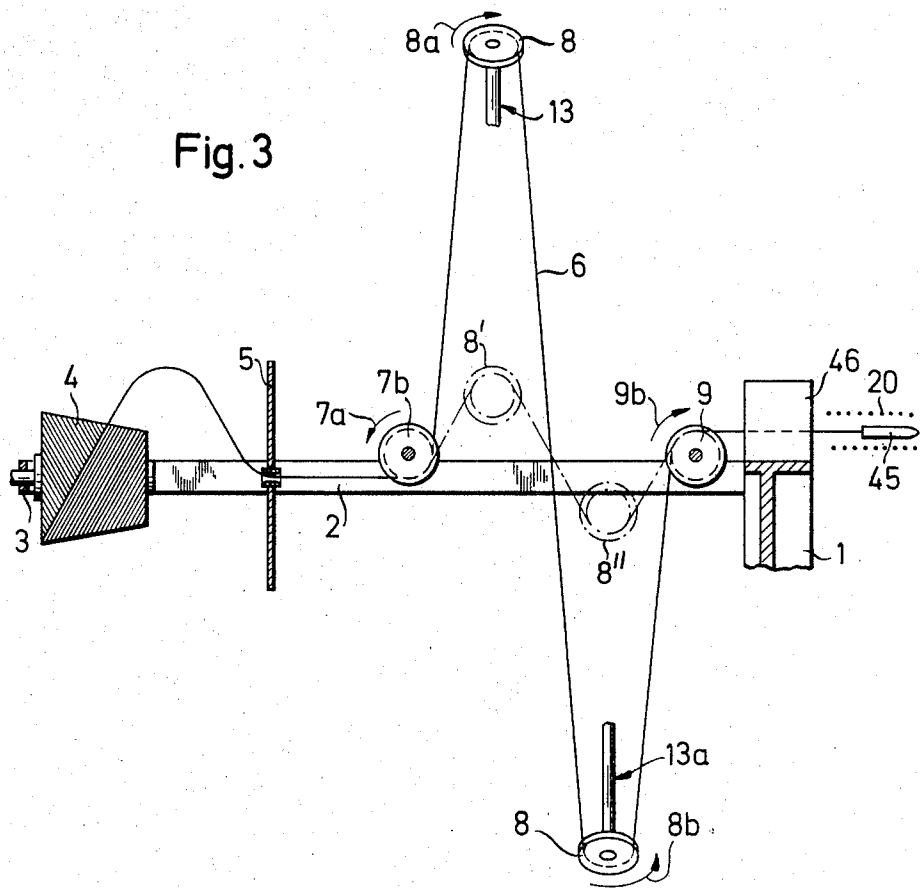
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Fig.4

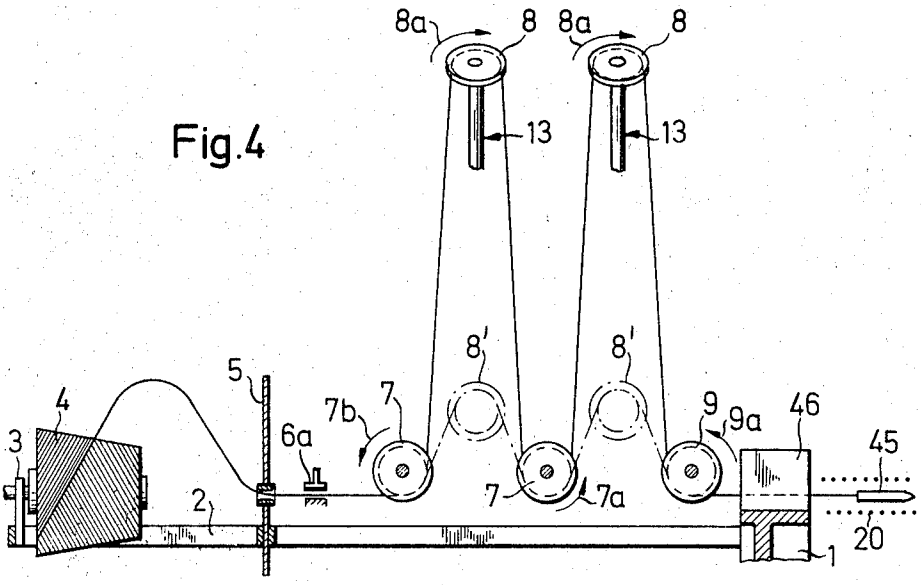
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Fig. 5

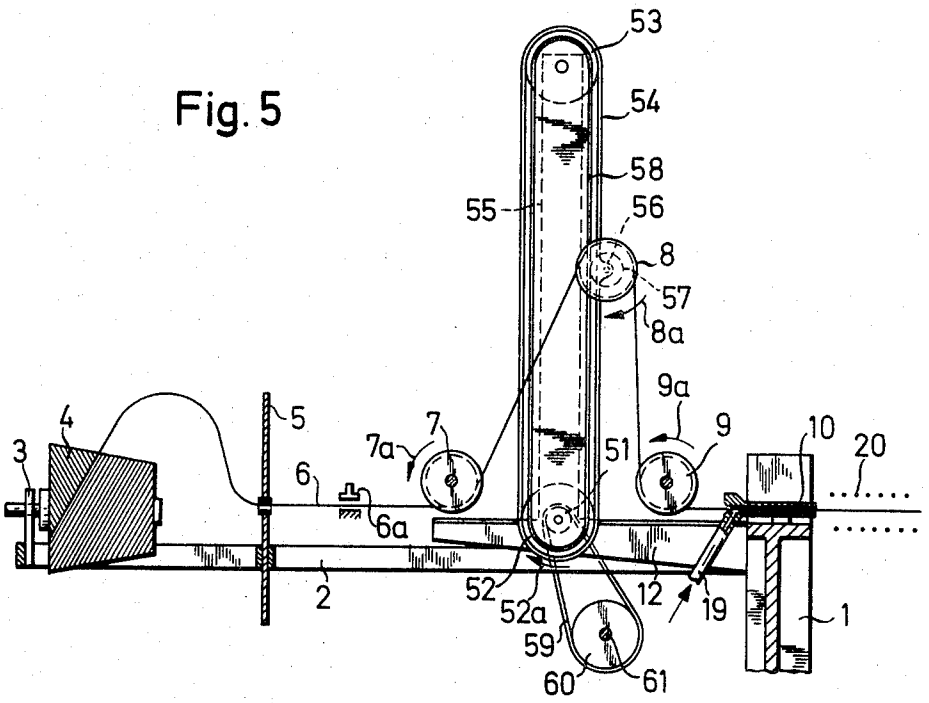


Fig. 6

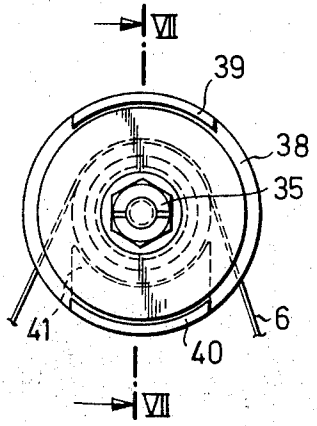
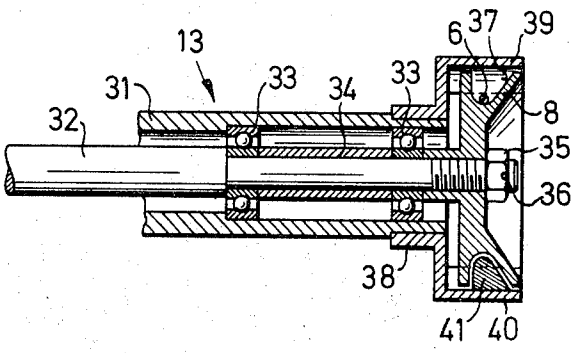


Fig. 7



WEAVING MACHINE HAVING A VARIABLE WEFT YARN PATH

This invention relates to a weaving machine in which a weft yarn is taken off a weft yarn supply bobbin mounted outside a shed. More particularly, this invention relates to a weaving machine having a variable weft yarn path.

Generally, weaving machines which have a weft yarn bobbin supply located outside the shed utilize various guide elements to guide the weft through a yarn path upstream of a picking mechanism. These guide elements are disposed between the bobbin and the shed with at least one of the guide elements being movable so that the yarn path can be varied temporarily.

In known machines of this kind, the weft is picked, e.g., by gripper shuttles and, in order to compensate for a pull-back movement subsequent to picking, the weft is kept tensioned until the next pick by a lever adapted to pivot out of of the yarn path. In order to prepare a length of weft yarn as required for a subsequent pick, it has been known to provide one or more guide levers for the weft yarn, such levers being pivotable transversely to the direct yarn path. This feature reduces weft yarn stressing, since the yarn is pulled off the bobbin substantially continuously instead of jerkily and is picked from the planned or designed yarn supply.

In other known weaving machines wherein the weft is picked into the shed by a flowing medium, such as an air stream, in order to reduce draw-off resistance, the weft yarn which runs off the supply bobbin has been engaged before picking by an entraining member disposed on a rotating chain and is laid out as a loop which serves as a means of storing the length of yarn required for the pick.

It has, however, been found that no great increase in picking power is obtainable in machines of the known kind which have the known facilities for increasing the yarn path when the yarn is picked very fast and with very reduced yarn tension as is the case, e.g., when the yarn is picked by a flowing medium.

Accordingly, it is an object of the invention to provide an improved weaving machine which has provision for storing the weft yarn to be picked and which helps to reduce considerably the power needed for the picking element, such as a gripper shuttle or a gripper rod or a flowing medium.

It is another object of the invention to provide a positive technique for moving a weft yarn through a weft yarn path prior to being picked into a shed.

It is another object of the invention to continuously supply a weft yarn for picking in a weaving machine.

Briefly, the invention provides a movable weft yarn guide element for enlarging a predetermined yarn path with a guide roller for passage of the thread and a drive means for rotating the roller in the direction of yarn movement in the yarn path. The guide element is disposed as one of a plurality of guide elements for guiding a weft yarn to be picked into a shed formed by a suitable means within a weaving machine. In addition, the movable guide element is used where a means is provided in a weaving machine to mount a weft yarn supply bobbin outside the shed.

The fact that the guide roller is driven reduces the tension of the weft yarn running over the guide roller by an amount corresponding to the looping angle and the coefficient of friction provided that the speed of guide roller rotation is equal to or greater than the speed of yarn movement.

Very advantageously, the drive means for the guide roller is so devised that the guide roller can be driven at a speed equal to or greater than the greatest possible speed of the weft yarn to be picked. If the speed of guide roller rotation is greater than the greatest speed of yarn movement, the tension of the piece of yarn running off the roller is always less than the tension in the piece of yarn which is entering or being supplied to the roller.

In a very advantageous form of the invention which requires little action on the mechanism of the weaving machine and which, for instance, enables existing machinery to be converted relatively cheaply, the drive means for the guide roller can be separate from the weaving-machine drive. It then becomes possible to use readily accessible and interchangeable components.

If, however, other points are important, e.g., if the machine is required to be of very simple construction or if it is necessary to limit the amount of alteration of a particular type of machine, then the drive means for the guide roller can be connected to the weaving-machine drive.

According to another feature of the invention, for accurate weft yarn guiding and, in wide machines, for storage and release in good time of the necessary yarn length, the guide roller can be disposed on a pivoted lever which has an independent drive facility.

A simple way of achieving accurate control of storage in association with the other functions of the machine is to have the drive means for the pivotal lever comprise a cam which cooperates with the weaving-machine drive. The cam can be devised exactly to suit the required pattern of movements so that, e.g., it is possible to choose within the cycle of operation, the optimum interval of time in which the yarn is stored but not released and vice versa.

In another embodiment of the invention and according to the construction of the machine, the movable guide element can be an endless belt-like or chain-like carrier or support or the like.

In still another embodiment of the invention, in order to ensure that the weft yarn does not slip off the roller despite the reduced weft yarn tension, the guide roller has a profiled running surface formed with a groove-like recess receiving the weft yarn and a cover provided at a radial distance from the guide roller outside edge less than the thickness of the weft yarn to be guided. The cover extends over the recess, is stationary relative to the roller and extends over some of the periphery of the roller.

To ensure against pulling of the weft yarn into the recess of the roller side distal from the yarn path where the yarn could be wound around the guide roller, a projection is disposed near the guide roller part remaining outside the yarn path. This projection is stationary relative to the guide roller and engages in the recess with radial and lateral clearance.

In still other embodiments, a pair of movable guide elements are used to vary the yarn path with each carrying a drive guide roller. In one case, the movable guide elements are moved in the same direction while in another case the guide elements are moved in opposite directions with respect to the yarn path.

These and other objects and advantages of the invention will become more apparent from the following de-

tailed description and appended claims taken in conjunction with the accompanying drawings in which:

FIG. 1 illustrates a partial elevational view of a weaving machine according to the invention, the view being in a section on the line I—I of FIG. 2;

FIG. 2 illustrates a sectional view taken on line II—II of FIG. 1;

FIG. 3 illustrates a view similar to FIG. 1 of a weaving machine using two movable guide elements which move in opposite directions in accordance with the invention;

FIG. 4 illustrates a view similar to FIG. 3 with two guide elements movable in the same direction according to the invention;

FIG. 5 illustrates a view similar to FIG. 1 of a movable guide element which uses an endless belt construction according to the invention;

FIG. 6 illustrates a view of a detail of the guide roller looking in the direction indicated by an arrow VI in FIG. 2; and

FIG. 7 illustrates a longitudinal section on the line VII—VII of FIG. 6.

Like elements have like references in the drawings.

Referring to the weaving machine shown in FIGS. 1 and 2, the weft-side machine-frame upright 1 mounts a means such as a stirrup 2 which carries a number of weft yarn supply bobbins 4, each mounted in a holder or carrier 3. Only a single bobbin 4 is shown for simplicity. A bobbin screen 5 is also secured to the member 2. This bobbin screen 5 has a number of eyes for guiding weft yarns 6 running off the bobbins 4.

A plurality of guide elements for guiding a weft yarn 6 are located between each bobbin 4 and a means for forming a shed. These elements include a yarn brake 6*a*, controllable from the weaving-machine drive, a stationary element such as a guide roller 7, a guide roller 8 movable transversely to the direct yarn path and another stationary element such as a guide roller 9. The weft yarn 6 is guided into a nozzle 10, disposed on side upright 1, of a pneumatic picker. This nozzle 10 is connected to a line 19 for supplying a continuous flow of air. For a predetermined interval of time in each cycle of operations, the air flow is increased. The increased air flow picks a weft into the shed formed by warp yarns 20 as is known.

The guide rollers 7, 9 are each disposed on a shaft of an electric motor 11. The two motors 11 are disposed on a bracket 12 mounted on upright 1 and are connected to a power supply (not shown). The movable roller 8 is disposed at one end of a pivotable lever 13 and is in driving engagement with a pulley 14 disposed at the other end of the lever 13. The lever 13 is secured in a collar 15, or the like, disposed on a carrier 16 pivotably mounted by means of a spindle 17 in a guide tube 18 secured to the upright 1.

Pivoted to one arm of carrier 16 is a thrust rod 21 which is connected to one arm of a roller-fitted lever 23 pivotable around a pivot 22 and cooperating with a double cam 24 disposed on a shaft 25 connected to the machine mainshaft.

The pulley 14 is connected via an endless belt 26 to a pulley 27 which is disposed on a shaft of a stationary electric motor 28 connected to a power supply (not shown).

Referring to FIG. 7, the lever 13 is formed by a tube 31 having a shaft 32 which projects at both ends of the tube 31. Each end of the shaft 32 is mounted in two ball bearings 33 which are disposed in the tube 31 and whose distance from one another is determined by a spacer ring 34. The pulley 14 is disposed on that end of the shaft 32 which is not shown, and the guide roller 8 is secured to the other end of the shaft 32, the latter end being visible in FIG. 7, by means of a nut 35 which is prevented from rotating by a split pin 36 or cotter or the like. The guide roller 8 is shaped in the circumferential surface with a groove-like recess 37 adapted to receive the weft yarn 6.

A flange 38 is secured to that end of the tube 31 which is near the guide roller 8. This flange 38 has two diametrically opposite overhung projections 39, 40 (FIG. 6). Each projection 39, 40 engages, with a radial clearance less than the thickness of the weft yarn 6, around a segment of the circumferential surface of the roller 8. One projection 39 covers that part of the yarn path which is near the roller 8, so that the weft yarn 6 cannot jump out of the recess 37. The other porjection 40 carries a profiled nose 41 which extends, with lateral and radial clearance, into that part of the recess 37 which remains outside the yarn path so that the nose 41 partly fills up the recess 37. The nose 41 ensures that the sagging piece of yarn is not pulled into this part of the recess 37 and wound around the roller 8.

In operation, a sufficient length of yarn for a pick is drawn off a bobbin 4 over end, formed into a loop between the guide rollers 7 and 9, and finally picked into the shed by a stream of compressed air. The yarn brake 6*a* is released in the time interval associated with the drawing-off and looping of the weft yarn 6. The motors 11 drive rollers 7, 9 in the direction indicated by arrows 7*a* and 9*a* respectively (FIG. 1), and motor 28 drives guide roller 8 continuously, in the direction indicated by an arrow 8*a*, via belt drive 27, 26, 14. After a previous pick, the lever 13 which carries the roller 8 moves into the chain-dotted position 13′ shown in FIG. 2. This draws the yarn 6 off the bobbin 4 and forms the loop of weft yarn. The cam 24, acting via the lever 23 and rod 21, then pivots the carrier 16 to pivot the lever 13 and roller 8 into the sold-line position shown in FIGS. 1 and 2. The stream of air which issues continuously from the nozzle 13 keeps the weft yarn 10 tensioned so that the yarn 10 cannot be pulled back. Consequently, the appropriate length of yarn is drawn off the supply bobbin 4 and stored as a loop for the next pick. Yarn brake 6*a* is then applied. In machines in which the amount of yarn stored is insufficient for a complete pick, the yarn brake 6*a* can stay off during all or some of the time interval associated with the next pick, so that yarn can be pulled off the bobbin directly by the picking means.

The drive means for the roller 8 — and in the example shown the drive for the rollers 7 and 9 — is so devised that the speed of rotation of the roller 8 is greater than the maximum likely speed of the weft yarn 6 running over the roller 8. The drawing-off power needed for the next pick, and therefore stressing of the weft yarn 6, is so reduced in accordance with the looping angle and the coefficient of friction between the yarn and the roller 8 that, for instance, there is less tension in the piece of yarn leaving the guide roller 8 than in the piece of yarn arriving thereat. The guide rollers 7, 9 can run slower or possibly be not driven at all or replaced by eyes or the like.

During the picking cycle time interval, the lever 13 pivots from the position shown into the position 13′ vis-

ible in FIG. 2. Simultaneously, the flow of compressed air supplied via line 19 is increased so that the weft yarn 6 is picked — from the yarn loop, which decreases in size as lever 13 descends — into the shed by the air stream issuing from nozzle 10. Upon completion of picking, the weft yarn is, in known manner, beaten up by a reed (not shown) at the selvedge where the cloth begins, and the shed is changed by a shed-forming device 29. The yarn brake 6*a* is released and the lever 13 pivots back into the solid-line position for the cycle described to repeat.

Referring to FIG. 3, the machine shown is devoid of a yarn brake and has two levers 13, 13*a*, each carrying a guide roller 8. Each of the two guide rollers 8 has a drive means corresponding to the components 14, 26–28, 32 of FIG. 1. Similarly, one drive means 16, 21, 23, 24 each is provided to pivot the levers 13, 13*a* oppositely to one another. Correspondingly, the roller 8 on the lever 13 can move between a solid-line top position and the position 8′, and the roller 8 on the lever 13*a* can move between a solid-line bottom position and the chain-dotted position 8″. The bottom roller 8 and the roller 9 are driven in the directions indicated by arrows 8*b* and 9*b*, respectively. The weft yarn 6 passes in one or more convolutions over a delivery roller 7*b*, over the two faster-running guide rollers 8 and over a guide roller 9 to a gripper shuttle 45 which is picked into the shed by a picking mechanism 46 on upright 1.

In operation, the weft yarn 6 is continuously drawn off the supply bobbin 4 by the roller 7*b*, driven by a motor 11, and formed into two loops by the two moving rollers 8. During picking, the rollers 8 move downwardly and upwardly respectively. As a result of the pivoting of the levers 13, 13*a* into the positions 8′ and 8″, the weft is picked from the loops which slacken as a result of the movements just described. After picking, the levers 13, 13*a* are pivoted, in a new storage step, towards the solid-line positions of FIG. 3. The construction shown in FIG. 3 is of use more particularly for machines having large cloth widths. For example, approximately twice the length of yarn can be stored as compared with the embodiment of FIG. 1.

Referring to FIG. 4, the weaving machine shown has a yarn brake 6*a*, two stationary guide rollers 7 and two levers 13. The two levers 13 are parallel to one another and are driven in the same sense. The guide rollers 8 can pivot between their solid-line positions and their positions 8′. With the yarn brake 6*a* off, the weft yarn is formed into two loops by the two moving guide rollers 8. The drive means for the rollers 8 and levers 13 are as for the machine of FIG. 1.

Referring to FIG. 5, the guide roller 8 can alternatively be mounted on a different movable guide element. As shown, the movable guide element is an endless belt 54 which is disposed between the rollers 7 and 9. This belt 54 runs around two pulleys 52, 53 which are disposed one above another on a vertical carrier 55 secured to the bracket 12. One pulley 52 is disposed on a shaft on which another pulley 51 is disposed. This latter pulley 51 is connected via a belt 59 to a pulley 60 which is disposed on a shaft 61 coupled with the machine drive.

The guide roller 8 is mounted in a carrier 56 secured to the belt 54. In addition, a friction wheel 57 is disposed on the shaft of the roller 8 and bears on a flange of a guide bar 58. The guide bar 58 extends parallel to the carrier 55 so that the flanges thereon serve as guideways for the friction wheel 57. To this end, the wheel 57 is of smaller diameter than the guide roller 8 and when the belt 54 is moving, is rotated and therefore drives the guide roller 8 in the direction indicated by the arrow 8*a*.

During operation, the weft yarn 6 passes via the rollers 7–9 to the picking nozzle 10. The belt 52 is driven as indicated by an arrow 52*a*. In the position shown, the guide roller 8 is descending, i.e., a pick is just in process of being made. While the roller 57 moves around the axis of the pulley 52, the yarn 6 passes in a straight line between the stationary rollers 7 and 9. The belt drives 51, 59, 60 and 52–54 are so devised that picking occurs during the descent of roller 8 and weft yarn storage occurs during the ascent of roller 8.

Depending upon the movement pattern required, the guide bar 58 can have an interrupted flange. In this case, the guide roller 8 is not driven in the interrupted or discontinuous zone.

Various other constructions are, of course, feasible. For instance, the drive of the moving guide element on which a guide roller is disposed can be derived from the machine drive in other than the manner described. Also, the drive means of a guide roller disposed on a pivoted lever can be connected to the machine drive.

Each of the guide rollers 7, 8 and 9 can be driven at a speed which is equal to or in any case less than the greatest speed of the yarn moving over them, with the result that correspondingly different tensions are produced in the weft yarn.

Instead of a belt (FIG. 5), a device such as an endless chain can be used in a similar construction. A chain or appropriate belt can extend over a number of deflecting elements, depending upon the movement pattern required in the cycle of operations.

The invention is also of use for weaving machines having picking facilities other than those described. For instance, the invention can be used in weaving machines in which picking is done by a gripper rod or by a water jet.

What is claimed is:

1. In a weaving machine having first means for forming a shed, second means for mounting a weft yarn supply bobbin outside said shed, and a plurality of guide elements between said shed and said second means for guiding a weft yarn to be picked into said shed, said guide elements including a pair of stationary elements, at least one of said guide elements being movable to vary the yarn path and form a loop of weft yarn between said stationary elements; a guide roller mounted on said movable guide element for passage of the weft yarn thereover and being rotatably mounted about a longitudinal axis and a drive means for rotating said roller about said axis in the direction of movement of the weft yarn to be picked.

2. A weaving machine as set forth in claim 1 further having a main drive shaft and wherein said drive means is independent of said drive shaft.

3. A weaving machine as set forth in claim 1 further having a main drive shaft and wherein said drive means is driven off said drive shaft.

4. A weaving machine as set forth in claim 1 wherein said movable guide element includes a pivotal lever and said roller is rotatably mounted on said lever.

5. A weaving machine as set forth in claim 4 further having a main drive shaft and wherein said drive means

includes a cam responsive to rotation of said drive shaft for synchronizing motion of said lever.

6. A weaving machine as set forth in claim **1** wherein said movable guide element is of endless belt construction.

7. In a weaving machine having first means for forming a shed, second means for mounting a weft yarn supply bobbin outside said shed, and a plurality of guide elements between said shed and said second means for guiding a weft yarn to be picked into said shed, at least one of said guide elements being movable to vary the yarn path; a guide roller mounted on said movable guide element for passage of the weft yarn thereover and being rotatably mounted about a longitudinal axis, said roller having a profiled circumferential surface including a groove-like recess for receiving a weft yarn and a cover extending over a portion of said recess in stationary relation and at a radial distance from said roller surface less than the thickness of the weft yarn and a drive means for rotating said roller about said axis in the direction of movement of the weft yarn to be picked.

8. A weaving machine as set forth in claim **7** which further has a projection mounted within said recess in stationary relation to said roller and outside of said yarn path, said projection being spaced from said roller with a radial and lateral clearance.

9. In a weaving machine having guide elements for guiding a weft yarn to be picked through a predetermined yarn path into a shed; said guide elements including a pair of stationary guide rollers and at least one movable guide roller between said stationary guide rollers to vary the length of said yarn path to form a loop of yarn between said stationary guide rollers, said guide roller being rotatably mounted about a longitudinal axis and a drive means for rotating said movable guide roller about said axis in the direction of movement of the weft yarn to be picked.

10. In a weaving machine as set forth in claim **1** wherein said drive means drives said guide roller at a speed greater than the maximum speed of the weft yarn running over said guide roller.

* * * * *