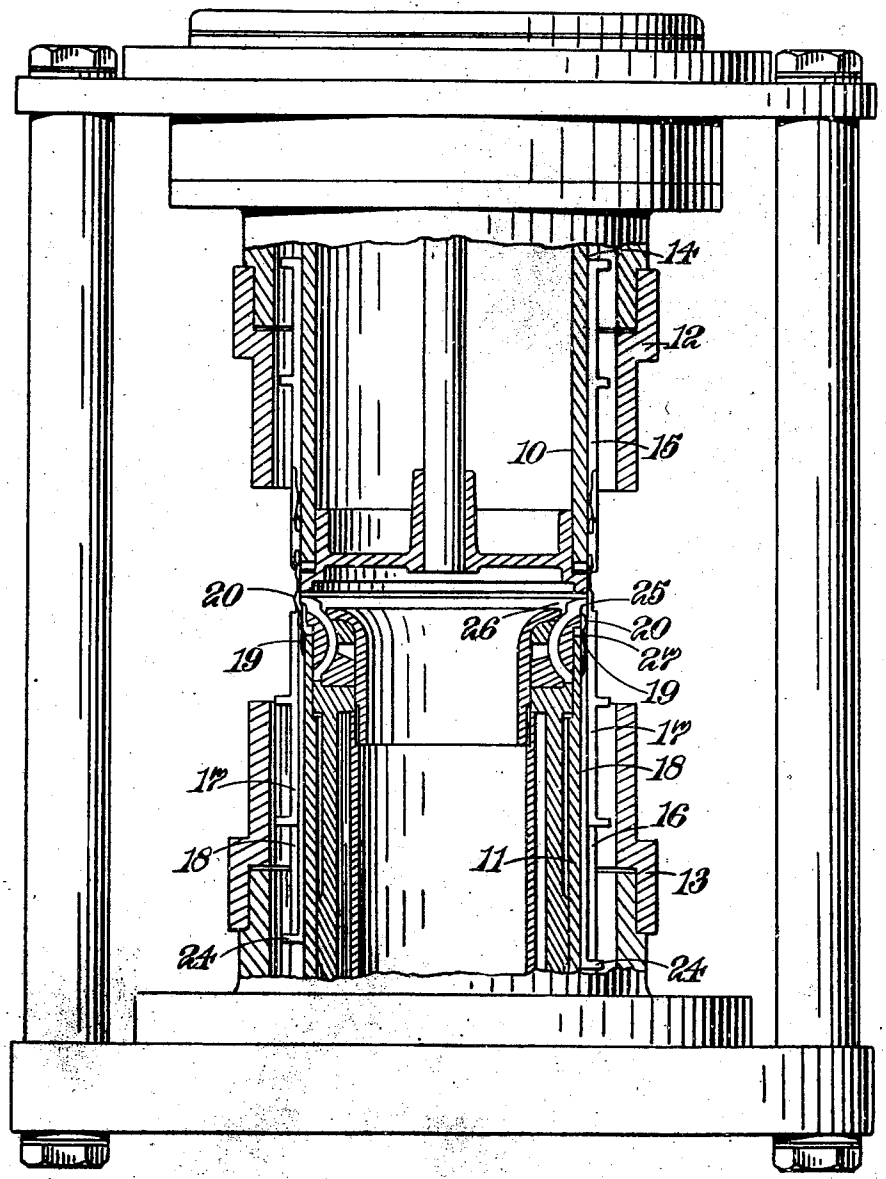
July 31, 1945. E. BROOKSBY ET AL 2,380,822

KNITTING MACHINE.

Filed Aug. 7, 1943 4 Sheets-Sheet 1

Fig. 1.



Inventors
Ernest Brooksby
and Frederick E. Deans
By Watson, Cole, Grindle & Watson
Attorneys

July 31, 1945. E. BROOKSBY ET AL 2,380,822

KNITTING MACHINE

Filed Aug. 7, 1943 4 Sheets-Sheet 2

Fig.2.

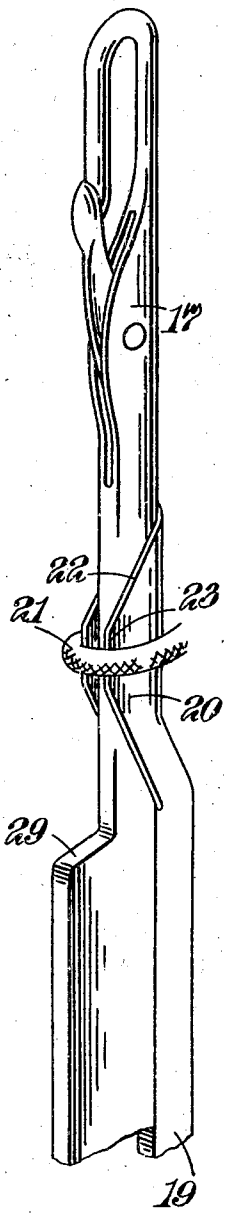


Fig.3.

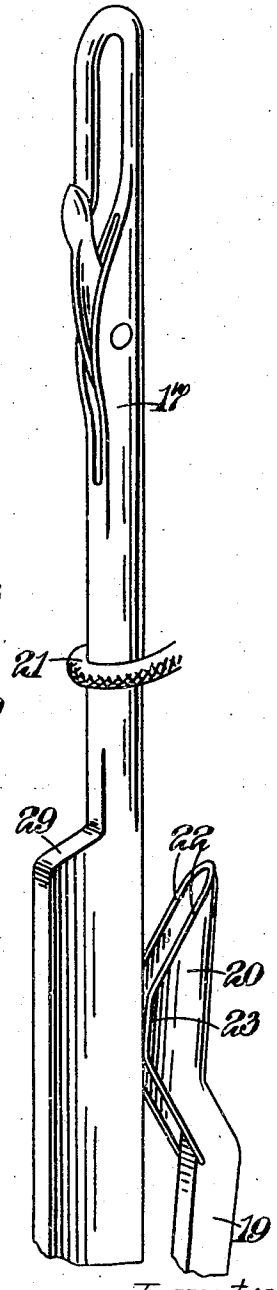
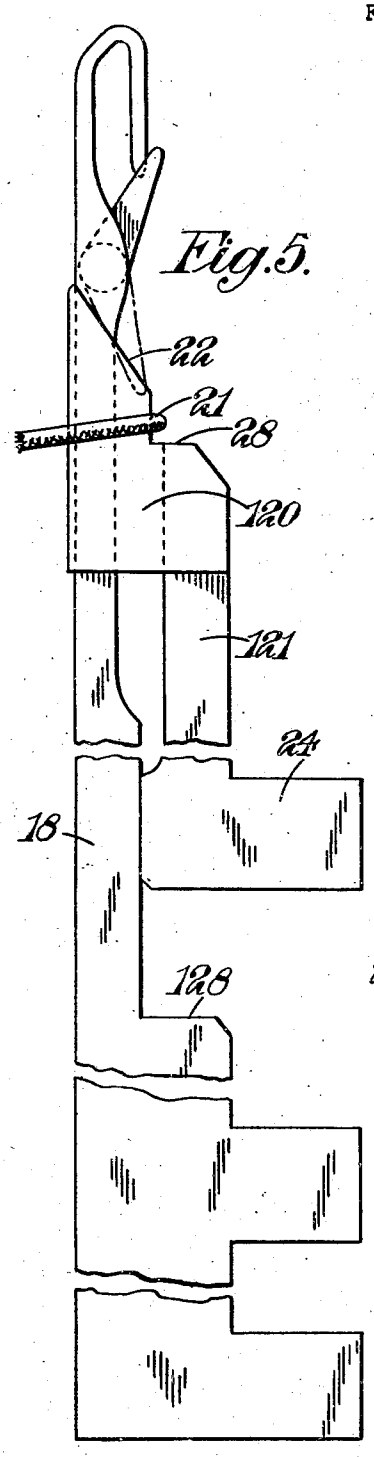


Fig.5.



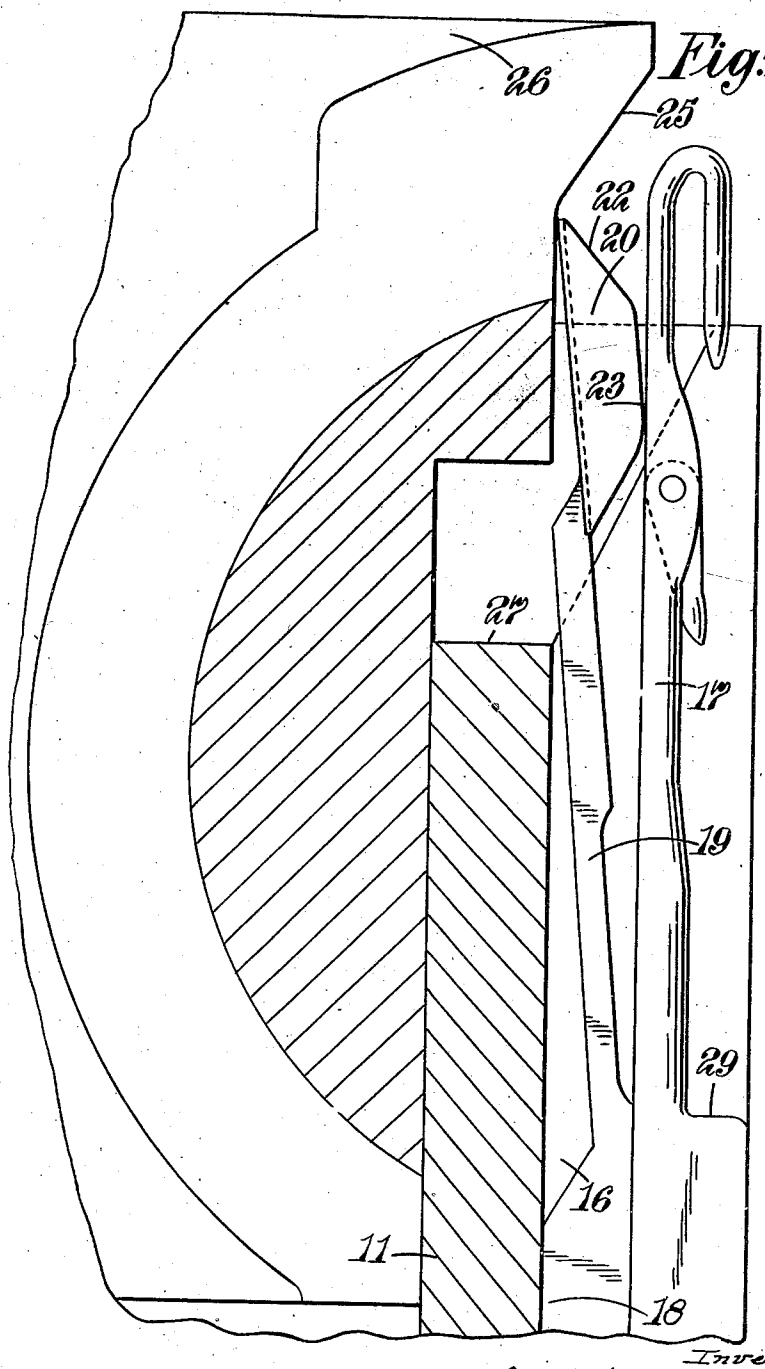
Inventors
Ernest Brooksby and Fredk. E. Deans
By Watson, Cole, Grindle & Watson
Attorneys

July 31, 1945. E. BROOKSBY ET AL 2,380,822

KNITTING MACHINE

Filed Aug. 7, 1943 4 Sheets-Sheet 3

Fig. 4.



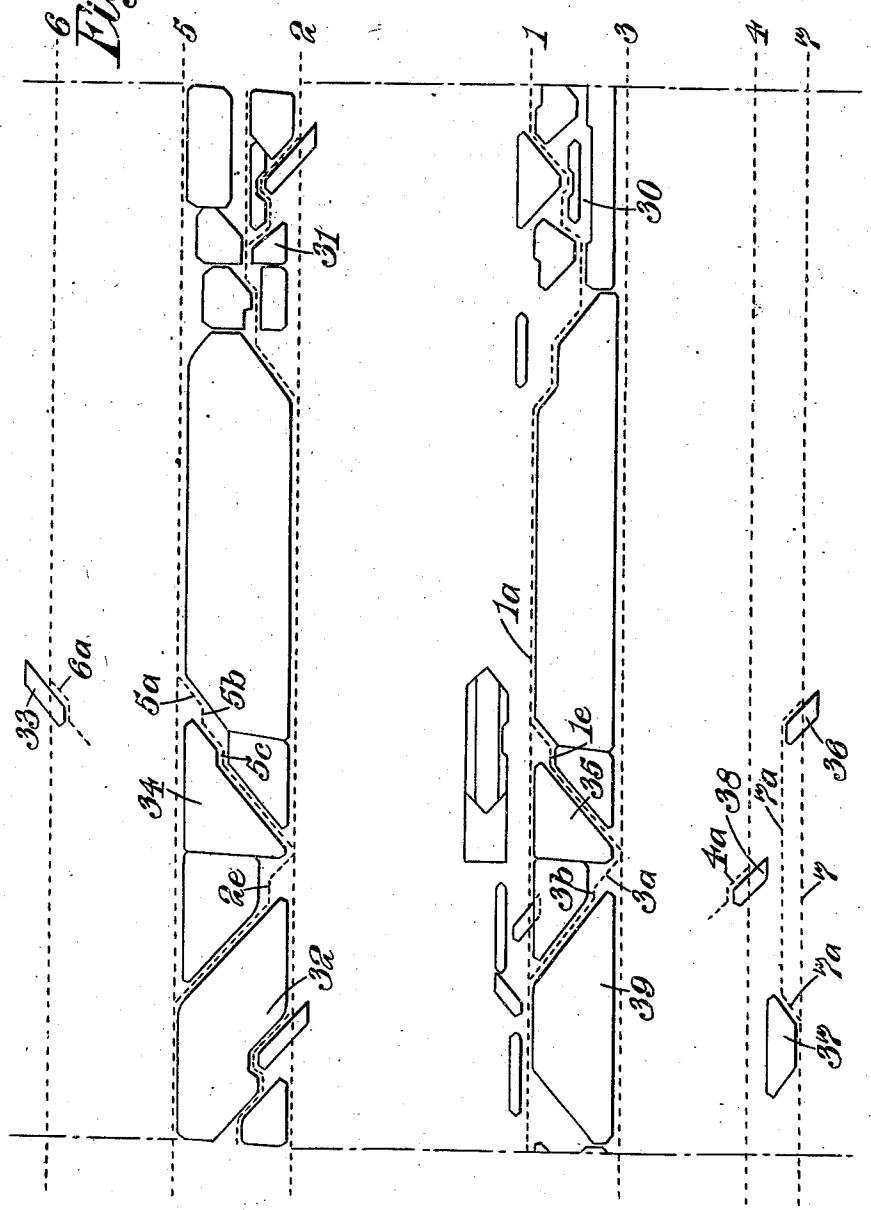
Inventors
Ernest Brooksby 3rd Fredk. E. Deans
By Watson, Cole, Grindle & Watson
Attorneys.

July 31, 1945. E. BROOKSBY ET AL 2,380,822

KNITTING MACHINE

Filed Aug. 7, 1943 4 Sheets-Sheet 4

Fig. 6.



Inventors
Ernest Brooksby and
Frederick E. Deans
By Watson, Cole, Grindle & Watson
Attorneys

Patented July 31, 1945

2,380,822

UNITED STATES PATENT OFFICE

2,380,822

KNITTING MACHINE

Ernest Brooksby and Frederick Edward Deans, Leicester, England, assignors to The Bentley Engineering Company Limited, Leicester, England, a British company

Application August 7, 1943, Serial No. 497,827
In Great Britain July 20, 1942

17 Claims. (Cl. 66—29)

This invention consists in improvements in or relating to knitting machines of the type having independently movable latch needles and is applied particularly, although not exclusively, to circular rib knitting machines of the superposed cylinder type.

However it has been proposed in single cylinder machines to transfer the loops automatically from one needle to another in the same bed. For this purpose transferring instruments are provided to co-operate with each needle to or from which loops are to be transferred.

In the case of a superposed cylinder type of machine it has been customary, however, to employ double-ended needles which when a transfer is to be made are moved bodily from the trick of one cylinder into a corresponding trick in the other.

The present invention comprises an improved transfer instrument having a body part received within the needle trick and near its end a sheath which embraces the needle, is movable at will to enter a stitch and is so shaped as to expand and hold the stitch so that it can be cleared from one needle, whereafter another needle can be entered into the sheath and the stitch held thereby.

In one form of the invention the transfer instrument is formed with a needle-embracing sheath so designed as to lie behind the needle so that the sheath will embrace the needle from behind and the sheath is carried on a resilient portion of the instrument which, when it is not in operation, will normally spring back clear of the needle and the stitches formed thereby. In other words, when a transfer instrument is lying behind an associated needle, the natural set of the resilient portion will hold the sheath in a position in which it does not embrace the needle but lies wholly or substantially wholly behind the latter in the needle trick.

Since the sheath will be necessarily wider than the needle it is preferred to accommodate the sheath in a space provided for it between the needle cylinder and the sinker ring in order to enable the fineness of the gauge of the needle tricks to be maintained.

Conveniently, such a transfer instrument is combined with a cam surface or cam surfaces in or associated with the needle cylinder whereby as the transfer instrument is moved into an operative position the cam surface will press outwardly the resilient portion of the instrument together with its sheath to a position at which the latter can enter a stitch drawn by an associated needle, and will then hold the stitch so that it may be completely cleared from that needle to be subsequently entered by a companion needle to which the stitch is to be transferred.

The invention also includes a construction of transfer instrument in which the said instrument is received within a needle trick in front of a needle and has a sheath of U-shaped section which extends around the body part of both sides and embraces the needle. The sheath is preferably formed of relatively thin material welded or otherwise secured to the body portion.

Alternatively, such a transfer instrument may be formed in any other way which will provide a body portion having in rear of it a slot in which the needle shank is received and which affords a loop-receiving sheath.

Such a transfer instrument will be provided with a shoulder on which the yarn rests in order to prevent the yarn from entering the hooks of inoperative sinkers during the knitting of heel and toe pouches.

In the case, however, of the first-described construction in which the sheath lies behind the needle such a shoulder is not possible and in consequence the needle itself is formed with such a shoulder.

The foregoing and other features of the invention will be more clearly understood from the following description of two preferred forms of the invention, in which—

Figure 1 illustrates essential portions of a superposed cylinder machine necessary to the understanding of the present invention;

Figures 2 and 3 are perspective views on an enlarged scale of a needle and the sheath portion of an associated transfer instrument in two different positions;

Figure 4 is an enlarged view of a fragment of the upper portion of the lower cylinder showing, in a section corresponding to Figure 1, a needle and its transfer instrument in relation to the needle trick and the sinker ring when both the needle and the transfer instrument are inoperative;

Figure 5 shows a modified form of transfer instrument which lies to the front of the needle, and

Figure 6 illustrates schematically a development of a cam system for a superposed cylinder type of machine for actuating the transfer devices.

Like reference numerals indicate like parts in the several figures of the drawings.

In Figure 1 an upper needle cylinder 10 and

a lower needle cylinder 11 are shown in their relative positions mounted in a framework for a knitting machine which may be of any preferred construction and may provide any preferred form of drive for the needle cylinders. The latter are surrounded by stationary cam boxes 12 and 13 respectively. In the upper cylinder, needle tricks 14 are shown with needles 15 therein, whereas in the lower cylinder needle tricks 16 are illustrated as accommodating lower cylinder needles 17 and transfer instruments 18.

Figures 2 and 3 illustrate a needle and the upper portion of an associated transfer instrument. As shown in Figure 1, the transfer instrument as a whole lies in the needle trick behind the needle and at its upper extremity is formed with a relatively narrow and resilient neck 19 terminating in a U-shaped sheath 20 which normally lies behind the needle owing to the resilience of the neck portion. The upper portion of the transfer instrument is shown in its inoperative position in relation to a needle in Figure 3 and it will be understood that when a stitch transfer is to be made, the sheath 20 is moved forwardly to embrace the needle and is thus relatively adjusted with respect to the needle so as to enter a formed loop 21 held by the needle as shown in Figure 2. The tip or extremity of the portion 20 is more or less pointed or shaped so that it will readily enter the stitch and the sloping edges 22 will, as the transfer point enters the stitch, expand the latter outwardly until, as in Figure 2, it reaches that position on the sheath giving maximum expansion to the stitch. At this position the sheath is flattened at the region indicated at 23 in order to allow the stitch to remain firmly thereon.

The resilient upper portion of the transfer instrument is conveniently formed in one piece with the shank thereof as illustrated and at the lower end the shank is formed with a butt 24 by which the instrument is actuated by cams in a manner to be described hereinafter.

The resilient shank portion may, if preferred, be formed separately from the rigid body portion of the instrument and may be interconnected therewith in any preferred manner, so that the two are movable together by the cams provided for the purpose of actuating the transfer instruments.

On the other hand, it is not essential that a transfer instrument having a resilient shank of the kind just described should be constructed so that it must necessarily lie behind the needle. The transfer instrument itself could be situated as a whole in front of the needle or while the body of the instrument may lie behind the needle, the resilient portion of the sheath may be so formed as to embrace the needle from the front.

In order to move the sheath 20 from the position of Figure 3 to that of Figure 2, a cam surface or surfaces are provided in the machine which, as the transfer instrument is raised upwardly from the position shown in Figures 1 and 3, will cause the resilient upper portion to be moved outwardly to the position of Figure 2. Such a cam surface or surfaces can conveniently be provided by a shaped upper periphery 25 of sinker ring 26. Alternatively, an annular portion providing the surface 25 can be formed separately from and secured to the sinker ring. In the normally inoperative position of the transfer instrument the sheath portion or head 20 will lie below this cam surface 25 as shown in Figure 1, but when the transfer instrument is raised it will engage the conical surface 25 and will be forced outwardly to the position of Figure 2.

The sheath portions of the transfer instrument would, if they were accommodated within the needle tricks, necessitate the widening of the tricks to a degree which would interfere with the requisite fineness of gauge of the machine. Consequently, the needle tricks terminate at a height 27 (Figures 1 and 4) which affords space in the sinker ring above the tricks in which the sheath portions are received.

In a modified form of the invention as illustrated in Figure 5, a construction of transfer instrument is shown in which the body portion of the transfer instrument lies in front of the needle in the needle trick and at its upper end is provided with a sheath 120 which is preferably formed of sheet material of U-section in a plane transverse to the length of the needle, the loop of the U-section embracing the back of the needle and the extremities secured by welding or otherwise to the upper end of the shank 121. In this case also the upper extremity provides a pointed or sloping surface 22 to facilitate entry of the transfer instrument into a previously formed loop 21.

In order to obviate the danger of feed yarn entering hooks of inoperative sinkers during reciprocating knitting for the production of heel and toe pouches, a shoulder 28 is provided on which the yarn can rest. In the case, however, of the form illustrated in Figures 1 to 4, the formation of such a shoulder is impossible and in consequence the needle itself is provided with a shoulder 29 to serve the same purpose.

In the case of the form shown in Figure 5, the transfer instrument may be moved into the position just described by actuating the needle 18 so that a shoulder 128 on the needle will engage beneath the lower extremity of the shank 121 of the transfer instrument when the needles are raised to the inoperative position during the knitting of the heel and toe pouches.

In Figure 6, a cam system is shown in which dotted lines 1 and 2 represent the knitting tracks for the needle butts of the lower and upper cylinders respectively; dotted lines 3 and 5 represent the tracks of the needle butts in the out-of-action position; and lines 4 and 6 similarly represent the needle transfer butt out-of-action tracks.

The cam systems indicated as a whole by reference numerals 30 and 31 are respectively the knitting cam systems for the lower and upper cylinders and that portion of the cam system indicated by reference numeral 32 is the welt cam system for the upper cylinder. The cam arrangements 30, 31 and 32 are all described in detail in the specification of co-pending United States application for Letters Patent Serial No. 497,826 to which reference may be made for a further understanding of their action, but as per se they form no part of the present invention they will not be described in greater detail herein.

When a loop is to be transferred from a lower needle to an upper one, bolt cam 33, which normally lies clear of the needle transfer butts, is advanced towards the cylinder far enough to engage the butt or butts of the needle or needles concerned. Each such butt then takes the track 6*a* and the knitting butt of the same needle takes track 5*a* until it reaches a height 5*b* where it is engaged by cam 34 and taken by that cam into the knitting track 2. At the height 5*b* the head of the needle so moved has just or almost just

made contact with the head of an opposing needle in the lower cylinder and as the knitting butt of the upper needle moves from height 5*b* to height 5*c* the opposing lower cylinder needle is pushed a similar distance which will take its knitting butt from height 1*a* to height 1*e*, the heads of the two needles being wholly within the trick of the upper cylinder during this movement. The knitting butt of the lower needle then engages cam 35 and is taken to the out-of-action track 3.

Butts 24 of the transfer instruments normally travel along an out-of-action track indicated by dotted lines 7 and when a loop transfer is to be made bolt cam 36, which normally is held clear of the butts 24, is moved inwardly to a position to engage the butt or butts of the transfer instrument or instruments which are to be operated, and each such instrument is moved from the position illustrated in Figure 3 to that of Figure 2 just prior to movement of the butts of the needles from position 1*a* to position 1*e*.

Thus, the incoming upper needle as it is operated by cam 34 will enter the sheath which has been moved by cam 36 and consequently will enter the loop expanded from the companion lower needle as the upper needle follows closely behind the lower cylinder needle which is being withdrawn by cam 35. Cam 37 subsequently withdraws the transfer instrument leaving the loop on the incoming upper cylinder needle, and this loop will be taken and worked by the upper cylinder needle when it next reaches the knitting cam system 31.

If, on the other hand, a loop is to be transferred from an upper needle to a lower one, bolt cam 38, which is normally held out of the paths of the needle transfer butts is advanced towards the cylinder far enough to engage the transfer butt or butts of the needle or needles concerned. Each butt then takes the track 4*a* and the knitting butt of the same needle takes the track 3*a* to a height 3*b*, where it is engaged by cam 39 and taken to the knitting track 1. At the height 4 of the out-of-action track the head of the needle is just clear of the head of an opposing needle in the upper cylinder whose knitting butt is at the height 2*a*. Movement of the knitting butt of the lower cylinder needle to the height 3*b* therefore pushes the opposing needle so that its knitting butt reaches the height 2*e*, the heads of the needles being wholly within the trick of the lower cylinder during this movement. The knitting butt of the upper needle then engages cam 32 and is taken to the out-of-action track 5. The transfer instrument operates as before to transfer the stitch, in this case from the upper needle to the lower one, and after this transfer has been effected the transfer instruments are all returned to the inoperative level 7 by means of fixed cam 37.

Generally, in order not to disturb the fineness of gauge of the tricks in the needle cylinder, the sheath portion of the transfer instrument is located at all times in a space above the tricks in the needle cylinder. The invention, however, is not limited to this particular disposition as for a relatively coarse gauge machine the needle tricks may be made wide enough to accommodate the upper sheath portions of the transfer instruments.

We claim:

1. In or for a knitting machine, the combination of a needle cylinder having on it tricks deep enough to accommodate in each such trick a needle and a transfer instrument lying one behind the other in the depth of the trick with the width of the latter no greater than that necessary to accommodate the needle, and a stitch transfer instrument having a body part received within such a trick and having near its end a sheath which embraces the needle, is movable at will to enter a stitch and is so shaped as to expand and hold the stitch for the purpose of enabling another needle to enter the sheath and the stitch held thereby.

2. In or for a knitting machine, a stitch transfer instrument according to claim 1 in which the needle embracing sheath is so designed as to lie behind the needle so that the sheath embraces the needle from behind and the sheath is carried on a resilient portion of the instrument so that when it is not in operation it will normally spring back clear of the needle and the stitches formed thereby, and in which the sheath and the resilient portion by which it is carried are formed separately from the body of the instrument, and means is provided for coupling the two parts together.

3. In or for a knitting machine, a stitch transfer instrument according to claim 1, in which the needle embracing sheath is so designed as to lie behind the needle so that the sheath embraces the needle from behind and the sheath is carried on a resilient portion of the instrument so that when it is not in operation it will normally spring back clear of the needle and the stitches formed thereby, and in which the sheath, the resilient portion on which it is carried, and the body of the instrument are formed in one piece, and in which the resilient portion is formed with a natural set such as to hold the sheath in rear of the needle in a position in which it does not embrace the needle but lies wholly or substantially wholly behind the latter.

4. In or for a knitting machine, a stitch transfer instrument according to claim 1 in which the transfer instrument is received within a needle trick in front of a needle so that the sheath embraces the needle at all times from the front.

5. In or for a knitting machine, a stitch transfer instrument according to claim 1 in which the transfer instrument comprises a body portion having in rear of it a slot in which the needle shank is received and which affords the loop-receiving sheath.

6. In or for a knitting machine, a stitch transfer instrument according to claim 1 in which the transfer instrument is provided with a shoulder on which the yarn can be laid during reciprocating knitting in order to prevent the yarn from fouling the hooks of inoperative sinkers.

7. In or for a knitting machine, an upper and a lower needle cylinder, a multiplicity of needle tricks in each cylinder, needles in the tricks of the upper cylinder, a hooked needle and a stitch transfer instrument in each of the tricks of said lower cylinder, said instrument being formed near its operative end with a sheath which is adapted to embrace its associated needle, the sheath being of a width radially of said cylinder which is at least equal to the corresponding width of the hook-and-latch portion of said needle, means for moving said instrument for entering a stitch, the instrument being so constructed and arranged as to hold the stitch so that it can be cleared from its associated needle whereafter the corresponding needle on the upper cylinder can be entered into the sheath and the stitch held thereby.

8. In or for a knitting machine, a stitch transfer instrument according to claim 1 in which the needle cylinder includes a movable sinker ring having an annular cam surface with which the sheath portions of the transfer instruments are engaged as they are moved to the stitch transferring positions and by which the sheaths are moved forwardly into a position to embrace the needles.

9. In or for a knitting machine, the combination according to claim 1 in which the needle embracing sheath of the transfer instrument normally lies beyond the end of the needle trick in the cylinder.

10. In or for a knitting machine, the combination according to claim 1 in which the transfer instrument is so designed that its body portion lies in front of the needle with which it is associated and the sheath portion of the instrument embraces the needle at all times.

11. In or for a knitting machine, the combination according to claim 1 in which the needle embracing sheath is so designed as to lie behind the needle and is carried by a resilient connection between it and the body of the instrument so that when it is not in operation the sheath will be normally sprung back clear of the needle and the stitches formed thereby, and a shoulder on the needle, on which shoulder the yarn can be laid during reciprocating knitting in order to prevent the yarn from fouling the hooks of inoperative sinkers.

12. In or for a knitting machine, the combination according to claim 1 in which the sheath of the transfer instrument is of undivided channel form throughout the operative portion of the sheath, and is so shaped as to penetrate a stitch and to expand it radially of the needle cylinder and also laterally clear of the needle hook.

13. In or for a knitting machine, the combination according to claim 1 in which the needle embracing sheath is so designed as to lie behind the needle and is carried by a resilient connection between it and the body of the instrument so that when it is not in operation the sheath will be normally sprung back clear of the needle and the stitches formed thereby.

14. In or for a knitting machine, the combination according to claim 1 in which the needle embracing sheath is so designed as to lie behind the needle and is carried by a resilient connection between it and the body of the instrument so that when it is not in operation the sheath will be normally sprung back clear of the needle and the stitches formed thereby, the said sheath, the resilient connection and the body of the instrument being formed in one piece.

15. In or for a knitting machine, the combination according to claim 1 wherein the needle cylinder is formed with an annular space at the ends of the needle tricks in which space the sheaths of the transfer instruments are accommodated.

16. In or for a knitting machine, the combination according to claim 1 wherein the needle cylinder is provided with an annular cam surface to be engaged by the sheath portions of the transfer instruments as they are moved to the stitch transferring positions, the said cam serving to move the sheaths forwardly to embrace the needles.

17. In or for a knitting machine, the combination according to claim 1 in which the needle embracing sheath is carried by a resilient connection between it and the body of the transfer instrument, and the sheath, together with its resilient connection is formed separately from but is coupled to the body portion of the instrument.

ERNEST BROOKSBY.
FREDERICK EDWARD DEANS.