Oct. 31, 1961 A. W. H. PORTER 3,006,172

FLAT WARP KNITTING MACHINES

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FIG. 1.

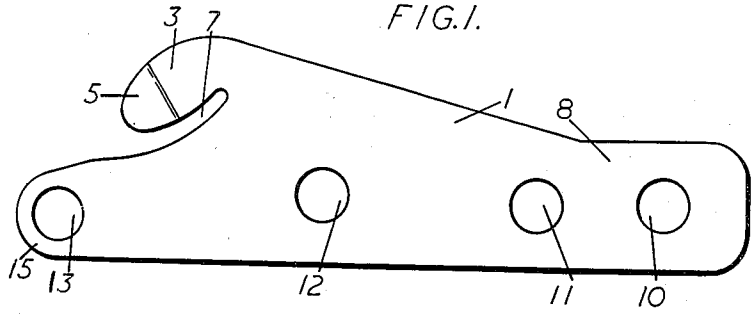


FIG. 2.

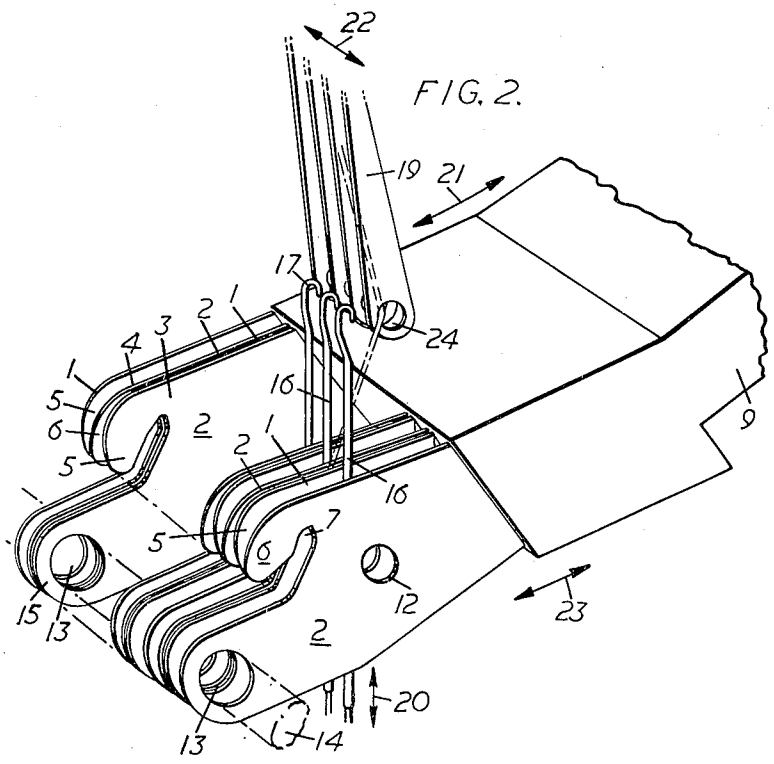


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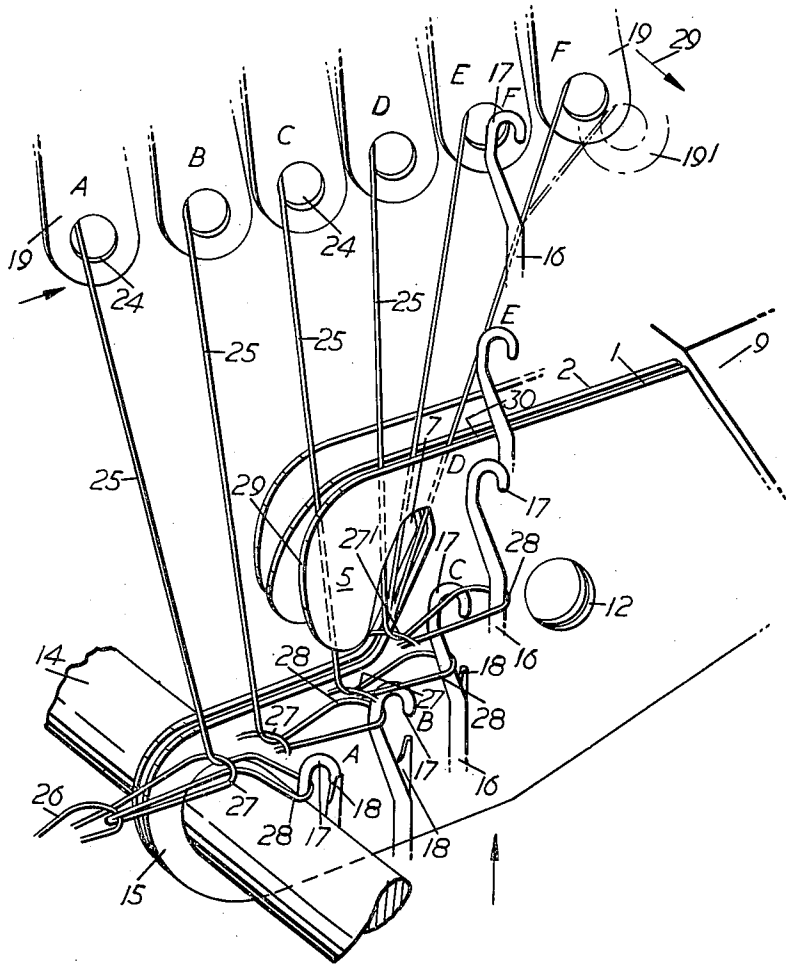
FIG. 3.

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# FLAT WARP KNITTING MACHINES

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5 Claims. (Cl. 66—109)

This invention relates to sinkers for flat warp knitting machines. Such machines have a row of reciprocating needles with hooks, one or more rows of warp thread guide eyes which are swung to and fro across the row of needles, and which make lapping and shogging movements along the row of needles, as well as a row of sinkers which are situated one between each adjacent pair of needles in the row. Each sinker has a neb and all the sinkers are moved to and fro together so that the nebs are moved into and out of engagement between the needles once during each knitting cycle.

When net or open-work fabrics having some stitches forming open loop pillars are knitted on such machines, one or more rows of guide eyes make lapping and shogging movements such that each eye moves back and forth across the same needle in successive knitting cycles. No wales are formed by these pillar threads around the sinker nebs, because the threads do not cross either of the adjacent sinkers. The loops formed around the needles, cannot, therefore, be held down effectively as the needles rise out from between the sinkers.

It has previously only been possible to overcome this difficulty by employing additional shogging warp separators or point dividers of a type similar to those used in the original English Milanese machines in which the threads are displaced along the row of needles by these point dividers.

According to the present invention a sinker for a flat warp knitting machine has a neb, the projecting portion of which beyond the throat is divided into two parts, the parts being face to face and diverging from each other in a direction towards their tips.

One part of each neb may be flat and lie in the plane of the remainder of the sinker and the other part may be inclined to this plane, but alternatively and preferably, the two parts of the sinker diverge at equal angles from a central plane containing the remainder of the sinker.

When the sinkers are mounted in position in a knitting machine and have their nebs in engagement between the needles the diverging parts of the nebs extend across the backs of the shanks of the needles; that is across the needles on the closed sides of the needle hooks. The two parts of each neb preferably diverge from each other a distance equal to the distance between adjacent sinkers so that one part of the neb of one sinker touches the other part of the neb of the adjacent sinker in a plane passing through the centre line of the intervening needle and lying at right angles to the row of needles. When this is done, the diverging parts of the nebs must be resilient so that they can be sprung apart as the needles pass between them when the nebs are withdrawn from between the needles.

The sinkers can most easily be made from two resilient plates fixed together face to face. Both plates have projections on one edge, the projections together forming the nebs and the tips of the projections being bent away from each other. As is usual, the sinkers are preferably fixed together face to face with spaces between them to a sinker bar. The sinker bar, together with the sinkers, form a complete sinker assembly ready for mounting in a machine.

The relative movements of the knitting elements of a machine having sinkers in accordance with the invention and the driving mechanisms which bring about these



relative movements, may be quite conventional. Preferably, however, the drying mechanisms and the other parts of the machine are in accordance with my co-pending application Serial No. 18,039, filed March 28, 1960, now Patent No. 2,988,906.

Sinkers constructed in accordance with the invention and also the manner in which these sinkers operate, will now be described by way of example only with reference to the accompanying drawings, in which:

FIGURE 1 is a side elevation of a single sinker;

FIGURE 2 is a perspective view of a sinker assembly comprising a number of sinkers fixed together face to face and showing also the associated needles and guides of a flat warp knitting machine; and

FIGURE 3 is a diagrammatic perspective view to a larger scale, illustrating the operation of a sinker in accordance with the invention.

Each sinker consists of a pair of flat plates **1** and **2** having on their upper edges projections **3** and **4** together forming a neb. The tips **5** and **6** of the projections **3** and **4** respectively beyond the throat **7** of the sinker diverge from each other as shown most clearly in FIGURES 2 and 3 of the drawings. A row of sinkers are fixed together side by side by having their rearmost ends **8** cast into a light metal block **9**. The plates **1** and **2** are formed with a number of holes **10** to **13**. The metal of the block **9** penetrates into the holes **10** and **11** and so anchors the plates **1** and **2** firmly in position in the block **9**. The holes **12** are merely to enable the plates to be held whilst the block **9** is cast, and a rod **14** shown in FIGURE 3 and indicated in chain-dotted lines in FIGURE 2, passes through the holes **13** to maintain the spacing of the front ends **15** of the sinkers. The blocks **9** are bolted side by side to a sinker bar as described in my co-pending application mentioned above.

Each sinker consisting of a pair of plates **1** and **2** is mounted between adjacent needles **16** in a flat warp knitting machine. The needles **16** are quite conventional and have hooks **17** and tongues **18** which reciprocate within tubular shanks of the needles **16** to open and close the hooks **17** in the manner described in my co-pending application already mentioned. The machine also has one or more rows of guide eyes, one of which is shown at **19**.

When the machine is in operation the needles **16** are reciprocated upwards and downwards in the direction of the arrows **20**. The guide eyes **19** are swung to and fro in the direction of the arrows **21** and they also make movements to and fro in a direction along the row of needles **16** as indicated by the arrow **22**. The sinkers reciprocate in the direction of the arrows **23**. Warp threads leading from a single warp beam pass one through each of the openings **24** in the guide eyes **19**.

The operation of the machine when it is knitting an openwork fabric having some stitches forming open loop pillars is illustrated in FIGURE 3 of the drawings. In this figure of the drawings, successive stitch loops **26**, **27** and **28** are knitted on the same needle with the one warp thread **25**. To enable this stitch loop formation to be produced the guide eye **19** makes shogging and lapping movements under the control of a pattern mechanism to and fro in a direction along the row of needles, but moves backwards and forwards across the throat of only one needle. When this operation takes place in a conventional knitting machine having sinkers with only single nebs which lie in the plane of the remaining parts of the sinker between a pair of needles, the warp thread does not pass underneath any sinker neb and the knitted loops are not therefore satisfactorily held down as the needles rise. With sinkers having double nebs in accordance with the present invention, however, this difficulty is overcome. The manner in which loops are formed under

the sinker nebs is shown in FIGURE 3 of the drawings. This figure is diagrammatic and shows a single sinker with its double neb in a fixed position.

The hooked needle on which the stitch loops are being formed is shown in six different positions illustrating six successive stages in the knitting cycle. In practice, of course, the needle reciprocates straight upwards and downwards and the sinker also reciprocates horizontally. For the purposes of illustration, however, a movement equal in magnitude, but opposite in direction, to that performed by the sinker has been superimposed on the needle so that it appears that the needle moves both upwards and to the right. The guide eye **19** is also shown in six successive positions which it occupies relative to the needle. The positions of the needle and guide eye in the six successive stages are shown at A to F.

At the beginning of the knitting cycle both the guide eye **19** and the hook **17** of the needle are in their positions marked A. The warp thread **25** passes through the opening **24**, through the loop **27** knitted in the previous knitting cycle on the needle **16**, thence through the hook **17** and back to the already knitted fabric. At this stage the hook **17** is completely closed by the tongue **18**. At stage B the hook **17** has started to rise, the tongue **18** has started to open the hook **17** and the sinker consisting of the plates **1** and **2** has moved a little to the left. This brings about the relative movement shown in FIGURE 3 of the drawings of the needle to the right. The guide **19** has also swung to the right. The movement of the hook **17**, the guide eye **19** and the sinker plates **1** and **2** continues to stage C. At this stage, the thread **25** passes downwards to the loop **27** which has been pulled over to the right, and in so doing, passes to the right of the left-hand extremity **29** of the tip **5** of the projection on the plate **1** forming part of the neb. When this happens the thread **25** passes behind the tip **5** and then under the tip **5** back into a position in front of the plate **1**. At stage D in the knitting cycle, the hook **17** is fully open because the tongue **18** is completely retracted into the tubular shank of the needle **16** and the needle rises a substantial amount relatively to the guide eye **19** and the sinker formed by the plates **1** and **2**. The loop **28** which previously lay in the hook **17** is held down around the shank of the needle **16**. This holding down takes place because the thread **25** is held in the throat **7** of the sinker due to the fact that the thread **25** has passed behind the tip **5**. The needle then rises passing through the position shown at E to the position shown at F, which is its top dead centre position, and the guide eye **19** swings to its fullest extent to the right as shown in FIGURE 3; that is in the position also shown at F. At this point in the knitting cycle the guide eye **19** makes a lapping movement in the direction of the arrow **29** to the position shown in chain-dotted lines at **19'**. This forms a thread helix around the throat of the needle **16**. Because the thread **25** is trapped behind the tip **5** on the plate **1** this helix runs from the top edge **30** of the plate **1**. If the thread **25** had not passed behind the tip **5** this helix would run directly from the last knitted loop **27'** in the fabric. Because of this alteration of the point from which the helices of thread lead, these helices are laid into the needle hooks at a shallower angle around the needle shanks than they would be if they ran down directly to the last knitted loops.

Making the angle of the thread helices shallower in this way is very advantageous because it enables the threads to pass into the hooks of the needles more quickly as the needles move downwards and this helps to prevent any tendency for mislapping to occur. It will be seen, therefore, that sinkers in accordance with the present invention are especially advantageous when knitting pillar stitches on single needles because they enable the knitted loops to be held down by the wales formed under the divided parts of the sinker nebs, but they are also advantageous when knitting any other types of stitch in which shogging motions of the guides take place between successive stitches which are formed on different needles. This is because, as already explained, the thread helices formed around the needle shanks lie nearer to the needle hooks than they would in a machine provided with conventional sinkers.



This is particularly important in a machine having three or more rows of guide eyes since, even though, when the guides have swung to the fronts of the needle hooks, the outermost row of guide eyes, that is the row furthest from the needle hooks, must be a substantial distance from the hooks and thus cause the threads to run at an oblique angle from the hooks, the thread helices are still prevented from running too far down the shanks.

After the the sinker wales have been formed in the thread **25** under the tip **5** in the stages from A to F of the knitting cycle, as already described, the needle **16** descends performing the motion described in my above-mentioned application, and as this happens the hook **17** of the needle is again closed by the tongue **18**. As this downward movement comes about, the sinker is withdrawn to the right so that the hook **17** passes between the tip **5** and the tip **6** of the adjacent sinker, which is not shown in FIGURE 3 of the drawings, which touches it. The tips **5** and **6** are sprung apart from each other to allow this to happen.

The new loop of the thread **25** which is laid in the hook **17** at stage F of the knitting cycle of course passes between the tips **5** and **6** at the same time as does the hook **17**. As the needle moves downwards the previously knitted loop **28** is cast off over the hook **17** and the needle then returns to the position shown at A and the knitting cycle is repeated. It will be appreciated that the difference between this cycle and that of a machine with a conventional sinker having a single neb is that with a single neb, as the needle moves upwards between positions A and C, the thread, instead of passing behind the tip **5**, will pass in front of the tip because the tip will lie in the same plane as the plates **1** and **2**; that is on the same side of the tip as the needle itself. Therefore, no wale will be formed under the sinker neb and when the needle rises into the positions shown at E and F there will be a tendency for the loop **28** formed around it to rise also. This gives rise to serious mislapping when attempts are made to knit fabrics having open pillar stitches in conventional flat warp knitting machines.

I claim:

1. In a flat warp knitting machine of the type comprising a row of needles each comprising a shank and a hook on the end of said shank, means for reciprocating said needles, at least one row of warp thread guide eyes, and means for swinging said guide eyes to and fro across said row of needles, the improvement which consists of a sinker assembly comprising a plurality of elongated sinker means arranged in a row with at least one sinker means located between each adjacent pair of shanks, said at least one sinker means comprising two resilient neb portions which project longitudinally and downwardly from said sinker means and terminate in diverging tips, each of which tips extends away from the other towards a neb portion of the adjacent sinker means on the opposite side of a needle, and means for reciprocating said sinker means in a direction transverse to said shanks, whereby during a knitting operation a thread passing through the hook of one of said needles and moving towards the tips of said neb portions is caused to pass under one of said neb portions.

2. A flat warp knitting machine according to claim 1, wherein said tips of said neb portions are in contact with the tips of the neb portions of the said adjacent sinker means.

3. A flat warp knitting machine according to claim 1, wherein the at least one sinker means between each pair of needles comprises a pair of plates arranged face to

face, each plate having a body portion with an edge and a hook-shaped neb portion extending from said edge of said body portion, said edge and said neb defining between them a throat and said neb portions being outwardly bent away from each other and tips of said neb portions being in contact with the tips of the neb portions of the adjacent sinker means in said assembly lying on the opposite side of a needle.

4. A sinker assembly for a flat warp knitting machine, said assembly comprising a plurality of sinker means arranged side by side in a row and means rigidly fixing said sinker means together, each of said sinker means comprising a pair of plates arranged face to face and each plate having a body portion with an edge and a hook-shaped neb portion extending from said edge of said body portion, said edge and said neb defining between them a throat and said neb portions being outwardly bent away from each other and tips of said neb portions being in contact with the tips of the neb portions of adjacent sinker means in said assembly.



5. Sinker means for a flat warp knitting machine, said sinker means comprising supporting means carrying a body portion consisting of at least one elongated member and two resilient neb portions projecting longitudinally from said body portion, each neb portion having a tip and a throat defined between said neb portion and said body portion, and said neb portions diverging from each other as their tips are approached.

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