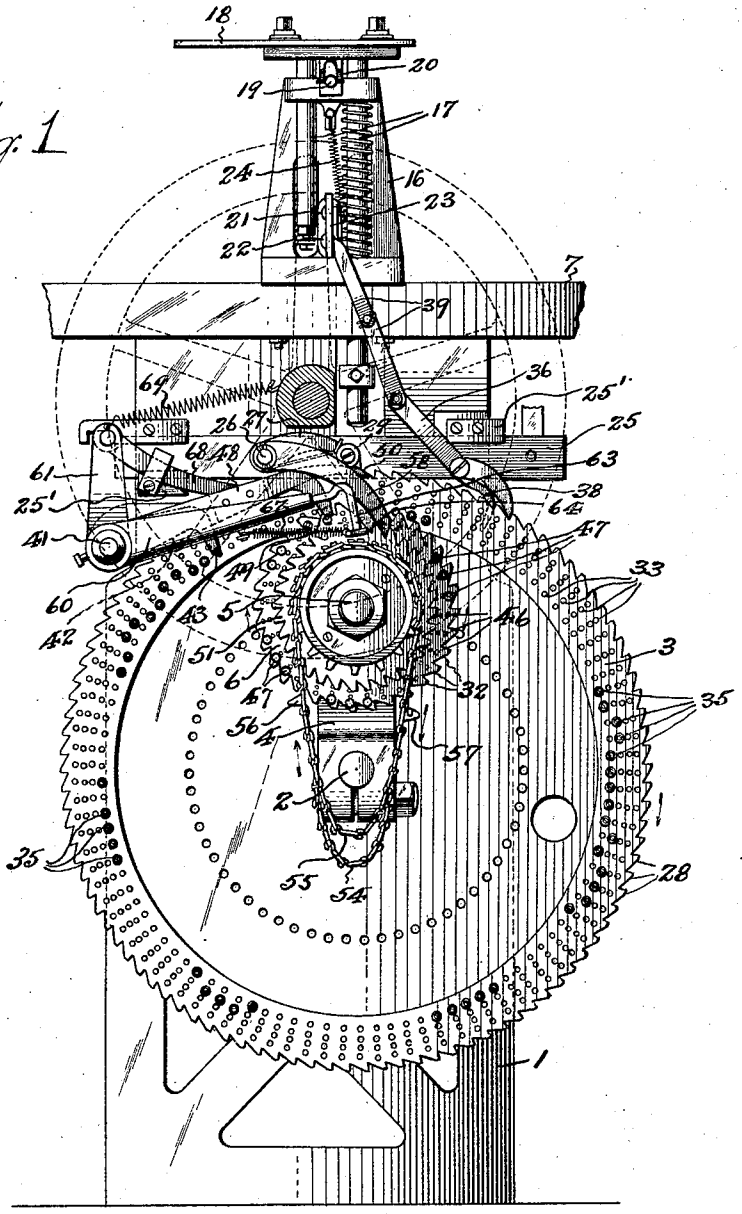
July 23, 1929. M. LERNER 1,721,824

KNITTING MACHINE

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Fig. 1



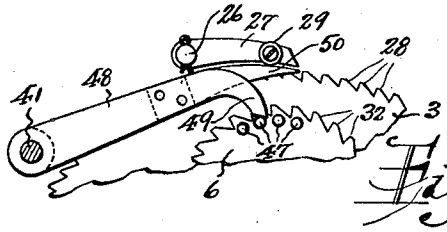


Fig. 8

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KNITTING MACHINE

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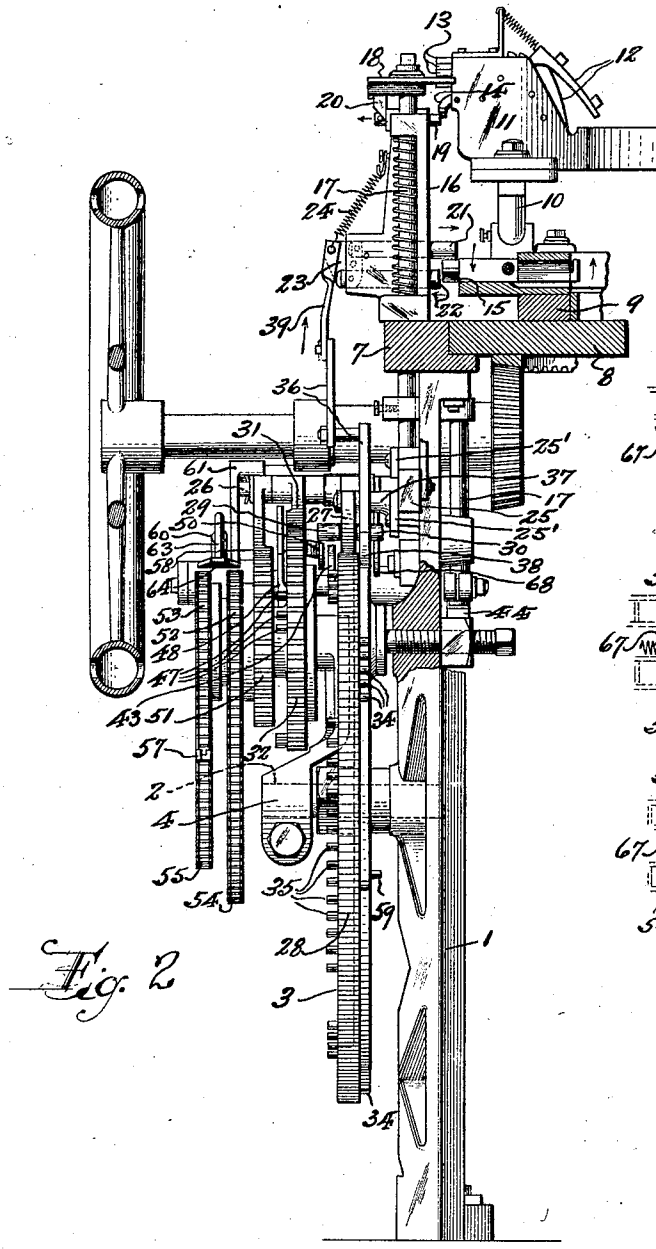


Fig. 2

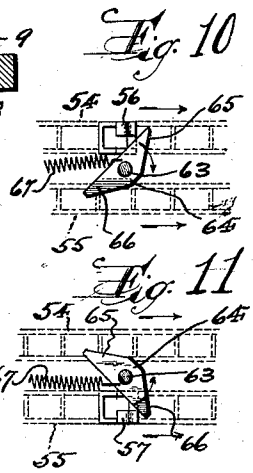


Fig. 10

Fig. 11

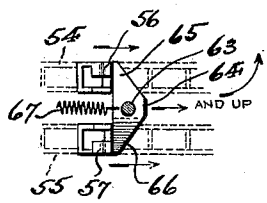


Fig. 12

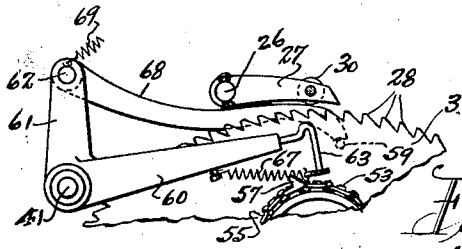


Fig. 9

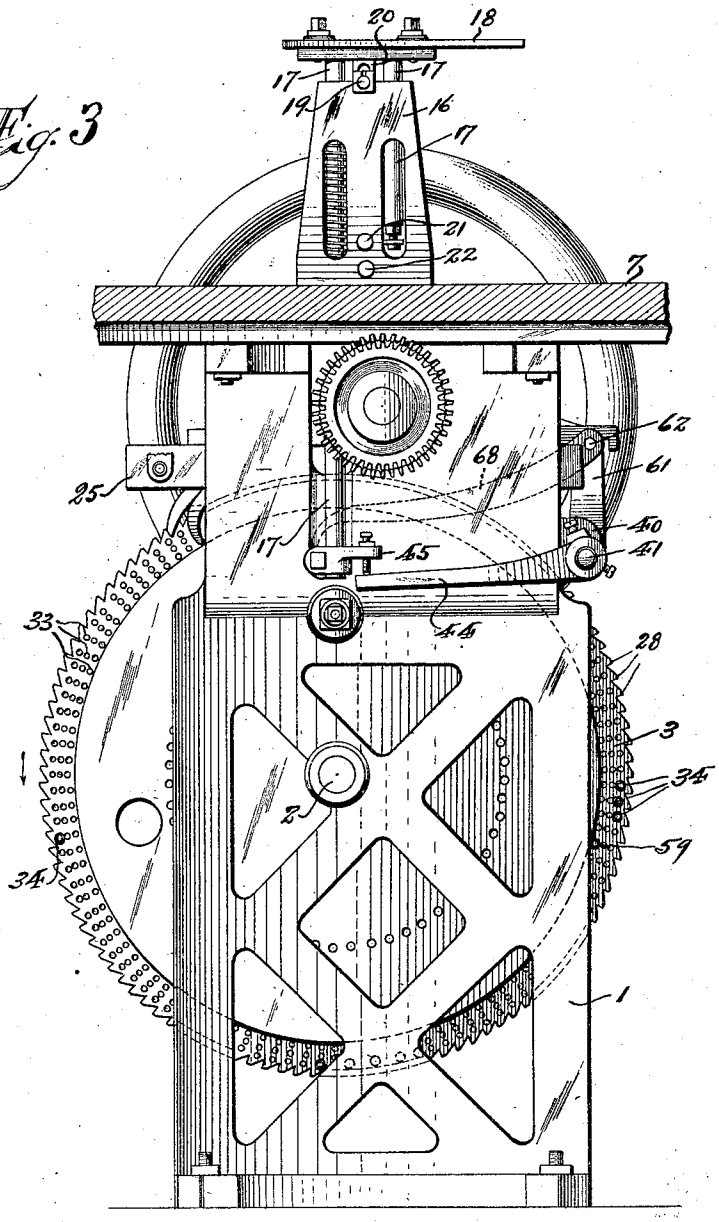
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KNITTING MACHINE

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Fig. 3



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Fig. 4

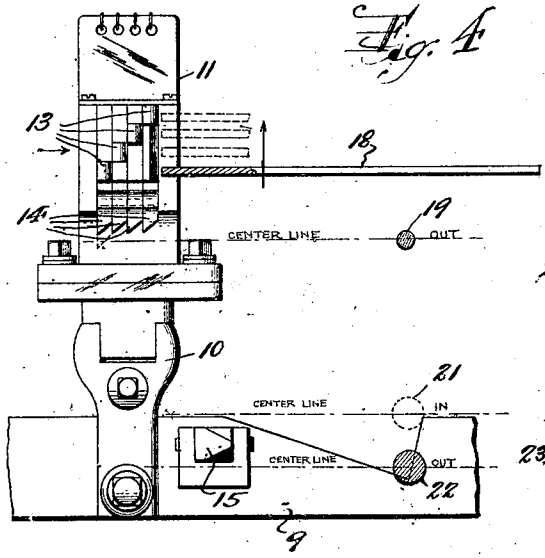


Fig. 5

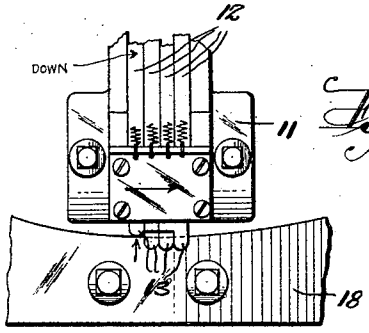


Fig. 6

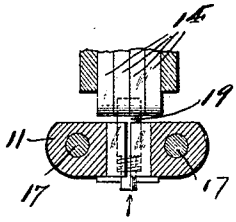
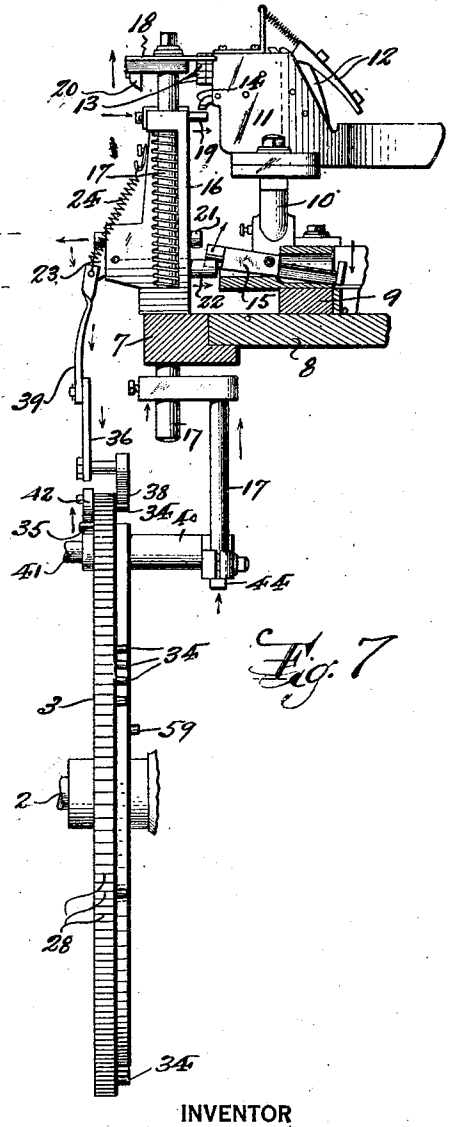


Fig. 7



INVENTOR
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Patented July 23, 1929. 1,721,824

UNITED STATES PATENT OFFICE.

MORRIS LERNER, OF NEWARK, NEW JERSEY.

KNITTING MACHINE.

Application filed April 10, 1928. Serial No. 268,822.

This invention relates to improvements in circular knitting machines operating to produce jersey cloth in fancy patterns or stripes of various colors and with various fancy stitch formations.

The invention has for its principal object to provide a novel arrangement and construction of pattern wheel control, whereby the latter, when functioning to set the knitting mechanism for variations in pattern, stitch structure and in color of the cloth produced, permits of the production of much longer lengths of finished cloth without repetition of the complete pattern or design during a single revolution of said pattern wheel than has heretofore been possible. With this general object in view, the invention consists in providing means auxiliary to the pattern wheel and cooperative therewith to automatically start and stop the latter, during the course of a single revolution thereof, so that a given pattern, stitch formation or color effect may be continued in the knitting for predetermined numbers of rounds or courses of knitted stitches while the pattern wheel idles, and whereby any given desired effect of the pattern wheel may be more or less prolonged.

A further object of the invention is to provide, in combination with means for arresting the movement of the pattern wheel upon completion of a revolution thereof, a novel means for predetermining the duration of arrested movement of the pattern wheel to the end that continued knitting of long lengths of cloth may be attained prior to again releasing the pattern wheel for repetition of its rotation and consequent reproduction of the pattern or design effects it is set or arranged to control.

Other objects of this invention, not at this time more particularly enumerated, will be clearly understood from the following detailed description of the same.

The invention is clearly illustrated in the accompanying drawings, in which:—

Figure 1 is an end elevation of parts of a circular knitting machine involving the improvements of this invention; Figure 2 is a side elevation of the same; and Figure 3 is an inside elevation of the same.

Figure 4 is a fragmentary detail face view of the yarn changer devices; Figure 5 is a fragmentary top or plan view of the same; and Figure 6 is a detail horizontal section showing the trip-plunger for releasing the yarn carrier fingers for return to normal positions; and Figure 7 is a detail side elevation view showing the yarn carrier mechanism and the tucking-bar mechanism together with the means cooperating with the pattern wheel for actuating said parts.

Figure 8 is a fragmentary view showing the means for controlling the intermittent movement of the pattern wheel to multiply the effects thereof.

Figure 9 is a fragmentary view showing the means for arresting the pattern wheel after each complete revolution thereof, and releasing the same at predetermined times for renewed operation.

Figures 10, 11 and 12 are detail plan views of the pattern wheel arresting and release control chains and their lift cam projections, showing various operations thereof.

Similar characters of reference are employed in all of the hereinabove described views, to indicate corresponding parts.

Referring now to said drawings, the reference character 1 indicates one of the side frames of a circular knitting machine. Fixed to and projecting outwardly from said side frame 1 is a journal stud 2 upon which is rotatably mounted a pattern wheel 3. Fixed on the outer end of said stud 2, beyond the pattern wheel 3, is an upwardly extending supporting bracket 4 having at its upper free end an outwardly extending journal stud 5 upon which is rotatably mounted a pattern wheel control means, which for convenience, I designate the multiplier wheel 6.

Fixed in connection with the upper end of said side frame 1 is the stationary bed ring 7, which extends horizontally of the machine, and upon which is slidably supported, for rotation in horizontal plane, the gear ring 8. Fixed upon said gear ring 8, so as to turn therewith, is the cam ring 9 which surrounds the needle cylinder (not shown). Connected with said cam ring 9 are the usual base members 10 upon which are carried the yarn changer heads 11. Pivotally connected with the yarn changer head 11 are the yarn changer fingers 12 which are provided, so as to project from the outer face of the yarn changer head, with the usual setting studs 13 and trip or release fingers 14 familiar to those skilled in the art, the selective actuation of which effects the desired changes in delivery of various colored yarns to the knitting needles, whereby changes in color for striping and other color patterns in the knitted fabric may be obtained. Also oper-

atively arranged in connection with the cam ring 9, adjacent to the yarn changer heads, are the pivoted tucking bars 15 which control the needles for altering the character or structure of the knitted stitch produced.

Secured to the bed ring 7 is a bob plate standard 16 in which are supported for vertical movement the bob plate posts 17, upon the upper ends of which is carried the bob plate 18, so that the latter is selectively movable into actuating relation to the setting studs 13 of the yarn changer fingers 12. Mounted in the bob plate standards 16 for horizontal movement is the trip plunger 19 which is actuated by the cam block 20 carried by the bob plate 18 to dispose the same in operative or inoperative relation to the release fingers 14 of yarn changer fingers 12 in the usual manner.

Mounted in said bob plate standard 16 for horizontal alternated reciprocation are the tucking bar actuating plungers, comprising an upper or tucking bar depressing plunger 21 and a lower or tucking bar lifting plunger 22. The rear or outer ends of said plungers 21 and 22 are pivotally connected with an actuating rocker plate 23 which is fulcrumed on the bob plate standard 16. A spring means 24 yieldably maintains said rocker plate 23 turned to a position whereby the upper or tucking bar depressing plunger 21 is projected and the lower or lifting plunger 22 is retracted, so that the tucking bar is normally positioned in inactive relation to the knitting needles of the machine.

The means for propelling the pattern wheel 3, comprises a transversely reciprocable slide-bar 25 which is movable in guides 25′ fixed on the outer face of said side frame 1, and which may be driven in any usual or suitable manner from the power transmission mechanism of the machine, as will be well understood by those skilled in the art. Carried by and projecting outwardly from said slide bar 25 is a fulcrum rod 26 upon which is pivoted a drive pawl 27 which is operatively engageable with the ratchet teeth 28 with which the periphery of said pattern wheel 3 is provided. Laterally projecting from the forward side of said drive pawl 27 is a lift stud 29, preferably of the anti-friction roller type; and in like manner, laterally projecting from the rearward face of said drive pawl 27 is a lift stud 30, which is also preferably of the anti-friction roller type. Pivoted on said fulcrum rod 26 is another drive pawl 31 which operatively cooperates with the ratchet teeth 32 with which the periphery of said multiplier wheel 6 is provided, whereby the same is rotated.

The outer marginal portions of said pattern wheel 3 are provided with a plurality of concentric rows of openings 33 which are tapped at their respective outer ends for the reception of pattern control pins. Arranged in predetermined selected grouping in connection with the rearward or inner side of said pattern wheel 3, by engaging the same in selected openings 33, are the tucking bar actuator pins 34, which through intermediate means control the movements of said tucking bar actuating plungers 21 and 22 for producing variations of stitch structure during the knitting operations. Similarly, arranged in predetermined selected grouping in connection with the forward or outer side of said pattern wheel 3, by engaging the same in selected openings 33, are the bob plate actuator pins 35, which through intermediate means control the movements of the bob plate 18 for producing variations of color and pattern shapes during the knitting operations.

The means coacting with the tucking bar actuating pins 34 for controlling the movements of said tucking bar actuating plungers 21 and 22 comprises a lever member 36 which is pivoted on a stationary boss 37, and which possesses at its free end a down curved finger 38 engageable by the actuating pins 34 on rotation of said pattern wheel 3. The opposite ends of said lever member 36 is interconnected with said rocker plate 23 by links 39. As the pins 34 pass under the finger 38, when the pattern wheel 3 advances, the lever member 36 is turned on its fulcrum to pull down on said links 39, thus rocking the rocker plate 23 against the tension of the spring 24 and thereby retracting the tucking bar depressing plunger 21 and projecting the lifting plunger 22 so that as a tucking bar is carried around it will, by engagement with the latter, be turned on its pivot to active relation to the knitting needles so as to vary the structure of knitted stitch produced, so long as the parts occupy the stated positions.

The means coacting with the bob plate actuator pins 35 for controlling the movements of the bob plate 18 whereby the yarn changer fingers 12 are selectively moved into operative position, comprises the following construction and arrangement of parts:—

Rotatably mounted in a bearing 40, which is fixed to said side frame 1, is a rock-shaft 41. Rigidly attached to said rock-shaft 41 is a lever member 42, having at its free end a down-turned finger 43 which is engageable by the actuating pins 35 on rotation of the pattern wheel 3. As the pins 35 pass under the lever finger 43, when said pattern wheel advances, the lever member 42 is raised more or less according to the position of the engaging pin 35, thereby turning the rock-shaft 41. Fixed on the inner end of said rock-shaft 41, at the inner side of said side frame 1, is a lever arm 44, the free end of which engages with an adjustable abutment 45 fixed on the lower end of one of said bob plate posts 17, whereby, when the rock-shaft is turned, the said lever arm 44 will swing upward more or less to raise the bob plate 18 to selected position for actu-

ating cooperation with a setting stud 13 of a given yarn changer finger 12, all in the well-known manner, to thereby select and position, for operative delivery to the knitting needles of the machine, yarn of a given desired color.

When it is desired to continue the knitting operation with a given color and pattern effect, or with a given stitch structure, the pattern wheel 3 according to this invention is caused to stop, thus producing a dwell thereof with the desired pins 34 or 35 or both in actuating relation to the knitting control mechanism respectively operated thereby as above described, thus multiplying the desired knitting effects for a greater or less number of rounds or courses of stitches without necessity for continued advancing movement of the pattern wheel 3, and thereby obtaining a greater length of finished cloth of desired pattern or design than is possible to obtain by use of a continuously impelled pattern wheel as provided in knitting machines as heretofore constructed. The means for automatically and selectively producing timed stops or dwells of the pattern wheel 3, during each revolution thereof, so as to multiply the desired pattern or design effects obtainable by a single revolution of said pattern wheel 3, comprises the multiplier wheel 6 and the here following described mechanism actuated thereby. The outer marginal portions of said multiplier wheel 6 are provided with a concentric row of openings 46 which are tapped for the reception of actuator pins 47 arranged in predetermined annularly spaced relation according to the timing of the stop or dwell periods desired to be produced during the revolution of the pattern wheel 3. Pivoted on said rock-shaft 41, for free turning movement thereon, is a lever device 48 having at its free end a down-turned finger 49 engageable by the actuator pins 47 of said multiplier wheel 6. As heretofore stated the multiplier wheel 6 is rotated by the drive pawl 31. The multiplier wheel 6 being of comparatively smaller diameter than the pattern wheel 3 may be rotated on a multiple ratio relative to the rotation of the latter, and the actuator pins 47 may be variously located and relatively spaced according to the number and timing of the stops or dwells to be produced during each revolution of the pattern wheel. The means whereby the actuator pins function to stop and start the pattern wheel 3 at desired predetermined times consists in an off-set lift finger 50 which is affixed to and which moves with the lever device 48. Said lift finger 50 is off-set so as to straddle the multiplier wheel 6, and so as to extend beneath the forward lift stud 29 which is connected with the pattern wheel drive pawl 27. As the multiplier wheel rotates and thus carries the actuator pins 47 into engagement with the finger 49 of the lever device 48, the latter will be swung upward, thereby carrying upward the lift finger 50 into lifting engagement with the lift stud 29 and consequently swinging the pattern wheel drive pawl 27 upwardly and out of engagement with the ratchet teeth of said pattern wheel. It follows therefore that, so long as the lever device 48 is maintained in raised position by engagement with the actuator pins 47, the drive pawl 27 will reciprocate idly without imparting motion to the pattern wheel, the lift stud 29 riding back and forth on the lift finger 50, but when a given group of the actuator pins 47 are carried away from the lever device 48 by the continuously advancing multiplier wheel 6, then the lever device 48 will drop down to normal position thus lowering the lift finger 50 and releasing the drive pawl 29 for renewed advancing or driving relation to the pattern wheel, until a succeeding group of actuator pins 47 are carried by the multiplier wheel into raising contact with the lever device 48 to again interrupt the advancing movement of said pattern wheel.

Means are provided for arresting the movement of the pattern wheel 3 upon completion of a full revolution thereof and consequent completion of a given design or pattern section in the knitted cloth, while at the same time permitting the continuation of the knitting operations for the producing of predetermined long lengths of plain cloth intermediate the design or pattern sections. This means comprises the following mechanism:—

Mounted on the journaled stud 5, outwardly of the multiplier wheel 6, and for free rotation on said journal stud, is a ratchet wheel 51 to which are secured, for rotation therewith in side by side relation, a sprocket wheel 52 and a sprocket wheel 53 of like diameters. Suspended on and driven by the sprocket wheel 52 is an endless link chain 54, and, likewise, suspended on and driven by the sprocket wheel 53 is an endless link chain 55. The chains 54 and 55 are of differing lengths, and the chain 54 is provided at one point with a link having a lift cam projection 56, and, in like manner, the chain 55 is also provided at one point with a link having a similar lift cam projection 57. The ratchet wheel 51 is driven by a drive pawl 58 which is pivoted on the fulcrum rod 26 carried by the reciprocating slide bar 25. Fixed on the rear side of said pattern wheel 3, for lateral projection therefrom, is a long stop pin 59. Pivoted on the outer end of said rock-shaft 41 is a bell-crank lever, one arm 60 of which projects forwardly so as to lie over and intermediate said sprocket wheels 52 and 53, and the other arm 61 extends upwardly, being provided with a rearward extension 62 directed toward the location of said pattern wheel 3. Connected with the extremity of said bell-crank arm 61 is a down-turned end-portion 63 directed toward said sprocket

wheels and the chains running thereover. Pivoted on the extremity of said end-portion 63 is a laterally disposed trip member 64 having oppositely projecting contact ends 65 and 66 respectively; the one such end 65 lies in the path of movement of the lift cam projection 56 of the chain 54 on the sprocket wheel 52, while the other such end 66 lies in the path of movement of the lift cam projection 57 of the chain 55 on the sprocket wheel 53. The trip member 64 is yieldably maintained in normal transverse relation to the chains by a spring 67. Pivoted on the extension 62 of the upper arm 61 of said bell-crank lever is a lift bar 68, the extremity of which lies in the path of movement of the stop-pin 59 of the pattern wheel 3 and extends beneath the lift-stud 30 of the pattern wheel drive pawl 27. The bell-crank lever, and parts connected therewith, is yieldably held in an inwardly swung position by means of a pull spring 69.

The operation of the pattern wheel arresting mechanism above described is as follows:—

Initially, on starting the machine, the chains 54 and 55 are arranged on their sprockets so that their lift cam projections 56 and 57 are side by side, with the bell crank lever mechanism operatively engaged thereby to release the pattern wheel 3 for operative revolution. Since the chains 54 and 55 are of different lengths, revolution of the chains during the operation of the machine will cause the lift cam projections 56 and 57 to advance at different speeds and so move out of transverse alignment, until the chains have made a predetermined number of revolutions, according to the requirement of their differential length, sufficient to allow the lift cam projections to meet again in transverse alignment as they pass under the arm 60 of the bell-crank lever. As the pattern wheel 3 completes its first revolution, the stop-pin 59 rides under the lift-bar 68, thereby swinging the same upward about its pivotal connection with the extension 62. This upward swinging movement of the lift-bar 68 causes the same to engage and raise the lift-stud 30 of the drive-pawl 27, thereby raising the drive-pawl 27 out of operative relation to the ratchet teeth of the pattern wheel thereby arresting further movement of the latter, until such time as the lift cam projections 56 and 57 simultaneously act on the bell-crank lever means. Straight or plain knitting will continue while the pattern wheel 3 is arrested, and as the lift cam projections pass successively instead of simultaneously under the trip-member 64 it will yield to the same without actuating the bell-crank lever means, since the said trip member 64 will merely turn on its pivot, as shown in Figures 10 and 11 of the drawings. When, however, under the continued revolution of the chains 54 and 55 their lift cam projections are again brought into transverse alignment as they approach the trip member 64, both said lift cam projections 56 and 57 will bear equally on opposite sides of said trip-member 64 which will be thereby kept from turning on its pivot. Under the latter circumstances the trip-member 64 will ride upwardly on the lift cam projections, thereby swinging upwardly the bell-crank arm 60 and swinging outwardly the bell-crank arm 61. The outward swinging movement of the bell-crank arm 61 transmits through the extension 62 an outward drawing movement to the lift bar 68 thereby drawing its extremity away from the stop-pin 59 so that the lift bar 68 swings downward by gravity, thus releasing the lifting pressure from the lifting stud 30 of the pattern wheel drive-pawl 27, so that the latter is caused to resume operative driving relation to the pattern wheel, which thereupon proceeds to make another revolution to again produce the design or pattern section in the knitted cloth. The spring 69 returns the bell-crank and associated parts to normal initial positions ready for a repetition of the above described operations, when the pattern wheel again completes one full revolution.

It will be obvious that by predetermining the relative lengths of the chains 54 and 55, the interval of idle time as to the pattern wheel 3 may be easily determined, so that greater or less lengths of plain knitted cloth may be produced at will between the pattern or design sections; and, furthermore, very much greater lengths of plain knitted cloth is obtainable, if desired, than is possible to attain by knitting machines as heretofore constructed.

I am aware that many changes may be made in the general construction and arrangement of the several devices and parts making up the novel control mechanism for knitting machines, as well as in the details of the construction of the same, without departing from the scope of this invention as defined in the appended claims. It is, therefore, to be understood that the specific disclosure of this application is to be considered as illustrative and not in a limiting sense.

Having thus described my invention, I claim:—

1. In a knitting machine, a revolvable pattern wheel, said pattern wheel having peripheral ratchet teeth, a reciprocated slide-bar adjacent to said pattern wheel, a drive pawl pivotally connected with said slide-bar to engage said pattern wheel ratchet teeth, said drive pawl having a laterally projecting lift stud, an independently revolvable multiplier wheel having peripheral ratchet teeth, a multiplier wheel drive pawl also pivotally carried by said slide-bar, said multiplier wheel having selectively arranged control pins, a pivoted lever engageable by said con-

trol pins, and said lever having a lift finger movable therewith into engagement with said pattern wheel drive pawl lift stud for the purposes described.

2. In a knitting machine, a revolvable pattern wheel, said pattern wheel having peripheral ratchet teeth, a reciprocated slide-bar adjacent to said pattern wheel, a drive pawl pivotally connected with said slide-bar to engage said pattern wheel ratchet teeth, said drive pawl having laterally projecting lift studs on opposite sides thereof, an independently revolvable multiplier wheel having peripheral ratchet teeth, a multiplier wheel drive pawl also pivotally carried by said slide-bar, said multiplier wheel having selectively arranged control pins, a pivoted lever engageable by said control pins, said lever having a lift finger movable therewith into engagement with one pattern wheel drive pawl lift stud for the purposes described, said pattern wheel having a stop-pin, a pivoted lift lever engageable by said stop-pin whereby said lift lever is carried into operative engagement with the other pattern wheel drive pawl lift stud to withdraw said drive pawl from active relation to said pattern wheel, and means to release said lift lever from said stop-pin to free said drive pawl for active relation to said pattern wheel to renew operation of the latter after a predetermined period of plain knitting is consummated.

3. In a knitting machine, a revolvable pattern wheel, said pattern wheel having peripheral ratchet teeth, a reciprocated slide-bar adjacent to said pattern wheel, a drive pawl pivotally connected with said slide-bar to engage said pattern wheel ratchet teeth, said drive pawl having laterally projecting lift studs on opposite sides thereof, an independently revolvable multiplier wheel having peripheral ratchet teeth, a multiplier wheel drive pawl also pivotally carried by said slide-bar, said multiplier wheel having selectively arranged control pins, a pivoted lever engageable by said control pins, said lever having a lift finger movable therewith into engagement with one pattern wheel drive pawl lift stud for the purposes described, said pattern wheel having a stop-pin, a pivoted lift lever engageable by said stop-pin whereby said lift lever is carried into operative engagement with the other pattern wheel drive pawl lift stud to withdraw said drive pawl from active relation to said pattern wheel, and means to release said lift lever from said stop-pin to free said drive pawl for active relation to said pattern wheel to renew operation of the latter after a predetermined period of plain knitting is consummated, said latter means comprising parallel driven chains of unequal length each having lift-cam projections, a bell-crank lever means to one arm of which said lift lever is pivotally related and having its other arm extending over said chains, and trip means carried by the latter arm, said trip means inactively yielding to the action of said either lift cam projection alone but operating to actuate said bell-crank lever means when simultaneously engaged by said lift cam projections.

4. In a knitting machine having a pattern wheel to control design formations in the produced knitted cloth, said pattern wheel having peripheral ratchet teeth, a reciprocated slide-bar adjacent to said pattern wheel, a drive pawl pivotally connected with said slide-bar to engage said pattern wheel ratchet teeth, said drive pawl having a laterally projecting lift stud, said pattern wheel having a stop pin, a pivoted lift lever engageable by said stop-pin whereby said lift lever is carried into lifting engagement with said lift stud to release said drive pawl from driving relation to said pattern wheel, and means to release said lift lever from said stop-pin to free said drive pawl for active engagement with said pattern wheel to renew operation of the latter after a predetermined period of plain knitting is consummated, said latter means comprising parallel driven chains of unequal length each having lift-cam projections, a bell-crank lever means to one arm of which said lift lever is pivotally related and having its other arm extending over said chains, and trip means carried by the latter arm, said trip means inactively yielding to the action of said either lift cam projections alone but operating to actuate said bell-crank lever means when simultaneously engaged by said lift cam projections.

5. In a knitting machine having a revolvable pattern wheel to control design formations in the produced knitted cloth, said pattern wheel having peripheral teeth, a reciprocated drive pawl cooperative with said teeth, an independently revolvable multiplying wheel having selectively arranged control pins, a pivoted lift lever engageable by said control pins, means on said lift lever to engage and displace the pattern wheel drive pawl from normal driving relation to temporarily hold the same stationary for desired repetition of given pattern effects controlled thereby, said pattern wheel having a stop pin, a pivoted stop lever engageable by said stop-pin when said pattern wheel completes a full revolution, said stop lever when engaged by said stop-pin being adapted to displace said pattern wheel drive pawl to arrest rotation of the pattern wheel on completion of a full revolution thereof, and means to release said stop lever from said stop-pin to free said drive pawl for return to driving relation to the pattern wheel after a predetermined period of plain knitting is consummated.

6. In a knitting machine having a revolvable pattern wheel to control design formations in the produced knitted cloth, said pattern wheel having peripheral teeth, a recipro-

cated drive pawl cooperative with said teeth, an independently revolvable multiplying wheel having selectively arranged control pins, a pivoted lift lever engageable by said control pins, means on said lift lever to engage and displace the pattern wheel drive pawl from normal driving relation to temporarily hold the same stationary for desired repetition of given pattern effects controlled thereby, said pattern wheel having a stop pin, a pivoted stop lever engageable by said stop-pin when said pattern wheel completes a full revolution, said stop lever when engaged by said stop-pin being adapted to displace said pattern wheel drive pawl to arrest rotation of the pattern wheel on completion of a full revolution thereof, and means to release said stop lever from said stop-pin to free said drive pawl for return to driving relation to the pattern wheel after a predetermined period of plain knitting is consummated, said latter means comprising parallel driven chains of unequal length each having lift-cam projections, a bell-crank lever to one arm of which said stop lever is pivoted and having its other arm extending over said chains, and trip means carried by said latter arm, said trip means inactively yielding to the action of either of said lift cam projections alone but operating to actuate said bell-crank lever when simultaneously engaged by said lift cam projections.

7. In a knitting machine having a pattern wheel, a reciprocated pawl and ratchet drive for said pattern wheel, a stop-pin carried by said pattern wheel a pawl disengaging means actuated by said stop pin when the pattern wheel completes a full rotation, and means to return said latter means to inactive position for restarting the pattern wheel, said latter means comprising parallel driven chains of unequal length each having lift-cam projections, an actuating lever, and a trip means carried by said lever, said trip means inactively yielding to the action of either of said lift-cam projections alone but operating to actuate said lever when simultaneously engaged by said lift-cam projections.

In testimony that I claim the invention set forth above I have hereunto set my hand this 7th day of April, 1928.

MORRIS LERNER.