W. O. TAYLOR.

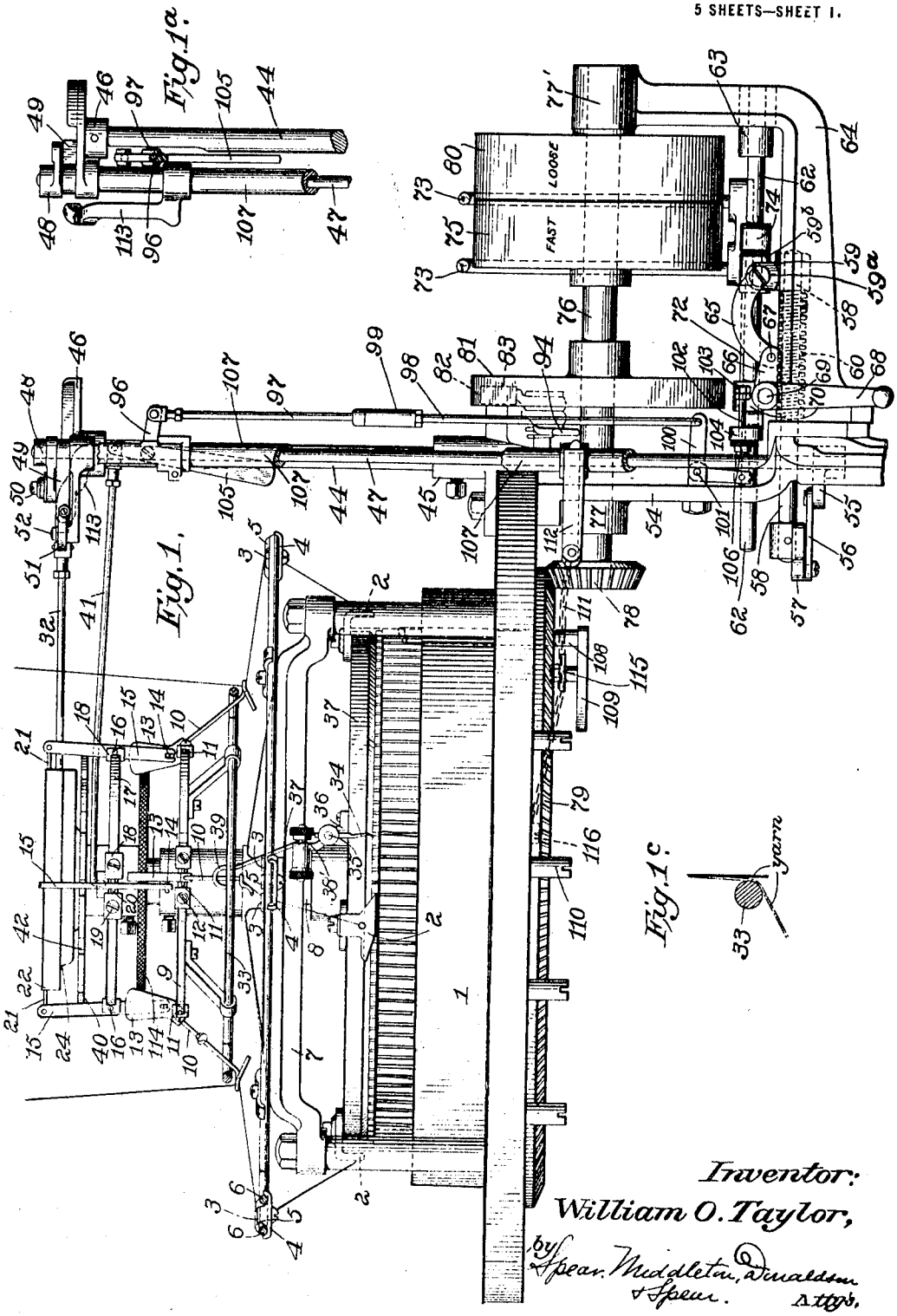
STOP MOTION FOR KNITTING MACHINES.

APPLICATION FILED AUG. 29, 1916.

1,316,928.

Patented Sept. 23, 1919.

5 SHEETS—SHEET 1.



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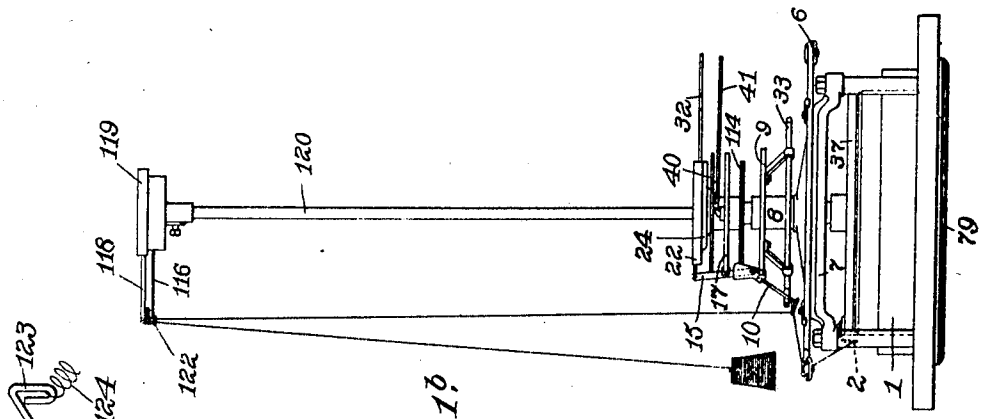


Fig. 1b.

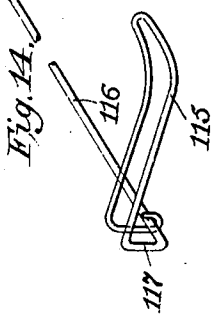


Fig. 14.

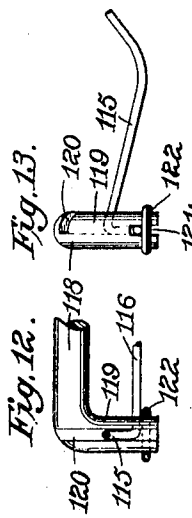


Fig. 13.

Fig. 12.

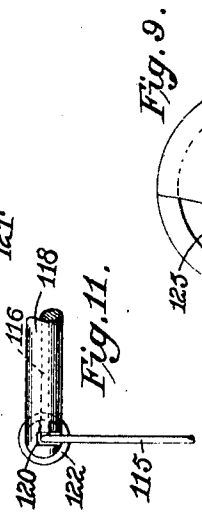


Fig. 11.

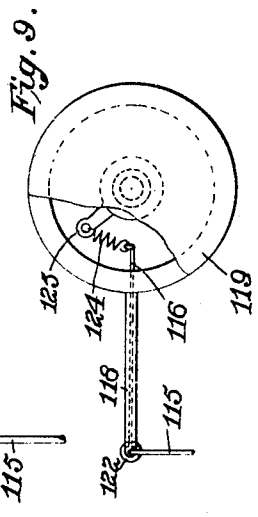


Fig. 9.

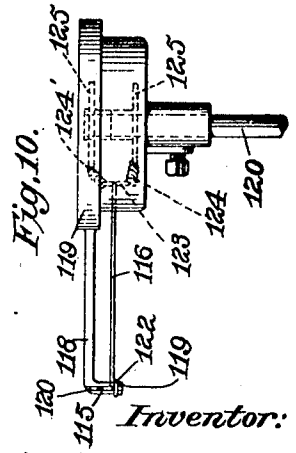


Fig. 10.

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5 SHEETS—SHEET 3.

Fig. 2.

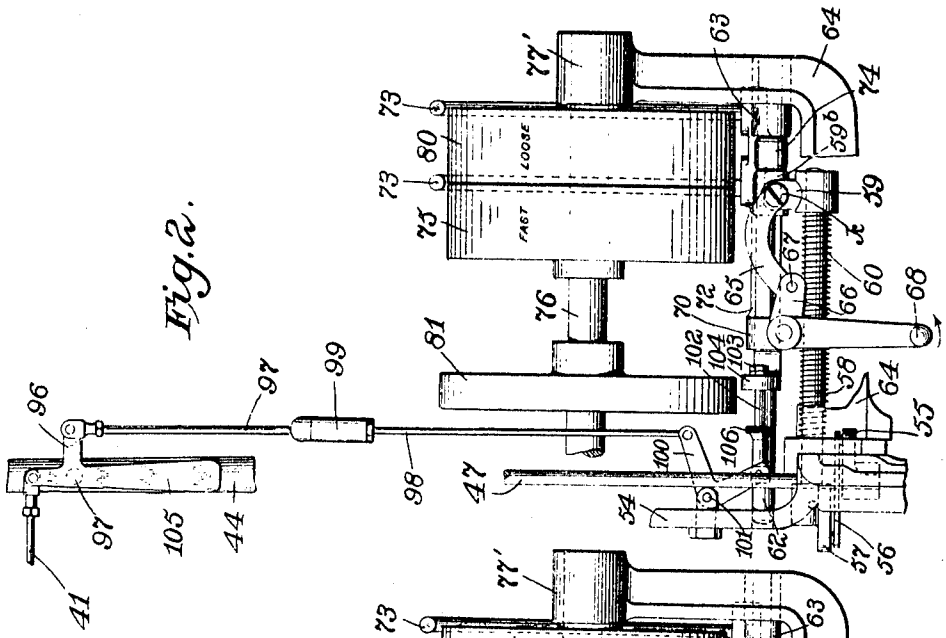
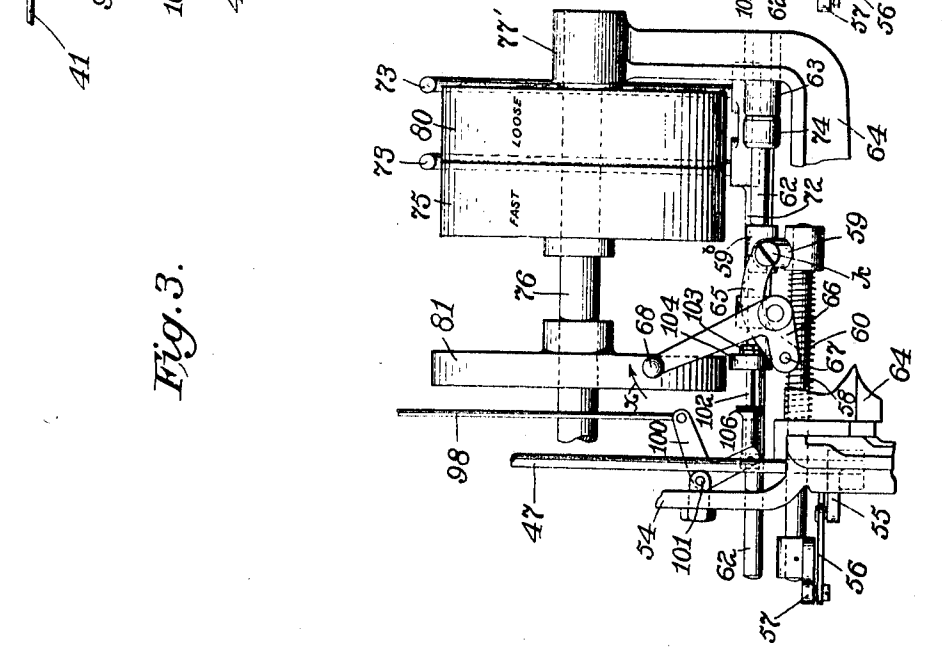


Fig. 3.



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5 SHEETS—SHEET 4.

Fig. 4.

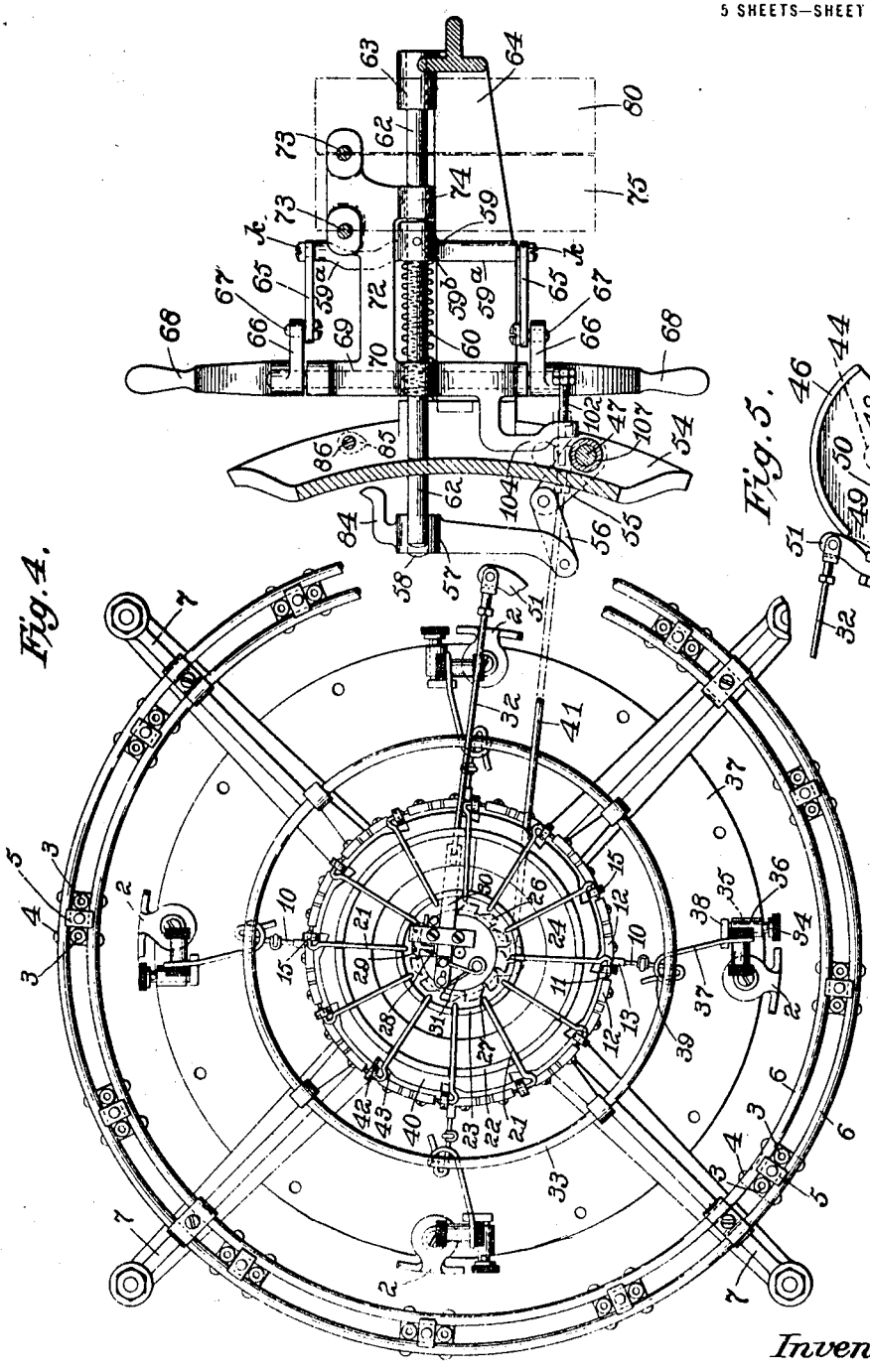


Fig. 5.

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5 SHEETS—SHEET 5.

Fig. 6.

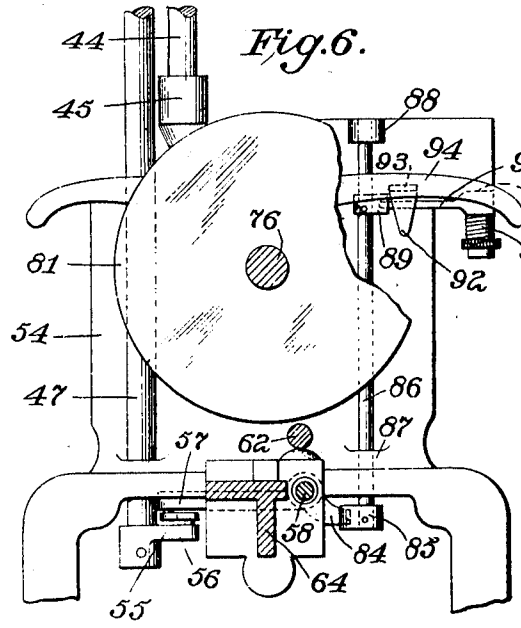


Fig. 8.

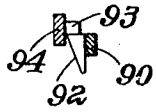


Fig. 7a.

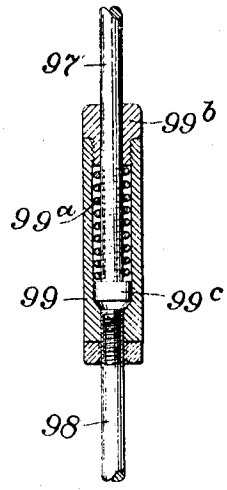
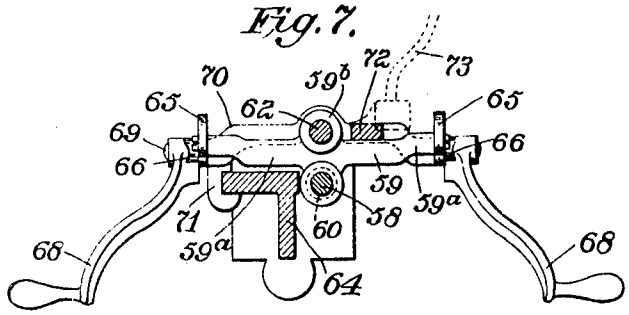


Fig. 7.



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UNITED STATES PATENT OFFICE.

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STOP-MOTION FOR KNITTING-MACHINES.

1,316,928. Specification of Letters Patent. Patented Sept. 23, 1919.

Application filed August 29, 1916. Serial No. 117,489.

To all whom it may concern:

Be it known that I, WILLIAM O. TAYLOR, a citizen of the United States, residing at Limerick, Pennsylvania, have invented certain new and useful Improvements in Stop-Motions for Knitting-Machines, of which the following is a specification.

Among the objects of the invention are the provision of means to secure a quick and direct action of the stop motion mechanism; to make it controllable by the draft or drag of the yarn in passing to the needles; to make the course of the yarn between the bobbins and the needles as direct as possible; to locate the trip mechanism and drop fingers as close as possible to the plane of the knitting to thereby shorten the run of yarn to the needles, after leaving the drop fingers; to avoid undue tension on the yarn and to render the stop motion sensitive and operable with yarns of poor quality as well as with high grade yarns; to provide automatic governor means whereby additional drag or draft on the drop fingers by the yarn will be created when free running yarn is employed, or yarn having slack portions therein or where slackness results from improperly wound yarn; to provide means for automatically restoring an operated drop finger to normal position after it has dropped, and operated the stop motion; to hold all of the unoperated drop fingers in normal position when one has dropped and operated the stop motion and to provide means for resetting the stop motion when the machine is started.

Other objects of the invention will appear hereinafter it being understood that the above statement is not to be regarded as including all the purposes sought to be accomplished by the invention.

In the accompanying drawings:

Figure 1 is a side view of a knitting head with the stop motion attached thereto and having also the let-off connections in the position as when the machine is running.

Fig. 1ª is a detail view looking from the right of Fig. 1.

Fig. 1ᵇ is a diagram of the knitting head and overhead guide, and controlling means for the yarn.

Fig. 1ᶜ is a diagram illustrating the increased frictional contact between the controller member and the yarn as the drop finger moves toward the stopping position.

Fig. 2 is a view of the let-off connections similar to Fig. 1 but having the parts in a different position from that of Fig. 1, *i. e.* with the let-off connections in the position when the belt is on the loose pulley.

Fig. 3 is a view similar to Fig. 2 but with the parts in the position assumed by them when the stop motion is reset but with the belt fork still remaining in the position as when the machine is at rest.

Fig. 4 is a plan view of the parts shown in Fig. 1 with some parts omitted.

Fig. 5 is a detail plan view of an intermediate trip mechanism.

Fig. 6 is a view of a brake lever and brake wheel and associated parts looking from the right of Fig. 1, parts being in section and parts omitted.

Fig. 7 is a view looking from the right of Fig. 1 of the belt fork frame and the resetting frame and handles with parts omitted and parts in section.

Fig. 7ª is a detail view of a yielding coupling.

Fig. 8 is a detail view.

Fig. 9 is a plan view of the upper head with drop hooks for guiding the yarn overhead.

Fig. 10 is a side view of the parts shown in Fig. 9.

Figs. 11, 12 and 13 are detail views of Figs. 9 and 10.

Fig. 14 is a perspective view of the upper drop hook.

In the drawings 1 indicates conventionally a knitting head of any suitable design, the type of machine shown for convenience, being the rotary needle carrier type, but the invention is not limited in this respect. The machine shown is a multiple feed but the number of feeds employed do not pertain to my invention.

The main yarn guides are indicated at 2 for directing the yarns to the needles. The machine is also a ribber but in this respect my invention is not limited. For directing the yarns to the guides 2, I employ eyes 3 of porcelain, these being arranged in pairs, for instance for a main and a plating yarn. These pairs of eyes 3 are mounted in blocks or clips 4 which are fitted to the underside of a pair of concentric rings to which they are clamped by screws passing through the blocks up into clips 5. The rings 6 can be inexpensively provided out of round wire. They are supported on the yoke arms 7, sup-

ported on the fixed frame, and which arms as in ordinary practice support the central dial post 8. The clips carrying these eyes can be placed at any desired points around the rings and secured by the clips and screws in position to suit the number of feeds employed. Just above the knitting head, a circular plate or disk 9 is arranged, being supported from the center post and at the periphery of this plate controllers or drop fingers 10, preferably formed of wire, are pivotally mounted at 11 on pivot wires extending between clips or blocks 12 screwed to the rim of said plate. The upper ends of these controller wires or fingers are connected with weights 13 and the natural tendency of these fingers is to fall by gravity to a vertical position or substantially so.

The ends of these fingers are bent or provided with partial loops to receive the yarns which pass down through the bent ends or eyes of the fingers from a suitable overhead guiding means over which the yarns are directed from the bobbins as will be hereinafter described. These controller fingers are connected by the slot and pin at 14 with supplemental levers 15 which are pivoted at 16 to a plate 17 fixed to the central post of the head, suitable blocks 18 being attached to this plate by screws 19 to support the pivot wires 20. The upper ends of the supplemental levers are connected with wires 21 extending radially inward, being guided in the flanges 22, 23 of the upper plate 24 also secured to the central post. The inner ends of these wires are adapted to operate trip mechanism within the head which when tripped will cause or allow the let-off mechanism to operate and shift the belt from the fast to the loose pulley and also apply a brake to quickly stop the machine.

The particular form of this trip mechanism is not of my invention and any suitable form may be employed. Such a trip mechanism is shown generally in plan in Fig. 4 and it is thought sufficient to say that it involves a toothed plate 26 shown in dotted lines and adapted to turn about the axis of the head to a limited extent when any one of the radial rods 21 is moved inwardly, the inner end of this rod working against the inclined edge of the peripheral tooth 27 of said plate or disk, and this movement of the disk causes a pin 28, carried thereby on its underside, to operate the trip dog 29 and release a slide 30, the spring 31 of which will shift the slide and draw upon the rod 32 with the result that the let-off mechanism will be operated as will be described hereinafter. Mechanism operating on the same general principle is shown in the patent of Crawford, 510,839, Dec. 12th, 1893.

It will be observed that the inward movement of the radial rods 21 takes place as a result of the fall of the drop wires or fingers 10 to vertical position from the inclined position shown in Fig. 1.

The drop fingers are normally held in the inclined positions indicated in Fig. 1 or in substantially said positions by the draft of the yarn thereagainst, said yarn passing down under said fingers at their outer ends and thence outwardly at nearly or substantially a right angle, and at a very low angle to the horizontal to the guide eyes 3, from whence the yarn passes downwardly and at an inward inclination to the needle.

The controller or drop wires 10 can move downwardly through a certain angle without operating the snpplemental levers 15 to such an extent as is necessary to operate the trip mechanism above described and cause the operation of the let-off, but falling movement of the fingers 10 below this point will cause the supplemental levers 15 to move the radial wires 21 inwardly and operate the trip mechanism. Falling movement of the drop or controller fingers may be due to causes calling for the immediate operation of the trip and let-off mechanism to stop the machine, or to causes which are temporary or passing in their nature, and which do not require the stopping of the machine but simply need normal conditions to be restored while the running of the machine is continued. Among the first causes *i. e.* those which call for the stopping of the machine, are the presence of knots, bunches on, or entangled portions, in the yarn, giving rise to increased tension and the dropping of the yarn from the overhead guide finger; the breaking of the yarn, or the exhausting of the supply on a bobbin, the fall of the finger in these cases being sufficient to immediately operate the trip mechanism and let-off and stop the machine.

Among the causes which are temporary or of a passing nature and which require simply the calling in of corrective or compensating measures, to restore normal conditions without stopping the machine, are, when slack portions of the yarn occurs such as is the case with poorly wound yarn, or the use of hard twisted yarn like lisle-thread, or when the yarn runs too freely at times, or when the speed of the machine is materially lowered, in which cases the affected drop finger will fall but because of the presence of compensating or corrective means which are immediately set to work the fall of the finger will be arrested before it reaches the point where the trip and let-off mechanism will be operated and said finger will be restored by the aid of said corrective or compensating means coöperating with and increasing the draft of the yarn on the finger. From what has been stated it will be understood that downward movement of the drop finger does not al-

ways operate the let-off but on the contrary it requires a downward movement to a certain extent or in other words to its "stopping" position before the tripping action will be effected. The finger can vibrate through a certain angle, say thirty degrees, from its normal working position, which is say 45 degrees, before the let-off will operate and if during the downward movement through the angle of safety, compensating influences are brought to bear and exert control on the yarn and consequently on the affected finger, said finger will be restored to normal position without operating the trip and let-off mechanism.

The control of the drop finger within the certain predetermined angle referred to above is exerted by a yarn friction ring 33 arranged adjacent the lower ends of the trip levers, that is the ends through which the yarn passes. When the machine is running normally, the yarn does not touch this ring because the draft of the yarn will hold the trip lever up and its guiding end will then be at its maximum distance out from this ring and the yarn as just stated will not touch the ring. When however slack yarn occurs, or the speed of the machine slackens, and the trip finger due to the decreased draft of the yarn falls slightly, the yarn will be brought against the friction ring.

The main purpose of this ring is to provide an automatic governor for the trip levers. For instance if the yarn is wound unevenly on the bobbin and therefore runs slack at times, or if very free running yarn is employed, or if the machine is slowed down the trip fingers will lower owing to the lessening of the draft due to said free running yarn or due to those portions which run more freely in the irregularly wound portion of the bobbin, or due to the slowing of the speed of the machine. In these events the yarn by the lowering of the finger will be brought into contact with the governor bar or ring and an increased tension will be thus applied to the yarn and the increased draft on the finger will cause the raising of said finger back again to proper working position where it will be substantially maintained.

This additional tension or draft of the yarn on the finger due to its touching the ring or rod 33 will increase the farther the finger falls, this being due to the fact that the yarn wraps to a greater extent about the rounded surface of the rod the farther the finger moves down and thus the tension or draft on the yarn automatically increases, and the effect of this is to lift the finger back again to normal position and hold the connections against operation. In the statement immediately preceding we are considering only those irregularities in the run of the yarn while it maintains its normal course and has neither broken or dropped from the overhead guide and has not been subjected to undue tension arising from knots, bunches or entanglements. Furthermore the lowering of the finger and the changes in the course of the yarn under the temporary irregularities above mentioned brings the finger and yarn into such angular relation that the lifting force on the finger is exerted in the most favorable direction for the return of the finger to normal position, being substantially at right angles thereto, so that the finger is rendered sensitive to the draft of the yarn tending to restore it to its upper working position shown in Fig. 1. The fingers normally are at about 45 degrees angle. They can fall from this about thirty degrees without letting off the trip. This will leave about 15 degrees of angular movement of the finger before it reaches a vertical position and this will be sufficient to insure quick and certain results. The angular movement of 30 degrees from the normal position of the fingers will provide ample margin within which variations of tension, due to irregular winding or other irregularites due to the character of the yarn will have no effect in setting off the trip mechanism. Fig. 1c shows diagrammatically the effect of this governor ring. It being round, the yarn, when first brought into contact therewith, will have a one-point bearing thereon but as the finger moves more and more toward stopping position *i. e.* the position at which it will operate the trip the extent of the frictional contact between the yarn and the rounded surface will increase because of the wrapping of the yarn about the governor wire and thus more and more tension will be placed on the yarn and increased draft on the finger 10 tending to restore it to normal position.

The fingers 10 besides being controlled by the draft of the yarn thereon are also controlled by needle protectors, one for each finger or one for several fingers. I have shown one of these consisting of a finger 34 carried by a rock shaft 35 journaled in a bracket 36 supported on the dial cap or cam plate 37. This rock shaft has an arm or cam 38 which when turned, due to the protector finger 34 being moved to the right by a bunch striking the same, will be removed from beneath an arm 37 on another rock shaft 38′ supported in the bracket. This will allow this arm 37 to be forced down under the pressure of a spring coiled around the shaft 38′. The arm has a hooked upper end 39, engaging the finger 10 so that this will be forced downwardly to operate the trip mechanism.

Other forms of needle protector mechanism may be employed, my invention here consisting of a needle protector of some

suitable form operating through the controller 10 to operate the let-off.

Drop finger restoring and holding means.

Means are provided for automatically restoring to normal position any finger which has dropped and operated the let-off mechanism, and said means is employed also for holding in operative position all of those fingers whose yarns remain intact and in normal condition for feeding. This will hold all of the fingers in normal working position while the machine is at rest, and, when started again, until it has attained sufficient speed to create the required drag of the yarn on the fingers to maintain them in said normal position for operation, when some abnormal condition arises. This restoring and holding or controlling means for the fingers may assume various forms but in the particular arrangement shown the primary element of this means is an oscillatory disk or plate 40 having a toothed or cam-shaped periphery, one tooth, or cam portion for each of the drop fingers 10. This controller plate is mounted to oscillate about the central post of the knitting head and is operated by a rod 41 extending to the let-off connections as will be described hereinafter. Normally when the machine is running the controller disk or plate is in position to present its notches or low parts of its cam portions 42 radially opposite the upper ends of the supplemental levers 15 so that any one of these levers is free to move inward when one of the drop fingers 10 falls to thus allow said supplemental lever to thrust the radial rod 21 thereof inwardly and operate the trip and cause the operation of the let-off to shift the belt from the fast to the loose pulley. When this happens the movement of the let-off mechanisms will immediately push upon the rod 41, as will be described, and the controller disk will be turned to bring the high part or incline 43 against the upper end of the supplemental finger or lever 15 and move the same outwardly thus lifting the controller or drop finger 10 to its normal position. This same movement of the controller disk or toothed wheel will also bring the other high parts or inclines of the plate into contact with the upper ends of all the supplemental levers and will hold them against dropping while the machine is stopping, or while it is at rest, and until the machine has been started again, and has attained a speed sufficient to create the necessary drag of the yarn on the fingers 10 to hold them up. Thereupon the toothed disk or plate is given a partial rotation in the opposite direction, which will restore it to normal position, and bring the notches or low parts of the controller plate or disk opposite to said supplemental levers ready for the operation of any one of them when its corresponding drop finger falls.

The arrangement of drop fingers and the restoring means therefor is similar in general features to that shown in an application filed by me for Letters Patent of the United States No. 873,247, dated November 21, 1914.

Let-off mechanism.

The rod 32 connects with the let-off mechanism through a supplemental trip arrangement which is supported at the top of a post 44 held in a bracket 45 secured to the base of the machine. This post supports at its upper end a plate or bracket 46 which forms the bearing for the upper end of a rod 47 adapted to turn, said rod carrying an arm 48 fixed thereto to which is adjustably connected a latch finger or arm 49 by a bolt and slot connection at 50. The latch finger 49 is held in normal position shown in Fig. 5 and also in Figs. 1 and 1ª by a catch 51 pivoted to the plate 46 at 52 and having a shoulder 53 to engage the end of the latch arm 49. The rod 32 connects with this catch lever 51 and when the main trip mechanism at the knitting head is operated the catch 51 is withdrawn thus freeing the latch arm 49 so that the rock shaft or rod 47 may turn. This rock shaft at its lower end finds a bearing in one of the side frames 54 of the machine and it has attached thereto an arm 55 connected by a link 56 with an arm 57 which is attached to a rod 58 slidably mounted in the side frame 54 carrying a cross head 59. A spring 60 surrounding the rod 58 and bearing at one end against the side frame 54 and at its other end against the cross head 59 tends to move said rod toward the right from the position shown in Fig. 1 to the position shown in Fig. 2. The cross head 59 has an upper boss or collar 59ᵇ attached to an upper guide rod 62 which slides in bearings, one of which is shown at 63 on the bracket 64 attached to the side frame 54 and the other bearing in which the other end of its rod 62 slides is provided by the side frame 54 which has an opening through which the said rod passes. The cross head 59 has arms 59ª extending on each side laterally therefrom and these are connected through curved links 65 to handles in the shape of bell-crank levers having short arms 66 to which the said links are pivotally connected at 67. These hand levers are shown generally at 68 and they are fixed to a rock shaft or rod 69, one at each end thereof, said rock shaft finding bearings in a belt fork frame or cross head 70 which is slidably mounted on the rod 62 to have movement independent thereof, the said cross head 70 being also guided by a depending finger 71 thereof engaging the edge of the bracket 64 as shown in Fig. 7. This belt

fork frame or cross head has an extension 72 carrying the belt fork members 73 and this end of the frame has engagement with the rod 62 to be guided thereby by an eye or collar 74 on said frame having an opening through which the rod 62 passes. This collar or boss 74 lies to one side of the boss or collar 59[b] of the cross head 59 before mentioned and therefore the spring 60 in pressing the cross head 59 to the right also acts to press the belt fork frame or cross heads 70 and 72 to the right when said spring is free to act.

Brake mechanism.

The fast driving pulley is shown at 75 suitably fixed to drive shaft 76 which turns in a bearing 77 of the side frame and a bracket bearing 77′ and this shaft carries a beveled gear 78 on its inner end meshing with a beveled gear or rack 79 connected with the rotary member of the machine. The loose pulley is shown at 80 and a brake wheel or disk at 81 the latter being fixed to the shaft 76 and having an overhanging flange 82 against which the brake block 83 bears. The detail of this brake mechanism forms no part of my invention and it may be of any suitable form. I have provided novel means however for operating the brake mechanism consisting of an extension or finger 84 on the arm 57 which as the cross head 59 and belt fork frame 70, 72 moves toward the right in Figs. 1 and 4 will come against a cam piece or arm 85 on a rock shaft 86 journaled at 87, 88 in the side frame, and the turning of this rock shaft will cause a cam or finger 89 to move a lever 90 pivoted at 91 to the side frame, and thus the catch 92 on said lever will be withdrawn from the lug 93 of the lever or arm 94 and as this arm 94, when released, is operated by a spring (not shown) and is connected with the brake shoe through an eccentric the said shoe will be thrust against the overhanging flange 82 of the brake wheel 81 and the movement of the machine will be quickly arrested. This brake device may be like that disclosed in Letters Patent of the United States granted to Frank Wilcomb, No. 680,829, August 20, 1901. A spring 95 serves to return the catch lever 90 to normal position.

Connections for operating the drop finger controller for restoring said fingers to and holding them in normal position.

As above stated the toothed controller disk or cam 40 for acting upon the upper ends of the supplemental levers 15 for restoring the drop fingers 10 to and holding them in normal position is operated automatically in said restoring and holding operation through a rod 41. This rod is connected to a bell crank lever 96 pivoted at 97′ to the post 44, said bell crank lever being connected through a link 97, 98 having an intermediate spring coupling 99 with a lower bell crank lever 100 pivoted at 101 in a bearing carried by the side frame 54. This bell crank 100 has a rod 102 extending therefrom with nuts or stops 103 at the end thereof, the intermediate part of this rod being embraced by a fork or finger 104 formed with or connected to the cross head or belt fork frame 70 and 72, the arrangement being such that a certain amount of lost movement of the fork or arm 104 will take place before the lower bell crank lever 100 is operated, this lost movement taking place on both the right and left hand movement of the said fork or arm. The upper bell crank lever 96 has an extension 105 therefrom adapted to be used as a handle as will be hereinafter described. The spring coupling 99 consists of a sleeve with a spring 99[a] therein held by a screw cap 99[b]. The upper section 97 of the link has an enlarged head 99[c] at its lower end against which the spring bears and the lower section 98 of the link is screw threaded into the sleeve.

Reverting to the trip mechanism at the upper end of the post 44 it will be seen from Fig. 5 that the catch 51 has an extension 51′ beyond its pivot having a screw or pin carried thereby and the purpose of this is to reset the trip mechanism 27, 28, 29 in the head of the stop motion mechanism automatically when the latch arm 49 has swung to the left into the position shown in Fig. 5, for then the said latch arm will strike the end of the pin in the end of the arm 51′ and will swing the catch 51 on its pivot 52 to bring it into the position shown in Fig. 5 so that the shoulder 53 will engage and hold the latch 49. This same movement of the catch 51, imparted to it through the resetting of the arm 49, to the position shown will draw upon the link 32 and automatically reset the main trip mechanism 27, 28, and 29 at the stop motion head.

The parts are shown in Fig. 1 in the position assumed by them while the machine is running. On the operation of the main trip 27, 28, 29 at the head by the falling of any one of the drop fingers, the intermediate trip 49, 51 at the post 44 will be operated allowing rod 47 to turn under action of the spring 60 of the sliding frame or cross head 59 which will shift the belt fork frame 70, 72 bodily with it, while maintaining as a whole the relative position shown in Fig. 1, this movement being to the right, and thus the belt fork will be set in position to transfer the belt to the loose pulley 80 as shown in Fig. 2, thus stopping the machine. This shifting of the belt fork frame to the right causes the turning of the toothed disk or cam 40 to hold all of the

fingers in operative position by engaging the supplemental levers 15. This action is due to the arm 104 striking the stop nuts 103 on the rod 102 connected with the lower bell crank lever 100 thus operating said bell crank, which through the vertical link 97, 98, upper bell crank 96, and horizontal radial rod 41 turns the toothed disk 40, to reset the operated drop fingers and to hold all of the unoperated fingers against accidental operation while the machine is at rest or is being started again, it being understood that as the fingers depend upon the draft or drag of the yarn thereon to normally hold them up, the stopping of the machine would cause the fall of other fingers besides the one which effected the stopping of the apparatus. Therefore all of the unoperated fingers 10 are held up by the toothed disk 40 this being turned through the connections stated as soon as the belt is shifted and it will be understood that this action also restores the operated finger to normal position. This operation of restoring the operated or lowered drop finger 10 to normal position and locking the unoperated fingers against dropping takes place in the final movement of the belt fork frame or cross head to the right and at about the same time that the belt is shifted onto the loose pulley 80.

Now in starting the machine again after the yarn has been repaired or rethreaded and understanding that the let-off mechanism is in the position shown in Fig. 2, *i. e.* the position in which the machine is at rest, the first action is to turn the handle 68 in the arrow direction Fig. 2. As the fork frame 70, 72 is now at its extreme right hand limit with its boss 74 resting against the bearing 63 of the fixed bracket 64 and as the said handle is pivoted to said frame 70, 72 the turning of the handle in said arrow direction will draw upon the curved links 65 and the cross head 59 will be moved leftward including also the two rods 58, and 62 to which the cross head is connected and this movement will cause the arm 57 of the rod 58 to draw upon the link 56, thus turning the rod 47 and setting the latch finger 49 at the top thereof into engagement with the latch 51 which holds the parts in this set position, it being understood that the spring 60 by the action just described has been compressed between the cross head 59 and the frame 54 ready to operate the let-off when the catch is again released by the operation of the stop motion. The parts of the let-off can not be reset or rather they will not be held in reset position unless the catch 51 is moved to position to retain the parts in place and this catch can not be set in position without resetting the main trip mechanism in the head, and as above described the setting of the catch is done automatically by the resetting of the cross head 59 to the left in Fig. 2. In other words the operator need operate only the handle 68 to shift the cross head 59 leftward from the position of Fig. 2 to that of Fig. 3, the resetting of the main trip mechanism following as a result of said action. The resetting action of the trip above described however has not released the drop fingers which still are held up, not by the yarn, but by the controller disk acting on the levers 15. In other words the action thus far described has merely reset the trip mechanism 49, 51 and 27, 28, 29 but has not released the yarn drop or trip fingers 10 nor has the belt been shifted onto the fast pulley. The position of the handle and other parts at the time the above resetting takes place is shown in Fig. 3 in which the handle has been raised and moved slightly beyond vertical position to the left; the fork carrying frame 70, 72 remaining stationary during this action, the links 65 draw the setting cross head 59 forward until the handle assumes the position stated and thus the connections back to the trips are set. The belt shifting frame is locked in its idle position when the handle is in the position shown in Fig. 3 because the centers of the link 65 and the handle 68 are out of line. This is true also in Fig. 1, the fork frame being locked by the non-alined centers to hold the belt shifting frame with the belt in driving position.

Now in order to shift the belt the handle 68 is moved back to right Fig. 3, see arrow direction *x*, and as the cross head 59 already has been set to the left and latched by catch 51 above described the pivot *k* becomes the fixed fulcrum in relation to which the movement takes place, this resulting in the parts assuming the position of Fig. 1 *i. e.* with the handle 68 pushed forward to the left by the straightening out of its arm 66 and link 65 and as the handle is pivoted to the forward end of the belt shifting frame 70, 72 this frame is drawn forward to the left to shift the belt onto the fast pulley.

Now to release the drop fingers from the toothed wheel or cam 40 by revolving the latter so that the supplemental levers will be freed from the high parts thereof and stand opposite the notches for individual operation, the arm or fork 104 on the belt fork frame comes against a collar 106 on the rod 102 and forces the bell crank 100 from the position shown in Fig. 2 to that shown in Fig. 1 and this will set the bell crank 100 and section rod 97, 98 in position together with the bell crank 96 and rod 41 to rotate the said toothed wheel 40 though the action of these connections is modified through hand manipulation as will presently appear.

It will be seen that the fork or arm 104 in moving from the position of Fig. 2 to the

position of Fig. 1 traverses considerable space before said fork contacts with the collar 106 and this last motion is taking place and the drop fingers are held up by the high parts of the toothed wheel 40 acting through the supplemental levers 15 while the belt fork is being moved to shift the belt from the loose to the fast pulley and this insures that the drop fingers can not be released from the positive control of the toothed wheel or cam 40, holding them up, until after the machine has been set in rotation, and until after the yarn has been subjected, to some draft it being borne in mind as before stated that it is the draft of the yarn through and on the drop fingers that holds them in the position to perform their function, and until this draft of the yarn has been inaugurated it would be contrary to the principle of the invention to release the drop fingers from the positive control of the cam plate 40 as said fingers would fall beyond the limit within which they may vibrate, without operating the let-off connections, and thus a tripping of said connections would result again.

In order to place this control *i. e.* the release of the drop fingers from the holding action of the plate 40 within the will of the operator I provide in the link or rod 97, 98 the yielding connection 99, and I provide the handle extension 105 for the bell crank 96. Now when the driving mechanism is let-off as indicated in Fig. 2 by shifting the belt onto the loose pulley the fork 104 by striking the stop nut 103 at the end of the rod 102 will draw upon said rod and tip the bell crank 100 into the position shown in Fig. 2, and through the rod 97, 98 and the yielding connection 99, the upper bell crank 96 and rod 41, the cam wheel 40 will be turned as above described to positively hold the drop fingers up, and this action will swing the hand lever 105 to the position shown in Fig. 2 in between the post 44 and the rotatable sleeve 107 on the rod 47. Now when the operator starts the machine by turning the handle 68 from the position of Fig. 2 up and down again to bring it to the successive positions of Fig. 3 and Fig. 1 he can, by gripping the post 44 and the sleeve 107. *i. e.* making his hand bridge the space between these two members where the handle 105 is located, hold said handle in the position shown in Fig. 2 notwithstanding the pull downward on the link 97, 98 because the coupling 99, will yield for this purpose. The spring of this coupling will be placed under tension however so that when the operator takes his hand away from the hand lever 105 the spring in the coupling 99 will pull the upper section 97 of the rod downwardly and through the bell crank 96 and the rod 41, the cam wheel 40 will be rotated to release the supplemental levers 15 and free the drop fingers from the positive control of said cam wheel and place them under the control of the yarn only, which, by reason of the machine having now attained a sufficient speed will give the yarn sufficient draft to hold the drop fingers up until any one of the several contingencies mentioned above happens when the drop finger will fall and through the supplemental lever the trip will be operated. The lost motion connection at 102 will take care of the proper release of the drop fingers under normal conditions but there are some conditions which require a further retarding of the release of the drop fingers, such for instance if a bad belt is being used and it does not pick up its work promptly, the operator by holding the handle 105 can further delay the release of the drop fingers until the machine has attained the desired speed to get the proper draft on the yarn.

It will be noticed that the belt fork is held against accidental displacement both when opposite the fast pulley for driving or when opposite the loose pulley for stopping, this being due to the center 67 being carried past the line cutting the pivot of the handle and the other pivot of the link.

A handle 68 is provided at each side of the let-off mechanism for convenience of control from either side of the machine. In order to operate the let-off when a bunch occurs at the needles I provide a needle protector which operates through the stop motion connections above described. This needle protector consists of a finger and other parts substantially like those shown in Letters Patent of the United States, granted to Frank B. Wildman 783,005, February 21, 1905 having a stem 108 which is lifted by a spring when the detector finger is moved by a bunch, broken needle or other obstruction near the knitting point. This post has a finger 109 which on the lifting of the post is brought into range of one of a number of pins 110 projecting down from the rotary part of the machine so that this finger will be struck and turned by one of said pins and thus through a chain 111 connected with the finger and with an arm 112 on the sleeve 107 surrounding the rod 47, said sleeve will be turned and through an arm 113 at its upper end and the tail 51′ the latch or catch 51 will be tripped, the effect being the same as though the rod 32 were drawn upon by the trip mechanism *i. e.* the latch 49 will be released and the rod 47 will be allowed to turn by the spring 60 and the cross head 59 will slide, and said cross head acting against the boss 74 of the belt fork frame or slide 70, 72 will move the frame to the right to shift the belt onto the loose pulley. The chain 111 is attached to an arm 115 on the arm 109 and another section of this chain connects the said arm with a screw 116 on the

base of the machine. This is for keeping the arm 109 in proper position to be struck by the pins 110.

This needle protector mechanism is supplemental to the one 34 which operates through the stop motion mechanism. It will be understood that it is in the nature of a safety device to operate in the event that the stop motion part of the mechanism does not operate. This needle protector, therefore, is entirely independent in its action of the stop motion proper and provides a direct means of control between the needles and the let-off. At 114 I show a cloth covered stop plate or ring for the weighted end of drop fingers. A metal stop would tend to hold the drop fingers if oil is present but this will not affect the cloth, which will allow the drop finger to be released quickly. In other words the drop fingers will not tend to stick to this stop.

It will be understood that while I have described the stop motion as having a number of drop fingers for a multiple feed machine the invention is not limited in this respect as it may be used with a single feed machine. Where in the appended claims I mention that the yarn "fails" I employ this term in a generic sense to mean the breaking of the yarn, its running off from the bobbin, or its increased tension due to bunches, knots or entanglements or other causes which render necessary the movement of the drop finger 10 to such an extent as to carry it to its "stopping" position *i. e.* the position in which it operates the stop motion to arrest the movement of the machine. On the other hand where I refer to "temporary" abnormal conditions in the yarn under which the finger 10 will have movement but will be restored to normal position automatically without stopping the machine, I mean those conditions such as free running portions of the yarn, slack portions, or temporary slowing down of the machine or other conditions which need only the maintenance of the finger 10 within a limit of movement less than that necessary to carry it to the "stopping" point and the automatic restoration of the finger to normal position to maintain the machine in operation during this temporary period and the resumption of normal running after the passing of the said temporary abnormal condition.

The invention is not limited to a construction in which the yarn is entirely free from contact with the controller 33 under normal conditions, as a slight contact with the controller at that time will not affect the operations of the device so long as increased draft on the finger to restore it to normal position takes place as a result of the movement of said finger toward its stopping position when temporary abnormal conditions exist.

Reverting to the let-off mechanism it will be seen that a long turning movement of the handle 68 takes place in moving the cross head 59—61 from the position shown in Fig. 2 to that shown in Fig. 3 for compressing the spring 60 and as the necessary movement of the cross head is slight as compared with the long arc through which the handle swings ease of action results, so that the let-off can be operated readily by a girl.

Overhead guide.

At a point some distance above the knitting head I arrange guide means for the yarns which lead up from the bobbins over these guides and thence downwardly to the drop or controller fingers 10. These overhead guides consist of fingers 115 curved as shown in Figs. 13, and 14 and Fig. 1^b, these fingers being of wire and having a rock shaft portion or extension 116 to which the fingers are connected by an upwardly extending portion 117. The outer ends of the rock shafts or stems 116 are journaled in arms 118 connected with the head 119 supported on the vertical post 120 extending axially from the knitting head or from the stop motion mechanism located immediately above said head. The arms 118 have downwardly bent outer ends 119 and these arms may be formed of heavy wire. The downwardly extending portions of the arms are slotted vertically at 120 and also at 121 the latter slots connecting with the slot 120 and extending from the lower end of the bent portion 119 only a short distance up along the same as shown in Fig. 13. The rock shaft 116 extends through one of the slots 121 and is held therein by a ring 122 frictionally or otherwise held on the end 119 so that a bearing is thus provided for the rock shaft between the ring 122 and the upper end of the slot 121. The vertical portion 117 of the guide finger device lies in the vertical slot 120 and when raised to normal position it is stopped in this position by bearing against the bottom of the slot or groove 120.

The inner ends of the rock shafts 116 are bent into loop form 123 Fig. 14 and springs 124 connected with these loops and with a plate 125 within the head serves to apply tension to the fingers 115 tending to hold them up in the position shown in the drawing Figs. 10 to 14. Some of the loops 123 of the rock shafts extend upwardly and some downwardly, those extending downwardly having their springs connected with the plate 125 while those extending upwardly have their springs 124′ connected with the upper plate 125′. These plates may be turned to adjust the tension of the springs but this forms no part of my invention.

If the tension of the yarn increases for any cause the spring 124 will allow the particular finger 115 of this tense yarn to be

depressed and such yarn will drop off from this overhead finger and consequently the corresponding drop finger 10 will no longer be held up and the stop motion will be operated.

It will be seen from the above that the course of the yarn from the bobbins to the drop fingers 10 is as direct as possible, in that the yarn passes over only one surface before reaching the drop finger 10, this surface being the finger 115. Further it will be noticed that I prefer to have the yarn pass to the drop finger 10 without contacting with the controller ring 33 under normal conditions. Little tension is, therefore placed on the yarn and very light yarns can be used in the machine and yet the stop motion will be effective in its control.

The yarn guide eyes 3 are adjusted to occupy positions radially in line with the dropper wires or fingers 10 so that the yarn will lead off from the said drop fingers in direct radial lines, and thus avoid side pressure on the fingers.

The relation of the yarn guide eyes 3 to the main yarn guides 2 is not important as the yarn may lead from the eyes 3 at an inclination to the yarn guide 2, as shown in Fig. 1.

The overhead hook is made double in order to gain a greater separation of the up and down going yarn strands to prevent the fibers of one (up) strand from interlocking with those of the down going strand and causing such interlocked fibers to be carried upward and wrapped about the wire of the hook, which would not only interfere with the free, stead flow of the yarn but, in time, would result in an accumulation upon the hook of such wrapped fibers, torn from the yarn, as would prevent the free shedding off of the yarn from the hook when abnormal tension on the yarn causes the point of the hook to be pulled down. The stop motion mechanism may be used with single yarns or with two yarns for plating.

Certain features disclosed but not claimed herein constitute subject matter for claims in other applications, viz., No. 117,490, August 29, 1916, and 117,491, Aug. 29, 1916.

What I claim is:—

1. In combination in a stop motion for knitting machines, trip mechanism, a finger engaging the yarn and held by the draft of the yarn thereon outwardly in respect to the axis of the machine, said finger when released by the failure of the yarn serving to operate the trip mechanism, an overhead guide for the yarn arranged to allow the same to drop when the tension increases abnormally, said yarn passing down from said overhead guide to the finger, a member directly adjacent the end of the finger and about which the yarn is bent when the finger moves inwardly toward the axis of the machine for operating the trip, said member being located out beyond the finger in respect to the center of the machine, a main yarn guide at the needles, and a guide intermediate the said finger and the said main yarn guide to direct the yarn at an abrupt angle outwardly from the finger in relation to the axis of the machine and the course of the yarn between said finger and the overhead guide, substantially as described.

2. In combination in a stop motion for knitting machines, a trip mechanism, a finger pivotally mounted and inclining downwardly and outwardly in respect to the axis of the knitting head, and when free from restraint swinging inwardly at its lower end toward the axis of the machine, means for guiding the yarn substantially vertically in relation to the said yarn finger, a member located adjacent toward the outside of the machine in respect to said finger and above the end of said finger which engages the yarn, and under and against which member the yarn is drawn when the finger moves inwardly, a main yarn guide and a guide intermediate the main yarn guide and the said finger to guide the yarn outwardly from the finger, said yarn lying on the side of said member toward the outside of the machine, substantially as described.

3. In combination in a stop motion for knitting machines, a plurality of yarn engaging fingers, one for each feed, trip mechanism controlled by any one of said fingers, and a circular controlling member arranged adjacent the fingers and under and against which the yarn is drawn when any finger moves inwardly upon the occurrence of temporary abnormal conditions in the yarn, said fingers being pivoted at their upper ends and having their lower ends extending on the inner side of the ring and under the same and to a point beyond the vertical plane of its outer side, said member increasing the tension on the yarn to restore the finger to normal position, said member consisting of a ring of wire, substantially as described.

4. In combination in a stop motion for knitting machines, a trip mechanism, a pivoted finger engaging the yarn to be controlled in its position thereby, and a supplemental pivoted lever extending up from the pivoted end of the finger to which it is pivotally connected and between the finger and trip to operate the latter when the finger moves to a certain extent, said lever maintaining its connection with the finger to be reset thereby when said finger is reset, said supplemental lever and finger moving radially in respect to the axis of the knitting head.

5. In combination in a stop motion mecha-

nism for knitting machines, a trip mechanism, a rod operating radially in relation to the axis of the knitting head for operating the trip mechanism, a vertically disposed lever pivoted intermediate of its length to move radially and at its upper end operating said rod, and a finger engaging the yarn pivotally supported at its upper end and connected with the said lever near its upper end, substantially as described.

6. In combination in a stop motion for knitting machines, a trip mechanism, a movable finger engaging the yarn and controlling said trip mechanism, said finger being held in substantially normal position by the draft of the yarn thereon, a needle protector extending into proximity to the needles and a connection between the said needle protector and the said finger to operate the same when the needle protector is operated, substantially as described.

7. In combination in a stop motion for knitting machines, a trip mechanism, a movable yarn engaging finger held in normal position by the draft of the yarn, and operating the trip mechanism when allowed to move to a certain extent by a failure of the yarn, a needle protector at the needles, and an arm extending from said needle protector and reaching over the said movable finger to operate the same, substantially as described.

8. In combination in a stop motion for knitting machines, a series of yarn fingers pivotally mounted and having weighted ends above their pivots, trip mechanism controlled by said yarn fingers, and a cloth covered stop ring for the upper weighted ends of said yarn fingers, substantially as described.

9. In combination in a stop motion for knitting machines, a trip mechanism, connections leading therefrom to a let-off mechanism, a yarn engaging finger for operating the trip mechanism when released by the failure of the yarn, restoring means for automatically restoring said finger to normal position when the trip mechanism is operated, releasing means for said restoring means operated by the resetting of the let-off to cause said restoring means to release the fingers when the machine is started, and a manually operated controller to retard the releasing action of the reset let-off at the will of the operator and until the machine has attained a sufficient speed to create the necessary draft of the yarn on the fingers to hold them in normal operative position, substantially as described.

10. In combination in a stop motion for knitting machines, trip mechanism, let-off mechanism, connections between the trip mechanism and let-off mechanism for operating the latter from the former, a yarn engaging finger movable to operate the trip mechanism when the yarn fails, a controller to restore the yarn finger to normal position when the trip mechanism is operated, a manually operated device for resetting the let-off mechanism and withdrawing the restoring controller from the yarn finger to allow the latter to remain under control of the draft of the yarn alone, and a manually operated device for controlling and retarding the action of the let-off on the restoring controller until the machine has attained the required speed to create draft of the yarn upon the finger, substantially as described.

11. In combination in a stop motion for knitting machines, trip mechanism, let-off mechanism operated thereby, a yarn engaging finger controlling the trip mechanism and causing its operation when the yarn fails, a controller for restoring the yarn finger to operative position when the let-off mechanism is operated, connections leading back from the let-off for operating the said controller including a yielding member and a manually operated member for holding the said connections against effective operation and causing said yielding member to be placed under tension by the operative force, said manually operated member when released, at the will of the operator, allowing said yielding member to operate said connections effectively to withdraw said controller member from the yarn finger, substantially as described.

12. In combination, trip mechanism, a yarn engaging finger to operate the trip mechanism when the yarn fails, driving means controlled by the trip mechanism, a manually operable device with connections for setting the driving means to drive the machine, restoring means for the drop finger to restore it to normal position when the trip is operated to stop the machine and a connection between said manually operable means and the restoring means to withdraw the latter from its action on the drop finger, said connection including a manually operable member to eliminate the function of said connection until such a time that the operator determines the machine to have acquired sufficient speed to create the necessary draft on the yarn.

13. In combination in a stop motion for knitting machines, a yarn engaging finger to move when the yarn fails, connections operated by the movement of said finger for stopping the machine, resetting means, a restoring controller for the finger to restore it to normal position, means in which power is stored automatically, when the connections are reset, for withdrawing the controller from the yarn finger and manually operated means preventing said power means from withdrawing the restoring means until the machine has attained the desired speed, substantially as described.

14. In combination in a stop motion for multiple feed knitting machines, a plurality of yarn fingers each movable when its yarn fails, connections controlled by either of said fingers to stop the machine, means operating automatically when said connections are operated to lock the unoperated finger or fingers against accidental movement, resetting means for said connections, said locking means being placed under stress by the resetting of said connections to release said finger or fingers and manually operating means for opposing said stress and eliminating the releasing function of said locking means at the will of the operator until the machine has attained the desired speed, to create draft of the yarn upon the said finger.

15. In combination in a stop motion for knitting machines, a finger held in position by the yarn, connections controlled by said finger to stop the machine when the yarn fails, means for locking said finger in normal position while the machine is at rest, connections operated when the stop motion operates for throwing said locking means into locking position, said connections including a yielding part adapted to be placed under stress for withdrawing the locking means to allow the finger to be free, said yielding part being placed under stress when the first mentioned connections are reset and a manually operated member for resisting said stress, at the will of the operator, until the machine attains the desired speed, substantially as described.

16. In combination in a stop motion for knitting machines, a yarn engaging finger, connections controlled thereby for stopping the machine when the yarn fails, means for holding the yarn finger in operative position when the machine is at rest, including link connections to the let-off mechanism and a spring coupling in said link connections, let-off mechanism including means to reset the same, the resetting action of said let-off mechanism serving to place said spring coupling under stress to withdraw the holding means from the yarn finger to allow the same to be subject to the draft of the yarn, to hold it in operative position when the machine is running, and a manually controlled device for eliminating the function of said spring coupling in withdrawing the holding means from the yarn finger until, at the will of the operator, the desired speed of the machine has been attained to create the necessary draft of the yarn upon said finger.

17. In a stop motion for knitting machines, the combination of a yarn finger, subject to draft of the yarn, let-off mechanism connections controlled by the yarn engaging finger when the yarn fails, to operate the said let-off mechanism, a controller to hold the yarn finger in operative position while the machine is at rest and while it is being started, a substantially radial rod connected with said controller for operating the same, an upper bell crank to which said rod is connected, a lower bell crank, a vertical link and spring coupling connecting the bell cranks, a connection between the lower bell crank and the let-off mechanism whereby the said bell cranks will be operated when the let-off is operated to shift the belt onto the loose pulley and also when the let-off is at rest, the said spring coupling being placed under stress when the let-off is reset, and a manually operated device for holding the spring coupling under stress and prevent it from operating the controller to release the yarn finger until after the machine has attained the required speed to subject the yarn finger to the desired draft of the yarn, substantially as desired.

18. In combination in a stop motion for knitting machines, a yarn finger subject to the draft of the yarn to hold it in position ready to operate when the yarn fails, let-off means for stopping the machine, connections between the let-off means and the yarn finger to be operated thereby, a controller for holding the yarn finger in operative position when the machine is at rest and when it is being started, connections between said controller and the let-off connections, including a lost motion device, a hand lever for resetting the let-off connections, operating through said lost motion device automatically to withdraw the controller and allow the yarn finger to be subject to the draft of the yarn when the machine has attained the desired speed, and a hand manipulated device for preventing the withdrawal of the said controller until after the desired speed has been attained.

19. In combination in a stop motion for knitting machines, a main trip mechanism, a yarn engaging finger controlling said main trip mechanism, let-off means, a secondary trip controlling said let-off means, and in turn controlled by the main trip, said secondary trip being automatically reset when the let-off means is reset and in turn automatically resetting the main trip, a controller to hold the yarn finger in operative position while the machine is at rest or when it is being started and means for automatically operating the said controller into holding position or into position for releasing the yarn finger, said connections including a lost motion device operated from the let-off means, substantially as described.

20. In combination in a stop motion for knitting machines, a main trip mechanism, a yarn engaging finger controlling said main trip mechanism, a secondary trip mechanism controlled by the main trip mechanism, let-off means controlled by the secondary trip mechanism, a vertical rock shaft between

said secondary trip and the let-off means, a second rock shaft, an arm on said second rock shaft to operate the said secondary trip, a needle protector and connections between said needle protector and the said second rock shaft for operating the same, substantially as described.

21. In combination in a stop motion for knitting machines, pivoted drop fingers movable in planes radial to the machine axis and having guide means for the yarn, main yarn guides adjacent the needles, and supplemental guides between the drop fingers and the main guides, and a ring support for the supplemental guides, said supplemental guides being individually adjustable on the ring circumferentially of the machine, whereby the draft of the yarn on the drop fingers may be preserved radially of the machine notwithstanding the positioning of the fingers out of radial lines with the main yarn guides, substantially as described.

22. In combination in a stop motion for knitting machines, pivoted drop fingers, having guide means for the yarn, main guides adjacent the needles, and supplemental guides between the drop fingers and the main guides, and a ring support for the supplemental guides, said supplemental guides being individually adjustable on the ring circumferentially of the machine, said ring support comprising a pair of concentric rings, members carrying said guides and means for clamping said members between the concentric rings, substantially as described.

23. In combination in a stop motion for knitting machines, drop fingers pivotally mounted at their upper ends to swing in radial planes in respect to the axis of the machine, a ring shaped member adjacent the lower free ends of the drop fingers arranged outside of said drop fingers, said drop fingers having guide eyes for the yarn at their lower ends extending outwardly under the ring-shaped member and receiving the yarn at the outer side of said ring shaped member, main yarn guides and guides intermediate the main yarn guides and the drop fingers, said intermediate guides being individually adjustable circumferentially of the machine and lying at points a greater distance from the axis of the machine than the yarn drop fingers and ring shaped member and trip mechanism operated by the drop fingers, substantially as described.

In testimony whereof I affix my signature.

WILLIAM O. TAYLOR.