

[54] **YARN FEEDING ARRANGEMENTS
FOR CIRCULAR KNITTING
MACHINES**

[72] Inventors: **Henry Sidney Burdett**, Oadby, Le-
icester; **Ronald Harris**, Leicester, Le-
icester, both of England

[73] Assignee: **Stibbe Machinery Limited**, Le-
icester, England

[22] Filed: **June 22, 1970**

[21] Appl. No.: **48,108**

[30] **Foreign Application Priority Data**

July 2, 1969 Great Britain.....33,421/69

[52] U.S. Cl.66/19, 66/131, 66/138

[51] Int. Cl.D04b 9/06, D04b 15/48

[58] Field of Search.....66/131, 19, 138

[56] **References Cited**

UNITED STATES PATENTS

3,563,059	2/1971	Martinetz	66/19
3,452,559	7/1969	Paepke	66/19
716,767	12/1902	Scott.....	66/19 X
3,422,638	1/1969	Widdowson et al.	66/19

FOREIGN PATENTS OR APPLICATIONS

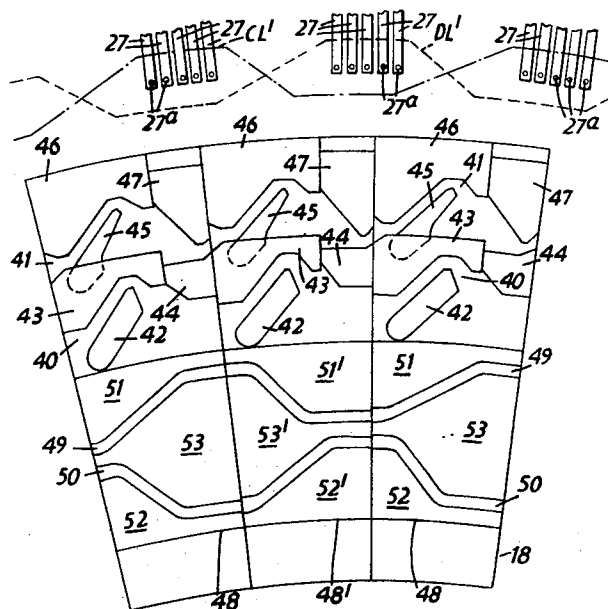
1,056,189	10/1953	France.....	66/131
1,340,280	9/1963	France.....	66/131

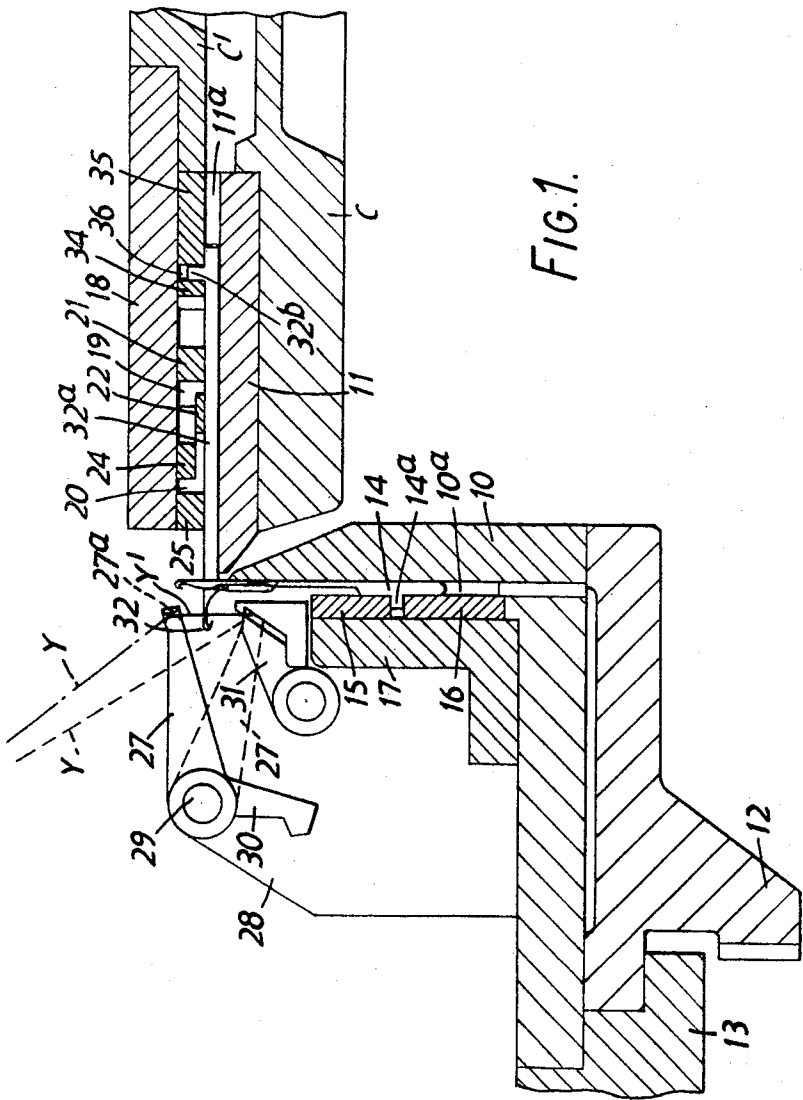
Primary Examiner—Wm. Carter Reynolds
Attorney—Larson, Taylor and Hinds

[57] **ABSTRACT**

A multi-feed circular knitting machine of the cylinder and dial type is equipped with selectively operable yarn change guides at each feed and has located in its needle dial yarn catching means for engaging a yarn supplied by a guide and positively introducing it to the cylinder needles. The dial cam cap has mounted on it entirely independent cam systems at the feeds for operating the yarn catching means in timed relation with the guides and the movements of the needles. The independent cam systems are located radially inwards of the conventional dial needle cam systems. With widely spaced feeds, a single yarn catch hook for service thereat is sufficient. But with closely spaced feeds there are two juxtaposed and differentiated yarn catch hooks, the independent cam systems in this case being so designed that the two hooks function at the alternate and the intervening feeds respectively.

7 Claims, 8 Drawing Figures





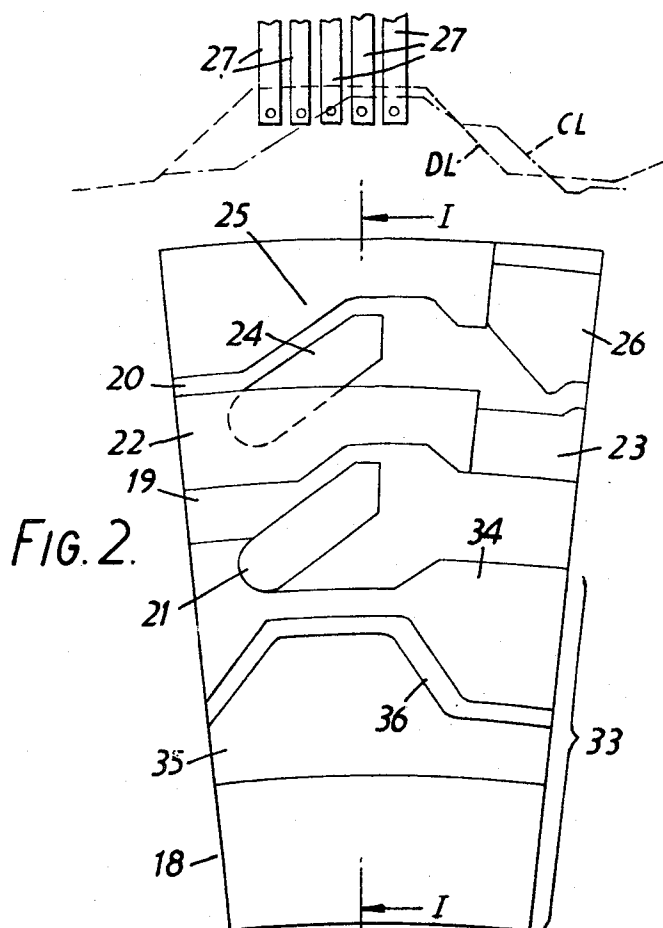


FIG. 3.

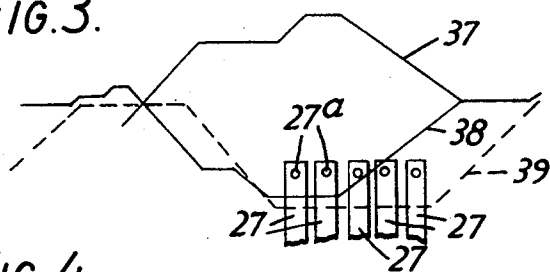
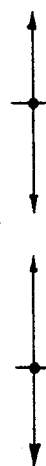
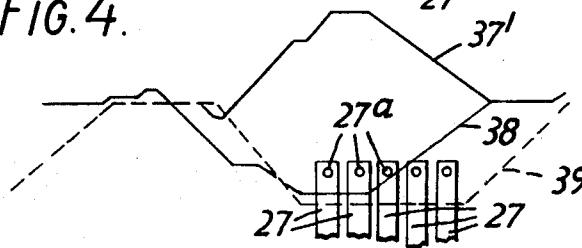


FIG. 4.



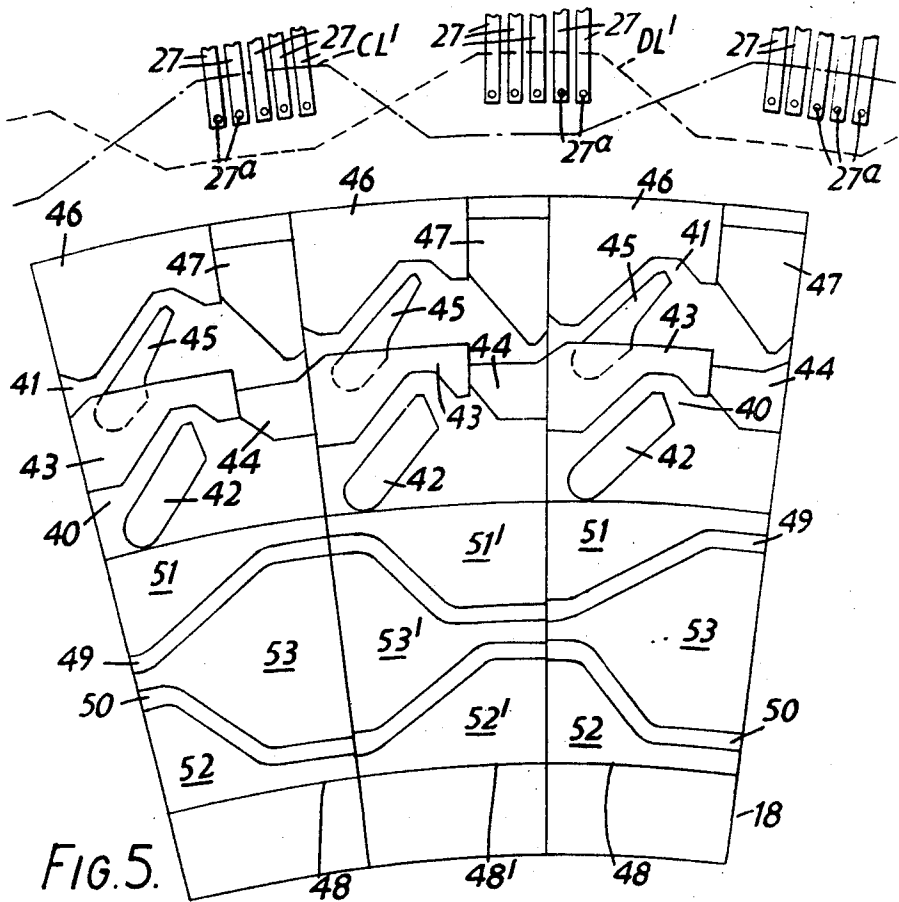


FIG. 6.

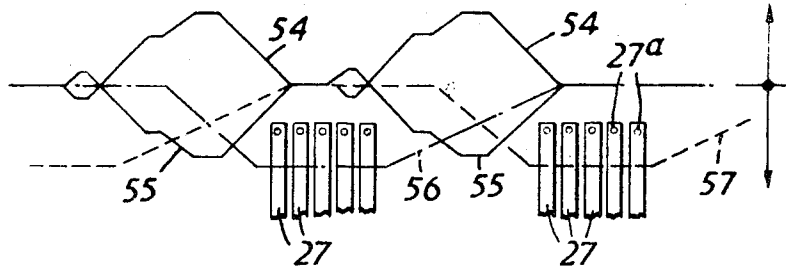


FIG. 7.

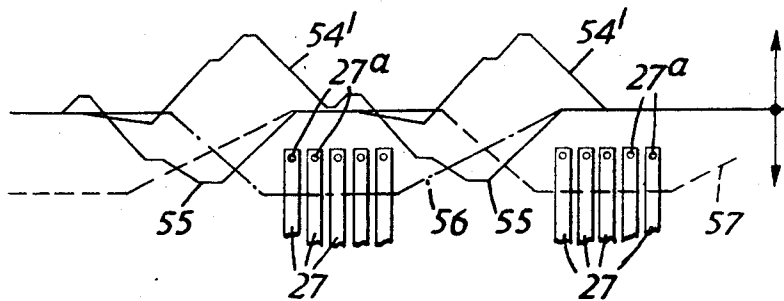
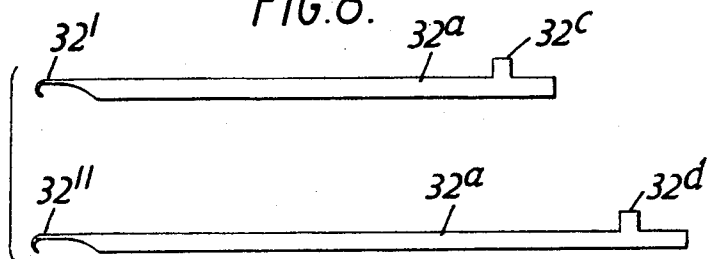


FIG. 8.



YARN FEEDING ARRANGEMENTS FOR CIRCULAR KNITTING MACHINES

This invention relates to yarn feeding arrangements for circular knitting machines, and concerns in particular arrangements of the kind applicable to machines of the independent needle type which include a plurality of yarn guiding elements or fingers (hereinafter briefly referred to as 'guides') disposed side by side and automatically movable interchangeably, under pattern control, into and out of operative positions at the so-called feeds.

Arrangements of this kind, conventionally called yarn changing or striping mechanisms, are used for feeding yarns of different characteristics, e.g. colors, to the needles so as correspondingly to vary the composition or/and appearance of the knitted fabric so produced, as, for example, by horizontal striping. In this respect it is essential that when yarn changes are made each of the different yarns should be positively taken by the needles at the feeds of the machines, that is to say at the feed, or (as is primarily the intention) in the case of a multi-feed machine at each feed, so as to avoid the production of imperfect knitted fabric by reasons of yarns being missed or insecurely taken.

Here-to-fore one way of doing this has been to arrange and actuate the respective guides suchwise that each guide is moved sufficiently to cause its yarn to pass through the circular line of the needles and to be taken by the needle hooks and knitted in. While this is satisfactory so far as single feeds, or well spaced feeds of a multi-feed machine, are concerned, there is a disadvantage in that with a multi-feed machine having closely adjacent feeds, the 'land' on the needle camming at a feed is not sufficient to allow time for a yarn to be presented, as aforesaid, from more than one or two guides when, as may be, the number of guides is in excess of two and as many as, say, five.

It is also known that by providing an independent yarn engaging element, such as a catch hook, cam operated in timed relation with the yarn changing mechanism, a yarn presented to the needles from any one of a number of guides can be positively introduced to the line of the needles so as to be taken by the needle hooks and thus securely knitted in. Nevertheless the provision of such a yarn engaging element, while disposing of the aforesaid disadvantage, has created another insofar as the actuation thereof has required a complicated mechanism. In an alternative previously adopted arrangement, applied to a circular knitting machine of the cylinder and dial type, a catch hook is used in the dial in place of a dial needle. This hook has a longer actuating butt, and the dial cam system is devised by incorporation of a cam for action upon the longer butt to project the catch hook in timed relation with a yarn change, the said butt being acted upon by the normal needle retracting and stitch cams to retract the hook and so positively introduce the caught yarn to the needles required to take it safely. The last described prior arrangement, however, is somewhat restrictive in that the retraction of the catch hook occurs simultaneously with the retraction of the adjacent dial needles which is not as safe as controlling the catch hook independently by entirely separate cam action.

The present invention has for its objects to provide improved means for obtaining yarn engagement with

the needles with certainty in the performance of yarn changes of the character aforesaid, in a simpler manner than here-to-fore.

Broadly considered, the invention consists of providing in a circular knitting machine of the independent needle type equipped with yarn changing mechanism of the kind described, yarn catching means for co-operation with the yarn guides at a feed and an entirely independent cam system at the feed for effecting the requisite movements of the said means in timed relation with the actuation of the yarn changing mechanism and the knitting movements of the needles at that feed.

In this respect the invention is applicable primarily and advantageously to circular independent needle knitting machines of the cylinder and dial type equipped with independent latch needles, with the yarn catching means located in the dial and the independent cam system mounted on the dial cam cap, concentrically with the dial needle cam system which consequently remains unaltered.

Conveniently the objects of the invention are achieved in a two-fold manner, that is to say

1. by providing but one single yarn catching element for service at a multiplicity of relatively widely spaced feeds with corresponding independent cam systems for the element located within the normal dial cam systems at the feeds and

2. by providing two differentiated and juxtaposed yarn catching elements in a machine having a multiplicity of closely spaced feeds, the corresponding independent cam systems in this case being so designed that the said two elements function respectively at alternate feeds.

In order that the invention may be more clearly understood and readily carried into practical effect, two such examples of the invention, applied to a multi-feed machine of the cylinder and dial type having two dial cam tracks respectively for differentiated dial needles, will now be described with reference to the accompanying drawings, wherein

FIG. 1 is a vertical sectional view of so much of such a machine as is necessary to illustrate an arrangement in which only one yarn catch hook is provided for service at a feed, the section of the dial and dial cam cap being taken on the line I—I of FIG. 2,

FIG. 2 is an underside plan view of a section of the dial cam cap at one feed of the machine, this figure also showing a few of the yarn guides and the paths of the single catch hook and the dial needle hooks,

FIG. 3 is a diagrammatic representation of the paths of a catch hook and the cylinder and dial needles in relation to yarn guides in point to point timing,

FIG. 4 is an equivalent representation appertaining to late timing,

FIG. 5 diagrammatically represents the paths taken by two different catch hooks alternately in relation to yarn guides at closely spaced feeds of a multi-feed machine,

FIGS. 6 and 7 illustrate (in the same manner as FIGS. 3 and 4) the paths of the said two different catch hooks and the cylinder and dial needles in relation to yarn guides at closely adjacent feeds, in point to point and late timing respectively, and

FIG. 8 comprises, for comparison, juxtaposed side views of the said two differentiated catch hooks.

Like parts are designated by similar reference characters throughout the drawings.

Referring to FIG. 1 it will be seen that the machine comprises a rotary needle cylinder 10 and a correspondingly rotatable needle dial 11. The cylinder drive gear is indicated at 12 and the head base of the machine at 13. The cylinder 10 is formed in the usual way with tricks such as 10a each of which accommodates an independent latch needle 14. The dial 11 is radially tricked as at 11a to receive independent dial needles of the latch type (not shown). Each cylinder needle 14 is furnished with an operating butt 14a arranged to be acted upon by cams 15, 16 in a stationary annular cam box 17 surrounding the cylinder 10. The stationary dial cam cap is indicated at 18. The dial 11 and the dial cam cap 18 are supported by carriers C and C' which are respectively rotatable together with the cylinder 10 and stationary.

Each section of the dial cam cap 18, one of which is illustrated in FIG. 2, has therein portions of two dial needle cam tracks 19 and 20 respectively for dial needles (not shown) all of an equal length some of which each have a butt engaging in the outer cam track 20 only, whereas the others each have two butts, one of which engages in the outer track 20 and the other of which engages in the inner track 19. The track 19 in each cap section is defined by an adjustable clearing cam 21 and guard cams 22 and 23. The track 20 in the section is defined by an adjustable clearing cam 24, a guard cam 25, a stitch cam 26 and the aforementioned two guard cams 22 and 23 which latter are common to both tracks. Both sets of dial needles are acted upon by the stitch cam 26.

At each feed of the machine there are provided, in the first illustrated example, five yarn change guides 27. All five guides are represented in FIG. 2, whereas in FIG. 1 only one of such guides of a multi-guide stripper unit 28 of known form is shown. As will be seen, each yarn guide 27 is arranged to turn about a pivot pin 29 and is furnished with an arm 30 by means of which it is operated. Each guide is movable from a lower inoperative, i.e. non-feeding, position, indicated in dotted lines, to an upper operative, i.e. yarn feeding, position represented by full lines, and vice versa. Each stripper unit 28 includes a yarn trapper 31 disposed below the level of dial needles in the dial 11. The inner, free end of each guide 27 has therein a feed hole 27a through which the relevant yarn Y, drawn from a supply, passes. The line taken by such a yarn when it is withdrawn from knitting by a downward swing of the guide 27 is indicated by a dotted line, whereas the line taken by the yarn when the guide is swung upwards to present a vertical portion Y' of the yarn to a catch hook is indicated by a chain line.

In accordance with the characteristic feature of the present invention, there is provided in one of the tricks 11a in the dial 11, in the place of a dial needle, one yarn catch hook 32 (see FIG. 1) the stem 32a of which is provided with an operating butt 32b to be acted upon by a cam system 33 (see FIG. 2) which is separate from and inside (towards the center of the machine) the hereinbefore described normal dial needle cam tracks 19 and 20. This separate cam system, generally designated 33, comprises cams 34 and 35 defining between them a track 36 for the catch hook operating butt 32b.

In this way there is eliminated the need for complicated actuating means and at the same time making the action of the catch hook completely independent of the normal dial needle cam tracks. This allows the action of the catch hook to be so timed as to safely cover the requirements of collecting a yarn from any one of the yarn guides 27 and feeding that yarn into the hooks of the cylinder needles 14, both on point to point and late timing settings, and furthermore to hold the yarn into the cylinder needles until they have safely locked in that yarn.

The operation of the single yarn catch hook 32 in relation to the yarn guides 27 and the dial needles is diagrammatically illustrated in FIG. 2, the paths of the catch hook and the dial needle hooks being represented by dotted and chain lines DL and CL respectively. The needles are assumed to be traveling from left to right in FIG. 2. In FIG. 3, which shows point to point timing, and in which needles are assumed to be travelling from right to left, the path of the hooks of the cylinder needles 14 (in a vertical plane) is indicated by a full line 37, the path of the hooks of the dial needles (in a horizontal plane) is indicated by a full line 38 and the path of the single catch hook 32 is indicated by a dotted line 39 — all three paths being shown in relation to the yarn change guides 27.

In FIG. 4, which shows late timing, the full line dial needle hook path 38 and the dotted line catch hook path 39 are precisely the same as in FIG. 3, the late timing being achieved by circumferentially shortening or contracting the path of the cylinder needle hooks — indicated in this case by the full line 37'. Such shortening or contracting may be done by removing cylinder cams and replacing them with shorter or contracted cams.

Because, in the arrangement illustrated in FIG. 1-4, the feeds of the machine are comparatively widely spaced, it is only necessary to provide one catch hook 32 to function at each of the feeds successively.

But in the alternative arrangement shown in FIGS. 5-8, wherein the feeds are much more closely spaced and there is insufficient linear space for one yarn catch hook to carry out its function safely, two such catch hooks 32' and 32'' of different lengths and occupying dial needle tricks such as 11a adjacent or close to one another are provided. Of these two catch hooks one of them is provided to service alternate feeds and the other to service the intermediate feeds.

The two catch hooks 32' and 32'' are clearly shown in FIG. 8. As will be seen, the stem 32a of the hook 32' is shorter than the stem of the hook 32''. The stem of the shorter catch hook is furnished with an operating butt 32c whereas the longer hook has an operating butt 32d.

In FIG. 5 are depicted three complete sections of the dial cam cap 18. Each of these sections, as in the first described example, has portions of two dial cam tracks 40 and 41 respectively for the differentiated dial needles. The portion of the inner track 40, in each section of the dial cam cap, is defined by an adjustable clearing cam 42 and two guard cams 43 and 44. The portion of the outer track 41 in each such section, on the other hand, is defined by an adjustable clearing cam 45, a guard cam 46 and a stitch cam 47 which latter is for causing both sets of dial needles to knit as required. Each section of the dial cam cap 18 in this second example has a separate cam system 48 or 48' on the in-

side of the dial needle-tracks 40 and 41, this separate system being designed to provide one track 49 for the operating butt 32c of the shorter catch hook 32¹ and another track 50 for the operating butt 32d of the longer catch hook 32¹¹. The camming 51, 52 and 53 of the separate cam systems 48 at alternate feeds, and the camming 51¹, 52¹ and 53¹ of the separate cam systems 48¹ at the intervening feeds are respectively opposite hand and such that one of the two catch hooks only is brought into action at said alternate feeds and the other at said intervening feeds. In this way ample space is given for each of the hooks to carry out its function safely, that is to collect yarn from any one of the yarn guides 27 at that feed, to draw that yarn into the cylinder needles 14 and to hold the yarn until the cylinder needles have safely locked the yarn in. Thus, as will be appreciated from a comparison of FIGS. 5 and 8, the shorter hook 32¹ will be projected radially outwards from the dial 11 and the longer hook 32¹¹ will be retracted radially inwards into the dial by the separate dial cam system 48 at each of the alternate feeds, whereas the separate dial cam system 48¹ at each of the intervening feeds will cause the longer hook 32¹¹ to be projected outwards and the shorter hook 32¹ to be retracted inwards.

In FIG. 5, the paths taken by the shorter and the longer yarn catch hooks 32¹ and 32¹¹ alternately in relation to yarn guides 27 at the closely spaced feeds are diagrammatically represented by chain and dotted lines CL¹ and DL¹ respectively. The needles are again assumed to be travelling from left to right in FIG. 5.

In FIG. 6, which shows point to point timing at two adjacent feeds, and in which the needles are assumed to be travelling from right to left, the path of the hooks of the cylinder needles 14 (in a vertical plane) at each of these feeds is shown by full lines 54, the path of the hooks of the dial needles (in a horizontal plane) at the same feeds is indicated by full lines 55 and the paths of the two catch hooks 32¹ and 32¹¹ are indicated by the chain and dotted lines 56 and 57 respectively — all the paths being shown in relation to the yarn guides 27.

It is sometimes necessary, particularly when knitting regular rib structures such as 1/1 or 2/2 as opposed to interlock to arrange for the cylinder needles to knit or draw yarn at a different position to that of the dial needles in order to prevent one needle robbing yarn from another needle causing uneven stitch structure. Such an arrangement is known as late timing. To understand FIG. 7 which shows the yarn catch hook paths 56 and 57 in relation to a late timing arrangement of the cylinder and dial needles, it must first be realized that the yarn feeders 27 are attached to and move with the dial cams controlling the dial needles.

In order to achieve late timing as shown in FIG. 7, it is first of all necessary to replace the cylinder needle stitch cams with steeper angled and earlier operating stitch cams so that a later timing of the dial needles relative to the cylinder needles is already achieved by a contracted cylinder needle hook path. It is secondly necessary to shog the dial needle control cams to an even later position relative to the cylinder cams to achieve the contracted cylinder needle hook path 54¹ in its earlier position in relation to the dial needle hook path 55 as shown in FIG. 7. It is to be noted that in this second operation both the yarn catch hook control

cams and feeders 27 move with the dial needle control cams which has the effect of making a late timing of the dial needles relative to the cylinder needles.

As will be observed in each case the action of the catch hook is so timed as adequately to cover the whole of the range of yarn guides 27 at a feed so that the hook reliably catches any one of the yarns introduced to the needles on a yarn change and that yarn is gathered by the needles and knitted in with certainty. The catch hook 32, or each of the two catch hooks 32¹ and 32¹¹, as the case may be, is inverted relatively to the dial needles so that the engaged yarn is easily released when securely taken by the needles.

We claim:

1. A circular knitting machine comprising, in combination, a needle cylinder, independent knitting needles in said cylinder, a cam box which surrounds said cylinder and is fitted with needle-operating cams; a multiplicity of closely spaced feeds, a radially tricked needle dial equipped with dial needles and an associated dial cam cap furnished at the feed with a conventional dial needle cam system, a yarn changing mechanism at each feed including a plurality of yarn guides disposed side by side for feeding yarns of different characteristics to the needles, said guides being automatically movable interchangeably into and out of yarn feeding positions; and yarn catching means including two differentiated and juxtaposed yarn catching elements for cooperation with the yarn guides at the feed, the machine being characterized in that it is provided at the feed with an entirely independent cam system for effecting the requisite movements of the said two yarn catching elements in timed relation with the actuation of the yarn change guides and the knitting movements of the needles at the feed, said independent cam system being located radially farther towards the center of the machine than the conventional dial needle cam systems and being so designated that the two elements function at alternate and intervening feeds respectively.

2. A circular knitting machine according to claim 1, characterized in that the yarn catching means are located in the said dial, and the entirely independent cam system is mounted on the dial cam cap concentrically with respect to the conventional dial needle cam system.

3. A circular knitting machine according to claim 1, wherein two yarn catch hooks with stems of different lengths each occupies a dial needle trick in the dial, said tricks being close to one another, and the stems having thereon butts arranged to be operated upon by cams defining two independent and respectively separate catch hook tracks in the dial cam cap — one track for the butt of the shorter catch hook and the other track for the butt of the longer catch hook whereby one of the two catch hooks only is brought into action at alternate feeds and the other at the intervening feeds.

4. A circular knitting machine according to claim 3, wherein there are in the dial cam cap inner and outer dial cam tracks respectively for differentiated dial needles.

5. A circular knitting machine according to claim 3, wherein the cams defining the catch hook tracks are so timed as to cover the catch hooks collecting yarns from

7

selected yarn guides at the feeds and feeding those yarns into the hooks of the cylinder needles and holding the said yarns until such needles have locked them in.

6. A circular knitting machine according to claim 5, wherein the path of the hooks of the cylinder needles at each feed, the path of the hooks of the dial needles at the same feeds and the paths of the two yarn catch

8

hooks in relation to the yarn guides at the feeds are such as to result in either point to point timing (FIG. 6) or late timing (FIG. 7).

7. A circular knitting machine according to claim 3, wherein the two yarn catch hooks of respectively different lengths are inverted relatively to the dial needles, for the purpose described.

* * * * *

10

15

20

25

30

35

40

45

50

55

60

65