Oct. 24, 1939. W. H. KIMPTON ET AL 2,176,970

YARN WINDING APPARATUS

Filed May 4, 1937 5 Sheets-Sheet 1

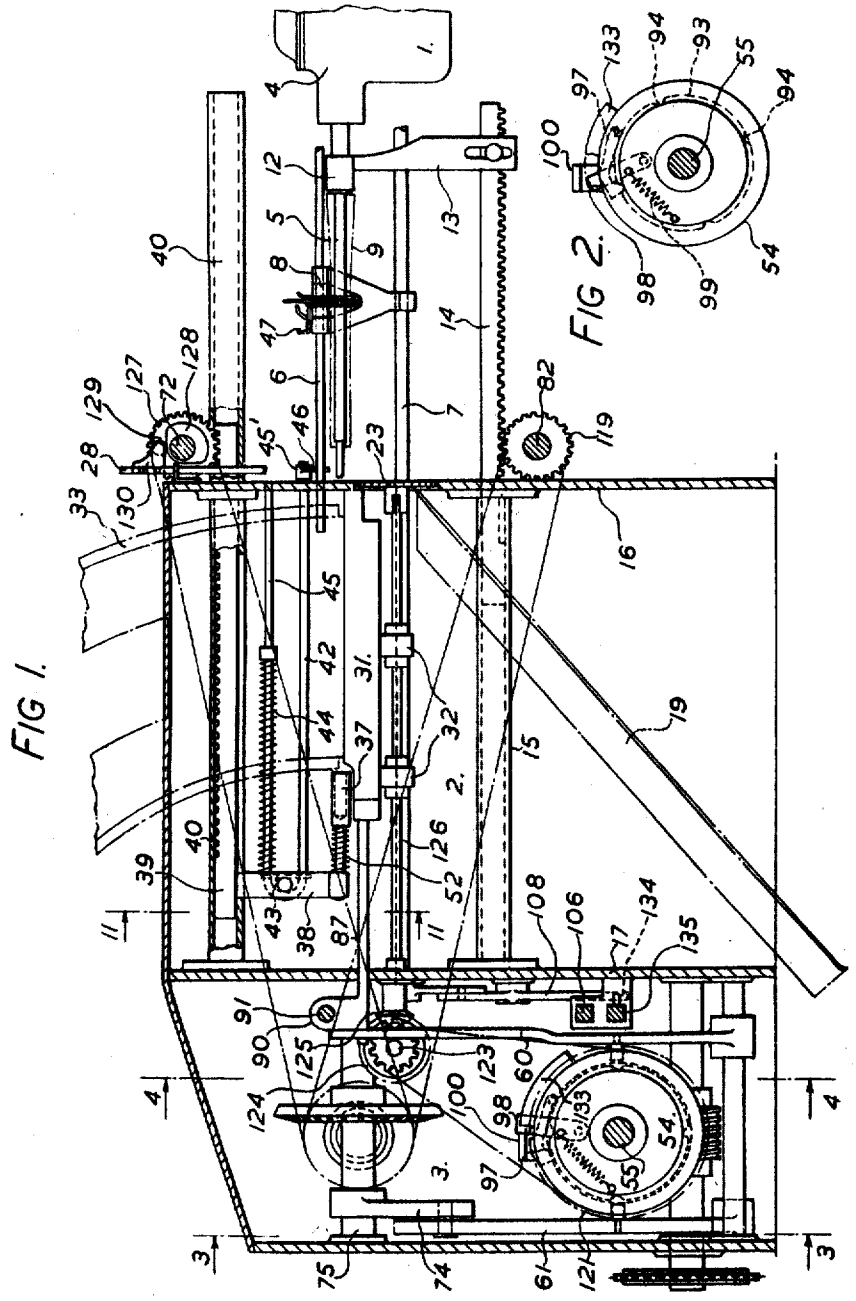


FIG 1.

FIG 2.

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Oct. 24, 1939. W. H. KIMPTON ET AL 2,176,970

YARN WINDING APPARATUS

Filed May 4, 1937 5 Sheets-Sheet 2

FIG 3.

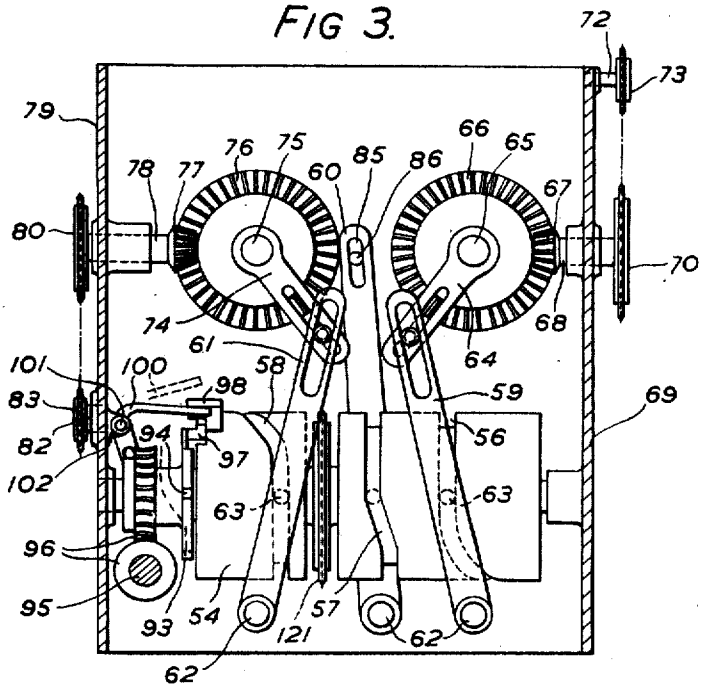
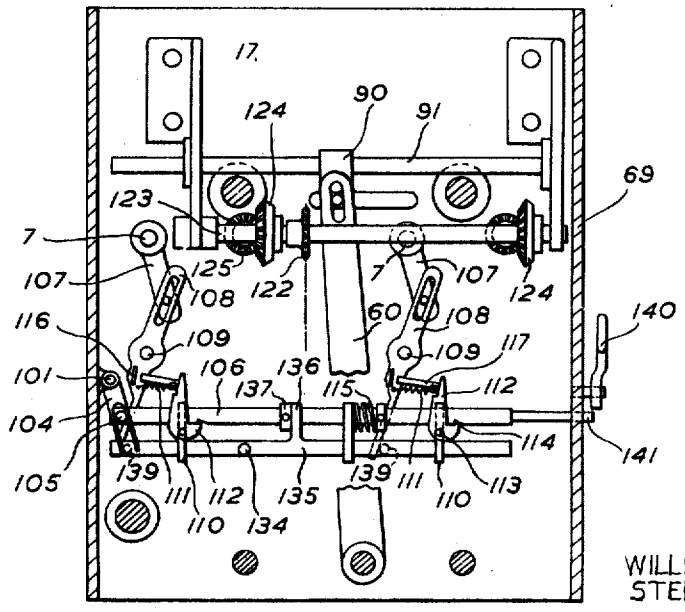


FIG 4.



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Oct. 24, 1939. W. H. KIMPTON ET AL 2,176,970

YARN WINDING APPARATUS

Filed May 4, 1937 5 Sheets-Sheet 3

FIG. 14

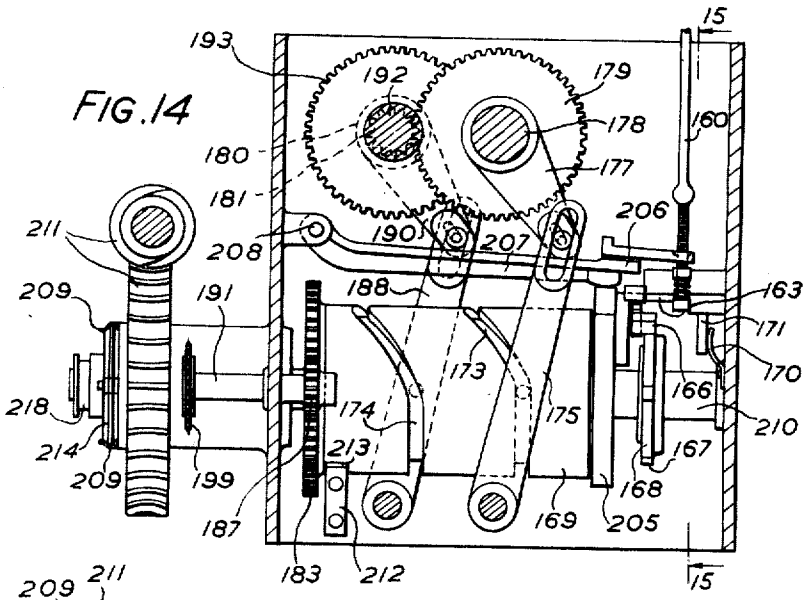


FIG. 17

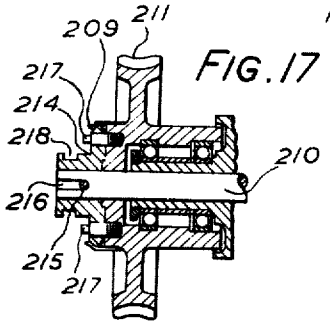


FIG. 15

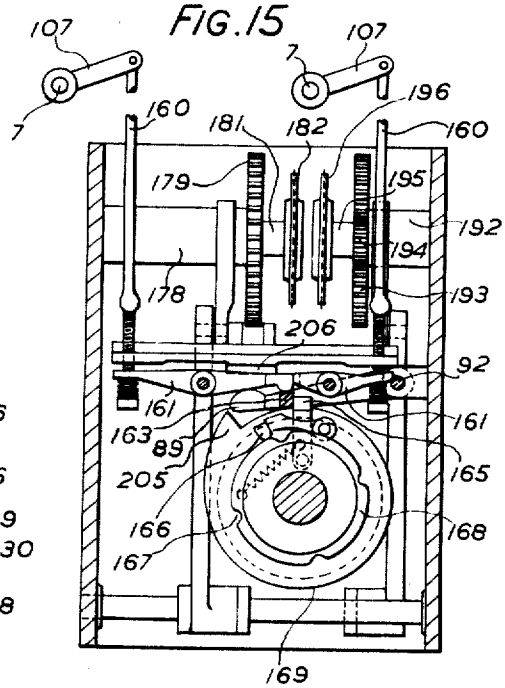
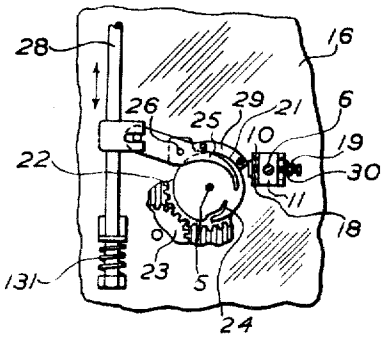


FIG. 5



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Oct. 24, 1939. W. H. KIMPTON ET AL 2,176,970

YARN WINDING APPARATUS

Filed May 4, 1937 5 Sheets-Sheet 4

FIG. 6

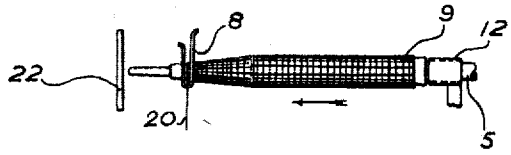


FIG. 7

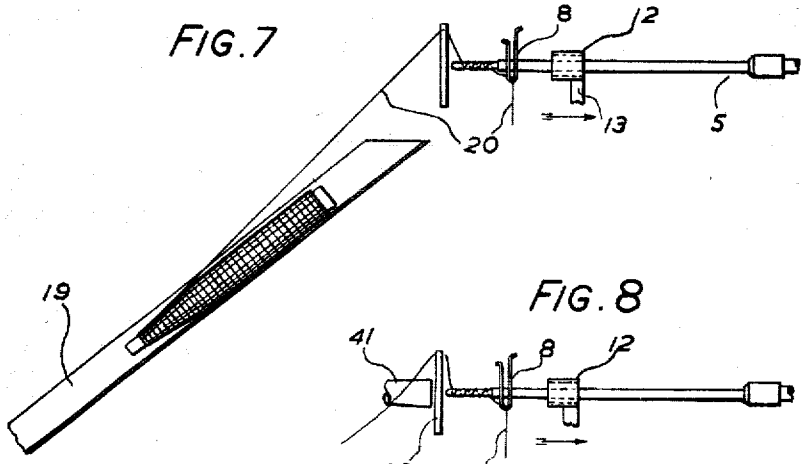
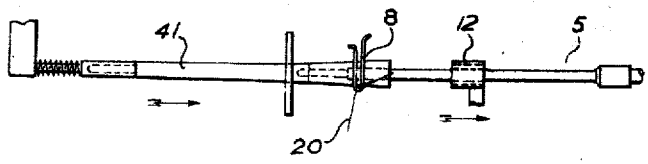


FIG. 8

FIG. 9



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Oct. 24, 1939. W. H. KIMPTON ET AL 2,176,970

YARN WINDING APPARATUS

Filed May 4, 1937 5 Sheets-Sheet 5

FIG. 13

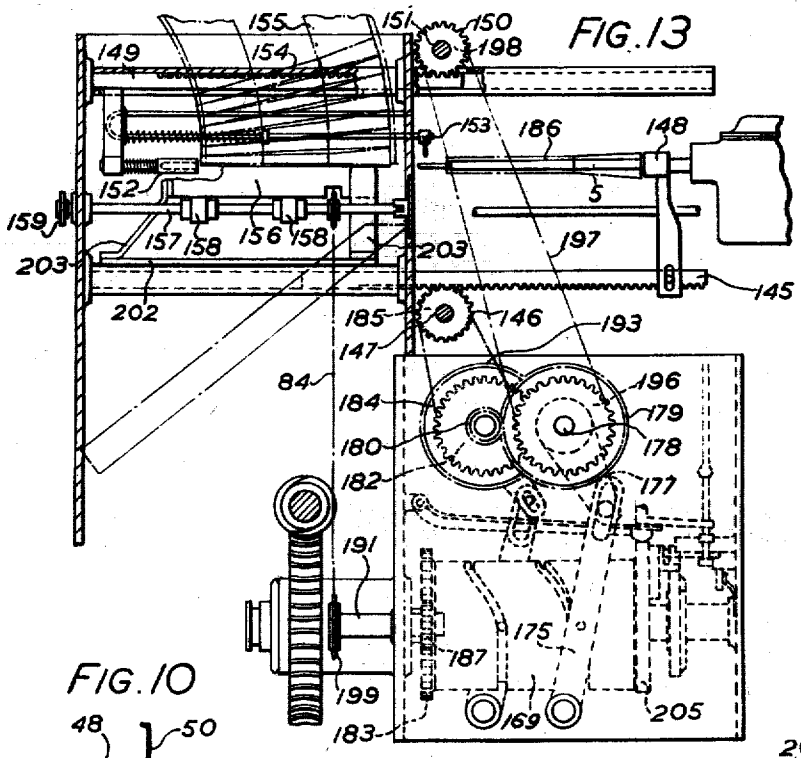


FIG. 10

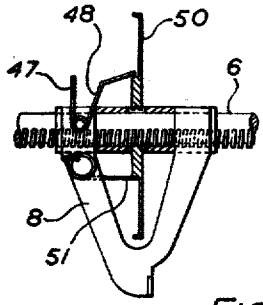


FIG. 16

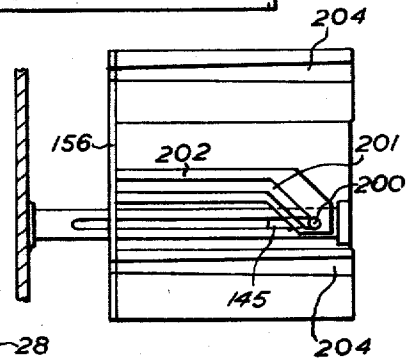


FIG. 11

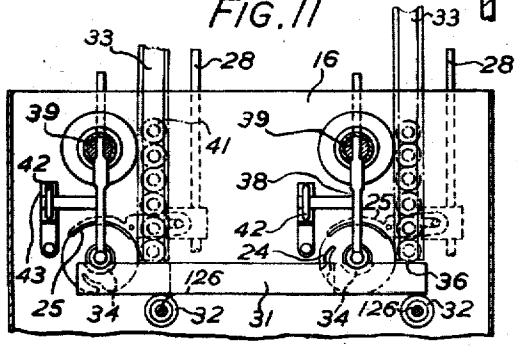
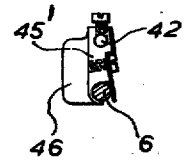


FIG. 12



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UNITED STATES PATENT OFFICE

2,176,970

YARN WINDING APPARATUS

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Application May 4, 1937, Serial No. 140,630
In Great Britain May 11, 1936

16 Claims. (Cl. 242—35.5)

This invention relates to yarn winding apparatus and is concerned more particularly with yarn winding apparatus of the type in which pirns, cops, spools or like packages (hereinafter referred to for brevity as "pirns") are automatically removed from the machine on completion of winding and replaced by fresh package supports on which the winding of new packages continues.

An object of the invention is to provide mechanism for ejecting a completed pirn from a winding spindle and for placing an empty pirn tube on the spindle.

A further object of the invention is to provide automatic means for attaching to a fresh pirn tube the end of yarn extending from the supply to the completed pirn, and for severing the yarn near the completed pirn in readiness for winding on the fresh tube.

A further object of the invention is to provide automatic means for carrying out the operations above referred to and for restarting the winding operation after pirn tube replenishment has been effected.

The invention also contemplates the provision in a winding machine in which a plurality of pirns are replaced by fresh tubes simultaneously of means for automatically delaying the operation of the ejecting and replenishing mechanism until all the pirns are completed.

The invention comprises broadly means in association with a pirn winding spindle for ejecting a completed pirn endwise from the winding spindle after stoppage of winding, a carriage adapted to deliver a fresh pirn tube from a supply to a point opposite the end of the spindle, and means for propelling the fresh pirn tube endwise from the carriage into winding position on the spindle. On withdrawal of the completed pirn from the spindle the end of yarn connected to the pirn and extending from the supply through the traverse guide of the machine is seized by a yarn-engaging member which brings about the engagement of the yarn with the fresh pirn tube as the tube is placed in position on the spindle, the yarn-engaging member cooperating with a severing member which severs the yarn at a point near the completed pirn and thus allows of the completed pirn freely leaving the vicinity of the spindle.

The fresh pirn tubes may be supplied to the carriage from a magazine capable of holding a plurality of tubes, the carriage conveniently cooperating with the magazine in a manner such that a fresh tube is released from the magazine and supplied to the carriage for transference to the spindle replenishing position on the completion of the winding of a pirn.

An important feature of the invention resides in means for seizing the length of yarn extending from the traverse guide to the completed pirn, and rotating the yarn about the winding axis in order to effect the engagement of the yarn with the fresh pirn tube. Thus the yarn-engaging member may be rotated about the winding spindle so as to wrap the yarn engaged by the member around the spindle, the yarn so wrapped being trapped by the oncoming pirn tube and thus securely engaged by the tube in readiness for winding.

A plurality or "set" of winding spindles may be served simultaneously by the pirn ejecting and replenishing mechanism according to the invention, the various movements of the pirns being effected in synchronism by ejecting and replenishing elements in association with each spindle and operated by a common controlling mechanism. During winding on the spindles the controlling mechanism may be maintained inoperative by a member in association with the spindles and adapted to be moved so as to render the controlling mechanism operative only when all the spindles of the set have ceased rotating.

Thus, the member may be a bar, spring-urged into operative position to render the controlling mechanism operative, but restrained against movement under the influence of its spring during the rotation of the spindles by locking mechanisms operated by the starting rods of the spindles, the locking mechanisms being released only as the spindles in association therewith stop under the action of their respective stop motions. In this manner the operation of the controlling mechanism can take place only when all the spindles have ceased rotating. The controlling mechanism may be adapted to restart the spindles and reset the bar and locking mechanisms therefor on completion of the pirn ejecting and replenishing operations.

The pirn ejecting and replenishing mechanism according to the invention may be applied to existing pirn winding machines and is particularly suitable for application to machines of the type in which each spindle has a separate stop motion and a separate rotatable starting rod.

As indicated above the initiation of the ejecting and replenishing operation may be dependent on the functioning of all the stop motions of the spindles in a set. Each stop motion may be adapted to operate after a predetermined number of revolutions of the spindle in association

therewith, or when a predetermined length of yarn has been wound on the pirn, or when the pirn itself has reached a predetermined length, similar setting of all the stop motions of a set of spindles bringing about stoppage of the spindles substantially simultaneously or in fairly quick succession when the same kind of yarn is wound on each pirn. A set of spindles served by the ejecting and replenishing mechanism according to the invention may conveniently comprise 2 to 4 or more spindles.

Means are preferably provided for giving warning to the machine operative on failure of the yarn being wound on a pirn. Thus the yarn may be felt by a feeler device adapted to move and close an electric circuit on yarn failure, the closing of the circuit bringing about the illumination of a warning lamp, or the operation of other electrically operated warning means. A similar feeler device may be incorporated in a pirn tube magazine and may operate to give similar warning on approaching exhaustion of the pirn tubes in the magazine. One or both of said feeler devices may also serve to operate stop mechanism adapted to disconnect the drive to the machine, the warning device serving to call the attention of the operative to the stoppage of the machine.

Two forms of pirn ejecting and replenishing mechanism according to the invention applied to a pirn winding machine of the type in which each spindle has a separate yarn traversing mechanism, starting rod, and stop motion, will now be described in greater detail with reference to the accompanying diagrammatic drawings of which:

Fig. 1 is a part cross-sectional end elevation of pirn ejecting and replenishing mechanism according to the invention applied to a pirn winding machine of the type referred to above;

Fig. 2 is an end elevation of part of the mechanism shown in Fig. 1, in a different position;

Fig. 3 is a front elevation viewed along the lines 3—3 of Fig. 1;

Fig. 4 is a front elevation viewed along the lines 4—4 of Fig. 1;

Fig. 5 is a fragmentary detail of part of the mechanism of Fig. 1;

Figs. 6–9 are diagrammatic illustrations of the pirn ejecting and replenishing operations;

Fig. 10 is a part cross-sectional plan of a detail of Fig. 1, on larger scale;

Fig. 11 is a front elevation of a detail of Fig. 1 viewed along the lines 11—11 of Fig. 1;

Fig. 12 is an end elevation of a detail of Fig. 1;

Fig. 13 is a part cross-sectional end elevation of another form of pirn ejecting and replenishing mechanism according to the invention;

Fig. 14 is a part cross-sectional end elevation of a part of Fig. 13 on larger scale;

Fig. 15 is a front elevation of the mechanism shown in Fig. 14 viewed along the lines 15—15 of Fig. 14;

Fig. 16 is a plan view of part of Fig. 13; and

Fig. 17 is a part cross-sectional elevation of a detail of Fig. 14.

Fig. 1 comprises sufficient of a two-spindle pirn winding machine (indicated generally by the reference numeral 1) to illustrate the application of the invention thereto, pirn ejecting and replenishing mechanism, indicated generally by the reference numeral 2, and controlling means for the pirn ejecting and replenishing mechanism indicated generally by the reference numeral 3. In the following description the function and operation of the various mechanisms will be described generally in the order referred to above.

The pirn winding machine is of the well-known type which comprises a gear box 4, clutch driven winding spindles 5, a reciprocating half-threaded traverse rod 6 and starting rod 7, in association with each spindle, and a yarn guiding device 8 mounted on each rod 6. For simplicity of illustration one spindle 5, traverse rod 6 and guiding device 8 only are shown in Fig. 1.

During winding each guiding device 8 traverses yarn along a short length of a pirn tube 9 (shown in dotted line) mounted on the associated spindle 5 and moves its field of traverse gradually from the base to the tip of the tube to complete the pirn, stop mechanism then operating to rotate the starting rod 7 to the inoperative position so as to bring the spindle to rest, all in the manner well-known to those skilled in the pirn winding art.

On stoppage of a winding spindle 5 at the completion of a pirn, the ejecting and replenishing mechanism according to the invention functions in the following manner:

A sleeve 12 encircling the spindle 5 at a point between the base of the tube 9 and the gear box 4 is mounted on an arm 13 upstanding from a toothed ejecting rod 14, the rod being slidably mounted parallel to the winding spindle 5 in a sleeve 15 extending between walls 16, 17 of the machine frame. The ejecting rod 14 is moved endwise along the sleeve 15 towards the wall 17, in a manner to be described later, and in so moving causes the sleeve 12 to engage the base of the pirn 9 and push the pirn endwise from the winding spindle 5. The yarn 20 (see Figs. 6 and 7) remains in engagement with the traverse guide 8 with the result that as the pirn is ejected from the spindle a few turns of yarn unwind from the pirn and trail behind the pirn to the guide.

As shown in Fig. 5 the wall 16 is formed with an aperture 21 in which is rotatably mounted a toothed ring 22 through which the completed pirn is pushed by the sleeve 12, the pirn ultimately falling away from the end of the spindle down an inclined chute 19.

At the commencement of the pirn ejecting movement of the rod 14 the ring 22 is rotated by a pinion 23 in engagement therewith, and as the pirn passes through the ring a finger 24 outstanding therefrom engages the trailing end of yarn and gives the yarn a few turns around the tip of the now empty spindle 5 (Figs. 7 and 8). When sufficient yarn is wrapped around the tip of the spindle to grip it a cutting blade 25 (Fig. 5) which is pivoted at 26 on the wall 16 is opened by the upward movement of a rod 28, the blade thereby engaging the yarn carried round the ring by the projecting finger 24.

Immediately after such engagement of the yarn the rod 28 moves downwardly to close the blade 25 and the yarn is cut in a scissor-like manner between the blade 25 and a co-operating blade 29 fixed to the wall 16 around the upper edge of the aperture 21. The ejecting rod is then moved endwise in the reverse direction to re-set the sleeve 12 at the base of the winding spindle 5. The ejecting of the completed pirn, the engaging and wrapping of the yarn on the tip of the winding spindle 5 and the cutting of the yarn are effected in very quick succession, the cutting operation taking place while the completed pirn is still near the top of the inclined chute 19 in order to prevent the unwinding of a long length of yarn from the pirn as it proceeds down the chute.

Just before the cutting of the yarn is effected

a carriage 31 (Figs. 1 and 11) mounted on freely rotatable rollers 32 beneath a pirn tube magazine 33 (shown in dotted line) is moved (to the right in Fig. 11) to bring a tube-receiving channel 34 formed therein beneath the magazine. The pirn tubes are normally prevented from dropping out of the magazine 33 by a flat portion 36 of the carriage 31. The moving of the channel 34, however, to a point directly beneath the magazine causes a fresh tube to drop into the channel, and the carriage is then moved in the reverse direction to bring the fresh tube directly opposite to the tip of the spindle 5, the flat portion 36 of the carriage preventing the remaining fresh pirns from dropping out of the magazine.

A push rod 37 is normally held coaxially with the spindle 5 at a point beyond the tip of the fresh pirn tube on the carriage 31 by an arm 38 depending from a toothed replenishing rod 39 which is slidably supported parallel to the winding spindle 5 in a slotted sleeve 40 which extends between the walls 16, 17 and outwardly towards the gear box 4. When the carriage 31 reaches the requisite point the rod 39 is moved endwise along the sleeve 40 towards the gear box, in a manner to be described later, and in so moving causes the push rod 37 to push the fresh pirn tube endwise from the channel 34 of the carriage 31 and along the spindle 5 into the winding position.

In passing along the spindle 5 the fresh tube (indicated by the reference numeral 41 in Figs. 8 and 9) slides over and traps the few turns of yarn wound thereon (Fig. 9) and carries the yarn to the end of the spindle at which winding is to recommence. The timing of the mechanism is such that the cutting of the yarn by the blades 25, 29 is effected just as the fresh pirn tube 41 is being pushed on to the winding spindle.

Simultaneously with the pushing on the spindle 5 of the fresh pirn tube the yarn guiding device 8 is moved along the half-threaded shaft 6 back to a point near the gear box 4 in readiness for the recommencement of winding, by a push rod 42 which is under the control of the arm 38 of the replenishing rod 39. Thus as the arm 38 moves to bring about the replenishment of the spindle (i. e. to the right in Fig. 1) a wing 43 (see Figs. 1 and 11) outstanding from the side of the arm engages a spring 44 secured to a guiding extension 45 of the push rod 42 and through the medium of the spring urges the push rod towards the gear box 4.

The end of the push rod 42 is furnished with a block 45' (Figs. 1 and 12) having a projecting wing 46 which engages an upstanding portion 47 (Fig. 10) of a small bell-crank lever 48 pivotally mounted on the yarn guiding device 8. On being pushed the bell-crank lever 48 rotates about its pivot and pushes the threaded disc 50 of the yarn guiding device out of engagement with the threads of the half-threaded shaft 6 against the pressure of a spring 51 which normally tends to keep the disc in engagement with the threads of the shaft. On being released from the threads in this manner the guiding device 8 is free to slide along the shaft 6 under the influence of the push rod 42 to the point at which winding of the new pirn is to recommence.

With the fresh pirn tube pushed fully into position on the winding spindle 5 and the yarn guiding device 8 pushed to the point at which winding is to recommence the replenishing rod 39 is retracted and withdraws the push rods 37, 42 into inoperative position, (viz. the position shown in Fig. 1). As the wing 46 of the block 45' recedes from the bell-crank lever 48 on the yarn guiding device the pressure on the portion 47 of the lever is released and the spring 51 is permitted to push the disc 50 again into engagement with the threads of the rod 6 in readiness for the recommencement of winding.

The lower extremity of the arm 38 is shaped so as to encircle the push rod 37 loosely, the operative connection between the two elements being established by a compression spring 52 which loosely encircles the rod and bears at one end against the arm 38 and at the other against an enlarged portion of the rod which is hollow to allow of the end of the rod passing over the tip of the spindle 5. In this way any tendency of the replenishing rod 39 to move outwardly towards the gear box 4 further than is necessary and thus causing the push rod 37 to damage the winding spindle 5, is prevented. Similarly, the operative connection between the wing 43 and the push rod 42 through the spring 44 is such as to prevent damaging of the yarn guiding device 8 in the event of the device jamming on the half-threaded rod 6.

The few turns of yarn wrapped round the tip of the winding spindle 5 and trapped and carried along the spindle by the fresh pirn tube 41 remain just inside the bore of the tube 9 during the winding of a pirn. On the removal of the completed pirn, the turns of yarns leave the spindle together with the pirn and appear at the base of the pirn as a short loop of yarn protruding from the bore. This loop can quickly and simply be trimmed off without interfering in any way with the yarn in the pirn.

The control of the pirn ejecting and replenishing mechanism described above is effected as follows:

Situated to the left of the wall 17 (as seen in Fig. 1) is a drum cam 54 freely mounted on a rotatable shaft 55. The drum cam is formed with three grooves 56, 57, 58 which control levers 59, 60, 61 respectively, the levers being pivotally mounted at points 62 and being furnished with projecting pins 63, each fitting in the corresponding groove of the cam. The lever 59 is in pin and slot connection wtih an arm 64 secured to a shaft 65 on which is fixed a bevel wheel 66 (Fig. 3), the bevel wheel engaging a cooperating bevel wheel 67 secured to a shaft 68 borne in a boss formed in a wall 69 of the machine frame. A chain sprocket 70 mounted on the outer end of the shaft 68 is connected with a shaft 72 (to be described later) by means of chain and sprocket gearing 73.

The lever 61 is in similar pin and slot connection with an arm 74 secured to a shaft 75 on which is fixed a bevel wheel 76, the bevel wheel engaging a co-operating bevel wheel 77 secured to a shaft 78 borne in a boss formed in a wall 79 of the machine frame. A chain sprocket 80 mounted on the outer end of the shaft 78 is in connection with a shaft 82 (to be described later) through chain and sprocket gearing 83.

The lever 60 is slotted at its upper extremity, as is shown at 85, to receive a pin 86 outstanding from an extension 87 of the pirn tube carriage 31, the extension 87 passing through a slot formed in the wall 17 and being formed with a bearing boss 90 which slidably engages a transverse guiding shaft 91.

Fixed to the shaft 55 closely adjacent to the left-hand end of the cam 54 is a disc 93 having a plurality of semi-circular notches 94 formed on its periphery, the disc being continuously driven

from a shaft 95 by worm and wheel gearing 96. A dog 97 freely pivoted on the end of the cam 54 near the periphery of the disc 93 normally rides idly on the periphery of the disc and drops into and pulls out of the notches 94 as the disc rotates, the drum cam 54 remaining stationary on the rotating shaft 55. The dog 97 is under the control of a catch 98 also pivoted on the end of the cam 54 and urged by a spring 99 into the position shown in Fig. 2 to lock the dog in any of the notches 94 so as to establish a driving connection between the disc 93 and the cam 54.

During winding, however, the catch 98 is restrained from dog-locking movement by a movable latch 100 which is secured to a shaft 101 rotatably mounted in lugs 102 outstanding from the wall 79 of the machine frame. Rotary movement of the latch 100 and shaft 101 is controlled by an arm 104 secured to the shaft 101 (Fig. 4) and forked at its lower end to engage a pin 105 outstanding from a bar 106 in connection with the starting rods 7 of the machine. The bar 106 is slidably mounted in brackets 110 outstanding from the wall 17, and is urged into endwise movement to the right by a compression spring 115 which surrounds the bar.

As will be apparent from the above description, the disc 93, dog 97 and catch 98, and latch 100 comprise a clutch device for driving the cam 54 and associated pirn ejecting and replenishing mechanism. The initiation of the drive to such mechanism is effected as follows:

Secured to the end of each starting rod 7 is an arm 107 in pin and slot connection with a lever 108 which is pivoted at 109 to the wall 17. During winding the position of each lever 108 is such as to hold under tension a spring 111 which connects the lever with a catch 112 rotatably mounted about a pivot 113 formed on a bracket 110, the catch having a claw 114 which engages a corresponding recess in the bar 106. In this manner the bar is restrained against sliding movement in the bracket 110 under the influence of its spring 115 during winding in the machine.

On completion of winding, however, the starting rods 7 are rotated in a clockwise direction by their stop motions to bring the corresponding spindles 5 to rest, each arm 107 consequently rotating its associated lever 108 anti-clockwise about the pivot 109. The rotation of each arm releases the tension in the associated spring 111 and brings a hammer 116 outstanding from the arm smartly against the end of a rod 117 which projects from the catch 112 with the result that the catch is rotated about its pivot 113 to free the bar 106 for movement under the influence of its spring 115.

Movement of the bar 106 on stoppage of winding rotates the shaft 101 (anti-clockwise as seen in Figs. 3 and 4) by means of its connection therewith through the pin 105 and arm 104, and thus raises the latch 100 out of contact with the catch 98 (viz. to the position shown in dotted line in Fig. 3). The catch 98 thereupon springs into contact with the dog 97 and locks the dog in engagement with the next notch 94 to be brought into contact with the dog by the rotation of the disc 93 (Fig. 2). The drum cam 54 is thus coupled to the rotating disc 93 and both rotate together.

At the commencement of the rotation of the cam 54 the groove 58 causes the lever 61 to swing (to the left in Fig. 3) to rotate the bevel wheel 76, such rotation driving through the chain and sprocket gearing 80, 83 the shaft 82 on which is mounted a pinion 119 in engagement with the teeth of the pirn ejecting rod 14. In this manner the sleeve 12 is caused to eject the completed pirn from the winding spindle 5 in the manner described above.

Substantially simultaneously with the movement of the lever 61 the lever 60 is swung (to the right in Fig. 3) to move the pirn carriage 31 into position beneath the magazine 33 to collect a fresh pirn tube and then back (to the left) to carry the fresh pirn tube to the spindle replenishing point.

The rotation of the cam 54 brings about the rotation of a chain sprocket 121 formed integrally therewith, the sprocket driving through chain and sprocket gearing 122 a shaft 123 on which are secured bevel wheels 124 (Fig. 4). Each bevel wheel is in engagement with a further bevel wheel 125 secured to the end of a shaft 126 which has secured at its other end the pinion 23 driving the yarn engaging- and wrapping-ring 22. On being driven by the rotation of the sprocket 121 the ring 22 functions in the manner described above and wraps a few turns of yarn from the ejected pirn round the tip of the winding spindle 5. It will be observed from Fig. 1 that the freely rotatable carriage supporting rollers 32 are mounted on the shaft 126, this, however, being merely for convenience, the rollers and the shaft having no further operative connection.

Shortly after the ejection of the completed pirn from the winding spindle 5 the groove 58 in the drum cam 54 swings the lever 61 back again into the position shown in Fig. 3, the ejecting rod 14 thereby being pushed towards the gear box 4 to reset the sleeve 12 at the base of the winding spindle 5. Simultaneously with the movement of the lever 60 into the position in which the carriage 31 brings the fresh pirn tube into alignment with the winding spindle 5 the groove 56 in the drum cam 54 causes the lever 59 to swing (to the right in Fig. 3) to rotate the bevel wheel 66 and consequently the shaft 72 through the chain and sprocket gearing 70, 73.

The shaft 72 carries a pinion 127 (Fig. 1) in engagement with the toothed replenishing rod 39, the rotation of the shaft thus bringing about the operation of the push rods 37, 42 to replenish the spindle 5 with the fresh pirn tube and reset the yarn guiding device 8 on the half-threaded rod 6, in the manner described above.

In addition to the pinion 127 the shaft 72 carries a cam 128 the rotation of which operates the cutting blade 25. Thus the cam 128 engages a follower 129 rotatably mounted in a bracket 130 outstanding from the vertically disposed rod 28, the rotation of the cam causing the rod to be raised and lowered during one rotation of the shaft 72. The rod 28 is urged downwardly by a compression spring 131 which ensures that the follower 129 always remains in engagement with the cam 128 and hence that a positive closing of the blade 25 is effected. The timing of the cam 128 is such that the lifting and lowering of the rod 28, and consequently the opening and closing of the blade 25, is carried out just as the ring 22 has wrapped sufficient yarn around the tip of the spindle to grip it, and immediately prior to the trapping of the wrapped yarn by the fresh pirn tube.

With the fresh pirn tube in position on the winding spindle 5 and the machine in readiness for re-starting the groove 56 swings the lever 59 back to the position shown in Fig. 3 with the result that the replenishing rod 39 and push rods

37, 42 are retracted and brought into the inoperative position shown in Fig. 1.

Simultaneously with such movement a raised portion 133 of the drum cam 54 contacts with a pin 134 outstanding from a bar 135 (Fig. 4) which is freely mounted beneath the bar 106 in the brackets 110, the cam moving the bar to the left. This movement of the bar 135 causes both a member 136 upstanding therefrom to bear against a collar 137 fixed on the bar 106, and pins 139 outstanding from the bar 135 to bear against the lower ends of the pivoted levers 108, with the result that the bar 106 is also moved to the left and rotates the shaft 101 so as to lower the latch 100 into position to engage the catch 98, and each starting rod 7 is rotated in anti-clockwise direction to start its windings spindle.

The engagement of the catch 98 by the latch 100 moves the catch against the tension in its spring 99 out of contact with the dog 97 which thereupon disengages itself from the disc notch 94, the drum cam 54 thus coming to rest until the newly started pirns are completed, when the cycle of operations described above is repeated.

The shape of the grooves 56, 57, 58 in the drum cam 54 is such that one revolution of the cam is sufficient to effect the whole of the pirn ejecting and replenishing operations and the re-starting of the winding spindles, the various ejecting and replenishing elements being moved from inoperative positions to perform their functions in due order, and returned to such positions after having functioned before the winding of the new pirn commences.

It will be apparent from the above description that any convenient number of winding spindles 5 may be served by the one ejecting and replenishing unit, a set of two spindles only having been shown in the present drawings merely for convenience of description and illustration.

It will, moreover, be observed that while the ejecting and replenishing mechanism is fully automatic there is no danger of the mechanism operating until the last spindle of a set has stopped rotating, the arrangement of the bar 106, and a catch 112 in association with each spindle preventing premature starting of the mechanism on the stopping of any one winding spindle.

When it is desired to render the pirn ejecting and replenishing mechanism inoperative after the winding of any particular set of pirns a hand lever 140 (Fig. 4) pivoted on the wall 69 may be rotated into position to engage a projection 141 of the bar 106. In this manner even though the winding spindles 5 stop rotating and the starting rods 7 cause the catches 112 to be rotated out of engagement with the bar 106 the bar cannot move under the influence of its spring 115 and consequently the latch 100 is not raised out of contact with the catch 98 which continues to allow the dog 97 to ride idly on the periphery of the disc 93.

Figs. 13 to 16 illustrate a modification of the invention in which the controlling mechanism for the ejecting and replenishing elements is disposed beneath the latter elements in order to reduce the overall width of the machine.

Thus, as shown in Fig. 13, the ejecting and replenishing mechanism is generally of similar construction to that described above in that a toothed ejecting rod 145 driven by a pinion 146 mounted on a shaft 147 operates a pirn ejecting sleeve 148 and a toothed replenishing rod 149 driven by a pinion 150 mounted on a shaft 151 operates both a pirn push rod 152 and a yarn guiding device re-setting rod 153, fresh pirns 154 being supplied from a magazine 155 to a carriage 156, and the yarn engaging- and wrapping-ring being driven by a shaft 157 upon which are freely rotatable rollers 158 supporting the pirn carriage.

Unlike the previously described apparatus, however, the arms 107 secured to the ends of the starting rods 7 are pivotally connected to rods 160, each of which is connected at its lower end to a pivoted lever 161. With the starting rods 7 in the "spindle running" position the connecting rods 160 cause the levers 161 to bear downwardly on a pivoted latch 163 which performs the same function as the latch 100 described with reference to the preceding figures in that during winding in the machine the latch prevents a spring-urged catch 165 from locking a dog 166 in a notch 167 formed in a rotatable driving disc 168, and thus transmitting drive to a drum cam 169.

On stoppage of the winding spindles 5, the starting rods 7 rotate in a clockwise direction and each arm 107 pushes its connecting rod 160 downwardly. The rod rotates the associated lever 161, and the rotation of both levers permits the latch 163 to raise out of the contact with the catch 165 under the influence of a spring 170 (Fig. 14) which presses against a projection 171 formed on the latch. The catch 165 is thus freed and locks the dog 166 to the driving disc 168 so as to couple the drum cam to the driving disc in the manner described above.

The drum cam 169 is formed with two grooves 173, 174 (Fig. 14). The groove 173 controls a pivoted lever 175 which is in pin and slot connection with an arm 177 secured to a shaft 178 upon which is mounted a gear wheel 179. The gear wheel drives a pinion 180 secured to a shaft 181 upon which is fixed a chain sprocket 182 (see Fig. 15), the chain sprocket driving through a chain 184 the sprocket 185 mounted on the shaft 147 bearing the pinion 146 in engagement with the teeth of the pirn ejecting rod 145. (The sprocket 185 is immediately behind the pinion 146 in Fig. 13.)

In this manner the swinging of the lever 175 by the groove 173 brings about the ejection of the pirn 186 from the winding spindle 5.

The groove 174 controls a pivoted lever 188 which is in pin and slot connection with an arm 190 secured to a shaft 192 upon which is mounted a gear wheel 193. The gear wheel drives a pinion 194 secured to a shaft 195 upon which is fixed a chain sprocket 196, the chain sprocket driving by means of a chain 197 a sprocket 198 mounted on the shaft 151 bearing the pinion 150 in engagement with the teeth of the pirn replenishing rod 149. (The sprocket 198 is immediately behind the pinion 150 in Fig. 13.)

The swinging of the lever 188 by the groove 174 thus brings about the movement of the pirn replenishing rod 149, the replenishing of the fresh pirn tube by the push rod 152 and the re-setting of the yarn guiding device by the push rod 153 being performed in the manner described with reference to Fig. 1.

Prior to the swinging of the lever 188, however, the pirn carriage 156 is operated to bring the fresh pirn tube 154 from the magazine 155 to a position coaxial with the winding spindle 5 in the following manner:—

Upstanding from the pirn ejecting rod 145 (see Fig. 16) is a pin 200 which engages a cam slot

201 formed in a movable plate 202 from which the carriage 156 is supported by pillars 203. On retraction of the rod 145 to eject a completed pirn from the winding spindle 5 the movement of the pin 200 within the cam slot 201 causes the plate 202 to move so as to carry the carriage 156 to a point beneath the magazine 155 where a channel 204 formed in the carriage receives a fresh pirn tube 154 in the manner described with reference to the carriage 31 of Figs. 1 and 11.

The reverse movement of the pirn ejecting rod 145 to re-set the sleeve 148 at the base of the winding spindle 5 causes the plate 202 to return to the position shown in Fig. 16 where the fresh pirn tube is held coaxial with the spindle 5. The movement of the replenishing rod 149 under the influence of the lever 188 then causes the push rod 152 to push the pirn tube endwise from the groove 204 and into position on the winding spindle 5.

The yarn connecting the completed pirn with the thread guide is wrapped round the spindle tip and cut in the manner described with reference to Figs. 5 to 9. The shaft 157 which drives the yarn engaging ring is driven from a gear wheel 183 disposed at the end of the drum cam 169, the gear wheel driving a pinion 187 secured to a shaft 191 to which is fixed a sprocket 199 which drives the shaft 157 by means of a chain 84. The shaft 157 is connected by chain and sprocket gearing 159 to a similar shaft driving a second yarn engaging and wrapping ring in connection with a second winding spindle 5. After the replenishing operation the rod 149 is retracted by the cam 169 into inoperative position (viz. as shown in Fig. 13).

The winding operation is now ready for restarting, and the raised portion of a cam 205 formed on the drum cam 169 is brought by the rotation of the drum cam into contact with a lever 89 (to be described later), which bears upwardly against a bar 206 formed with apertures which loosely surround the lower ends of the connecting rods 160. On being lifted, the bar 206 pushes the connecting rods upwardly with the result that the starting rods 7 are rotated anti-clockwise into spindle running position and the winding operation recommences.

The upward movement of the connecting rods 160 to restart the winding spindles 5 rotates the levers 161 about their pivots and brings the ends of the levers against the spring-urged latch 163 which is forced downwardly into position to disengage the catch 165 from the dog 166. In this manner on recommencement of winding the drive to the drum cam 169 is disengaged and the cam comes to rest.

The timing of the cam 205 is such that it moves away from the lever 89 and thus allows the bar 206 to descend from the ends of the connecting rods 160 before the cam 169 ceases to rotate. The connecting rods 160 are thus free to descend on the completion of the winding of the pirns, when the sequence of operations described above is repeated.

The bar 206 is formed as a T-shaped member, the long limb 207 of which is pivoted at 208 to allow of the rising and falling of the bar 206 in a substantially vertical plane so that the ends of the bar do not foul the lower ends of the connecting rods. The lower ends of the connecting rods are rounded and the apertures in the bar 206 which engage the ends of the rods are of complementary shape to allow of smooth contact between the members as the bar is lifted. The pivoted lever 89 prevents any tendency for sideways movement of the bar 206 relatively to the connecting rods 160 under the influence of the cam 205.

As with the apparatus described in connection with Figs. 1, 3 and 4, the controlling mechanism for the pirn ejecting and replenishing mechanism of Figs 13 to 15 is fully automatic, and one revolution of the cam 169 is sufficient to bring about the whole of the pirn ejecting and replenishing operations, and the ultimate restarting of the winding spindles. Moreover, like the previously described apparatus, any convenient number of winding spindles can be served by the one unit of ejecting and replenishing mechanism, it merely being necessary to provide an arm 107, push rod 160 and suitable lever 161 in connection with each spindle starting rod. Premature starting of the cam 169 and associated controlling mechanism on the stoppage of any one spindle of a set is rendered impossible by the provision of the levers 161 bearing on the latch 163, the latch being freed to free the dog-locking catch only when all the spindles of the set have ceased rotating, and the associated levers 161 are rotated about their pivots by the connecting rods 160.

If on the completion of any particular set of pirns it is desired to stop the pirn winding operation, the pirn ejecting and replenishing mechanism described above may be rendered inoperative simply by rotating the spring 170 (Fig. 14) out of contact with the extension 171 of the latch 163. The latch thus remains in contact with the catch 165 which consequently cannot move to lock the dog 166 to the driving disc 168, on completion of winding.

In the event of jamming of the pirn ejecting and replenishing mechanism through any cause (e. g. the jamming of a full pirn during removal or of a fresh pirn tube during spindle replenishment), means are provided for bringing the mechanism quickly to rest.

Thus the disc 168 is secured to a shaft 210 (Fig. 17) upon which the drum cam 169 is freely mounted, the shaft being continuously driven by worm and wheel gearing 211. The drum is prevented from rotating idly together with the shaft during winding in the machine by a spring finger 212 (Fig. 14) which presses against a flat 213 formed in the face of the drum. The pressure of the finger 212 is, of course, insufficient to prevent the rotation of the drum when the dog 166 is locked to the driving disc 168.

The drive from the worm and wheel gearing 211 is transmitted to the shaft 210 through a flanged disc 214 which is mounted on the end of the shaft and is in connection therewith by means of a soft copper pin 215 which passes diametrically through the flange of the disc and through a slot 216 formed in the end of the shaft. Pins 217 outstanding from the side of the worm wheel 211 engage corresponding holes formed in the disc, the pins 217 and the copper pin 215 thus forming the positive driving connection between the wheel and the shaft.

When the torque required to drive the shaft 210 exceeds a predetermined value as, for example, on the jamming of the pirn ejecting and replenishing mechanism, the copper pin 215 shears and thus disconnects the drive from the worm wheel to the shaft. The diameter of the copper pin 215 is predetermined in accordance with the load to which the shaft 210 is normally subjected.

The disc 214 is held against the side of the

wheel 211 by spring fingers 209 which allow of quick withdrawal of the disc and replacement by a fresh disc complete with a new copper pin when the cause of jamming is removed. The flange of the disc 214 is formed with an annular groove 218 into which a key may be fitted for ease of withdrawal and replacement of a disc.

Fig. 5 illustrates an arrangement by which the half threaded traverse rod 6 may be finely adjusted towards or away from the winding spindle 5 in order to regulate the thickness of the pirn wound by the spindle. Thus the end of the rod is formed without threads and is reciprocably mounted in a bearing block 11 slidably held in an aperture 18 formed in the wall 16 in the vicinity of the yarn engaging- and wrapping-ring 22, the upper and lower edges of the aperture dovetailing in corresponding grooves formed along the upper and lower edges of the block. A screw 19 threaded through a lug 30 bears against one side of the block 11 and a compression spring 10 mounted within the aperture so as to bear with its ends respectively against the block and the end of the aperture enable the block to be held in any desired position lengthwise of the aperture.

The operation of the pirn winding apparatus according to the invention will now be described briefly with reference to the embodiment illustrated in Figs. 1 to 12, it being understood that the apparatus illustrated in Figs. 13 to 16, while comprising the modifications described above, functions in a generally similar manner as will already be apparent from the foregoing description.

During the winding of pirns by the spindles 5 and traverse mechanisms 6, the apparatus parts 2 and 3 (Fig. 1) are stationary, the starting rods 7 being in the "running" position and thus holding the latch 100 in engagement with the catch 98 to prevent the coupling of the dog 97 with the rotating disc 93. On completion of a pirn the associated starting rod 7 is rotated by the stop mechanism to stop the winding spindle, and in so rotating, moves the corresponding catch 112 (Fig. 4) out of engagement with the bar 106. When the winding spindles 5 of the set have stopped, the corresponding catches 112 are moved out of engagement with the bar 106 which is thereupon freed to move (to the right in Fig. 4) under the influence of the spring 115.

The movement of the bar 106 rotates the latch 100 out of engagement with the catch 98 which is thus freed to lock the dog 97 to the periphery of the rotating disc 93 so as to couple the drive to the drum cam 54. The rotation of the drum cam reciprocates the sleeve 12 in association with each spindle 5 to eject the completed pirn from the spindle (see Figs. 6 and 7) and return the sleeve to inoperative position near the gear box 4 again.

On being ejected from the spindle 5, the completed pirn is passed through the ring 22 (Fig. 5) which is set into rotation so that the finger 24 outstanding therefrom engages the length of the yarn extending from the supply to the pirn and rotates the yarn round the stationary spindle 5 to wrap turns of yarn thereon. When sufficient yarn is wrapped round the spindle 5 to grip it, the yarn extending between the completed pirn and the turns wrapped on the spindle is severed by the blades 25, 29.

In the meantime on rotation of the drum cam 54 the groove 57 has caused the lever 60 to "swing" to the right in Figure 3 to move the pirn carriage 31 into position beneath the magazine 33 (in Figs. 1 and 11) to collect a fresh pirn and carry it to a point opposite the end of the spindle 5 where a push rod 37 reciprocates to push the empty tube endwise on the spindle so that the turns of yarn on the spindle are trapped between the spindle and the tube while the tube is being secured on the spindle. While the push rod 37 is replenishing the spindle 5, the associated push rod 42 resets the yarn guiding device 8 along the traverse rod 6 at the point at which the winding of the new pirn is to commence. The push rods 37 and 42 are then retracted to their inoperative positions (viz. the positions shown in Fig. 1).

With the empty pirn tube in winding position on the spindle 5 and in engagement with the yarn extending from the supply, and the yarn guiding device 8 reset on the traverse rod 6 in position for the commencement of winding, the drum cam 54 pushes the bar 106 back to its original position against the pressure in the spring 115 (as shown in Fig. 4), the retraction of the bar both rotating the starting rods 7 to restart the winding spindles 5 (the rods thereby bringing the catches 112 into bar-locking position) and lowering the latch 100 into position to engage the catch 98, (when the rotation of the drum carries the catch into latch-engaging position) so as to free the dog 97. The dog is thus permitted to move to uncouple the drive between the disc 93 and the drum cam 54 and the drum cam comes to rest until the pirns are completed, when the cycle of operations described above is repeated.

Having described our invention, what we desire to secure by Letters Patent is:

1. Pirn winding apparatus having means for automatically replacing a completed pirn by an empty tube upon which the winding of a new pirn continues, comprising a winding spindle on to which a pirn tube may be pushed, means for ejecting the filled pirn tube endwise from the spindle on stoppage of winding, means for engaging the length of yarn extending from the supply to the completed pirn and rotating said yarn round the stationary spindle so as to wrap turns of yarn thereon, means for carrying an empty pirn tube to a point opposite the end of the spindle, means for pushing the empty tube endwise on to the spindle so that the turns of yarn are trapped between the spindle and the tube while the tube is being secured on the spindle, and means for restarting the winding operation.

2. Pirn winding apparatus having means for automatically replacing a completed pirn by an empty tube upon which the winding of a new pirn continues, comprising a winding spindle on to which a pirn tube may be pushed, means for ejecting the filled pirn tube endwise from the spindle on stoppage of winding, means for engaging the length of yarn extending from the supply to the completed pirn and rotating said yarn round the stationary spindle so as to wrap turns of yarn thereon, means for severing the yarn near the completed pirn, means for carrying an empty pirn tube to a point opposite the end of the spindle, means for pushing the empty tube endwise on to the spindle so that the turns of yarn are trapped between the spindle and the tube while the tube is being secured on the spindle, means for operating the yarn severing means prior to the pushing on the spindle of the empty tube, and means for restarting the winding operation.

3. Pirn winding apparatus having means for automatically replacing a completed pirn by an empty tube upon which the winding of a new pirn continues, comprising a plurality of winding spindles on to which pirn tubes may be pushed, means in association with each spindle for ejecting the filled pirn tube endwise from the spindle on stoppage of winding, means in association with each spindle for engaging the length of yarn extending from the supply to the completed pirn and rotating said yarn round the stationary spindle so as to wrap turns of yarn thereon, means for carrying an empty pirn tube to a point opposite the end of each spindle, means for pushing each empty tube endwise on to the corresponding spindle so that the turns of yarn on such spindle are trapped between the spindle and the tube while the tube is being secured on the spindle, means for delaying the operation of said pirn ejecting, yarn engaging and wrapping, and the pirn tube carrying and pushing means until all the pirns of the set are completed, and means for restarting the winding operation after the replenishment of the spindles with the fresh tubes.

4. Pirn winding apparatus having means for automatically replacing a completed pirn by an empty tube upon which the winding of a new pirn continues, comprising a plurality of winding spindles on to which pirn tubes may be pushed, means in association with each spindle for ejecting the filled pirn tube endwise from the spindle on stoppage of winding, means in association with each spindle for engaging the length of yarn extending from the supply to the completed pirn and rotating said yarn round the stationary spindle so as to wrap turns of yarn thereon, means for carrying an empty pirn tube to a point opposite the end of each spindle, means for pushing each empty tube endwise on to the corresponding spindle so that the turns of yarn on such spindle are trapped between the spindle and the tube while the tube is being secured on the spindle, common mechanism for operating the pirn ejecting, yarn engaging and wrapping, and the pirn tube carrying and pushing means in connection with all the spindles, means for delaying the operation of the common mechanism until all the pirns are completed, and means operated by said common mechanism for restarting the winding operation and bringing said mechanism to rest after the replenishment of the spindles with the fresh tubes.

5. Pirn winding apparatus having means for automatically replacing a completed pirn by an empty tube upon which the winding of a new pirn continues, comprising a winding spindle on to which a pirn tube may be pushed, means for ejecting the filled pirn tube endwise from the spindle on stoppage of winding, means for engaging the length of yarn extending from the supply to the completed pirn and rotating said yarn round the stationary spindle so as to wrap turns of yarn thereon, a pirn tube magazine, a carriage for carrying an empty pirn tube from the magazine to a point opposite the end of the spindle, means for pushing the empty pirn tube endwise from the carriage on to the spindle so that the turns of yarn are trapped between the spindle and the tube while the tube is being secured on the spindle, and means for restarting the winding operation.

6. Pirn winding apparatus according to claim 5, comprising means for mounting the pirn tube magazine above the carriage, and means for reciprocating the carriage between the bottom of the magazine and the spindle, the carriage being formed both with a channel for receiving an empty tube from the magazine and carrying the tube to spindle-replenishing position, and a flat portion adapted to support the remainder of the tubes in the magazine during the winding of a pirn.

7. Pirn winding apparatus having means for automatically replacing a completed pirn by an empty tube upon which the winding of a new pirn continues, comprising a winding spindle on to which a pirn tube may be pushed, a half-threaded traverse rod in association with the spindle and adapted to be reciprocated, a threaded yarn guide mounted on said rod and adapted to screw along said rod while traversing yarn to and fro along the pirn tube, a lever for disengaging the threads of the guide from the threads of the traverse rod so as to free the guide for resetting movement along the rod, means for ejecting the filled pirn tube endwise from the spindle on stoppage of winding, means for engaging the length of yarn extending from the supply to the completed pirn and rotating said yarn round the stationary spindle so as to wrap turns of yarn thereon, means for carrying an empty pirn tube to a point opposite the end of the spindle, means for pushing the empty tube endwise on to the spindle so that the turns of yarn are trapped btween the spindle and the tube while the tube is being secured on the spindle, means for pressing the lever on the yarn guide to free the guide from the threads of the traverse rod and reset the guide on the rod in position for the recommencement of winding, and means for restarting the winding operation.

8. Pirn winding apparatus, comprising a pirn winding spindle, a guide adapted to traverse yarn to and fro along a pirn tube on the spindle, a rotatable ring disposed concentrically with the spindle near the tip thereof, a finger formed on the ring and projecting inwardly of the ring, means in association with the spindle for ejecting a completed pirn endwise from the spindle through the ring after stoppage of winding, a carriage for delivering a fresh pirn tube from a supply to a point opposite the end of the spindle, means for rotating the ring so as to engage by the projecting finger the length of yarn extending from the traverse guide to the ejected pirn and to wrap said engaged yarn around the tip of the winding spindle, means for propelling the fresh pirn tube endwise from the carriage and into winding position on the spindle so as to trap the wrapped yarn by the fresh pirn tube while replenishing the spindle, means for severing the yarn near the completed pirn, and means for restarting the winding operation.

9. Pirn winding apparatus having means for automatically replacing a completed pirn by an empty tube upon which the winding of a new pirn continues, comprising a winding spindle on to which a pirn tube may be pushed, means for ejecting the filled pirn tube endwise from the spindle on stoppage of winding, means for engaging the length of yarn extending from the supply to the completed pirn and rotating said yarn round the stationary spindle so as to wrap turns of yarn thereon, means for carrying an empty pirn tube to a point opposite the end of the spindle, means for pushing the empty tube endwise on to the spindle so that the turns of yarn are trapped between the spindle and the tube while the tube is being secured on the

spindle, controlling mechanism for operating the pirn ejecting, yarn engaging and wrapping, and the pirn tube carrying and pushing means, means operated by the controlling mechanism for restarting the winding operation, driving means for the controlling mechanism, clutch mechanism interposed between the driving means and the controlling mechanism and adapted to couple the driving means with the controlling mechanism on stoppage of winding and to uncouple the driving means from the controlling mechanism after such mechanism has restarted the winding operation.

10. Pirn winding apparatus, comprising a pirn winding spindle, a rotatable starting rod for controlling the rotation of the spindle, means in association with the spindle for ejecting a completed pirn endwise from the spindle after rotation of the starting rod to stop winding, a carriage for delivering a fresh pirn tube from a supply to a point opposite the end of the spindle, means for propelling the fresh tube endwise from the carriage into winding position on the spindle, a rotatable cam adapted to operate the pirn ejecting, delivering and propelling means, a rotatable driving disc having a notched periphery and disposed coaxially with said cam, a dog pivoted on said cam and adapted to contact with the periphery of the disc, a catch pivoted on the cam near to said dog and adapted to move into contact with the dog to lock the dog in a disc-notch and thereby to establish driving connection between the disc and the cam, a latch under the control of the starting rod and adapted to restrain the catch during winding and to free the catch for dog-locking movement on rotation of the starting rod to stop winding, and means operated by the cam for rotating the starting-rod to restart winding and resetting the latch in catch-engaging position so as to disengage the drive to the cam on completion of the pirn ejecting and replenishing operation.

11. Pirn winding apparatus, comprising a plurality of pirn winding spindles, a rotatable starting rod in association with each spindle, means for ejecting completed pirns from the spindles, means for replenishing the spindles with fresh pirn tubes, means for severing the ends of yarns connecting the completed pirns with the supply, means for attaching said ends to the respective tubes, a rotatable cam adapted to operate the pirn ejecting, replenishing, and yarn severing and manipulating means, means for driving said cam, a movable recessed bar adapted to bring about coupling or uncoupling of the driving means and the cam, a catch in association with each starting rod and adapted during winding by the corresponding spindle to engage a recess in the bar so as to lock it in uncoupling position, and, on rotation of the associated starting rod to stop winding by its spindle, to move from the recess so as to free the bar to move into coupling position when permitted to do so by the remaining catches, and means in association with said cam for resetting said bar in uncoupling position, and bringing about the rotation of the starting rods to start winding and the resetting of the catches in bar-recess engaging position so as to lock the bar in the said uncoupling position on completion of the pirn ejecting, replenishing and yarn severing and manipulating operations.

12. Pirn winding apparatus, comprising a plurality of pirn winding spindles, a rotatable starting rod in association with each spindle, means for ejecting completed pirns from the spindles, means for replenishing the spindles with fresh pirn tubes, means for severing the ends of yarn connecting the completed pirns with the supply, means for attaching said ends to the respective tubes, a rotatable cam adapted to operate the pirn ejecting, replenishing, and yarn severing and manipulating means, means for driving said cam, a movable latch adapted to bring about coupling or uncoupling of the driving means and the cam, a lever in association with each starting rod, each of said levers being adapted during winding by the corresponding spindle to hold the latch in uncoupling position and, on rotation of the associated starting rod to stop winding, to free the latch to move into coupling position when permitted to do so by the remaining levers, and means in association with said cam for rotating the starting rods into winding position and thereby moving the associated levers into latch-engaging position so as to uncouple the driving means from the cam on completion of the pirn ejecting, replenishing and yarn severing and manipulating operations.

13. Yarn winding apparatus, comprising a plurality of pirn winding spindles, means in association therewith for ejecting completed pirns endwise from the spindles after stoppage of winding, a carriage for delivering a fresh pirn tube from a supply to a point opposite the end of each spindle, means for propelling the fresh tubes endwise from the carriage into winding position on the respective spindles, common mechanism for controlling the operations of said ejecting, delivering and propelling means, means under the control of said common mechanism for restarting the winding operation and bringing said mechanism to rest after the replenishment of the spindles with the fresh tubes, means for driving said common mechanism, end means for disconnecting the drive to said common mechanism when the torque required to drive said mechanism exceeds a predetermined value.

14. Yarn winding apparatus, comprising a plurality of pirn winding spindles, means in association therewith for ejecting completed pirns endwise from the spindles after stoppage of winding, a carriage for delivering a fresh pirn tube from a supply to a point opposite the end of each spindle, means for propelling the fresh tubes endwise from the carriage into winding position on the respective spindles, common mechanism for controlling the operations of said ejecting, delivering and propelling means, means under the control of said common mechanism for restarting the winding operation and bringing said mechanism to rest after the replenishment of the spindles with the fresh tubes, a slotted shaft for driving said common mechanism, a wheel for driving said shaft, and a soft-metal pin passing through said shaft and transmitting the drive thereto from said wheel, said pin being capable of transmitting only a predetermined degree of torque to said shaft so as to shear and disconnect the drive to the common mechanism when the torque required to drive said mechanism exceeds the predetermined value.

15. A mechanism for incorporation in a pirn winding machine of the type comprising a spindle on to which a pirn tube may be pushed, and a starting rod and stop motion in association therewith, said mechanism comprising means for ejecting a filled pirn tube endwise from the spindle on stoppage of winding, means for engaging the length of yarn extending from the supply to

the completed pirn and rotating said yarn round the stationary spindle so as to wrap turns of yarn thereon, means for carrying an empty pirn tube to a point opposite the end of the spindle, means for pushing the empty tube endwise on to the spindle so that the turns of yarn are trapped between the spindle and the tube while the tube is being secured on the spindle, and means for restarting the winding operation.

16. A mechanism for incorporation in a pirn winding machine of the type comprising a spindle on to which a pirn tube may be pushed, and a starting rod and stop motion in association therewith, said mechanism comprising means for ejecting a filled pirn tube endwise from the spindle on stoppage of winding, means for engaging the length of yarn extending from the supply to the completed pirn and rotating said yarn round the stationary spindle so as to wrap turns of yarn thereon, a pirn tube magazine, a carriage for carrying an empty pirn tube from the magazine to a point opposite the end of the spindle, means for pushing the empty pirn tube endwise from the carriage on to the spindle so that the turns of yarn are trapped between the spindle and the tube while the tube is being secured on the spindle, and means for restarting the winding operation.

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CERTIFICATE OF CORRECTION.

Patent No. 2,176,970. October 24, 1939.

WILLIAM HARRY KIMPTON, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 9, second column, lines 25 and 44, claims 13 and 14 respectively, for the word "Yarn" read Pirn; same column, line 40, claim 13, for "end" read and; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of December, A. D. 1939.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)

the completed pirn and rotating said yarn round the stationary spindle so as to wrap turns of yarn thereon, means for carrying an empty pirn tube to a point opposite the end of the spindle, means for pushing the empty tube endwise on to the spindle so that the turns of yarn are trapped between the spindle and the tube while the tube is being secured on the spindle, and means for restarting the winding operation.

16. A mechanism for incorporation in a pirn winding machine of the type comprising a spindle on to which a pirn tube may be pushed, and a starting rod and stop motion in association therewith, said mechanism comprising means for ejecting a filled pirn tube endwise from the spindle on stoppage of winding, means for engaging the length of yarn extending from the supply to the completed pirn and rotating said yarn round the stationary spindle so as to wrap turns of yarn thereon, a pirn tube magazine, a carriage for carrying an empty pirn tube from the magazine to a point opposite the end of the spindle, means for pushing the empty pirn tube endwise from the carriage on to the spindle so that the turns of yarn are trapped between the spindle and the tube while the tube is being secured on the spindle, and means for restarting the winding operation.

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