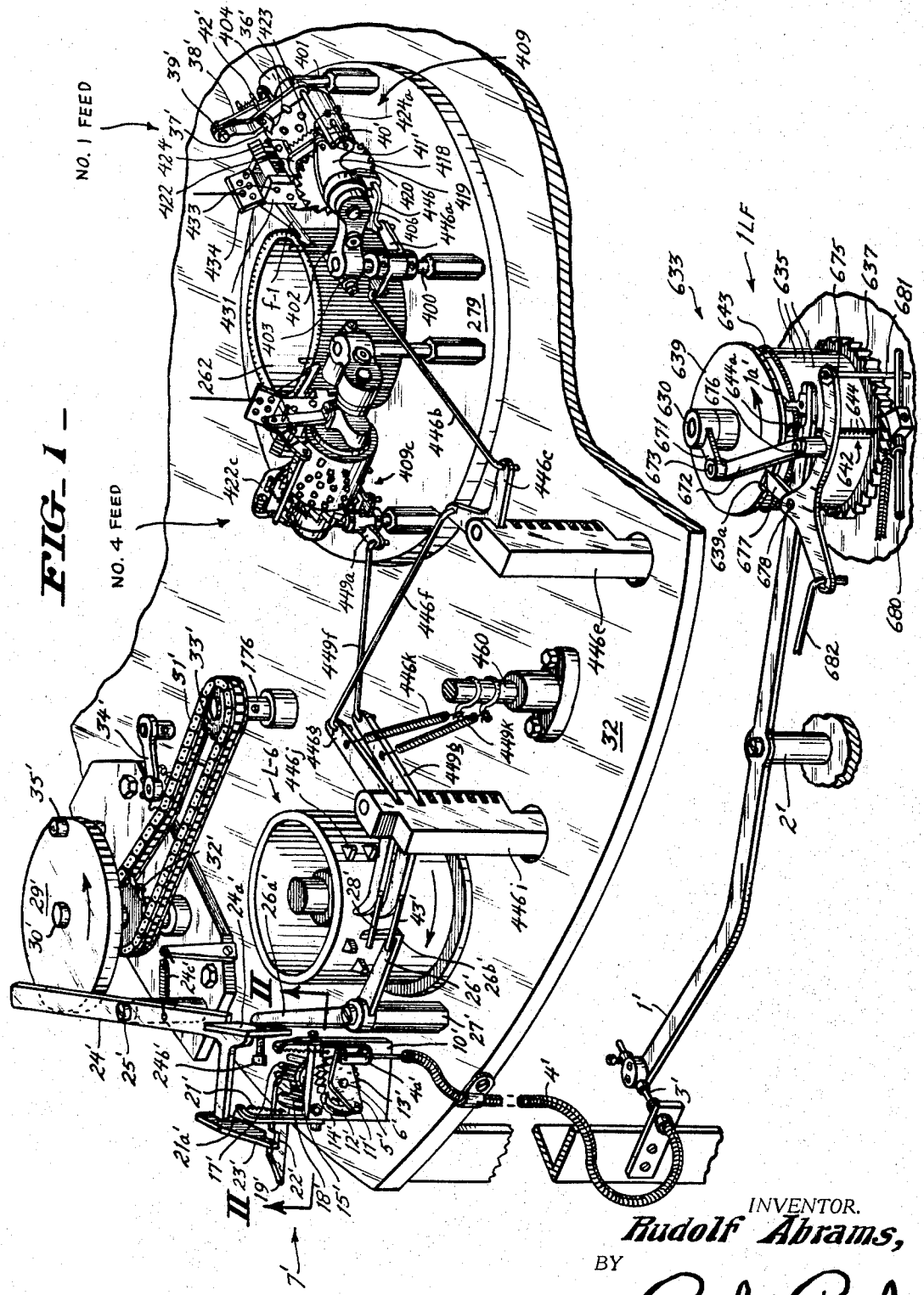
Oct. 29, 1968 R. ABRAMS 3,407,631

YARN FINGER SELECTION MECHANISM

Filed April 1, 1966 2 Sheets-Sheet 1

FIG. 1



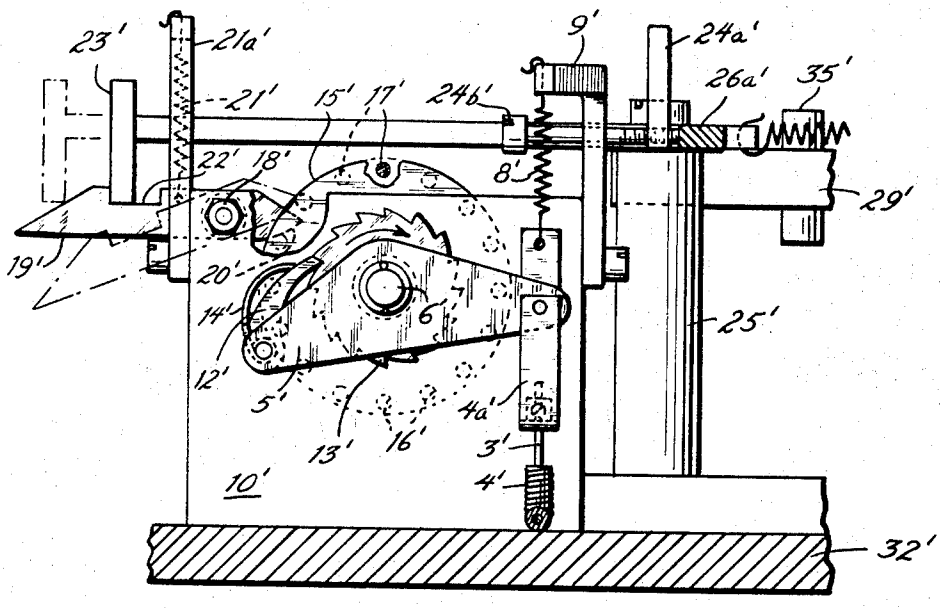
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YARN FINGER SELECTION MECHANISM

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FIG. 2



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3,407,631

YARN FINGER SELECTION MECHANISM

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2 Claims. (Cl. 66—138)

ABSTRACT OF THE DISCLOSURE

The knitting machine yarn fingers are operated by a yarn finger control drum which in turn is controlled by a main pattern drum and an auxiliary mechanism for imparting movement to the yarn finger control drum intermittently and independently of the movement imparted thereto by the main pattern drum.

This invention relates to mechanism for control of yarn fingers in circular knitting machines.

In recent years, yarn finger selection drums have found increasing popularity as a means of controlling the activation and deactivation of yarn feeding fingers. These devices are mounted adjacent the fingers and are equipped with circumferentially arranged pins which engage the fingers to take them out of action.

In the past, yarn finger control drums have been rotated by cams on a second drum mounted on the machine at approximately the same level as the yarn finger control drum. Although this arrangement is operable, it has substantial drawbacks. In order to understand the latter and to provide a background for understanding the present invention, reference will now be made to a typical arrangement of yarn finger control drums, namely, that shown in U.S. Patent 3,136,145.

In the '145 patent each yarn finger is controlled by pins or buttons displaced in selected holes arranged in a circumferential row about the circumference of a rotatable yarn finger control drum. The rotation of such drums is controlled by a pattern drum. The pins or buttons effect raising and lowering of the yarn feed fingers to take a given yarn out of action while introducing another yarn into action at the desired time in the knitting cycle. When each yarn finger carries a yarn of different color, the timed activation of certain yarn fingers and the deactivation of other yarn fingers at a station produces a pattern, as is well understood in the art.

The yarn finger control drums **409** and **409***c* for the No. 1 and No. 4 Feeds, respectively, are each equipped with a twelve-tooth ratchet wheel which is shogged by a pawl actuated by cams on the left main control drum **L–6**.

Drum **L–6** rotates only once per knitting cycle and, since it carries only six cams for each ratchet wheel, the yarn finger control drums **409** and **409***c* are advanced only six times per cycle, i.e. through only half a revolution per cycle. A yarn finger which is controlled by pins on one of said drums **409** or **409***c* can thus be manipulated, i.e., either raised or lowered, a maximum of six times per cycle.

The yarn finger control drums for the No. 2 and No. 3 Feeds are identified as **409***a* and **409***b* in the '145 patent and each is equipped with a twelve-tooth ratchet wheel also. These ratchet wheels are shogged by a pawl which is actuated by cams on the right main control drum **R–6**. The drum **R–6** carries twelve cams for each pawl. Since drum **R–6** rotates once per cycle, yarn finger control drums are shogged twelve times per cycle, i.e., through one complete revolution per cycle. Thus, a yarn finger controlled by one of the drums **409***a* or **409***b* can be manipulated a maximum of twelve times per cycle.

The limited number of manipulations possible for a given yarn finger using the above arrangement is undesirably small because only patterns of limited complexity can be produced. In order to provide for patterns for far greater complexity, it might, at first, appear that this could be achieved merely by increasing the number of cams on drums **L–6** and **R–6**. However, there is only limited space about the circumference of drums **L–6** and **R–6** and it is, therefore, not possible to increase significantly the number of cams on such drums.

The primary object of this invention is to provide means for producing highly complex patterns with knitting machines of the circular type.

It is a more specific object of this invention to produce very complex patterns through novel means for selectively controlling the movement of rotatable yarn finger control drums.

Another important and even more specific object of the present invention is to provide means for increasing the number of yarn changes per cycle in knitting machines of the type shown in the '145 patent to make possible the production of patterns far more complex and variegated than can be produced by apparatus built strictly in accordance with said patent.

To achieve the foregoing objects, I utilize an auxiliary control for the control of yarn finger control drums. I also utilize means for activating this auxiliary means whereby the control of the yarn finger control drum is transferred from the usual main control drum to the auxiliary control whenever highly complex pattern effects are desired during the knitting cycle.

For a more complete understanding of additional advantages and features of my invention, reference is made to the detailed description which follows and to the drawings, wherein:

FIG. 1 is a perspective view taken from above the left front corner of the top base plate of a knitting machine of the type shown in U.S. Patent 3,136,145, wherein only a part of the base plate is shown and many other parts are omitted for clarity, and wherein the trick drum and associated components are illustrated somewhat schematically.

FIG. 2 is an elevational view, partly in section taken along lines II—II of FIG. 1 showing details of part of the auxiliary control of this invention.

My invention is illustrated adapted to the knitting machine disclosed in U.S. Patent 3,136,145 and only those features of which are necessary to an understanding of the present invention are shown. For convenience, features which are common to the '145 patent are identified by the same reference numerals as used in said patent. Features which are not common to the '145 patent are indicated by primed numbers herein.

FIG. 1 is a view similar to FIG. 2 of the '145 patent. However, as indicated, many parts shown in said patent are omitted for clarity, including the No. 2 and No. 3 Feeds and associated controls.

In FIG. 1, there is depicted a portion of the top platform **32** above which is the top supporting plate **279** which surrounds the needle cylinder **262**. Mounted upon plate **279** are the No. 1 and No. 4 Feeds.

The mechanism at the No. 1 and No. 4 Feeds are the same, except as hereafter noted, as that shown in the '145 patent. Thus, at Feed No. 1, a pair of posts **400**, **401** is mounted upon supporting plate **279**. An arm **402** having a bifurcated end to enable the same to be adjusted vertically on post **400** is clamped to the post by a bolt **403**. A similar arm **404** is clamped to post **401**. A shaft **406** is is secured to the solid ends of arms **402** and **404**. A yarn finger control drum **409** is rotatably mounted upon the shaft **406** and is provided with six circumferentially extending rows of threaded holes, each row having twenty-four holes and adapted to have pins mounted in selected

holes thereof. The pins or buttons in each of the first five rows are disposed so as to effect raising of an adjacent yarn feed finger to take a yarn out of action. The pins in the sixth row operate a synchronizing bar **40'**, as will be explained. In the '145 patent, only four rows per drum are used.

A ratchet wheel **418** is secured to one side of drum **409**. In contrast to the '145 patent, however, which discloses a twelve-tooth wheel, the ratchet wheel **418** shown herein has twenty-four teeth. A lever **419** is rotatably mounted upon shaft **406** and is held in engagement with the outer side of wheel **418** by a collar **420**. Lever **419** carries a pin upon which a pawl **422** is mounted for engaging ratchet wheel **418** to impart intermittent rotary movement to the drum **409**. A spring **423** is connected at one end thereof by a pin **424** to pawl **422** and its other end is connected by a pin **424***a* to the lever **419**.

Mounted between cylinder **262** and drum **409** is a yarn finger supporting block **431** having a shaft **433** upon which four yarn fingers, such as finger F–1 visible in FIGURE 1, are pivotally mounted. Block **431** also supports a yarn guide bracket **434** having eyelets for the individual yarns. In the manner of the '145 patent, each yarn finger is constantly urged downwardly toward the needles by a tension spring, and a lever is provided to raise each finger to the inactive position when the end of the lever is engaged by one of the pins on drum **409**. These details are fully described in the '145 patent and are, accordingly, not shown herein.

The control mechanism for the drum **409** at the No. 1 Feed comprises a link **446**, one end of which is connected to lever **419** and the other end connected to a bell crank **446***a* pivotally mounted on post **400**. A second link **446***b* connects bell crank **446***a* to a second bell crank **446***c* pivotally mounted in a slotted bracket **446***e*, and a third link **446***f* connects bell crank **446***c* to a third bell crank **446***g* pivotally mounted in a slotted bracket **446***i*. The opposite end of bell crank **446***g* is an inturned portion adapted to be engaged by cams **446***j* projecting from drum L–6. A spring **446***k*, having one end connected to bell crank **446***g* and its other end connected to a post **460**, acts upon crank **446***g* to urge the inturned end thereof toward drum L–6. From the foregoing, it is evident that so long as the inturned end of bell crank **446***g* is maintained closely adjacent the surface of drum L–6, the cams **446***j* on the drum will successively engage the bell crank **446***g* and actuate lever **419** to cause pawl **422** to turn the ratchet wheel.

The control mechanism described thus far is substantially in accordance with that shown in the '145 patent. However, as previously mentioned, since drum L–6 revolves only once per cycle, the maximum number (6) of yarn changes per finger which can be effected by drum L–6 alone is undesirably small. In order to provide patterns of greater complexity, I have invented auxiliary control means for the control of the yarn finger control drums **409** and **409***c*. It will be understood that one or more such auxiliary control means can be provided to control the yarn finger control drums at other feeding stations, such as the Nos. 2 and 3 stations which are shown in the '145 patent but omitted for clarity here.

Briefly described, the auxiliary control means includes the use of a trick or selector drum to control the rotational advance of the yarn finger control drum. Since, in the case of current models of the machine shown in the '145 patent, the selector drums revolve twice per cycle and are fitted with one hundred fifty jacks or trick bars, it is possible to obtain three hundred picks per cycle. This is in contrast to the drums L–6 and R–6 which are equipped with six and twelve cams, respectively.

As will be described in detail, the yarn finger control drums for the No. 1 and No. 4 Feeds are controlled by the No. 1 left forward trick drum of the '145 patent. The yarn finger control drums for the No. 2 and No. 3 Feeds are controlled by the right forward trick drum of said patent. Since the mechanism for the latter is the same as the former, only the former will be described in detail.

As indicated, an important part of the auxiliary control mechanism is the trick drum assembly **1LF** located on the left front of No. 1 deck of the machine shown in the '145 patent. This assembly includes a drum **633** which is rotatably mounted upon a shaft **630**. In the present case, there are one hundred fifty vertical slots **635** arranged circumferentially about the outer periphery of drum **633** with a bar or trick jack **642** disposed in each slot. The jacks **642** are notched near their upper ends and are retained in their associated slots by a garter spring **643** embracing said notches. Each jack **642** is originally provided with plurality of lugs **644**, selected ones of which can be broken off to set a desired pattern.

The timing mechanism for the drum **633** comprises a bar **671** fixed at one end to the upper end of shaft **630** and having its other end connected to one end of a link **672** by a bolt **673**. A lever **675** is pivotally connected to link **672** at a point medially of its length by a pivot bolt **676**. A detent **677** is secured to the underside of lever **675** by a bolt **678**.

So far described, the timing mechanism is substantially the same as that shown in the '145 patent. However, in the '145 patent the end of detent **677** nearest the trick drum **633** is arranged to enter a timing space provided by breaking off two of the uppermost lugs **644** above spring **643** to positively stop the trick drum against rotation at a given time in the cycle. In the present invention, however, the uppermost lugs (here identified as **644***a*) are utilized for a different purpose. As a result, the mechanism has been modified by raising detent **677** enough to engage a slot **639***a* cut into the periphery of upper plate **639** of the drum to provide the braking action referred to the above.

The trick drum ratchet wheel **637** for turning the drum is adapted to be intermittently rotated by a pawl **679** mounted on a rod **680** which is oscillated in the manner described in the '145 patent. As in the '145 patent, lever **675** carries a depending pin **681** disposed adjacent the free end of the rod **680**. The pin **681** is adapted to engage said rod **680** to move the pawl **679** away from the ratchet **637** to thereby prevent the rod **680** from actuating the trick drum when the detent **677** enters the slot **639***a*. Actuation of the lever **675** to permit the detent **677** to engage slot **639***a* and act as a timing device to stop the drum **633** is effected through a link **682**. The operation of link **682** to control timing detent **677** and the pin **681** for shifting pawl **679** is governed by drum L–1, as is described in detail in the '145 patent.

As previously indicated, the upper butts **644***a* of the trick jacks **644** are employed in a novel manner and serve to control the operation of the auxiliary yarn finger drum control. Thus, selected butts are broken off; the remaining butts, as exemplified by butt **644***a* of the single trick jack **644** shown in FIG. 1, engage a finger **1***a'* of a lever **1'** which is pivotally mounted upon a post **2'**. The opposite end of lever **1'** is attached to one end of the inner wire **3'** of a Bowden wire **4'**. The other end of the wire **3'** is attached to the bottom of a U-shaped bracket **4***a'*. One leg of bracket **4***a'* is connected to a lever **5'** pivotally mounted upon one end of shaft **6'** of a tripping assembly, generally designated **7'**. The other leg of bracket **4***a'* is connected to a spring **8'** which is attached to an upstanding bracket **9'** secured to the vertical side plate **10'** of the tripping assembly **7'**.

The opposite end of lever **5'** carries a pin **11'** upon which a pawl **12'** is mounted for actuation of a sixteen-tooth ratchet wheel **13'** secured to shaft **6'**. As will be understood, when lever **1***a'* is moved by a butt **644***a* on the trick drum **1LF**, the consequent retraction of wire **3'** of Bowden wire **4'** pulls bracket **4***a'* down toward base plate **32**. The downward movement of bracket **4***a'* rotates lever **5'** clockwise and pawl **12'**, urged inwardly by a leaf spring **14'**, shogs ratchet **13'** in the same direction.

The shogging of ratchet 13' turns shaft 6' and a disc 15' mounted on said shaft on the opposite side of side plate 10'. Disc 15' has sixteen circumferentially located equally spaced holes 16' into which sixteen pins 17' are force-fitted.

A pivot rod 18', secured to side plate 10' at a point above and to the left of shaft 6', extends across to the approximate center of the spindle-like structure formed by pins 17' and provides pivotal support for a trip lever 19'. Lever 19' has a sloping nose 20' which is arranged to fit between adjacent pins 17' when lever 19' is horizontal. A spring 21', having its upper end attached to a post 21*a*' upstanding on plate 10 and its lower end attached to lever 19' behind the pivot point, urges lever 19' in a clockwise direction so that its nose 20' presses down upon one of the pins 17'. When the disc 15' is held stationary, the nose 20' is held in this position by a pin and, consequentially, lever 19' is maintained horizontal.

The upper edge of lever 19' behind the pivot point carries a slot 22' for the reception of a trip finger 23' which is an extension of an auxiliary control lever 24' pivotally supported on a post 25'. As shown in FIG. 1, the end of the main arm of lever 24' nearest the assembly 7' is fitted with a plate 24*a*' through which an adjustment screw 24*b*' is threaded. A spring 24*c*' is connected to lever 24' and serves to urge it in a counterclockwise direction when viewed from the top, i.e., the finger 23' and the plate 24*a*' are urged toward the approximate center of the machine by spring 24*c*'.

Lever 24' is constantly urged in a clockwise direction by one end 26*a*' of a bell crank lever 26' which is pivotally mounted on a post 27' adjacent drum L–6. As shown in FIG. 1, end 26*a*' engages the screw 24*b*' and the counterclockwise force of arm 26*a*' tends to move finger 23' in a direction out over the tip or tail of lever 19'. The other end 26*b*' of lever 26' is engaged by a pin 28' affixed to the inturned end of bell crank lever 446*g*. As heretofore explained, a spring 446*k* tends to urge the inturned end of lever 446*g* toward drum L–6 and, through pin 28' bearing against lever 26', the force of spring 446*k* is transmitted to lever 26'.

When finger 23' is in slot 22' of trip lever 19', finger 23' is prevented from moving out over the end of lever 19' and thus bell crank lever 26' is held in a fixed position as determined by the adjustment of screw 24*b*' on lever 24'. Preferably, screw 24*b*' is adjusted so that lever 26', acting on pin 28', maintains the inturned end of lever 446*g* about 3/16 of an inch away from the surface of drum L–6. It will be understood that the holding action of finger 23' in slot 22' is sufficient to overcome the pulling force of spring 446*k*.

However, when finger 23' of auxiliary control lever 24' is released from slot 22', the force exerted by spring 446*k* is longer counteracted, and tail 23' is swung out over the tail of trip lever 19' by the action of lever 26'. The movement of lever 26' permits bell crank 446*g* to move toward drum L–6 under the influence of spring 446*k*. Although this movement only covers about 3/16 of an inch, i.e., the distance between the inturned tip of lever 446*g* and the surface of drum L–6, this movement is enough to cause pawl 422 to advance ratchet 418 of yarn finger control drum 409.

When pawl 12' of the auxiliary control mechanism advances ratchet 13', the pins on disc 15' are rotated clockwise and the pin upon which nose 20' of lever 19' rests raises nose 20' and lever 19' is moved counterclockwise. As the tail of lever 19' is thus lowered, finger 23' is released. Thus, by the action already described, each rotational movement of disc 15' causes an advance of the yarn control drum 409. Depending on the number of trick drum jacks 644*a* which are available to engage lever 1*a* in a given time, the yarn finger control drum 409 is advanced.

As shown in FIG. 1, the end of lever 24' remote from the assembly 7' is displaced closely adjacent the top of a resetting control disc 29' which is secured to a shaft 30' for a rotation therewith. Shaft 30' is rotated continuously by means of a chain 31' connecting a sprocket 32' on shaft 30' and a sprocket 33' on the quarter turn shaft 176 of the machine. There is also provided an idler tension generally indicated as 34'.

By the foregoing means, disc 29' is rotated continuously in a counterclockwise direction. When finger 23' of lever 24' is in slot 22' of trip lever 19', a roller 35' on the top of the disc 29' lightly strikes the adjacent end of lever 24'. The corresponding movement of finger 23' is slight and is less than the dimension of slot 22' and finger 23' remains within the slot. However, when finger 23' swings out over the tail of lever 19', the remote end of lever 24' moves inwardly toward the center of disc 29' and roller 35' strikes the displaced end of lever 24' and urges lever 24' in a counterclockwise direction so that finger 23' once again is moved over the sloping tail of lever 19' and into slot 22'. It will be understood, of course, that immediately after trip lever 19' is rotated by the movement of disc 15', it is brought back to the horizontal position by spring 21' and is retained in a horizontal position by the next succeeding pin 17' on disc 15'.

The above described resetting of lever 24' serves to return lever 26' into its original position so that it holds bell crank lever 446*g* once again 3/16 of an inch away from the surface of control drum L–6.

In the present invention, yarn finger control drum 409 has an additional row of holes around the perimeter of the drum remote from the ratchet wheel 418. These holes are provided with buttons or pins as desired. The purpose of the latter is to engage the depending tip 36' of a lever 37' which is pivoted on a brace 38' at 39'. As shown in FIG. 1, the end of lever 37' remote from the pivot 39' carries a pin 40' which extends across the drum 409 and is adapted to engage into a depression 41' in plate 419 which carries pawl 422. A spring 42' serves to maintain the depending tip 36' of lever 37' normally against the surface of drum 409. Thus, as long as no button is encountered, pin 40' is maintained in the groove 41' of plate 419.

The purpose of the foregoing arrangement is to synchronize the movement of pawl 422 with trick drum 633 when the auxiliary control mechanism is in operation. More specifically, the dimension of lever 419 for pawl 422 is such that when the lever 419 is moved by the linkage 446*b*, pawl 422 is moved a distance covering two teeth of ratchet wheel 418. However, when the auxiliary control mechanism is activated, it is desirable to have ratchet wheel 418 move the distance of only one tooth for each shogging movement caused by the rotation of ratchet 13' of the auxiliary control mechanism. During this period, no pins are provided under tip 36' of lever 37' and pin 40' is thus permitted to enter the groove in lever 419. Pin 40' acts as a brake on the movement of lever 419 so that pawl 422 covers only the distance of one tooth when lever 419 is moved by linkage 446.

The tripping assembly 7' and resetting lever 24' are also utilized for the auxiliary control of the yarn finger control drum 409*c* through a pin 43' connecting bell crank lever 26' to lever 449*g* of the linkage 449*f* which actuates pawl 422*c* of said drum 309*c*, This auxiliary control functions as described above in connection with yarn finger control drum 409 of the No. 1 Feed and hence need not be described in further detail.

It is also to be clearly understood that the terms and expressions used herein are employed as terms of description, and not of limitation, and that there is no intention in using such terms and expressions to exclude any equivalents of the apparatus described. It is also to be clearly understood that what is specifically shown and described herein represents a preferred embodiment only of the invention, and that various changes and equivalents in addition to those mentioned may be resorted to without departing from the principles of the invention or the scope

of the claims hereof. Accordingly, it is intended to claim the present invention broadly, as well as specifically, as indicated in the appended claims.

Having thus described my invention, I claim:

1. In a circular knitting machine having a needle cylinder; at least one yarn feeding station adjacent the cylinder including a plurality of yarn fingers movable from active to inactive position; a rotatable yarn finger control drum mounted adjacent said fingers having projections at selected locations about its periphery operative to move said fingers to one of said positions as the drum is rotated; a ratchet affixed to said drum for rotation therewith; a pawl mounted adjacent said ratchet and operable to advance said ratchet to thereby rotate said drum; and main yarn finger control drum means including

a rotatable main control drum having cams about its periphery;

a primary bell crank pivotally mounted adjacent said main control drum having one arm disposed in the path of said cams whereby upon rotation of said main control drum the cams move said bell crank;

primary linkage means connecting said primary bell crank to said pawl whereby movement of the primary bell crank causes said pawl to advance said ratchet;

the improvement comprising auxiliary control means for automatically imparting selected intermittent rotary movement to said yarn finger control drum including, in combination:

(a) a pivotally mounted auxiliary bell crank adapted to engage said primary bell crank, said auxiliary crank being movable from an inactive position to an active position whereby said primary bell crank is engaged and is correspondingly moved to cause said pawl to advance said ratchet,

(b) a pivotally mounted auxiliary control lever movable from an inactive position to an active position and operative, during such movement, to move the auxiliary crank from its inactive to its active position,

(c) a movable trip lever operative while at a holding position to engage and hold said auxiliary control lever in its inactive position, said trip lever being movable to a release position whereby said auxiliary control lever is released for movement to its active position,

(d) trip lever control means operatively connected to said trip lever for moving said lever to its release position, and for holding said lever in its holding position,

(e) a rotatable trick drum having a plurality of trick jacks about its circumference,

(f) butts on selected ones of said trick jacks operative to successively actuate said trip lever control means to move said lever to its release position.

2. In a circular knitting machine having a plurality of yarn fingers, a rotatable yarn finger drum for selectively activating said fingers, means for controlling the rotational motion of said yarn finger drum comprising:

(a) a rotatable trick drum having a complement of trick jacks about its circumference,

(b) butts on selected jacks,

(c) a lever mounted adjacent said trick drum and movable when engaged by said butts on said selected jacks as the trick drum rotates,

(d) a bowden wire connected to said lever and movable therewith,

(e) a pawl connected to said bowden wire and movable therewith,

(f) a ratchet adjacent to said pawl and movable in response to movement of said pawl,

(g) a disk connected to said ratchet and movable therewith, said disk having a plurality of pins arranged substantially in a circular series projecting from one side thereof,

(h) a trip lever pivotally mounted adjacent said pins, said trip lever having a nose at one end adapted to be held between said pins when said pins are stationary; said trip lever having a notch adjacent its other end,

(i) a spring attached to said trip lever for moving said trip lever when the nose thereof is released from between said pins when said pins move as said disk rotates,

(j) a pivotally mounted auxiliary lever having a portion adapted to be engaged and retained in said notch of said trip lever,

(k) means for moving said auxiliary lever when said trip lever is moved to the extent that the auxiliary lever is released from said notch, and

(l) means operatively connecting said auxiliary lever to said yarn finger drum for transmitting motion of said auxiliary lever to rotate said drum.

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