

FIG. 1.

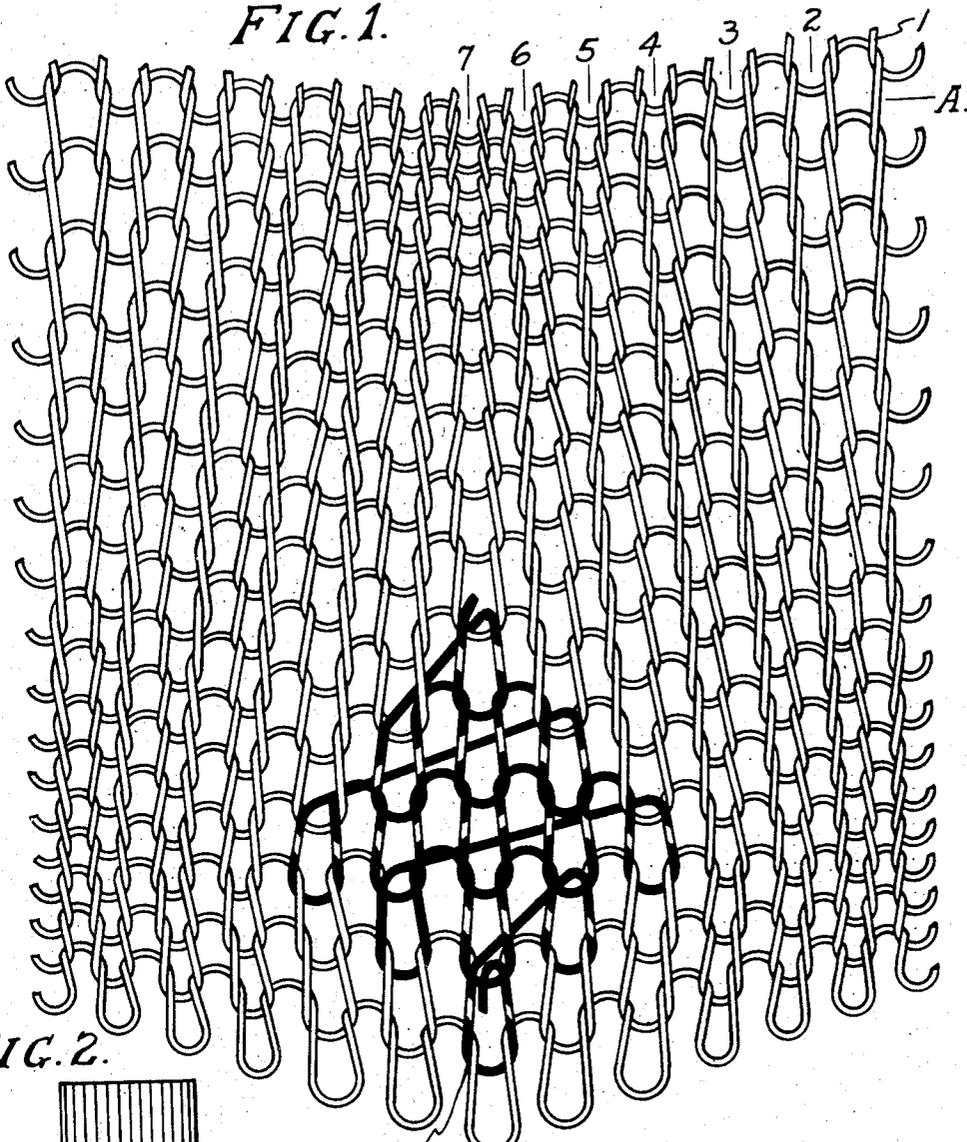


FIG. 2.

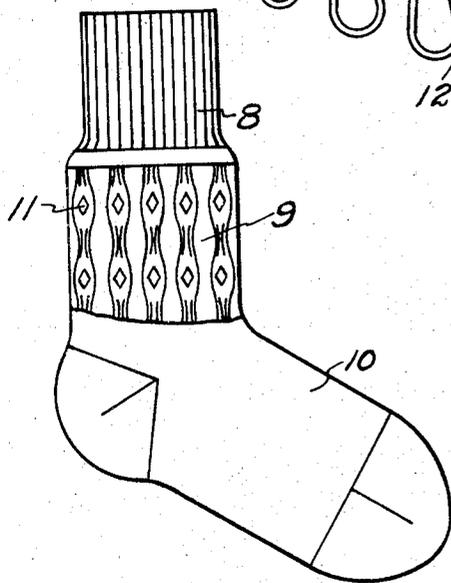
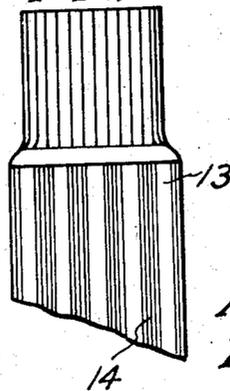


FIG. 3.



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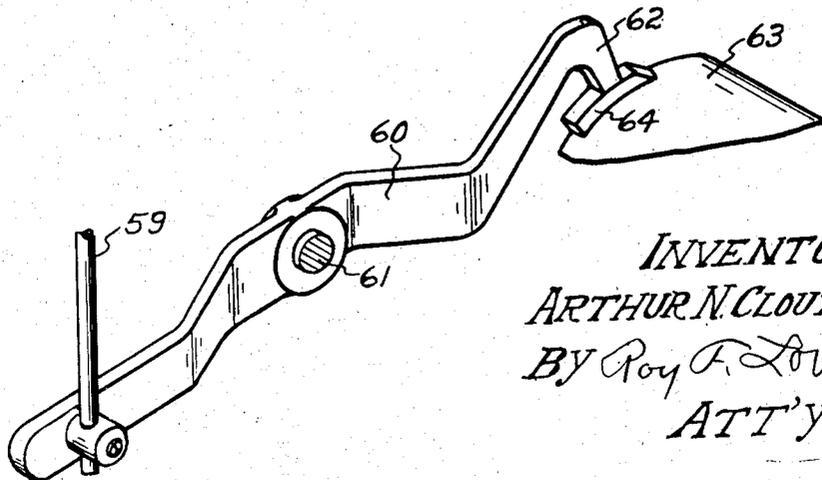
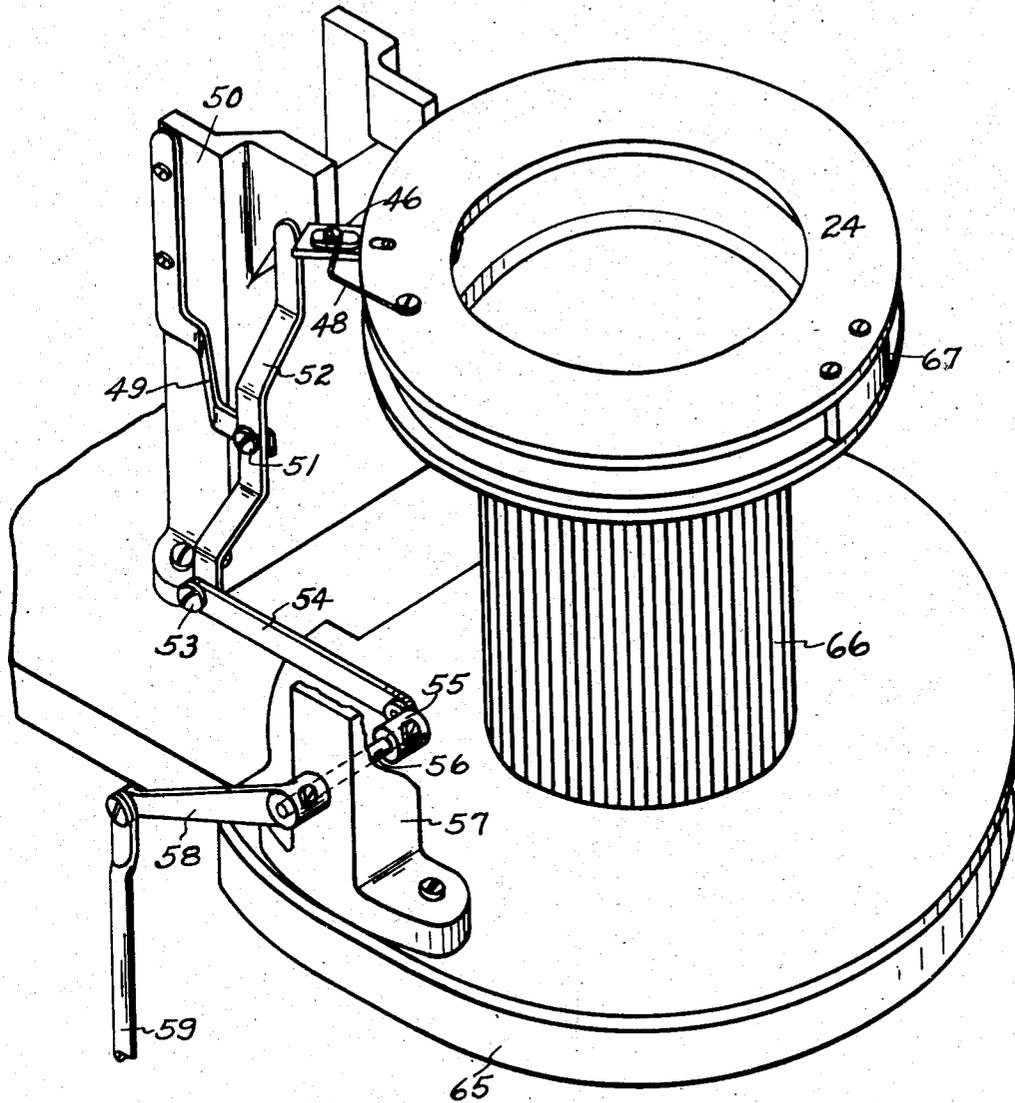
Dec. 21, 1943.

A. N. CLOUTIER  
MACHINE FOR KNITTING  
Filed Feb. 18, 1942

2,337,153

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FIG. 4.



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FIG. 5.

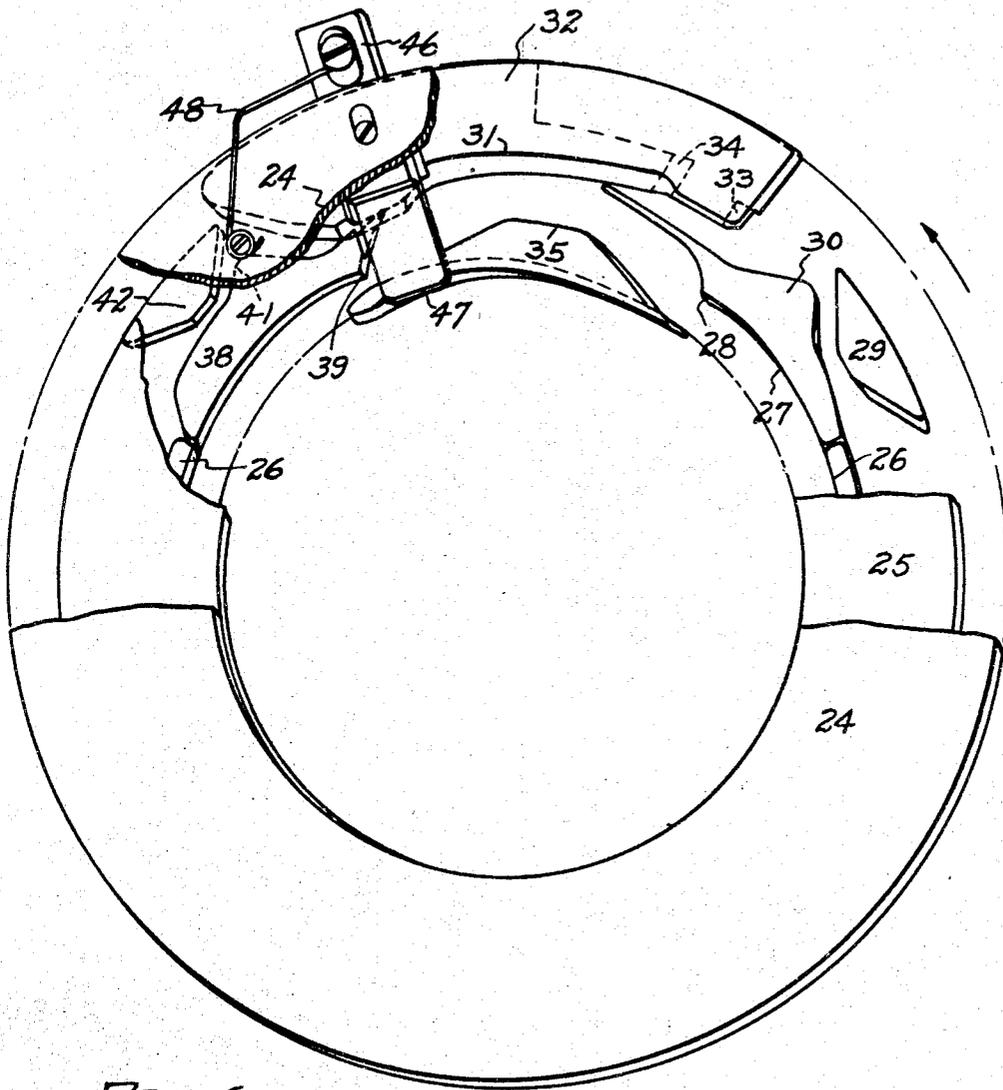
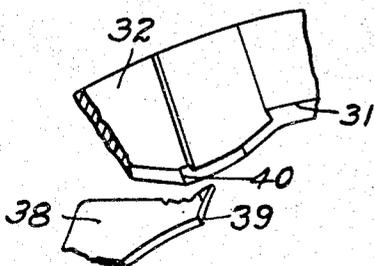


FIG. 6.



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FIG. 7.

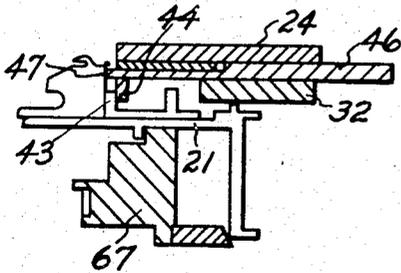


FIG. 9.

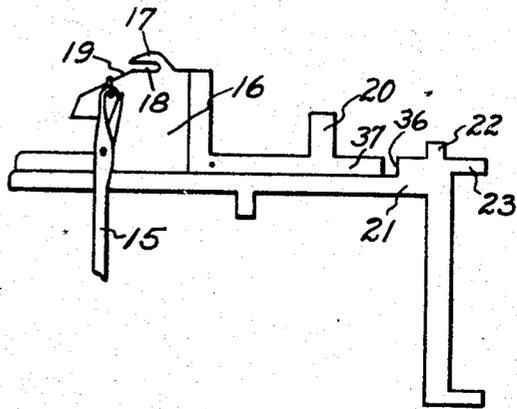


FIG. 8.

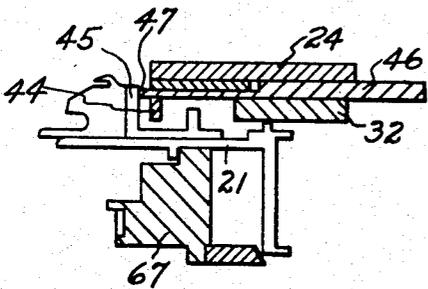


FIG. 10.

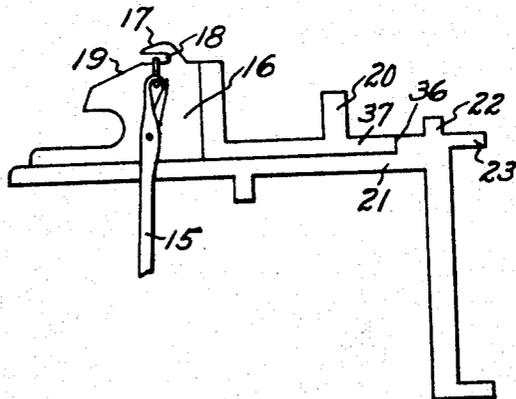
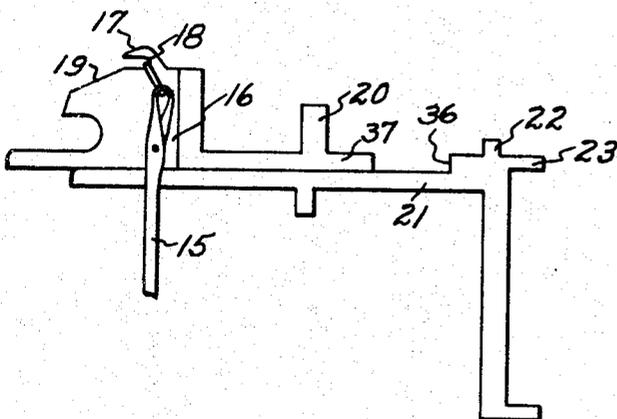


FIG. 11.



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# UNITED STATES PATENT OFFICE

2,337,153

## MACHINE FOR KNITTING

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Application February 18, 1942, Serial No. 431,372

8 Claims. (Cl. 66—108)

This case has for its subject matter an invention in circular, independent needle knitting machines in which fabric is knitted having patterned tight and loose stitches, the fabric thus knitted and method of knitting it.

In the figures of drawings:

Fig. 1 is a view showing a section of fabric knitted in accordance with the invention, stitches thereof being shown to a greatly enlarged scale;

Fig. 2 is a view showing a half hose knitted in accordance with the invention and illustrating one particular pattern effect;

Fig. 3 is a view similar to Fig. 2 but showing another pattern which may be knitted;

Fig. 4 is a perspective view showing connections from a pattern drum to a cam at the sinker cap for slackening stitches;

Fig. 5 is a view showing cams in the sinker cam cap adapted to control sinkers and sinker jacks;

Fig. 6 is a detail showing casting off cam points, one of which is hidden in Fig. 5;

Figs. 7 and 8 are sections through the sinker head and sinker cam cap illustrating action of the stitch slackening cam;

Fig. 9 is a detail view of a needle, sinker and jack showing drawing of a short loop;

Fig. 10 is a similar view but showing drawing of a long loop;

Fig. 11 is a similar view illustrating the position of the needle, sinker and jack at casting off a short loop.

The fabric herein described is knitted by selective control of knitting instrumentalities such as the sinkers in a circular, independent needle knitting machine and ornamentation of the fabric is based upon differences in stitch length. A so-called shadow effect is obtained by drawing certain looped areas of relatively tight loops and other and adjacent areas of loops appreciably looser. The dense and relatively loose fabric thus produced create the so-called shadow effect, especially when worn. The pattern areas blend into each other since there is some stitch robbing at the theoretical intersection of areas including different length stitches and this shadow effect is also accompanied by a raised appearance of the fabric since the loose areas tend to bulge or appear at a different plane in the fabric as compared to the surface or plane occupied by the tight stitched areas. The actual bulging or embossed effect depends to a great extent on the relative amounts and disposition of tight stitches with respect to loose stitched areas.

In addition to the ornamental effect resulting

from the areas of different length loops or stitches, wrap stripe patterns are in certain instances added so that there is ornamentation involving a shadow effect plus a colored effect, for example, clocks or other wrapped designs of an all over pattern. The wrapping may be confined to either tight or loose areas, or, if desired, may progress from one area to another as from loose to tight areas and vice versa.

Now referring to the figures of drawings, a section of fabric is illustrated in Fig. 1, such section being a greatly enlarged portion of one of the patterned areas in Fig. 2. The fabric is preferably knitted from a single yarn such as the yarn 1 and that yarn will be drawn into different length loops depending upon a selection imparted to the knitting instrumentalities. While it is entirely possible and within the scope of the invention to draw these different length loops by needle control, that is, selectively drawing certain needles to a greater depth than others, the preferred form of the invention contemplates special control of sinkers or other stitch drawing instrumentalities over which loops are measured and drawn. Here the sinkers are controlled by independent jacks although the selecting means may, if desired, function upon the sinkers themselves or extensions thereof.

The theoretical pattern as laid out to produce the fabric of Figs. 1 and 2 would appear as a checker board or squared design in which there would be alternating squares of tight and loose stitches. However, in actual practice, there is a robbing or redistribution of yarn between the squared areas so that the effect is more in line with that illustrated. Taking course A, for example, a large loop at wale 2 is adjacent progressively smaller loops at wales 3, 4, 5, 6 and 7, the pattern then being repeated in the reverse manner as loops increase in size toward the left of the figure. As an actual matter of fact, the larger ones of these loops were all drawn the same size and are referred to as long or loose loops while the shorter loops were originally all drawn smaller but to the same extent. It will be noted that if one is to follow any wale lengthwise of the fabric, the same phenomenon is found.

In Fig. 2 a stocking having a top 8, leg 9 and foot 10 is ornamented by a pattern such as illustrated in detail in Fig. 1 and in addition has diamond shaped areas 11 which are ornamented by needle wrapping. In Fig. 1 yarn 12 has been shown blackened to illustrate the manner in which this wrap yarn thread is plated over certain of the stitches. The said wrap thread in all

stitches but one has been broken away at certain points to show the base thread 1 over which the wrap thread is plated.

This wrap stripe ornamentation may be superimposed upon the fabric by any desired wrapping means and, as herein shown, occurs only in areas of loose loops. The said wrap striped patterns may extend in any direction, for any extent throughout the fabric, and may take any of the desired shapes or pattern forms. If the said wrap striping is to progress from an area of loose loops to tight, and vice versa, the wrap stripe mechanism is to be set so as to control the tightness or length of wrap yarn stitch so as to accommodate the plated loops to the different lengths of basic loops which are to be plated. This feeding will be something intermediate that which would be more desirable considering either length of loop only.

In Fig. 3 part of a similar stocking is shown in the leg portion of which tight loops are drawn at vertical panels 13 and loose loops at the intermediate panels 14. This patterning gives the effect of vertical rib work such as is commonly produced on so-called English or broad rib machines. Here the effect of stitch robbing or redistribution of the stitch is less pronounced than in the type of pattern in Fig. 2.

Referring to Figs. 9 and 10 there are a plurality of needles 15 and cooperating sinkers 16. Each of the sinkers has a nib 17 a throat 18 in front of which is an inclined edge 19. This edge 19 is employed for drawing the short loops, that is, those which make up the tight or dense parts of the fabric. These sinkers have butts 20 which are controlled by cams hereinafter to be described. The drawing of a short loop is illustrated in Fig. 9 and it can be seen that the needle drawing over the inclined edge 19 does not draw as long a loop as it would if the yarn were measured and drawn at the throat, see Fig. 10.

Each of the sinkers has a sinker jack generally indicated by numeral 21 and which is very similar to the jacks employed in Banner 12-step, reverse plating machines. In fact, these jacks are practically identical with those in United States Patent #2,052,777. Each jack has a butt 22 by means of which it is controlled for the purpose of moving its sinker or by means of which it may be retained in an outermost or inactive pathway. Each jack also has a plurality of removable pattern butts 23. There is a selecting plunger or other selection imparting instrumentality for each pattern step or butt on a jack, and according to the control of said plungers by a pattern drum, and the disposition of butts 23, sinkers may be caused to take either one of two pathways thereby to determine the knitting of long or short loops.

If a jack is selected it will affect its cooperating sinker in such a way that that sinker will be moved in to a position corresponding to the position of Fig. 10 and a so-called long loop will be drawn over the lower edge of the sinker throat. Those sinkers, the jacks of which are not selected are merely controlled by sinker cams acting on the butts 20 and such sinkers will have so-called short loop drawn as in Fig. 9. By adjustment of the sinker cam which controls movement of sinkers at this point, the position along the inclined edge 19 at which loops are drawn may be varied and thereby the length of a short loop varied. Of course, any adjustment of stitch as by raising or lowering needle cams will make a

corresponding change in stitch length drawn over either the edge or in the throat.

Now referring to Fig. 5, the sinker cam cap has two annular members 24 and 25 to which are attached several sinker and sinker jack controlling cams. A thin annular cam 26 merely maintains both sinkers and jacks in position as they travel about the machine except at points adjacent, at, and just beyond the stitch drawing zone at which rather complex movements are imparted to each of the elements. Movement of the sinkers and jacks is in the direction of the arrow and sinker butts first contact cam 27 then are moved inwardly slightly at the point of the cam, such point being indicated by numeral 28.

The jacks, more specifically, the butts 22 thereof, first engage cam 29 and are moved in to be aligned and to be moved outwardly by cam 30 to a position in which they may have selecting movements imparted to them. At a point just beyond the point of said cam 30, the selecting plungers similar to plungers 44, Patent #2,052,777 are positioned to impart selecting movements to the jacks in the event a plunger is in inward position and a jack has a butt at that particular plunger level. The details of this selection are disclosed in the patent just above mentioned and no further explanation will be given here.

Those jacks which are selected move inwardly so that the butts 22 will engage and be controlled by the cam surface 31 on a long cam 32. This cam 32 has other cam surfaces 33 and 34 in its lower plane by means of which jacks not selected by one of the said plungers are pushed downwardly and follow their movement about the machine in an inactive position. Sinkers individual to those jacks not selected are controlled only as cams contact and affect the sinker butts 20.

Center sinker cam 35 moves all sinkers outwardly and the outward position thus attained by them is such as to cause yarns to be drawn over the inclined surface 19, Fig. 9. Of course, all sinkers are moved outwardly and if there were no jack control all stitches would be short stitches drawn as in Fig. 9. The cam surface 31 acting on jack butts 22 causes the jacks to move inwardly until the shoulder 36 on each jack thus controlled engages an extension 37 on each of the cooperating sinkers, Fig. 10, and further movement results in pushing the sinkers in so that the measuring and drawing of yarn occurs at the level of the throat.

In casting off the old loops, a different extent of projection for each group of sinkers is used. Sinkers drawing short loops and which incidentally are not affected by jacks, merely cast off by the usual cam 38, the point 39 of which determines the greatest degree of inward projection and is known as the casting off point. A sinker thus projected for casting off is illustrated in Fig. 11. That point 39 would not in most instances be a satisfactory casting off point for sinkers drawing long loops. For that reason those sinkers are especially controlled at that time for their jacks and have imparted to them an additional movement so as to make sure that their casting off action is positive.

In Fig. 6 cam 38 is shown cut away so as to allow a full view of the casting off point 40 of cam 32. Jack butts 22 move along the surface 31 of the cam 32 and the position of the point 40 is such that this jack control governs rather than the point 39 of the regular casting off cam.

Sinkers which draw long loops will be moved inwardly by their jacks for about  $\frac{1}{2}$  to  $\frac{1}{4}$  of an inch farther than are the sinkers drawing short loops and which are affected by casting off point 39 acting on sinker butts 20 only.

After passing these casting off points, sinker jacks are aligned by cams 41 and 42 while sinkers merely move along within the cam 38 and on to cam 26 which extends entirely about the machine until cam 27 is again contacted.

Now referring to Figs. 4, 5, 7 and 8, certain mechanism is to be described the purpose of which is to control sinkers specially for stitch slackening and when introducing an extra or reinforcing yarn at a high splice or a so-called double sole. Sinkers are generally divided into two groups, one group at the instep side having a conformation, Fig. 7, whereby there is a cut-out behind the nib so that the shoulder portion 43 does not extend upwardly beyond a point at which the sinker will be affected except as contacted by the end 44 of center cam 35 beneath cam 47. Now a second and opposite group of sinkers knitting the sole side of the stocking does have this shoulder portion extended upwardly to full extent as at 45.

A plunger 46 is slidable within a slot in the cam 32 and has a cam-like sinker engaging end 47 which is at such an elevation as to contact sinkers having full shoulders 45, but will not affect those sinkers cut away as illustrated in Fig. 7. When projected inwardly as is the case if knitting in a high splice, double sole or other reinforced area in which it is desired to slacken stitches, the plunger is pushed inwardly and the cam end 47 will perform its intended function. Contact with sinkers as in Fig. 8, pushes those sinkers in a little farther so that loops will be extended and slackened, this being a function well known in the knitting of such reinforced areas or at such times as an additional yarn introduced to the needles would tend to render the knitted stitch too tight and the fabric more dense than desired.

For the operation of this plunger 46 there is a spring 48 under tension so as to draw the plunger outwardly except at such times as it is pushed inwardly to its active position by a system of linkage shown in Fig. 4 as affected by a cam or cams on the main cam drum. A bracket 49 is connected to yarn lever portion 50 and has pivoted at 51 a bent lever 52, the upper end of which pushes against the outer end of the plunger and at its lower end is pivoted at 53 to link 54 which in turn connects to a lever 55 fixed at one end of a short spindle 56. This short spindle is rotatable in a bearing in the widening pick bracket 57 and has fixed at its other end a lever 58. This lever connects by link 59 to a lever 60 pivoted at 61 at a plane just above the center of the main cam shaft this lever having a cam following toe 62 engageable with one or more cams on the main cam drum 63. A cam 64 is herein illustrated, such a cam being one of a possible plurality of such cams depending upon the number of times within one knitted stocking or article which it is desired to operate the slackening cam. This Fig. 4 has been broken away and, of course, the main cam drum and the lever 60 are at a point fairly well removed from the base of the machine generally indicated by numeral 65, the cylinder 66 and the sinker head 67 upon which is carried the sinker cam cap having a top plate 24 as heretofore described, Fig. 5.

### Operation

The pattern is normally to be knitted in the leg and foot portions of the stocking, but of course, may be knitted anywhere desired. The pattern mechanism comes into play at such time by appropriate control as by a move of the main cam drum, whereupon sinker jacks will then begin to impart pattern selections to the sinkers. A sinker the jack of which is unaffected by the pattern means will be moved outwardly by cam 30 and will pass down into the inactive pathways so that those sinkers are controlled only as influenced by sinker cams acting upon butts 20. They have their stitches drawn over the incline 19 and thus determine the knitting of the areas of short loops.

Those sinkers, jacks of which are affected by the pattern means will be pushed inwardly so that the butts 22 will be under the control of the cam surface 31 on cam 32; then actual inward projection of the sinkers will be governed by cam control of the jacks rather than by cam control through the sinker butts 20. Such sinkers will move inwardly to a position wherein the stitches drawn over them will be drawn in the throats. Selected sinkers will have the relatively long loops drawn over them and thereby determine the areas in which the long or relatively loose stitches occur. As before explained, there is no sharp line of demarcation between these long and short looped areas, but a redistribution of yarn in stitches brings about an effect whereby the areas merge or blend thereby giving the effect of a shadow pattern illustrated in Figs. 1, 2 and 3. This redistribution of the yarn in these border stitches occurs at the knitting and is probably due to the robbing of yarn in the progressive stitch drawing movements.

The wrap yarn or yarns may be superimposed at any desired points or areas such as the diamond shaped figures illustrated in Figs. 1 and 2. As before stated, the wrap mechanism is so set or adjusted as to give a size of wrap loop, that is, a wrap loop of such proportions and tightness as to accommodate itself as a plating loop over a basically long or short stitch.

Casting off of stitches is by cam points 39 and 40, casting off point 39 being the usual one. It acts upon sinker butts 20 for those sinkers which draw short loops. For the sinkers drawing long loops (those primarily affected by the jacks), casting off is under influence of cam point 40 as it engages jack butts 22. This casting off movement pushes sinkers inwardly farther than does that of the ordinary casting off point and thus long stitches are positively cast from the needles and are held in such a position that as needles again rise, no unintended reengagement of the cast off stitch by the needle is experienced.

In the reinforced areas cam 64 or other appropriate cam on the drum 63 will engage the toe of lever 60 moving the linkage of Fig. 4 in a direction to push plunger 46 inwardly against the tension of spring 48. The cam end 47 will then engage the shoulders 45 on the backs of sinkers and will push those sinkers in to an additional extent for stitch slackening.

The invention has been described by reference to mechanism which constitutes one specific embodiment of the same in a hosiery knitting machine, but it is to be understood that this is only by way of illustration and the principles of the invention are applicable to other hosiery machines and, in fact, to other types of knitting machines such as body fabric knitting machines

of the so-called flat or V-bed types. Modifications will occur to those skilled in the art, but the invention is not to be limited except as by the scope of the appended claims.

I claim:

1. In a circular, independent needle knitting machine, the combination of means for forming a fabric by drawing knitted loops including needles and sinkers, said sinkers being so constructed as to have two surfaces at different levels over which loops may be measured and drawn by the needles, jacks for imparting selecting movement to said sinkers and means for controlling said jacks upon selection thereof to follow either one or the other of two pathways in one of which sinkers will be so controlled as to have relatively short loops measured over one of their stitch drawing surfaces and in the other of which, long loops may be drawn, and casting off means including cams functioning, one said cam for moving sinkers inwardly to one extent for one type of loop, and another cam for moving other sinkers in to a greater extent for casting off the other type of loop.
2. In a circular, independent needle knitting machine, means for drawing knitted loops including needles and sinkers, means for separating said sinkers into two pathways whereby loops may be selectively drawn at different levels to determine the knitting of long or short loops, and casting off means operable upon said sinkers to move them inwardly for casting off previously drawn loops, said casting off means being so constructed and so operable as to push sinkers controlling the drawing of short loops in to one extent and then those sinkers over which longer loops are drawn in to a different and greater extent.
3. In a circular, independent needle knitting machine, sinkers and sinker controlling jacks, butts on sinkers and butts on jacks and cams operable on said butts for moving sinkers to cast off stitches, one cam being operable on sinker butts for casting off stitches by those sinkers upon which short loops are drawn, and another cam operable upon jacks and so constructed as to cause sinkers cooperating with said jacks to be moved in to a greater extent for casting off relatively long stitches.
4. In a circular, independent needle knitting machine, means for drawing knitted loops including needles and sinkers, said sinkers being so constructed as to have two stitch drawing surfaces at least one of which is variable in effective height over which needles may measure a yarn and draw loops therefrom, means for separating said sinkers into two pathways whereby loops of the said yarn may be drawn over either of said stitch drawing levels, and means for varying the stitch drawing position of sinkers so that loops may be drawn at different points of said variable surface and hence varied in length.
5. In a circular, independent needle knitting machine, the combination of means for forming a fabric by drawing knitted loops including needles and sinkers, said sinkers being so constructed as to have two surfaces the effective height of one of which is variable over which loops may be measured and drawn by needles, jacks for imparting selecting movement to said sinkers and means for controlling said jacks upon selection thereof to follow either one or the other of two pathways in one of which sinkers will be so controlled as to have relatively short loops of a yarn measured over one of their loop drawing surfaces and in the other of which, long loops of the said yarn may be drawn over the stitch drawing surface and means for varying the position of the surface over which the relatively short loops are drawn to vary the length of such loops.
6. In a circular, independent needle knitting machine, means for drawing knitted loops including needles and sinkers, said sinkers being constructed with nibs and a throat beneath each nib, and in front of each throat, a downwardly inclined edge over which yarn may be drawn, means for separating said sinkers into two pathways whereby loops may be drawn selectively either in the throats or over the inclined edges and means for varying the position of sinkers which have loops drawn over their inclined edges so as to determine the point at which short loops are drawn and hence the length of such loops, and casting off means operable to project sinkers over which longer loops are drawn, inwardly to an additional extent as compared to the movement imparted to the other sinkers at the casting off point.
7. In a knitting machine of the type described, needles and sinkers, said sinkers having nibs, a throat beneath each nib and an inclined edge forwardly of each nib and throat over which stitches may be drawn, means for positioning said sinkers so that stitches may be drawn at the throats or may be selectively drawn over the inclined edges, said last mentioned means being variable to the extent that said last mentioned sinkers may be positioned so that loops may be drawn at different points of said inclined edges.
8. In a knitting machine of the type described, needles and sinkers, means for selectively positioning said sinkers so that the needles may draw loops over those sinkers at different positions thereby to determine the drawing of different lengthed loops and casting off means including two different cams so constructed as so operated that in accordance with the selection of sinkers for drawing loops of different lengths, the said sinkers will be projected inwardly to different extents properly to cast off loops drawn thereover.

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