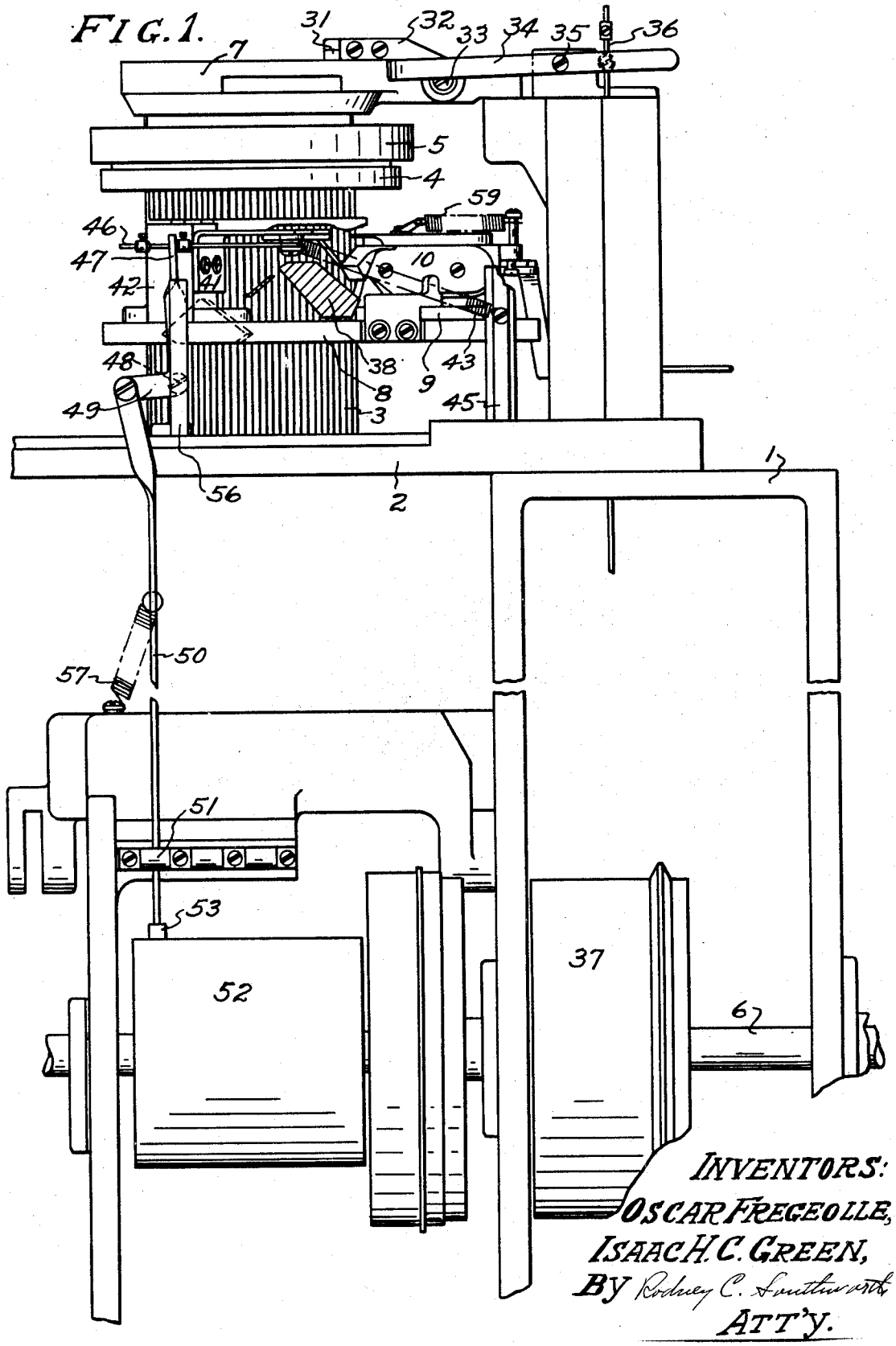
April 4, 1944. O. FREGEOLLE ET AL 2,345,664

KNITTING MACHINE AND METHOD

Filed Sept. 19, 1942 4 Sheets-Sheet 1

FIG. 1.



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KNITTING MACHINE AND METHOD

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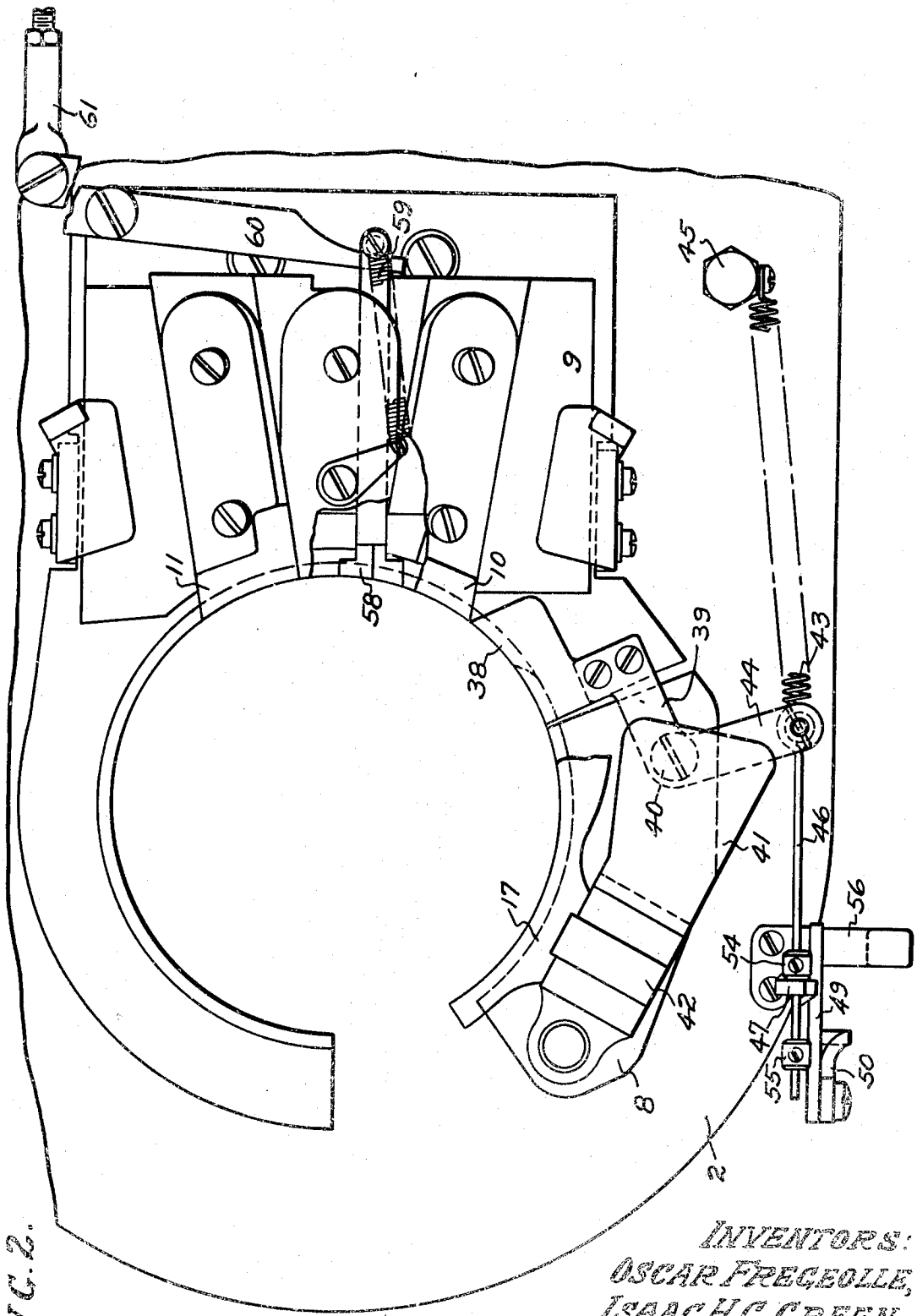


FIG. 2.

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KNITTING MACHINE AND METHOD

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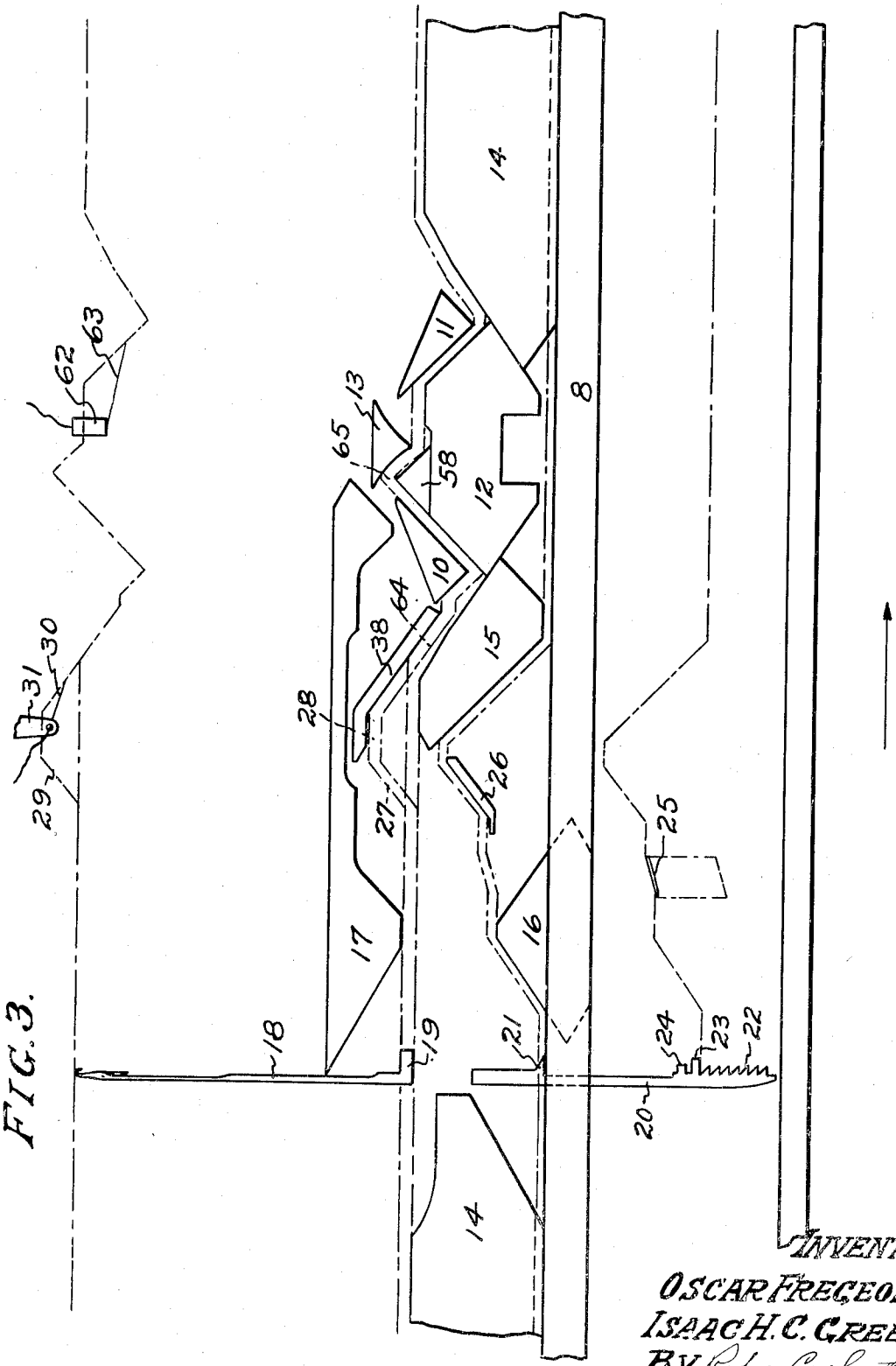


FIG. 3.

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April 4, 1944. O. FREGEOLLE ET AL 2,345,664

KNITTING MACHINE AND METHOD

Filed Sept. 19, 1942 4 Sheets-Sheet 4

FIG. 4.

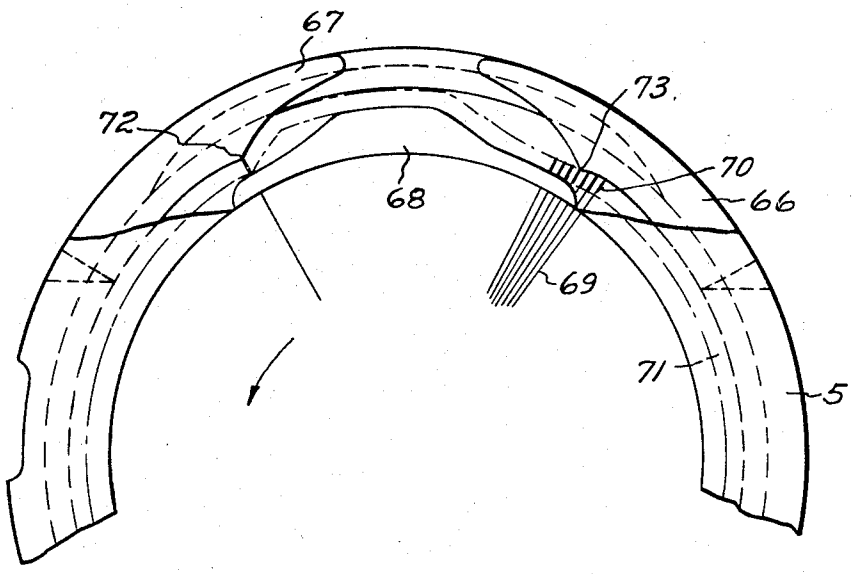


FIG. 5.

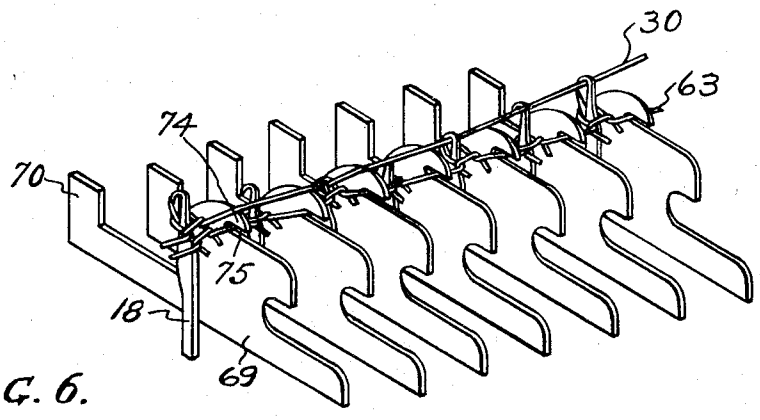
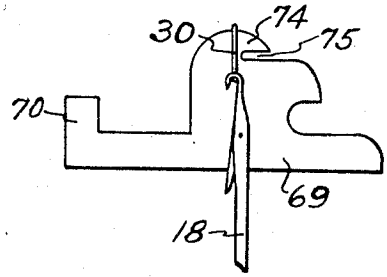


FIG. 6.



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Patented Apr. 4, 1944

2,345,664

UNITED STATES PATENT OFFICE

2,345,664

KNITTING MACHINE AND METHOD

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Application September 19, 1942, Serial No. 458,972

9 Claims. (Cl. 66—42)

This case has for its subject matter an invention relating to circular, independent needle type knitting machines adapted to knit at least two yarns at separate feeding points. More specifically, the case concerns a machine organization and a method for knitting an auxiliary yarn such as an accordian yarn or incorporating an elastic yarn in plain knitted fabrics when such yarns are desirably separately fed to be knitted or otherwise incorporated.

Heretofore, it has been customary to feed and knit accordian or other auxiliary yarns at a separate point from the main feeding station or mouthpiece of the machine and separate cam means have been employed at the auxiliary feeding station for that purpose. That involves considerable mechanism and where machines are complicated the added parts and controlling means for those parts sometimes make it decidedly impracticable to incorporate these features. Furthermore, in existing machines such mechanisms added as an attachment are difficult of application and quite costly.

According to the invention herein described and claimed, only one set of knitting cams is employed and that includes the cams at the main cam block which are standard equipment on practically all machines of this type. The front stitch cam of that block is made movable to and from a needle butt engaging position, so that the cam block of existing machines, with one exception, can be used as found. This movable cam functions to elevate needles for clearing their latches just before those needles contact the center guard cam prior to moving downwardly to take yarn and knit under the rear stitch cam.

In addition to the slight modification of the main cam block construction as above outlined, a movable, needle butt engaging cam is provided, the same functioning in advance of the front stitch cam. That cam serves to draw certain selected needles downwardly after they have taken the so-called auxiliary yarn so that butts on those needles will move down the front edge of the stitch cam rather than being moved upwardly to a latch clearing position as would be the usual practice in straight-away knitting on a machine of this type. With that combination of cams, and with an auxiliary feeding means in addition to proper selecting devices in advance of that feeding means, needles may be selected and so controlled as to knit an auxiliary yarn under the front stitch cam and then knit the main yarn beneath the rear stitch cam in the usual way. Thus with very little additional mechanism, main yarns are controlled according to the usual practice and with the slight additional mechanism and its combined use with the main cam set, an auxiliary yarn is controlled to be knitted or otherwise incorporated with all the advantages heretofore available only by incorporating in a machine of this type a second complete cam construction.

In addition to a second complete cam means according to the previously employed mechanism and method, it has always been essential to build into those machines a separate set of sinker controlling cams. The front stitch cam is so positioned relatively to the cooperating sinker cams if those sinker cams are properly set for this purpose, that the side sinker cam working with the front stitch cam in reciprocatory work, serves as a casting off cam when knitting in double feed work as herein described. Of course, in straight-a-way knitting the sinker cam cap which is capable of oscillating to and fro, moves with the direction of knitting or advances so that the side sinker cam over the rear stitch cam serves as a casting off cam in the usual way. At the same time, that advance of the sinker cam cap will bring the side sinker cam over and a little beyond the front stitch cam in a position to act as a casting off cam for use at the auxiliary side. During reciprocatory work when stitches are being drawn first in one direction of knitting and then in the other, these side sinker cams function in the usual way. They are always adjustable in the cam cap and by such adjustment, it is possible to take care of casting off the auxiliary yarn stitches without any additional sinker controlling means.

Now referring to the figures of drawing in which one preferred embodiment has been illustrated as applied to a typical hosiery machine, the invention will be described more specifically with reference to the figures of drawing in which:

Fig. 1 is an elevation showing part of a knitting machine frame, circular base, cylinder and attendant parts to which the invention has been applied;

Fig. 2 is a plan showing the cam means employed for controlling needles according to the invention;

Fig. 3 is a diagrammatic view showing needle and jack butt engaging cams and pathways of needle and jack butts as they are controlled by the various cams during knitting of both a main and an auxiliary yarn;

Fig. 4 is a plan of part of the sinker cam cap

showing sinker cams and the pathway of sinker butts as they pass through these cams;

Fig. 5 is an isometric view showing knitting at the so-called auxiliary side and especially casting off stitches at that side; and

Fig. 6 is a detail view of a needle and sinker which shows stitch drawing over a sinker nib.

Now referring to the figures of drawing, in Fig. 1 a typical hosiery knitting machine is shown having a frame 1, circular base 2 and a needle cylinder 3. The needle cylinder is preferably, although not necessarily, of rotatable type and is slotted for the usual needles of latch type which are independently actuated by a series of butt engaging cams. The needles knit in conjunction with sinkers which are as usual carried in a sinker head 4 and a plurality of sinker cams are retained with a sinker cam cap 5 which is to be oscillated to and fro during reciprocatory knitting as described in United States Patent #933,443. The machine has a main cam shaft 6 with a series of drums thereon carrying the usual cams for controlling the functions of the machine during knitting an article of hosiery. A carrier ring 7 has a mouthpiece (not shown) and within that mouthpiece would be pivotally arranged a plurality of feeding levers, said levers being controlled to feed different yarns by mechanism well-known to those skilled in the art.

On the cam plate 8 there are mounted a plurality of cams including a main cam block 9 shown in greater detail in Fig. 2. That main cam block carries a front stitch cam 10, a rear stitch cam 11, a center raise cam 12 and a guard cam 13, Figs. 2 and 3. This cam plate also carries fixed cam 14 which is a raise cam and is adapted to hold needles at a level where their stitches which were last drawn hang on the latches. A cam 15 serves to control jacks and also affects needles to level them and to raise them to the level of cam 14 during reciprocatory work. Cam 16 levels jacks while cam 17 which is one of the instep cams serves to control needles after knitting a heel or a toe and also guides those needles all as described in United States Patent No. 2,260,020.

A needle 18 having a butt 19 is shown in the diagrammatic Fig. 3 and under each of these needles is a jack 20 having a master butt 21, a series of saw tooth butts 22 and two other butts 23 and 24, these latter butts being for the purpose of selection and also for certain other functions not a part of this particular case. A series of selecting plungers 25 equal in number to the number of selective butts on a jack, are controlled by a drum or other means as is the usual practice so that selecting movements may be imparted to the jacks according to whatever needle control is desired. A cam 26 acts upon the master butts 21 of those jacks which have been raised, but one of the selecting plungers and a jack thus raised will elevate its corresponding needle so that the butt of that needle moves in pathway 27 up to an elevation 28. Then the hooks of needles selected in that way follow in pathway 29 so that they take the yarn 30 feeding through yarn feeding finger 31. That yarn is the auxiliary yarn and the finger 31 is connected at one end of a pivoted lever 32 which swings about the pivot 33. A second lever 34 pivoted at 35 is drawn downwardly at appropriate times by a wire 36. A spring normally tends to maintain the lever 32 and its finger 31 down so that the auxiliary yarn will feed to selected needles. When it is not to be fed, these elements are raised by lever 34 since the wire 36 will be pulled downwardly under the influence of certain cams on a drum 37. These cams are not illustrated at this point since they are well-known in the art and their construction is evident in Patent No. 933,443.

A cam 38 is attached to bell crank lever 39 and that lever is in turn pivoted to swing at the point 40. The lever and its cam are supported by a bracket 41 attached to a post 42. The cam 38 is normally maintained inwardly against the cylinder by a tension spring 43 connected at the outer end of arm 44 of the bell crank lever and to a post 45 projecting upwardly from the circular base. A wire link 46 also connects at the outer end of the arm 44 and projects through a hole in the arm 47 of a second bell crank lever which pivots at 48 and has a horizontally disposed arm 49. To this last mentioned arm there is connected a bar 50 which extends down through guide 51 and bears either on the drum 52 or on a cam 53 on that drum. The wire link 46 has collars 54 and 55 which are adjustably fixed on that wire at either side of the arm 47 of the bell crank lever. A bracket 56 is attached to the circular base and serves as a support for the bell crank levers having arms 47 and 49. A spring 57 is connected to the bar 50 and to a fixed part of the machine structure, this spring being considerably stronger than the spring 43.

When the bar 50 rides upon a cam 53 as in Figs. 1 and 2, the mechanism is moved so that spring 43 can draw the bell crank lever 39 in a direction so that cam 38 will go in against needle butts and eventually against the cylinder. When the bar drops from that cam 53, spring 57 will pull the bell crank having arms 47 and 49 in such a direction that the slack between the collars 54 and 55 will be taken up and pull on the wire rod 46 will withdraw the cam 38. The cam 53 is so constructed that the cam 38 will be pulled outwardly in two steps, that is, first so that it will engage only long butts and thereafter, to such an extent that it will engage neither the long nor short butts. This is accomplished by providing a step on cam 53 so that the bar drops first to the step and then from the step to the drum.

At the main cam block a movable cam 58 is arranged to slide on an upper surface of center raise cam 12. A spring 59 normally maintains cam 58 inwardly against the cylinder in which position it acts as a raise cam for needles and will elevate them to a position in which their latches will be cleared. At desired times, the cam 58 may be withdrawn by lever 60, link 61 and other connected parts leading down to appropriate cams on one of the cam drums.

At the main side of the machine one of the yarn levers at the main mouthpiece is indicated by numeral 62. That lever is feeding a yarn 63 which is one of the several yarns which may be fed at that point. The needle butts 19 move in a pathway 64 during any knitting in which both the main and auxiliary yarn are feeding, and such needles as take yarn 30 will knit it beneath the point of cam 10. After that all needles rise in the pathway 65 until their latches are cleared and then move down as influenced by cams 13 and 11, taking yarn 63 and drawing stitches of that yarn beneath the point of the said cam 11.

Now referring to Fig. 4, the sinker cam cap 5 has been shown cut away so as to illustrate the front side sinker cam 66, the rear side sinker cam 67 and center sinker cam 68. It is to be

understood that the usual complement of sinkers is carried in the sinker head and a few only of these sinkers 69 are shown. Each sinker has a butt 70. These sinker butts pass along in a pathway 71 which is more or less concentric except as sinkers are governed by the cams just above mentioned.

It is to be understood that the sinker cam cap is capable of being oscillated to and fro in reciprocatory work all as described in Patent No. 2,116,632. In circular work, the cap will be moved around against its adjustable stop so that as stitches are drawn from yarns fed at the main feeding station and beneath cam 11, the casting off point 72 of cam 67 will be in a proper position to assure casting off of stitches by the sinkers or web holders. When using the main cam block for drawing stitches of yarn fed at the main mouthpiece only, the sinker cam 66 has no particularly useful function. Of course, during reciprocatory work, the cap will oscillate so that on reverse strokes of reciprocation (clockwise strokes), the side sinker cam 66 will perform the usual casting off function as stitches are drawn beneath cam 10.

Now when practicing the method of this case and when the sinker cam assembly has been oscillated around against a stop in the direction of the arrow, Fig. 4, or counter-clockwise, the side sinker cam 66 performs an additional function. At that time stitches are being drawn from the so-called auxiliary yarn as needles are moved down by cams 38 and 10, and the point 73 of the cam 66 becomes a casting off point for previously drawn stitches as the so-called auxiliary yarn is knitted by the above mentioned action of cams 38 and 10 upon the needles. By proper adjustment of cam 66 it functions very effectively to act as a casting off cam as stitches are drawn under the cam 10, either in straight-a-way circular work or in so-called reverse strokes of reciprocation.

In Fig. 5 several sinkers 69 are illustrated and these sinkers have butts 70 and nibs 74. Beneath the said nibs is the usual throat 75. Alternate ones of the needles 18 have taken in their hooks the auxiliary yarn 30, said yarn floating behind hooks of intermediate needles. The yarn 30 is drawn over the nibs of all of the sinkers and in this particular instance sinker nibs are of rounded construction or are what is known as standard sinkers. Other types of sinkers may be employed, for example, sinkers having flat topped nibs or sinkers having nibs with inclined or beveled edges over which the yarns may be drawn.

In this Fig. 5 previously drawn loops of the main yarn 63 are shown, alternate needles havin those loops about the shanks since they have been cleared below latches and intermediate needles having the loops of that yarn in their hooks. The loops which were cleared, that is, those on alternate needles, are cast off at this point under the influence of the casting off point 73 of cam 66.

The timing of the inward sinker movement under the influence of cam 73 is so governed that maximum projection occurs just after a cooperating needle has reached the lowest point under cam 10. Since the yarn 30 is drawn over the tops of all sinker nibs, the casting off of previously drawn stitches is done by the combined effect of sinkers pushing inwardly on the fabric held in their throats and also, the pushing inwardly of the course drawn from yarn 30 as floats of that yarn are forced behind intermediate needles.

In Fig. 6 a needle 18 is shown drawing a stitch of the yarn 30 over the top of a sinker nib 74. According to that practice stitches from an auxiliary yarn may be drawn on spaced needles and the intervening floats elongated so that the resulting fabric will have greater possibilities of lateral extension.

Operation

Now referring to Figs. 3, 4, 5 and 6, operation of the mechanism will be described briefly. Assuming that an auxiliary yarn 30 is feeding at the so-called auxiliary side and that a main yarn 63 is feeding at the main side of the machine, needles are selected by their jacks as alternate jacks ride up the plunger 25 and then those same jacks are further elevated by the cam 26. Thus alternating needles will be raised to take the yarn 30 in their hooks whereas the intermediate needles will not have their latches cleared nor will they take yarn. Needle butts 19 then engage cam 38 so that needles are drawn downwardly to engage the cam 10 as shown in Fig. 3, that cam drawing them down to their fullest extent so that stitches of the yarn 30 will be drawn as in Fig. 6. As illustrated in Figs. 4 and 5, sinkers are moved in just after needles reach their lowest point of travel, taking for example a cooperating sinker and needle, so that by means of the casting off point 73 the previously drawn loops of yarn 63 will be cast from the needles, at least from alternate nedles. Of course, intermediate needles did not clear their latches and can not cast off until they reach the so-called main knitting point.

All needles are raised up cam 12, and since the cam 58 will be in active position at this time, all needles will be elevated above that cam or to a latch clearing level. Then all needle butts will draw downwardly between cams 13 and 11 so that they all take the yarn 63 and draw knitted stitches from it. Casting off at that side is accomplished by the point 72 of the cam 67 and, of course, alternate needles will cast off the last drawn stitches of the yarn 30 while intermediate needles will cast off stitches of yarn 63, those stitches having been drawn when those same needles pass the main stitch drawing point on the previous revolution. Thereafter all needles are raised by cam 14 and sinkers move around being maintained in position by the concentric cam race in the sinker cam assembly.

In straight-a-way work the cam 58 may be withdrawn, although it is not essential that it be withdrawn at that time although it is essential to withdraw it during reciprocatory knitting. Cam 38 will be withdrawn just as soon as knitting of the yarn 30 is to be discontinued. Of course, the feeding means for the yarn 30 will be elevated at that time too. The cam 38 is moved outwardly in two steps, first, to a half way position while long butts are passing it. Then after all the long butts have been moved down the cam 38 to engage and pass below cam 10, it is moved outwardly to completely inactive position. That assures that all needles taking yarn 30 will pass beneath and will knit under cam 10, that not being possible of accurate accomplishment if the cam 38 were to be moved out on short butts or were to be moved completely out all in one step.

The machine organization and method has

been described as applied to knitting in which one yarn is to be knitted beneath a rear stitch cam on all needles passing and an auxiliary yarn by the combination of cams at the front stitch cam while spaced needles only are to draw knitted stitches. That is by way of example only, and, of course, all needles might knit at the front stitch cam, or some only of the needles might knit at both stitch cams. Selecting means may be provided whereby the needles knitting at the front cam are not the same needles as would knit at the rear stitch cam.

If it is desired to tuck, the movable cam 58 is provided with suitable withdrawing means to withdraw it periodically, that being possible of accomplishment in such a way that tuck stitches of any desired length may be produced. The feeding of yarns may not be limited to a single at each stitch, but a plurality of yarns may be fed at either or both and, if desired, yarn change may be effected so that striping or other ornamental or varied effects will be knitted. The yarn or yarns employed may be of any common type and may be inelastic or elastic as the occasion requires. The invention is not to be limited other than by the scope of the appended claims.

We claim:

1. In a circular, independent needle knitting machine, knitting instrumentalities and means for feeding two yarns at separate points about the said machine, stitch cam means at one of said points for controlling knitting instrumentalities to draw and knit stitches of one of said yarns, and other stitch cam means functioning to control the knitting instrumentalities in conjunction with part of said first mentioned stitch cam means for drawing and independently knitting the other of said yarns.

2. In a circular, independent needle knitting machine having in combination a cylinder and needles carried by said cylinder, feeding means for feeding a yarn and stitch cam means for knitting that yarn in one direction of travel of the said needles through the cam means and also when moving said needles reciprocatorily to knit said yarn, a second yarn feeding means slightly in advance of that first mentioned and a stitch cam operable upon needles and functioning in conjunction with part of said first mentioned stitch cam means to cause said needles independently to draw stitches from this second yarn.

3. In a circular, independent needle knitting machine, a cylinder, needles carried by and slidable in slots in said cylinder, yarn feeding means and cam means including a front and a rear stitch cam operable upon said needles and causing them to draw stitches either in straight-a-way knitting or in reciprocatory work, a second yarn feeding means for feeding yarn in advance of the first mentioned yarn feeding means and a movable cam operable in conjunction with the front stitch cam of said first mentioned cam group to cause needles to be drawn downwardly in a stitch drawing wave and thereby to draw and knit stitches from the second mentioned yarn.

4. A circular, independent needle knitting machine having in combination knitting instrumentalities and means at one point for causing said instrumentalities to perform a knitting function and means for causing said instrumentalities to perform a second and distinct knitting function which latter means includes a cam separate from but operable cooperatively with part of the first mentioned means.

5. A circular, independent needle knitting machine having in combination a needle cylinder and needles carried by and slidable in slots in said cylinder, yarn feeding means and a main cam block associated with said yarn feeding means including a front stitch cam and a rear stitch cam operable upon said needles to cause them to draw stitches in both straight-a-way and reciprocatory knitting, a second yarn feeding means in advance of that first mentioned and a movable cam in advance of the front stitch cam and so constructed as to draw needles downwardly so that they will be caused to pass below the front stitch cam thereby taking yarn and drawing stitches of the second mentioned yarn at that point.

6. In a circular, independent needle knitting machine, a needle cylinder, needles carried by said cylinder, a sinker assembly and cams associated therewith including front and rear side sinker cams, yarn feeding means including a main yarn feeding means and a so-called auxiliary yarn feeding means in advance of the main yarn feeding means, a cam set including a front and rear stitch cam associated with the main yarn feeding means and a cam movable to and from active position, and cooperating with said front stitch cam for drawing needles downwardly to take and knit the yarn fed by said auxiliary feeding means, the construction being such that two yarns are simultaneously fed and separately knitted and that the said side sinker cams function to cast off stitches.

7. A circular, independent needle knitting machine having in combination a cylinder, needles in said cylinder, a main yarn feeding means and a so-called auxiliary feeding means, cam means for the main yarn feeding means including a front and a rear stitch cam, a sinker assembly and cams for sinkers including front and rear, side sinker cams, the auxiliary feeding means being positioned in advance of the first mentioned feeding means and having associated therewith a cam for drawing needles downwardly in advance of the front stitch cam so that needles may drawn yarn and knit beneath said front stitch cam, the construction further being such that during straight-a-way knitting the front sinker cam will function to cast off stitches drawn beneath the front stitch cam while the rear sinker cam casts off stitches drawn beneath the rear stitch cam and that during reciprocatory work, the sinker cams function to cast off stitches, one for one direction of knitting and the other for the other direction of knitting.

8. A circular, independent needle knitting machine having in combination a cylinder, needles in said cylinder, a main yarn feeding means and a so-called auxiliary feeding means, cam means for the main yarn feeding means including a front and a rear stitch cam and a movable clearing cam between said front and rear stitch cam, a sinker assembly and cams for sinkers including front and rear, side sinker cams, the auxiliary feeding means being positioned in advance of the first mentioned feeding means and having associated therewith a cam for drawing needles downwardly in advance of the front stitch cam so that needles may draw yarn and knit beneath said front stitch cam, the construction further being such that during straight-a-way knitting the front sinker cam will function to cast off stitches drawn beneath the front stitch cam while

the rear sinker cam casts off stitches drawn beneath the rear stitch cam and that during reciprocatory work, the sinker cams function to cast off stitches, one for one direction of knitting and the other for the other direction of knitting.

9. In a circular, independent needle knitting machine, a needle cylinder, needles in said cylinder, a sinker assembly and cams for controlling said sinkers including side sinker cams, means for feeding a yarn and cam means including a front and rear stitch cam for causing needles to draw stitches from that yarn in both straight-a-way and reciprocatory knitting, a second yarn feeding means in advance of said first mentioned feeding means, selecting means for raising predetermined needles and a movable cam for drawing those needles downwardly after taking yarn from the second feeding means to a point where said needles will be engaged and drawn down by the front stitch cam thereby to draw knitted stitches of the second mentioned yarn.

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