This invention relates to yarn carriers for straight, or full-fashioned hosiery knitting machines, and more particularly to those having associated therewith a releasably mounted yarn guide device, or tube, of the resilient type, such as disclosed in U. S. Patent No. 2,317,318 issued to F. G. Weisbecker on April 20, 1943.

One object of my invention is to provide a novel and improved resilient yarn guide device, or tube, for such yarn carriers, which can be readily produced by automatic machinery in that all, or certain of the constituent parts thereof, including a latch element, are formed from a single piece of resilient or other material, or wire.

Another object is to provide such a resilient yarn guide device, or tube, having a novel and improved latch element integrally united therewith, at one end thereof, or intermediate of its ends.

An additional object is to provide novel and improved retaining means for the replaceable and resilient yarn guide device, or tube, of such a yarn carrier.

It is also an object to provide such a yarn carrier with novel resilient yarn guide means having structural and functional features of advantage over similar devices of the prior art.

With these and other objects in view, which will become readily apparent from the following detailed description of the practical illustrative embodiments of my novel yarn carrier improvements, shown in the accompanying drawings, the invention comprises the new elements, features of construction and arrangement of parts in cooperative relationship, as herein disclosed and more particularly pointed out in the appended claims.

In the drawings:
Figure 1 is a front elevational view, on an enlarged scale, of the lower end of a conventional yarn carrier of the type illustrated in U. S. Patent No. 2,317,318, having my invention applied thereto.

Fig. 2 is a view corresponding to Fig. 1, and shows another embodiment of my invention.

Fig. 3 is an enlarged front elevational view of the yarn guide device, or tube, of Fig. 1.

Fig. 4 is an enlarged front elevational view of the yarn guide device, or tube, of Fig. 2.

Fig. 5 is an enlarged cross-sectional view taken as indicated by the arrows 5–5 on Fig. 1.

Fig. 6 is an enlarged cross-sectional view taken as indicated by the arrows 6–6 on Fig. 2.

Fig. 7 is a cross-sectional view similar to Fig. 5, and illustrates how the latch element of my novel yarn guide device is moved forward to effect release of the latter.

Fig. 8 is a view similar to Fig. 7, and likewise illustrates the latch release position of the form of my novel yarn guide device shown in Figs. 2, 4 and 6.

Figs. 9 and 10 are perspective views of the lower ends of two conventional yarn carriers of the type having an offset or bent portion, as disclosed in said U. S. Patent No. 2,317,318, however adapted, or modified, for cooperative association with my novel yarn guide devices shown in Figs. 3 and 4, respectively.

Figs. 11 and 12 are perspective views of the lower ends of the yarn carriers of Figs. 1 and 2, respectively, with the yarn guide devices, or tubes, omitted.

Fig. 13 is a view corresponding to Figs. 1 and 2, but on a larger scale, and shows another embodiment of my invention.

Fig. 14 is a view corresponding to Fig. 13, but with the yarn guide device omitted.

Fig. 15 is an elevational view of the yarn guide device, or tube, of Fig. 13.

Fig. 16 is an enlarged cross-sectional view, taken substantially as indicated by the arrows 15–16 on Fig. 13.

Since my invention is primarily directed to the improvement of the replaceable, or releasably mounted resilient yarn guide devices, or tubes, such as are cooperatively associated with the lower ends of yarn carriers for straight or full-fashioned hosiery knitting machines, of the general type disclosed in the above referred to Patent No. 2,317,318, the drawings hereof depict only those pertinent parts of such a yarn carrier as are directly associated with, and related to my novel improvements. For more detailed information concerning the construction and operation of a complete conventional yarn carrier of the type to which this invention relates, and its use on a straight or full-fashioned hosiery knitting machine, reference may be had to the noted patent, as well as to U. S. Patent No. 2,014,341, which issued September 10, 1935.

The practical embodiment of my invention illustrated by Figs. 1, 3, 5, 7 and 11, comprises a conventional yarn carrier arm 20, the lower end of which is constructed and arranged to support one form of my novel flexible yarn guide device, or tube, generally indicated by the reference numeral 21.

The yarn guide device 21, is formed of a single piece of resilient material, or wire, and comprises a resilient tubular part, or section 22, which is
adapted to be releasably associated with the yarn carrier arm 20, and a latch element 23, which extends crosswise in opposite directions beyond the upper end of the tubular section 22, and is arranged to cooperate with complimentary latch means on the yarn carrier arm 20.

The resilient tubular section 22, and the latch element 23, are preferably made from a single continuous piece of flat resilient wire, with the tubular section 22 in the form of spirally wound convolutions containingly arranged edge-to-edge in such manner as to provide a tube construction of either cylindrical or longitudinally tapered configuration.

As shown more particularly in Fig. 3, the latch element 23 is formed by extending the wire from the top convolution of the tubular section 22, first laterally in one direction to provide the straight part 23a, then laterally in the opposite direction to form an arcuate part 23b, and then bending the end piece 23c back along the concave surface of the part 23a.

Since it has already been found in practice that the spiral winding of a wire to form the tubular section 22 can be readily carried out by an automatic machine, and the latch element 23 may be formed as a few simple wire bending operations, it will be realized that the entire yarn guide device, or element 21, is subject to production by automatic machinery. This constitutes an important feature of my invention, and one which is believed to be of real significance in that it greatly facilitates the production, and reduces the manufacturing cost, of such devices.

As previously indicated, the yarn carrier arm 20 is generally constructed and shaped in accordance with the type of carrier arm disclosed in U. S. Patent No. 2,917,318. The lower section of such a yarn carrier arm is usually tapered longitudinally so that its thinnest portion is at the end arranged to support the yarn guide device, or tube 21. This end of carrier arm 20 is also tapered to its opposite edges, as shown in Figs. 5 and 7.

It is noted that conventional straight, or full-fashioned hosiery knitting machines have as many as seven or nine yarn carriers for use in knitting with a flat or i.e. fabric, or blank, and that the lower ends of the yarn carriers 20, travel in closely spaced parallel paths, the individual carriers having reciprocating movement and traveling in an edgewise direction.

Along the longitudinal center line, the thickness of the arm 20 may be substantially the same, or only a little greater, than the external diameter of the upper end of the tube 22, depending upon the number of yarn carrier arms operating in a given knitting machine section, and consequently the space available to permit the individual arms to freely pass each other, as well understood in the art.

In conformity with prior practice, the bottom edge 24 of the carrier 20 is of such curved configuration as to provide space for free lateral flexing movement of the protruding end of the resilient yarn guide tube 22.

A bore or passage 25 extends along the center line of the carrier arm 20 from the bottom edge 24 to an eye, or aperture 26. The diameter of the bore 25 is such as to provide a free sliding fit for the yarn guide tube 22. Where the central section of the carrier arm 20 is thicker than the diameter of the bore 25, and the bore is located in the middle thereof, the process of forming the bore 25 will not result in a break in the front or rear faces of the carrier arm. Where, however, the bore is located substantially flush with the front face of the carrier 20, to provide a continuous wall section in the carrier at the rear of tube 22, the said process will effect a slight separation in the front face, as indicated at 27 in the drawings.

The aperture 26 is relatively narrow so as to avoid weakening of the yarn carrier arm 20, and is preferably not much wider than the external diameter of the yarn guide tube 22. Where the carrier arm 20 is of sufficient thickness, a recess may be provided in place of the aperture 26, to thereby leave the reverse carrier face unbroken.

As shown in Fig. 9, if the carrier arm is of the type having a bend 26, the upper end of aperture 26 is terminated adjacent to, and below the bend, and a yarn guide groove 23 is provided along the front face of the carrier arm 20 which terminates at the aperture 26.

To retain the device 21 in operative position on the carrier arm 20, the latter is provided with complementary latch means for the latch element 23, comprising a recess, or recesses 30, formed in the front face of the carrier arm 20, which extend laterally from opposite sides of the aperture 26. As clearly shown in Figs. 5 and 6, the recesses 30 are of such size and shape as to substantially conform with the size and shape of the latch element 23 of the device 21, so as to form a cooperating seat, or socket for said element. The tubular portion 22 is of such length that, when the latch element 23 is in position in the recesses 30, the portion 22 extends downwardly, partly through the aperture 26, through the bore 26 and beyond the lower end of the latter. To a point located its tip in proper position relative to knitting needles and the other knitting elements with which the yarn carrier cooperates during its yarn laying or feeding operation.

As previously indicated, if the tubular portion 22 which projects below the end of the carrier 20 strikes an obstruction during use of the yarn carrier on a knitting machine, the projecting tube end will yield due to its flexible construction. When the obstruction has been passed, the deflected tube end will return to normal yarn feeding position due to its resiliency. During such yielding movements, the projecting tube end can freely move in the space defined by the curved bottom edge 24 of the carrier arm 20.

The yarn guide device 21 can be readily removed from the carrier arm 20 by pressing the latch element 23 forwardly, as shown in Fig. 7, and then sliding the tube portion 22 endwise upwardly, until the bottom tip of the tube is withdrawn from the bore 25. The tube removal may be accomplished with suitable tweezers, or other equivalent means. The tweezers are manipulated to grip the tubular portion 22 adjacent to, and below the latch element 23, and when so held, the indicated withdrawing movement of the tube 22 can be readily carried out.

The device 21 may be inserted in place in the carrier arm 20 by placing the bottom tip of the tubular section 22 in the aperture 26, and then in the upper end of the bore 25. When endwise force is then exerted on the device 21, in a downward direction, it will slide into position in the bore 25. As the latch element 23 assumes a position opposite the recess or recesses 30, the latch element, due to the resiliency of the flexible tube portion 22, snaps into the recesses and occupies the position illustrated in Fig. 5. The resiliency of the tubular portion 22 opposes any
tendency of the latch element 23 to move out of its recesses 30, and the device 21 is thus retained in assembled relation with the carrier arm 20. The latching means just described also prevents longitudinal movement of the yarn guide device 23 along the carrier arm 20, and the tubular member 23 is thus held in proper yarn laying, or feeding, position on the carrier arm 20. It is also noted that the resiliency of the tubular member 22, of the device 21, opposes any tendency of the latch element 23 becoming unseated due to jarring of the yarn carrier while in operation of the machine, and additionally provides the desired yieldability and resiliency which facilitates quick and easy withdrawal and replacement of the device by the machine operator, or attendant.

The curved part 23a of the latch element 23, contacting the corresponding walls of the recesses 30 and this arrangement, together with the side walls of the recesses, effects adjustment of the latch element 23, under the influence of the resilient tubular section 22, so that the latter automatically assumes the straight line position shown in the drawings. The embodiment of my invention disclosed by Figs. 2, 4, 6, 8 and 12 of the drawings, differs from the embodiment already described only in the provision of a modified form of latching means for the yarn guide device 21, and correspondingly modified form of the complementary latching means on the support or arm 20. To facilitate an understanding of the differences involved, the same reference numerals used in connection with the description of the first embodiment, have consequently been applied to the corresponding parts in the illustrations of the said figures, and only the variations are designated by new reference characters.

In this second embodiment of my invention, the latch element 34 is also formed from the same resilient face of wire comprising the tubular section 22. The wire is extended laterally from the top convolution of the section 22, and its end is hook-shaped as indicated at 34e.

As shown in Figs. 6, 7, and 8, a continuous recess or groove 31, in the carrier arm 20, extends sidewise across the right front face section of the latter, around its right edge, and partly along its rear face, to snugly accommodate the hook-shaped latch element 34. To release the yarn guide device having the latch element 34 at its top, from the operative position shown in Fig. 2, the latch element 34, and the integral upper end of the yarn guide tube 22 extending into the aperture 26, are moved laterally to the right, and forwardly, as shown in Fig. 8, until the hook-shaped end 34e is released from engagement with the yarn carrier 20. The tubular section 22 can then be withdrawn from the bore 26, by an upward movement of the entire device 21 through the aperture 26. Insertion of such a yarn guide device can, of course, be accomplished by taking these steps in reverse order. As explained in connection with the previously described embodiment of my invention, successors may be employed for the purpose of removing or replacing this second form of yarn guide device.

It is to be noted that the two embodiments of my invention which have so far been described, include a resilient yarn guide device, or tube, having a latch element integrally formed at its top. It is also within the purview of my invention to provide such a yarn guide device having a latch element integrally united with the resilient yarn guide tube intermediate of its ends. Such an arrangement is disclosed in Figs. 13, 14, 15 and 16 of the drawings. Here again, certain of the parts of the yarn guide arm and resilient tubular yarn guide correspond with those of the previously described embodiments of my invention, and such parts are consequently designated by corresponding reference numerals.

By referring more particularly to Fig. 15, it will be seen that the resilient tubular section of the yarn guide device 21 is, in this instance, provided with a latch element comprising an expanded portion 35. This portion 35 is produced by first progressively increasing and then decreasing the diameter of certain convolutions of the yarn guide tube formed of resilient wire. Accordingly, convolution 35a is of slightly greater diameter than the preceding convolutions forming the lower section 22a of the yarn guide tube, whereas convolution 35b is slightly larger than that designated 35a; and convolution 35c is slightly smaller than that designated 35b, but slightly larger than the diameter of the upper tube section 22c. It will be understood that more than, or less than, three convolutions of the resilient wire forming the yarn-guide tube can be arranged in this manner, if desired, but I have found that the arrangement as disclosed in Fig. 15 will provide a practical and satisfactory latch element of this type.

The yarn carrier arm 20 is correspondingly modified to include complementary seat, or socket means for the latch element 35, comprising an aperture 36, which in outline substantially corresponds with the outline, or contour of the enlarged tubar portion forming the latch element 35. As shown, the aperture 36 is located in the carrier arm 20 intermediate the aperture 26 and the bore 25. A groove or channel 37 is provided in the carrier 20, intermediate the apertures 26 and 36, which channel is of a width slightly greater than the outer diameter of the upper tubular section 22c of the yarn guide device 21, so as to snugly accommodate the latter when the yarn guide device 21 is in active position on the yarn carrier 20, as shown in Fig. 13.

In order that the latch element 35 may not extend beyond the front or rear faces of the yarn guide arm 20, the wire convolutions comprising the same are compressed so as to take on an elliptical shape, as clearly shown in Fig. 16. It will be noted that the spiral convolutions comprising the latch element 35, at their narrowest or central sections, provide a yarn passage which is at least equal in diameter to that of the upper and lower resilient sections 22a and 22c of the yarn guide tube.

As in the case of the previously described embodiments, vertical movement of the tube 22 is prevented by the snugly fitting association of the latch element 35 with its complementary element, or aperture 36, in the yarn guide arm 29. To prevent the device 21 from rotating, or shifting in such manner as to cause edgewise disalignment of element 35 relative to the aperture 36, the width of the latter is made slightly less across its central section than the widest convolution 35c. As a result, the latter is slightly tensioned or compressed, and frictionally engaged with the lateral walls of aperture 36, and held in place with sufficient tensional force to prevent any rotating tendency of device 21 when in cooperative association with the carrier arm 20.

To remove the yarn guide device 21 from the
carrier 20, the latch element 35 and the upper section 22 of the yarn guide tube beyond the latch element 35, are pressed forwardly to a point freeing the latch element 35 from the walls of the aperture 36. The device 21 can then be withdrawn from the core 25 by an upward movement.

Of course, it will be apparent to those skilled in the art that the improvements herein shown and described are subject to various changes, modifications and additions, without departure from the invention disclosed. For example, in accordance with the prior art practice, a hardened steel, or other form of wear-resistant tip, can be added to the lower ends of the various resilient yarn guide tubes herein shown and described, in accordance with the disclosure of U. S. Weisebecker Patent No. 2,218,977, or other conventional features can be combined with the several embodiments of my invention, the scope of which is more particularly defined by the hereto appended claims.

I claim:

1. A knitting machine yarn guide device adapted to be releasably associated with a support and comprising, a yarn guide section provided with an integral part which extends beyond the confines of said section and forms a latch element adapted to cooperate with complementary latching means on the support for retaining the device in position on the latter.

2. A knitting machine yarn guide device adapted to be releasably associated with a support and comprising, a tubular yarn guide section formed from a single piece of spirally arranged flexible material a part of which extends beyond said section and is shaped to provide a flexible latch element adapted to cooperate with complementary latching means on the support for retaining the device in operative position on the latter.

3. A knitting machine yarn guide device adapted to be releasably associated with a support and comprising, a tubular yarn guide section formed from a single piece of spirally arranged resilient material a portion of which extends beyond the end convolution of said section and is shaped to provide a latch element adapted to cooperate with complementary latching means on the support for retaining the device in operative position on the latter.

4. In a yarn carrier for knitting machines, the combination comprising a relatively rigid yarn carrier arm, a removable yarn guide tube supported by said arm and having a portion thereof of resilient construction in the form of a coiled wire provided with an integral latch element, means on said carrier arm arranged to cooperate with said element for retaining the tube and carrier arm in assembled relationship said tube being removable from said arm by flexing said tube to disengagae said latch element and sliding said tube endwise.

5. A knitting machine yarn guide device formed from a single piece of resilient material and comprising in combination, a yarn guide member adapted to be releasably associated with a support, and a resilient latch element on said member arranged to cooperate with complementary latching means on the support for retaining the device in operative position on the latter.

6. A knitting machine yarn guide device formed from a single piece of resilient wire and comprising in combination, a yarn guide member adapted to be releasably associated with a support, and a resilient latch element on said member arranged to cooperate with complementary latching means on the support for retaining the device in operative position on the latter.

7. A knitting machine yarn guide device formed from a single piece of resilient wire and comprising in combination, a flexible tubular yarn guide member adapted to be releasably associated with a yarn carrier arm, and a resilient latch element on said tubular member arranged to cooperate with complementary latching means on the yarn carrier arm for retaining the device in operative position on the latter.

8. A knitting machine yarn guide device formed from a single piece of resilient wire and comprising in combination, a tubular yarn guide member adapted to be releasably associated with a yarn carrier arm, and a resilient latch element at one end of said tubular member arranged to cooperate with complementary latching means on the yarn carrier arm for retaining the device in operative position on the latter.

9. A knitting machine yarn guide device formed from a single piece of resilient wire and comprising in combination, a tubular yarn guide member adapted to be releasably associated with a yarn carrier arm, and a resilient latch element extending crosswise in opposite directions beyond the upper end of said tubular member and arranged to cooperate with complementary latching means on the yarn carrier arm, for retaining the device in operative position on the latter.

10. A knitting machine yarn guide device formed from a single piece of resilient wire and comprising in combination, a tubular yarn guide member adapted to be releasably associated with a support, and a resilient latch element intermediate the ends of said tubular member arranged to cooperate with complementary latching means on the support for retaining the device in operative position on the latter.

11. A knitting machine yarn guide device formed from a single piece of resilient wire and comprising in combination, a tubular yarn guide member adapted to be releasably associated with a support, and a resilient latch element on said member arranged to be brought into tensioned engagement with complementary latching means on the support.

12. A knitting machine yarn guide device formed from a single piece of resilient wire and comprising in combination, a resilient tubular yarn guide member adapted to be releasably associated with a yarn carrier arm, and a resilient latch element extending laterally beyond the upper end of said tubular member and arranged to cooperate with complementary latching means on the yarn carrier arm for retaining the device in operative position on the latter.

13. A knitting machine yarn guide device formed from a single piece of resilient wire and comprising in combination, a resilient tubular yarn guide member adapted to be releasably associated with a yarn carrier arm, and a resilient latch element extending laterally beyond the upper end of said tubular member and arranged to cooperate with complementary latching means on the yarn carrier arm for retaining the device in operative position on the latter.
latch element extending laterally beyond the upper end of said tubular member and arranged to cooperate with complementary latching means on the yarn guide arm for retaining the device in operative position on the latter.

15. A knitting machine yarn guide device formed from a single piece of resilient wire and comprising in combination, a resilient tubular yarn guide member adapted to be releasably associated with a yarn carrier arm, and a latch element in the form of an enlarged resilient section intermediate the ends of said yarn guide member arranged to cooperate with complementary latching means on the yarn carrier arm for retaining the device in operative position on the latter.

16. A knitting machine yarn guide device comprising in combination, a resilient tubular yarn guide member adapted to be releasably associated with a support, and a resilient latch element in the form of an enlarged elliptically-shaped section intermediate the ends of said tubular member arranged to be brought into tensioned engagement with complementary latching means on the support for retaining the device in operative position on the latter.

BENJAMIN SUBIN.