Dec. 21, 1954 A. M. BROWN ET AL 2,697,337

KNITTING MACHINE

Filed Oct. 2, 1952

4 Sheets-Sheet 1

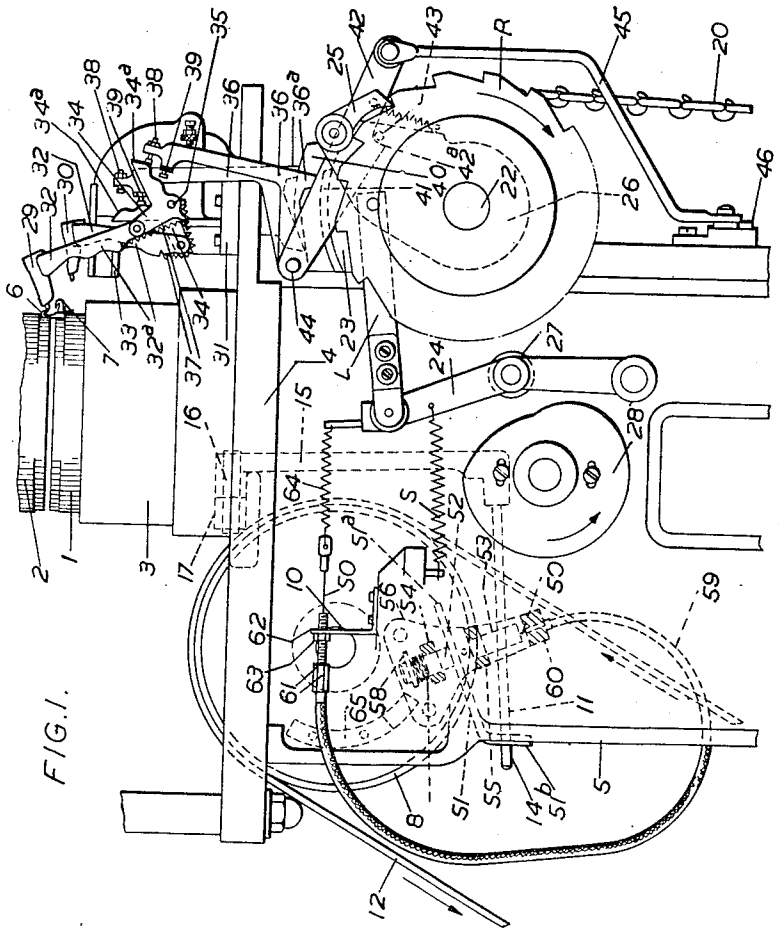


FIG. 1.

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4 Sheets-Sheet 2

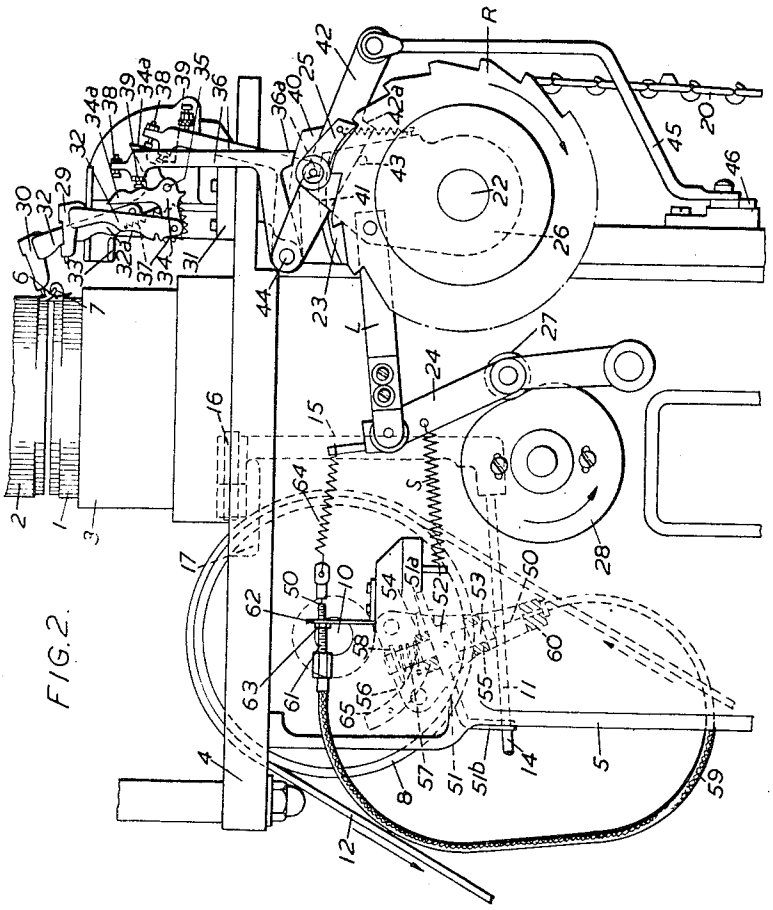


FIG. 2.

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KNITTING MACHINE

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4 Sheets-Sheet 3

FIG. 3.

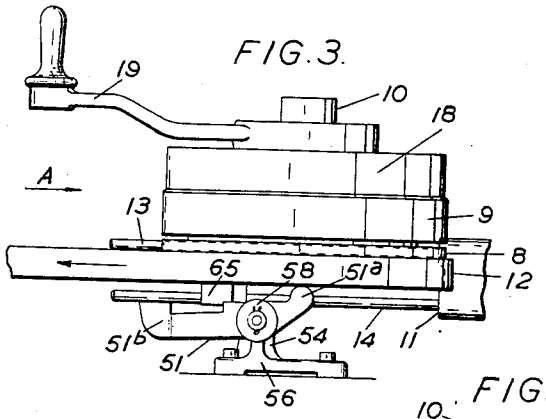


FIG. 4.

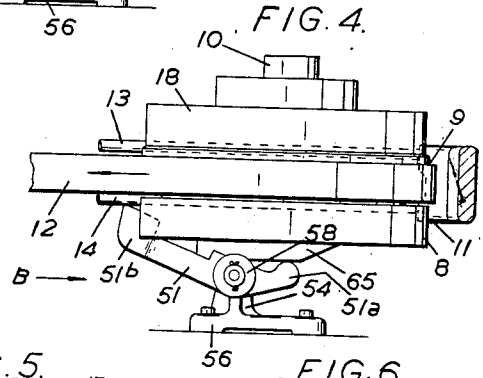


FIG. 5.

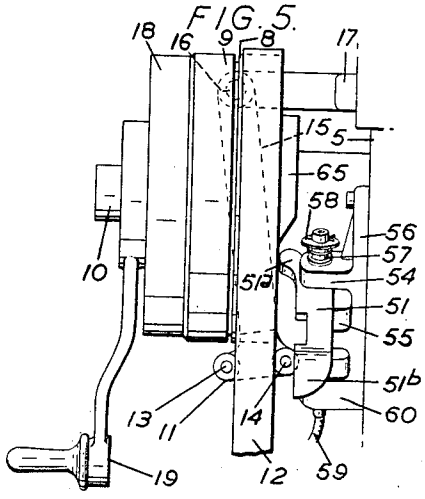
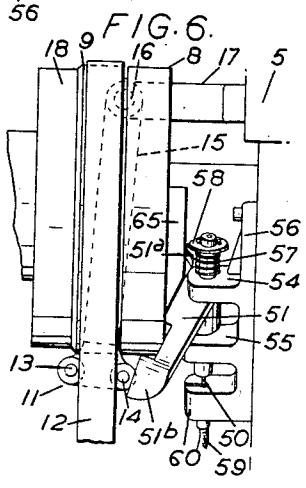


FIG. 6.



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Dec. 21, 1954 A. M. BROWN ET AL 2,697,337

KNITTING MACHINE

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4 Sheets-Sheet 4

FIG. 7.

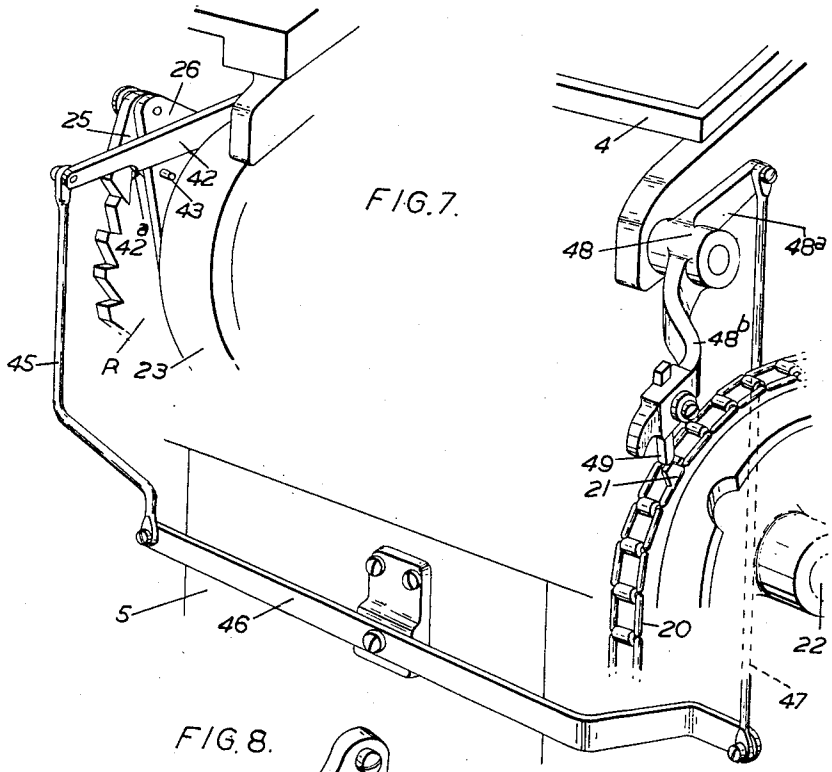
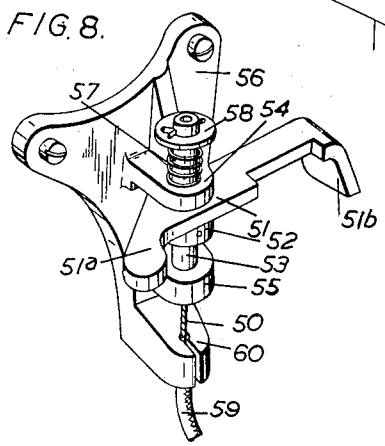


FIG. 8.



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United States Patent Office 2,697,337 Patented Dec. 21, 1954

2,697,337

KNITTING MACHINE

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Application October 2, 1952, Serial No. 312,716

Claims priority, application Great Britain October 5, 1951

13 Claims. (Cl. 66—56)

This invention relates to knitting machines, and has reference to such machines of the class equipped with (*a*) change speed means operable either to slow down or to speed up the operation of the machine, according to knitting requirements, and (*b*) a timing component for initiating the various motions and operations of the machine.

In this regard it is principally the intention to apply the invention to machines of this class equipped with change speed mechanism comprising "high" and "low" speed pulleys mounted co-axially with respect to a driving shaft, and associated means, including a fork, for shifting a belt from one of these pulleys to the other, and wherein the timing component consists of an intermittently movable timing chain provided with suitably pre-arranged control bits, although there is no limitation in these respects.

As an example of a machine of the class concerned may be quoted a circular automatic rib knitting machine of the superimposed needle cylinder type, such, for instance as a seamless hose or half hose machine.

Now when a knitting machine of this class is equipped with, say, a yarn supplying and changing mechanism, such as a horizontal striping attachment, comprising a plurality of individually and selectively operable yarn feeders and associated devices for trapping and severing yarns withdrawn from knitting, it is desirable, in view of the complicated nature or/and manner of operation of the mechanism, that the speed of the machine shall be temporarily reduced every time the mechanism is brought into commission as determined by the timing component and, conversely, speeded up again whenever the said mechanism is rendered inoperative at the dictates of the said component. The invention is not, however, necessarily limited to a machine equipped with a yarn supplying and changing mechanism, as the necessity for, or desirability of, decreasing the speed of the machine may arise when periodically bringing into commission, as determined by the timing component, any other appropriate mechanism such, for instance, as one used for effecting the fashioning of fabric during knitting. For the sake of convenience, any such mechanism including a yarn supplying and changing mechanism as aforesaid will hereinafter be referred to in the following further description and in the appended claims, and where the context so admits, as "mechanism for effecting a change in the character or shape of the knitting."

The object of the present invention is to provide improved mechanical means of a particularly simple and efficient character for automatically effecting a reduction in the speed of the machine every time a mechanism for effecting a change in the character or shape of the knitting is brought into operation at the dictates of the timing component, and vice versa.

According to this invention there are provided, in a knitting machine of the class concerned, means movable at the dictates of the timing component to initiate the bringing into commission of a mechanism for effecting a change in the character or shape of the knitting, and connections which are associated with these movable means and arranged to influence the change speed means, whereby whenever the said mechanism is brought into commission the speed of the machine is reduced, and vice versa.

In cases where the machine includes a driving shaft, high and low speed pulleys combined with said shaft

and a fork for shifting a belt from one of these pulleys to the other, the means of this invention may conveniently comprise a movable member and connections which are associated with the latter and arranged for action on the belt-shifting fork, whereby whenever the mechanism for effecting a change in the character or shape of the knitting is brought temporarily into commission, the belt-shifting fork will be automatically acted upon to shift the belt from the high speed pulley onto, or partly onto, the low speed pulley, and vice versa. That is to say, each time the relevant mechanism is rendered inoperative, as the result of a reverse movement of the aforementioned movable member determined by the timing component, the belt-shifting fork will be automatically caused to shift the belt from the low to the high speed pulley, thereby speeding up the machine.

In the accompanying drawings,

Figure 1 is a side view of so much of a circular half hose knitting machine equipped with horizontal striping mechanism, as seen from the left-hand side thereof, as is necessary to illustrate the striping mechanism and the means of this invention, the machine being shown knitting normally at the high speed,

Figure 2 is a somewhat similar side view of the machine but showing the racking arm released to initiate a yarn change, and the pivoted lever moved into the path of the cam on the high speed pulley,

Figure 3 is a detail plan view depicting the high and low speed pulleys, the belt-shifting fork, and the pivoted lever for action thereon, the belt being shown on the high speed pulley,

Figure 4 is a further plan view similar to Figure 3 but with the belt shifted onto the low speed pulley,

Figures 5 and 6 are two side views corresponding to, and as seen in the directions of the arrows A and B in, Figures 3 and 4 respectively,

Figure 7 is a fragmentary perspective view, as seen from the front of the machine, of connections through the medium of which a catch lever is released at the dictates of the timing chain, for the purpose hereinafter to be described, and

Figure 8 is a perspective view of the aforesaid pivoted lever and the bracket in which it is mounted.

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

In each of Figures 1 and 2, the bottom or plain rotary needle cylinder of the machine is indicated at **1**, and the superimposed top or rib rotary needle cylinder at **2**. **3** indicates the cam box surrounding the bottom needle cylinder **1**, this box being firmly secured upon the bed plate **4** which is in turn mounted upon the main frame **5** of the machine. One of the double-ended needles with which the machine is equipped is shown at **6** working in the bottom cylinder **1**, whilst **7** designates the operative end of one of the inside sinkers or web holders co-operating with the said needles.

The machine is equipped with change speed mechanism comprising high and low speed pulleys **8** and **9** respectively mounted co-axially with respect to a driving shaft **10**, and a fork indicated generally at **11** for shifting a belt **12** from one pulley to the other, according to knitting requirements. The fork **11** consists of two parallel prongs **13** and **14** which are arranged at opposite sides of the upwardly and forwardly running portion of the belt **12** and are secured in sockets at the lower end of a carrier arm **15** arranged to swing about a pivot pin **16**. This pivot pin is fixed in a bracket **17** attached to the right-hand side of the machine frame—viewing the latter from the front of the machine. In each of Figures 3–6, there is shown, at **18**, the customarily provided free pulley to which the belt **12** is shifted whenever it is required to disconnect the machine from the driving means, and at **19** is depicted the conventional handle whereby the machine can be driven by hand, as occasion demands.

For initiating the various motions and operations of the machine there is provided an intermittently movable timing chain **20** which, as shown more clearly in Figure 7, is made up in the usual way of a plurality of interconnected links prearranged ones of which are formed with control bits such as **21**. This timing chain is passed around a sprocket mounted to turn upon a horizontal

shaft 22 upon which is also mounted a control drum 23 of the machine. For racking round this drum there is secured to, and located at the right-hand side of the latter, a ratchet wheel R adapted for co-operation with a spring-influenced pawl 25 carried by an oscillatory member 26. The member 26 is oscillated to rack round the drum 23 by means of a racking arm 24 to which the said member is connected by a link L (see Figures 1 and 2). The racking arm 24, which is controlled by a tension spring S is furnished with a roller 27 adapted to be acted upon at required times by means of a continuously rotatable cam 28 as will be hereinafter more fully described.

Now the particular machine illustrated is equipped with horizontal striping mechanism including a plurality of individually and selectively operable yarn feeders two of which are depicted at 29 and 30 in Figures 1 and 2. The feeders are mounted in a bracket 31 secured upon the front part of the bed plate 4 adjacent to the bottom cam box 3. Each of the feeders is secured to the upper end of a flat section shank 32 which is arranged to work in a vertical slot formed in the bracket 31 and is appropriately contoured at its front edge 32*a* for engagement with a relatively fixed guide piece 33. At its lower end each feeder shank 32 is articulated to a pivoted bell-crank lever 34 which is fulcrumed at 35 in the bracket 31 and is adapted to be actuated and controlled by a corresponding cam lever 36. Each feeder shank 32, moreover, is connected to the relevant bell-crank lever 34 by means of a tension spring 37. The appropriate edge of the outer arm 34*a* of each bell-crank lever 34 is contoured for engagement by one of two abutment screws 38 and 39 fitted in the upper end of the associated cam lever 36. The said cam levers are provided with downwardly directed toes 36*a* arranged to be acted upon by cams, such as 40 and 41 (Figures 1 and 2), of different heights provided at pre-determined positions upon the striping control drum 23. The cams may, if desired, be in the form of bits of different heights on a chain fitted to the drum. In any event, the construction and arrangement are such that each time this drum is racked round to the extent of one step by a forward stroke of the oscillatory member 26, one of the cam levers 36 will be lifted to turn the corresponding bell-crank lever 34 inwards and so effect withdrawal from knitting of the associated feeder, whilst another cam lever will be permitted to drop and swing downwards with the result that the feeder controlled thereby will be moved into the feeding position. Thus, in Figure 1, the feeder 29 is in its operative, i. e. feeding, position, whilst the feeder 30 is withdrawn from knitting, and in Figure 2 these conditions are reversed. In the illustrated machine the selective manipulation of the individually operable striping feeders is accordingly controlled from the drum 23, and the latter is adapted to be racked round, at appropriate times only, at the dictates of the timing chain 20.

In this last regard the spring-controlled racking arm 24 is normally held forward, against the action of the spring S clear of the continuously rotatable cam 28 by means of a catch element in the form of a lever 42, which, as shown in Figure 1, is shouldered at 42*a* for latching engagement with a pin 43 or equivalent extending laterally from the inner side of the oscillatory member 26. This catch lever 42 is fulcrumed on the same pin 44 as that about which the cam levers 36 are arranged to turn, and at its outer end the said lever 42 is connected, by means of a downwardly extending link 45, with the left-hand end of a centrally pivoted lever 46 located at the front of the machine (see Figure 7). The right-hand end of the lever 46 is connected, by means of another link 47, with the tail end 48*a* of a two-armed lever 48 the other arm 48*b* of which is provided with an adjustable toe element 49 adapted to be acted upon by control bits 21 on the timing chain 20. Accordingly, when a bit 21 acts on the toe element 49 and so raises the arm 48*b* of the two-armed lever 48, the catch lever 42 will be raised, through the medium of the lever 46 and the link 45, with the result that the shoulder 42*a* will be moved clear of the pin 43 as depicted in Figures 2 and 7. As a consequence, the racking arm 24 and the oscillatory member 26 will be released, and the tension spring S will be permitted to pull the said arm into operative engagement with the continuously rotatable cam 28 (see Figure 2). Thus, whenever a change of yarn necessary to produce a stripe is initiated from the timing chain 20, the racking arm 24 will be released as just described so that a rack will be imparted to the striping control drum 23 by means of the cam 28, through the medium of the said arm and the pawl 25 carried by the oscillatory member 26. It is, of course, a movement of the control drum which actually effects the yarn change.

In accordance with the present invention, the racking arm 24 is connected, by means of a Bowden cable 50, with a pivoted lever 51 shown more clearly in Figure 8. This lever 51, which is bossed at 52 on its underside, is rigidly secured to a spindle 53 to which is secured the end of the cable 50 remote from the racking arm 24. As will be seen in Figures 1, 2, 5, 6 and 8, the spindle 53 is mounted to turn about its axis and also to slide axially within bearing holes drilled in spaced lugs 54 and 55 integral with a fixed bracket 56. This bracket is secured in an inclined position to the right-hand side of the machine frame 5. A compression spring 57 surrounding the upper end of the spindle 53 is interposed between the underside of a washer 58, arranged as shown in Figures 5, 6 and 8, and the top side of the opposed lug 54. One end of a tubular sheath 59 serving to house the flexible cable 50 is anchored beneath a further lug or ear 60 extending laterally from the lower end of the fixed bracket 56, whilst the opposite end of this sheath has combined therewith a tubular screw-threaded adjuster 61 which is screwed into a small right-angular bracket 62 and is adapted to be secured, after adjustment, by a locknut 63. The end of the Bowden cable 50 remote from the pivoted lever 51 is connected with the racking arm 24, through the medium of a tension spring 64 provided for a purpose hereinafter to be explained. Attached to the inner side of, and revolving with, the high speed pulley 8 is a master cam 65. At one end thereof the pivoted lever 51 is formed with a nose 51*a* for engagement by the master cam 65; the opposite end 51*b* of the said lever is bent down for action on the prong 14 of the belt-shifting fork 11.

With the machine knitting normally at the high speed, the racking arm 24 is quiescent in the forward position indicated in Figure 1, and the pivoted lever 51 is held down against the action of the compression spring 57 clear of the path of the master cam 65 (see Figures 1, 3 and 5). Whenever, however, the racking arm 24 is released from the timing chain 20 for movement backwards onto the cam 28 which operates it, the cable 50 also moves with the result that the compression spring 57 will be permitted to re-act and force the pivoted lever 51 into the path of the master cam 65 as shown in Figure 2. The cam 65 thereupon acts upon the nose 51*a* of the lever 51 and turns the latter aside so that it in turn acts on the belt-shifting fork 11 and so shifts the belt 12 laterally from the high speed pulley 8 onto or partly onto the slow speed pulley 9 as illustrated in Figures 4 and 6. As a consequence, the machine slows down and permits efficient operation of the horizontal striping mechanism during the formation of a stripe. When the racking arm 24 moves forward again at the dictates of the rotatable cam 28, the Bowden cable 50 is also pulled forward so that the pivoted lever 51 will be pulled down, against the action of the compression spring 57, clear of the master cam 65, so permitting the belt 12 to move back onto the high speed pulley 8. Whenever the racking arm 24 is moved forward in this way, the pin 43 or equivalent on the oscillatory member 26 will also be moved forward to a point where it is re-engaged by the catch lever 42. As will therefore be appreciated, the machine is automatically slowed down during the knitting of each stripe and speeded up again between stripes.

According to a further feature of the invention, provision may advantageously be made for a certain amount of lost motion between the racking arm 24 and the appropriate end of the Bowden cable 50 suchwise as to enable the master cam 65 on the high speed pulley 8 to be extended for the purpose of prolonging, where desired, the slow speed phases of the operation of the machine. In the specific example illustrated it is the tension spring 64 which provides such lost motion.

We claim:

1. In a knitting machine, in combination, change speed means operable both to slow down and to speed up the operation of the machine according to knitting requirements, control means associated with the speeding up of the change speed means, a timing component from which

various motions of the machine are initiated, mechanism for effecting a change in the character of the knitting, means movable at the dictates of the timing component to initiate the bringing into operation of the said mechanism, further means movable into relationship with said control means, and connections associated with the said movable means and further movable means and arranged to influence the change speed means whereby whenever the said mechanism is brought into operation the speed of the machine is reduced, or increased.

2. In a knitting machine, in combination, a driving shaft, high and low speed pulleys combined with the said shaft, control means associated with the high speed pulley, a drive-transmitting belt, a fork for shifting the said belt from one of said pulleys to the other according to knitting requirements, a timing component from which various motions of the machine are initiated, mechanism for effecting a change in the character of the knitting, a member which is movable at the dictates of the timing component to initiate the bringing into operation of the said mechanism, means movable into relationship with said control means and adapted in such relationship to act on the fork, and connections which are associated with the said member and movable means and arranged for action on the belt-shifting fork whereby whenever the said mechanism is brought into operation the belt-shifting fork will be automatically acted upon to shift the belt from the high speed pulley onto the low speed pulley, for the purpose specified.

3. In a knitting machine, in combination, a driving shaft, high and low speed pulleys combined with the said shaft, control means associated with the high speed pulley, a drive-transmitting belt, a fork for shifting the said belt from one of said pulleys to the other according to knitting requirements, an intermittently movable timing component from which various motions of the machine are initiated, a yarn supplying and changing mechanism including a plurality of individually and selectively operable yarn feeders, a member which is movable at the dictates of the timing component to control the yarn supplying and changing mechanism and initiate a yarn change, means movable into relationship with said control means and adapted in such relationship to act on the fork, and mechanical connections which are associated with the said member and movable means and arranged for action on the belt-shifting fork, whereby whenever a yarn change is initiated the belt-shifting fork will be automatically acted upon to shift the belt from the high speed pulley onto the low speed pulley, for the purpose specified.

4. In a knitting machine, in combination, a driving shaft, high and low speed pulleys combined with the said shaft, a cam associated and rotatable with the high speed pulley, a drive-transmitting belt, a fork for shifting the said belt from one of said pulleys to the other according to knitting requirements, a timing component from which various motions of the machine are initiated, mechanism for effecting a change in the character of the knitting, a member which is movable at the dictates of the timing component to initiate the bringing into operation of the said mechanism, a pivoted lever which is movable into and out of the plane of the aforesaid cam and is adapted, when in the plane of this cam to act upon the belt-shifting fork, and a connection between the said movable member and the pivoted lever whereby whenever the said mechanism is brought into operation the belt-shifting fork will be automatically acted upon to shift the belt from the high speed pulley onto the low speed pulley, for the purpose specified.

5. In a knitting machine, in combination, a driving shaft, high and low speed pulleys combined with the said shaft, a cam associated and rotatable with the high speed pulley, a drive-transmitting belt, a fork for shifting the said belt from one of said pulleys to the other according to knitting requirements, a timing component from which various motions of the machine are initiated, mechanism for effecting a change in the character of the knitting, a control unit from which periodic operation of the said mechanism is controlled, a movable arm which is normally held inoperative but is releasable at the dictates of the timing component for racking round the control drum and so initiating the bringing into operation of the said mechanism, a pivoted lever which is movable into and out of the plane of the aforesaid cam and is adapted, when in the plane of this cam, to act upon the belt-shifting fork, and a connection between the said racking arm and the pivoted lever whereby whenever the said mechanism is brought into operation the belt-shifting fork will be automatically acted upon to shift the belt from the high speed pulley onto the low speed pulley, for the purpose specified.

6. A combination according to claim 5, wherein the racking arm is normally held clear of a continuously rotatable cam but is adapted to be released for engagement with the said cam at required times at the dictates of the timing component whereby a rack is imparted to the control unit, for the purpose specified.

7. In a knitting machine, in combination, a driving shaft, high and low speed pulleys combined with the said shaft, a cam associated and rotatable with the high speed pulley, a drive-transmitting belt, a fork for shifting the said belt from one of said pulleys to the other according to knitting requirements, a timing component from which various motions of the machine are initiated, mechanism for effecting a change in the character of the knitting, a control unit from which periodic operation of the said mechanism is controlled, a movable arm for racking round the control unit to initiate the bringing into operation of the said mechanism at required times, a continuously rotatable cam for actuating the said arm, means for normally holding the latter clear of the continuously rotatable cam, the said means being adapted to be tripped from the timing component to release the racking arm for engagement with the continuously rotatable cam at the required times, a spring-controlled pivoted lever which is movable into and out of the plane of the cam rotatable with the high speed pulley and is adapted, when in the plane of this cam, to act upon the belt-shifting fork, and a flexible cable connecting the racking arm with the pivoted lever, the said cable normally holding the pivoted lever against the spring action out of the plane of the last mentioned cam and the lever being automatically movable under the spring action into the path of the cam rotatable with the high speed pulley whenever the racking arm is released for engagement with the continuously rotatable cam whereby at such times as the aforesaid mechanism is brought into operation the belt-shifting fork will be automatically acted upon to shift the belt from the high speed pulley onto the low speed pulley.

8. A combination according to claim 7, wherein the appropriate end of the cable is connected with the racking arm through the medium of a tension spring, for the purpose specified.

9. A combination according to claim 7, wherein the pivoted lever is combined with a spindle to which the appropriate end of the cable is secured, the said spindle being mounted to turn about its axis and also to slide axially within portions of a fixed bracket.

10. A combination according to claim 9, wherein a compression spring surrounding the spindle is interposed between a part associated with the latter and an opposed portion of the fixed bracket.

11. In a knitting machine, in combination, a driving shaft, high and low speed pulleys combined with the said shaft, a cam associated and rotatable with the high speed pulley, a drive-transmitting belt, a fork for shifting the said belt from one of said pulleys to the other according to knitting requirements, a timing component from which various motions of the machine are initiated, mechanism for effecting a change in the character of the knitting, a control unit from which periodic operation of the said mechanism is controlled, a ratchet wheel secured to the said unit, an oscillatory member carrying a pawl for engagement with the said ratchet wheel, a racking arm which is connected with the oscillatory member, a continuously rotatable cam for actuating the said arm, a catch element for normally maintaining the oscillatory member in such a position as to hold the racking arm clear of the continuously rotatable cam, means operable from the timing component to trip the catch element and so release the racking arm for engagement with the continuously rotatable cam and thereby initiate bringing into operation the aforesaid mechanism at required times, a pivoted lever which is movable into and out of the plane of the aforementioned cam rotatable with the high speed pulley and is adapted, when in the plane of the latter cam, to act upon the belt-shifting fork, and a connection between the racking arm and the pivoted lever whereby whenever the said mechanism is brought into operation the belt-shifting fork will be automatically

acted upon to shift the belt from the high speed pulley onto the low speed pulley, for the purpose specified.

12. A combination according to claim 11, wherein the timing component consists of an intermittently movable chain provided with control bits and the catch element is connected with a lever arranged in the path of such control bits.

13. In a knitting machine, in combination, a driving shaft, high and low speed pulleys combined with the said shaft, a cam associated and rotatable with the high speed pulley, a drive-transmitting belt, a fork for shifting the said belt from one of said pulleys to the other according to knitting requirements, a timing component from which various motions of the machine are initiated, mechanism for effecting a change in the character of the knitting, a member which is movable at the dictates of the timing component to initiate the bringing into operation of the said mechanism, a pivoted lever which is movable into and out of the plane of the aforesaid cam

and is adapted, when in the plane of this cam, to act upon the belt-shifting fork, a flexible cable connection between the said movable member and the pivoted lever whereby whenever the said mechanism is brought into operation the belt-shifting fork will be automatically acted upon to shift the belt from the high speed pulley onto the low speed pulley, and means adapted to provide lost motion between the movable member and the appropriate end of the flexible cable connection, for the purpose specified.

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