July 9, 1957 S. E. O. CHRISTIANSSON 2,798,356

DEVICES FOR CAUSING AUTOMATIC LOWERING IN SPINNING MACHINES AND TWISTING MACHINES WITH FIXED SPINDLE BANKS AND MOVABLE RING RAILS

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Fig. 1.

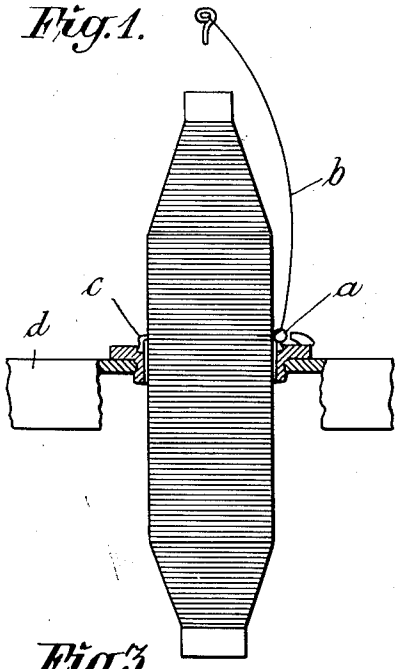



Fig. 2.

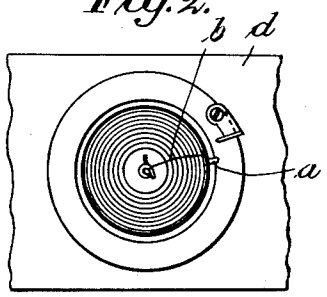



Fig. 3.

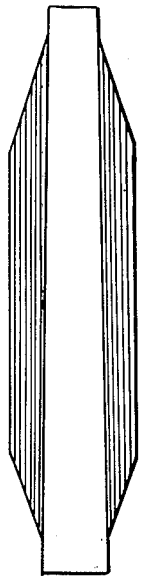


Fig. 4.

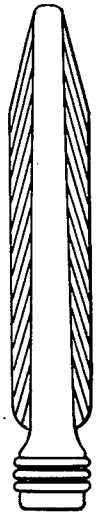
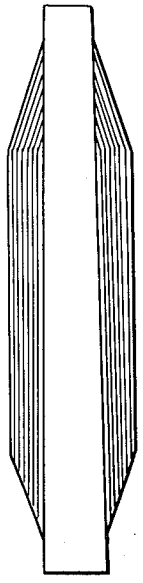


Fig. 5.



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*Fig. 6.*

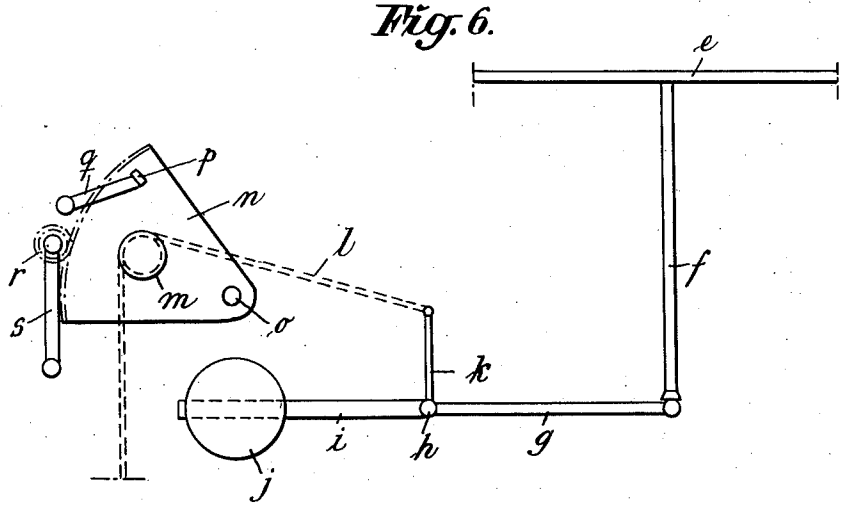
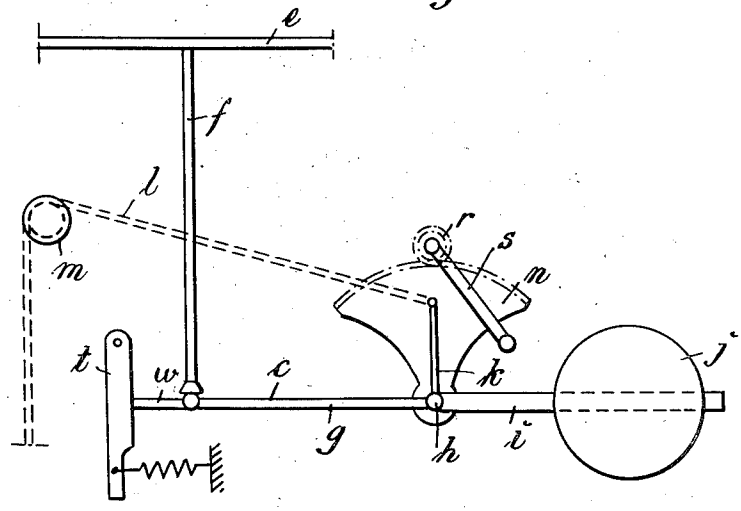



*Fig. 7.*




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Fig. 8.

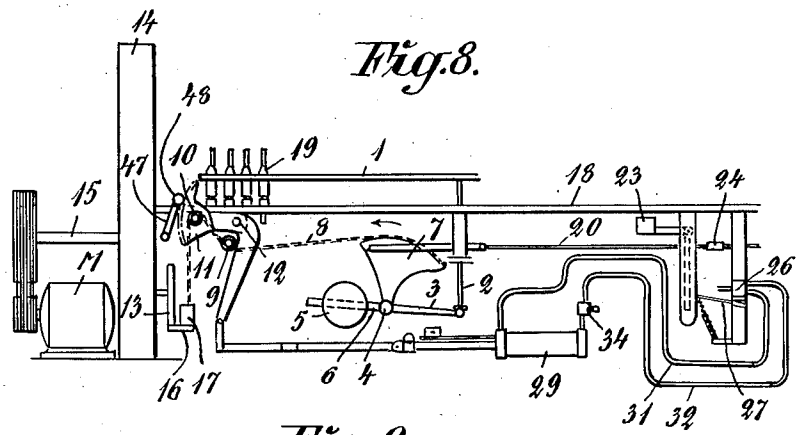



Fig. 8a.

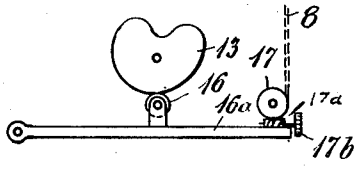
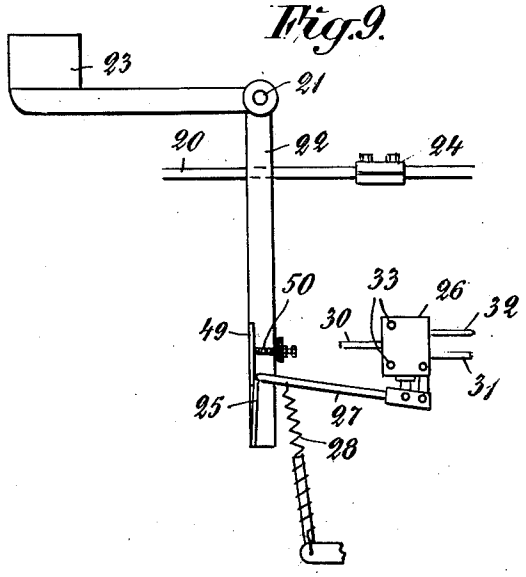



Fig. 9.




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Fig. 10.

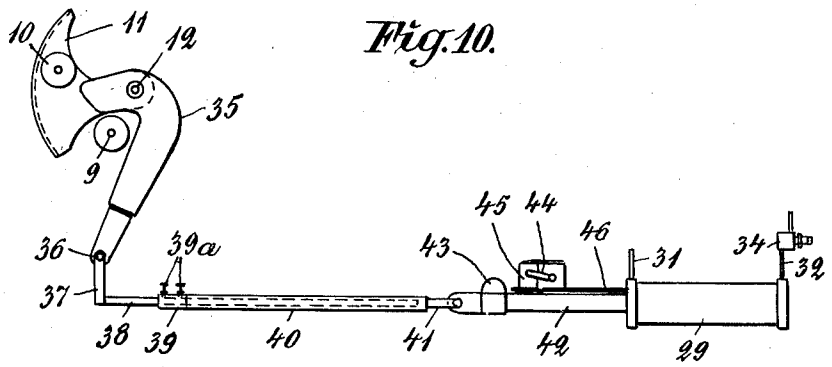



Fig. 11.

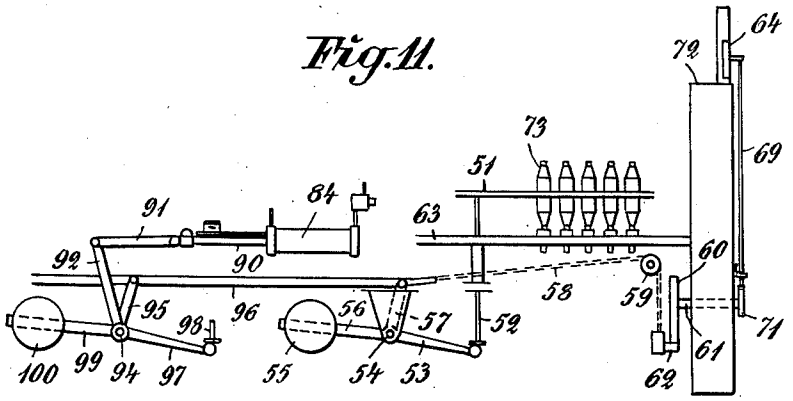
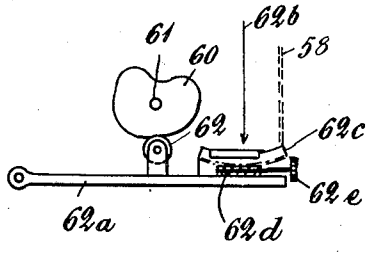



Fig. 11a.




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Fig. 12.

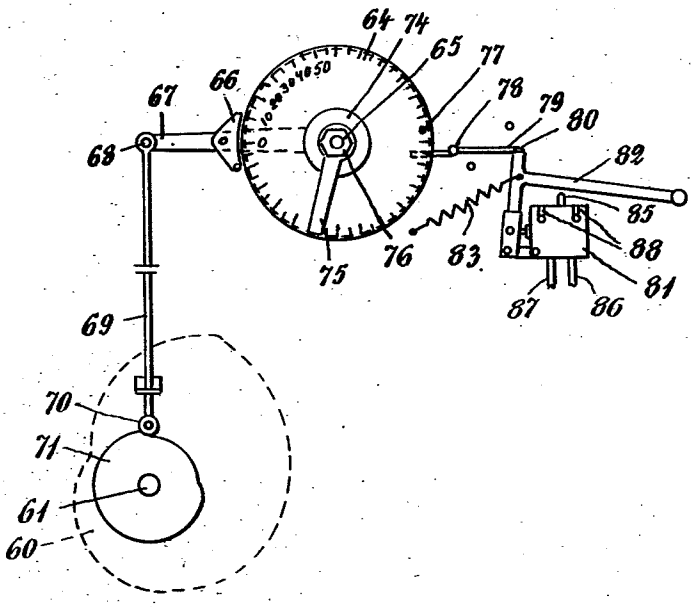
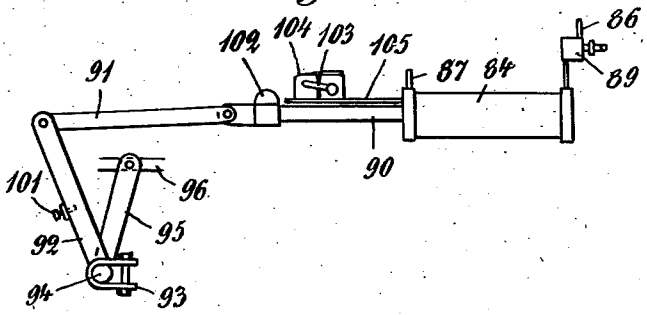



Fig. 13.




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*Fig. 14.*

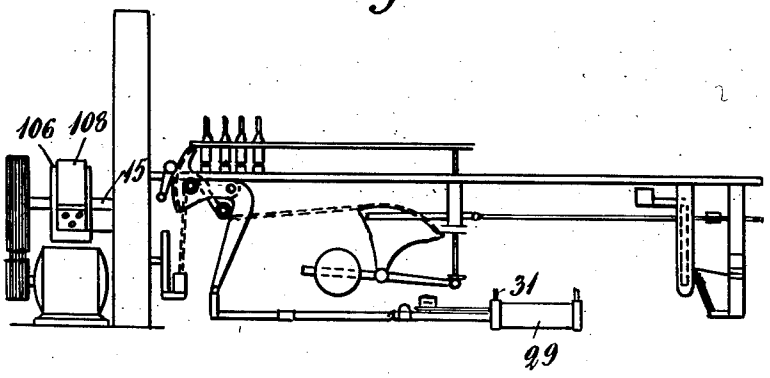
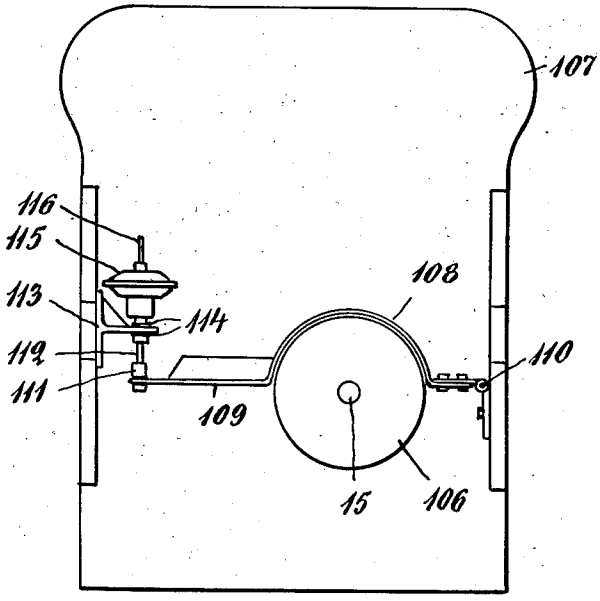



*Fig. 15.*




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United States Patent Office 2,798,356 Patented July 9, 1957



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# DEVICES FOR CAUSING AUTOMATIC LOWERING IN SPINNING MACHINES AND TWISTING MACHINES WITH FIXED SPINDLE BANKS AND MOVABLE RING RAILS

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Application October 4, 1954, Serial No. 460,101

Claims priority, application Sweden October 8, 1953

11 Claims. (Cl. 57—52)

In spinning machines and twisting machines the question of stopping the winding on the usually considerable number of cops at a winding stage that can be fixed in advance and set in a simple way has constituted a problem that up till now has not been solved in a satisfactory manner. In a certain type of the said machines, for which type the subject of the invention is intended, the cop tubes resting on spindles in a stationary spindle bank are arranged in a ring rail, which during the operation of the machine carries out an up and down movement within the operating zone, in which yarn is wound on the cops in layers or lays of a previously fixed number, cop length and arrangement (twist lay or parallel winding, weft lay, combined lay). Stoppage of the machine comprises the shifting of the ring rail from the operating zone to a bottom position and the braking of the cop drive to bring it to a stop as close as possible to the winding stage at which the cops are fully wound in the manner intended. This stoppage of the machine is commonly called "lowering."

Lowering has up till now always been executed by hand and it calls for careful supervision and great skill by those doing the work. Faulty execution of lowering involves great disadvantages, not least of which is waste of yarn. In recent times therefore proposals have been made for carrying out the lowering by automatic means, but so far no complete solution of the problem has been produced.

The present invention has for a primary object to provide an automatic lowering device, which is operated by pneumatic means, and which is adaptable for use with machines with heavy ring rail as well as with machines with heavy counterweight that are designed to produce warp lay, weft lay or combined lay.

Another important object of this invention is to provide a control means for the lowering device, such control means being actuated in connection with and being dependent on the winding being executed and controlling a peumatic operating means for lowering the ring rail.

A further object of this invention is to provide adjustment means for the control means, so that such control means may be adjusted for any utilization desired of the cop length.

A still further object of this invention is to provide a braking mechanism which is actuated, simultaneous with the operation of the pneumatic operating means, to produce the desired braking of the machine in an adjustable manner and at the same time as the lowering operation, for a stopping time of suitable extent.

In the drawings:

Fig. 1 is a side elevational view of a conventional cop made with warp lay; Fig. 4 showing a cop made with weft lay; and Fig. 5 showing a cop made with combined lay.

Fig. 2 is a top plan view thereof.

Figs. 3 to 5 are showings of different types of cops;



Fig. 3 showing a cop made with warp lay; Fig. 4 showing a cop made with weft lay; and Fig. 5 showing a cop made with combined lay.

Fig. 6 is a diagrammatic showing of a conventional heavy ring rail type of spinning and twisting machine.

Fig. 7 is a diagrammatic showing of a conventional heavy counterweight ring rail type of spinning and twisting machine.

Fig. 8 is a side elevational view, partly diagrammatic of an automatic lowering device, in accordance with this invention, shown in use with the machine of Fig. 6.

Fig. 8*a* is front detail elevational view of the transmittal means for the operating power for the ring rail.

Fig. 9 is an enlarged detail showing of the control means for the automatic lowering device.

Fig. 10 is a detail elevational showing of the lowering means per se.

Fig. 11 is an elevational view, partly diagrammatic of an automatic lowering device, in accordance with this invention, for use with the machine of Fig. 7.

Fig. 11*a* is a detail showing of the transmittal means for the operating power for the ring rail.

Fig. 12 is an enlarged front elevational showing of the control means for the lowering device of Fig. 11.

Fig. 13 is a detail elevational showing of the lowering structure per se.

Fig. 14 is an elevational showing of the device of Fig. 8 and includes a braking mechanism.

Fig. 15 is a detail front elevational view of the braking mechanism.

To give some idea of the demands which must be imposed on a satisfactory automatic lowering of the ring rail and stopping of the machine, a brief account of the process of this operation will be given.

The lowering should be carried out at the instant the cops fitted have been wound with the fixed number of lays and in the correct position of the last lay. The length of yarn utilised for the subsequent winding turns required should be as short as possible.

The type of cop that is wound is also important in the execution of the lowering. More clearly to illustrate this condition there are shown in Figs. 1 and 2 the accessories for winding a cop, Fig. 1 constituting a side view and Fig. 2 a top view. The letter *a* designates a ring runner or guide fitted on a ring *c* and by means of which the thread *b* is guided as it is delivered to the cop. The ring *c* with its ring runner *a*, together with a ring rail *d* acting as a fixture for the ring, is given during the winding operation an up and down movement as the cop tube rotates. In this way with each up and down movement of the ring rail the thread forms a lay on the cop tube. This lay may be given different lengths and may be laid in different axial positions on the cop tube. By variation of the length of lay and the axial position on the cop tube different types of cops are produced, the most common being shown in Figs. 3–5. Fig. 3 shows a cop with warp lay. This type of cop is characterised by the first lay having the greatest axial length and the following lays progressively showing shorter axial length. Fig. 4 shows a cop made with weft lay. This is characterised by conically wound lays, with axial lengths equal, with the sole exception of the first lays, which are shorter. Fig. 5 shows a cop made with combined lay, the execution constituting a certain combination of the two foregoing, among its characteristics being that all lays have the same axial length.

With spinning machines and twisting machines having fixed stationary spindle banks, to facilitate the operation of the ring rail a device is employed by which the ring rail is mechanically balanced by means of a counterweight. In some types of machines the weight of the ring rail is greater than that of the counterweight and

these are designated machines with heavy ring rail. In other types of machines the opposite prevails, and these are therefore designated machines with heavy counterweight.

Fig. 6 shows in diagram the parts of interest in this connection of a well known form of execution of the first-named type, the ring rail of which is therefore heavier. The ring rail *e* is carried on a raising rod *f* which is connected by an articulated joint with the free end of a lifting arm *g*. This lifting arm is attached to a journalled shaft *h*, on which are also fixed a counterweight arm *i* which carries at its free end a counterweight *j* and a chain arm *k*, to the free end of which is attached one end of a chain *l*, which last during the operation of the ring rail transmits to the ring rail its up and down movement from a driving mechanism not shown. From the chain arm *k* the chain *l* is carried over a guide pulley *m* on a toothed segment plate *n* which is pivoted on a pivot pin *o*. A stop *p* is fitted on plate *n* and this operates in conjunction with a pawl *q* which can be moved. A spur gear *r*, which can be rotated by means of a hand crank *s* for installation of plate *n* round pivot pin *o*, engages the toothed segment of plate *n*.

During the repeated up and down movement of the ring rail which is required for the winding-on operation the plate *n* is held stationary in the position shown on Fig. 6, by engagement of the stop *p* and the pawl *q*. When lowering is to take place the pawl *q* is disengaged from the stop and the plate *n* is rotated counter-clockwise as shown on the figure, by means of crank *s* and gear *r*. The guide pulley *m* is thereby moved downwards as per the figure and the chain *l* permits the mechanical system, consisting of the ring rail and the counterweight, to swing clockwise, owing to the ring rail's weight being greater than that of the counterweight.

In Fig. 7 there is shown in similar manner a well known type of machine with heavy counterweight. The parts designated by *e, f, g, h, i, j, k, l, m, n, r,* and *s* each agree with the parts which have the same designation in Fig. 6, with the difference, however, that the plate *n* in Fig. 7 is attached to the shaft *h* and the guide pulley *m* in Fig. 7 is journalled on a pivot shaft fixed in the machine stand. Moreover, with the arrangement as per Fig. 7 the crank is suitably made detachable or disconnectable, so that it is connected to the gear *r* only for lowering of the ring rail. Owing to the counterweight with this form of execution having greater weight than the ring rail, there is in addition a pawl *t* which, when the rail bank has been lowered sufficiently, engages an extension *w* of the lifting arm *g* to lock this lifting arm and thereby the ring rail in lowered position.

With the arrangement as per Fig. 7 also, the ring rail is given the repeated up and down movement required for winding on by means of the chain *l*, it being observed that the toothed segment plate *n* in this device follows the movement by swinging to and fro. During this winding on, the ring rail is never carried so far down that locking engagement is produced between the extension *u* and the pawl *t*. For lowering, the crank *s* is connected to the gear *r* and is turned clockwise as shown on the figure, whereupon the mechanical system consisting of ring rail and counterweight is swung counter-clockwise against the action of the heavier counterweight until the extension is locked by engagement with the pawl *t*. This lock engagement must later be released to enable the next winding process to be done.

The present invention aims at producing a new and improved device, by means of which the previously known devices' many drawbacks are avoided and which is simple, yarn-saving, time-saving in operation and moreover does not require specially skilled personnel for its operation.

With the device according to Figs. 8–10 the machine comprises as in device as per Fig. 6 a ring rail **1**, carried on a raising rod **2** which is connected by an articulated joint with the free end of a lifting arm **3**. This lifting



arm is attached to a journalled shaft **4**, on which are also fixed a counterweight arm **6** carrying a counterweight **5** and a chain arm **7** formed as a segment of a circle and on which is attached one end of a chain **8** intended for driving the ring rail in its up and down movement. From the chain arm **7** this chain **8** is first carried over a guide pulley **9**, which is pivoted on a pivot shaft fixed in the machine stand and then over a guide pulley **10** on a toothed segment plate **11**, which is journalled to swing on a pivot pin **12** fixed to the machine stand.

The operating power, which is transmitted by chain **8** to the ring rail **1**, is taken from an excentric disc or cam **13**, which is driven through a gear, not shown, in the end **14** of the machine stand and through a shaft **15** by a motor M, which is the driving motor for the machine. An excentric roller **16**, which is journalled on a swing arm **16***a* serving as guide for the excentric roller **16** in such manner that the roller is given an up and down movement in a rather bent path, lies against the cam. On this same swing arm **16***a* is fixed the bearing, not shown, for a chain wheel **17** which follows the swing arm's movement. As is shown more particularly in Fig. 8*a* there is attached to the end of the chain wheel a worm-wheel which engages with a worm gear **17***a* journalled on the swing arm **16***a* and to which is attached a gear **17***b*, which gear is made to follow in the up and down movement of the swing arm and by this means is rotated through an angle by joint working with a driving tooth not shown, journalled in the machine stand, for each movement stroke and constantly in the same direction. By this means through screw gear **17***a* the chain wheel **17** is also rotated through a small angle round its own axis for each up and down movement of the swing arm **16***a*. The other end of chain **8** is attached to chain wheel **17** in such a manner that the chain is wound on the wheel during the movement thus being shortened at its free end. The chain **8** will clearly with this arrangement be given both a forward and backward movement and an intermittent but regularly repeated shortening movement superimposed on the up and down movement. The resulting chain movement is transmitted in a way easily realised to the ring rail, which is thereby given an up and down movement with step for step displacement upward of the ring rail's mean level in relation to the fixed spindle bank **18** of the machine and the spindles **19** rotating in fixed position on same, so that the required lay is produced. The device allows of the production of both weft lay and combined lay.

In accordance with the invention the machine is provided with a device for automatic lowering, the main parts of which are constituted by a control device actuated in connection with the winding executed and a pneumatic operating device controlled by this and acting as a servomotor.

The control device, the chief parts of which are shown in larger scale in Fig. 9, comprises a control rod **20**, horizontally placed in Figs. 8 and 9 and arranged as indicating organ for the extent of winding on. One end of control rod **20** is connected by an articulated joint with the chain arm **7** which gives it a movement corresponding to the movement of the ring rail **1**, thus a movement which is forward and backward while, at the same time, the mean position of its movement stroke is continually displaced to the left as per Figs. 8 and 9. The control device also comprises a holding arm **22** journalled to swing round a shaft **21**, which arm in the example is held by a weight **23** in holding position, in which it exercises pressure to the right as per Fig. 9. On the control rod **20** there is fitted a tripping lug **24**, the position of which on the rod is adjustable. As winding proceeds this tripping lug is brought by each movement stroke of the rod **20** nearer and nearer to engaging position with the holding arm **22** until finally when spools or cops are fully wound it is able to swing the holding arm **22** clockwise against the action of the weight **23**. This causes the liberation by a

stop 25 on holding arm 22 of a tripping lever 27 belonging to a pneumatic servo-valve 26, which is then switched over under the action of a spring 28 from a first to a second outside position.

The servo-valve 26 comprises together with a pneumatic double-acting operating cylinder 29 the pneumatic operation device acting as servo-motor. This is fed with compressed air, delivered from a compressed air source, not shown, through a pipe-line 30 to the servo-valve 26. When the tripping lever 27 of the servo-valve 26 takes up the position shown in Fig. 9, the compressed air is conveyed through the servo-valve and a pipe-line 32 to the right-hand end of the operating cylinder 29, as per Fig. 8, causing the operating cylinder piston to be held in its left-hand end position in the operating cylinder by the compressed air. When the tripping lever 27 is liberated by the holding arm 22 and takes up its second outside position, the compressed air is carried through the servo-valve and a pipe-line 31 to the left end of the operating cylinder 29, causing the piston to be moved to the right to produce the lowering of the ring rail. When either of the pipe-lines 31 and 32 is not receiving compressed air it is instead connected in the servo-valve 26 with a return pipe-line through a regulating valve 33, by means of which the velocity of the return air stream can be regulated. There is also inserted in pipe-line 32 a separate regulating valve 32 for fine regulation of the return air stream speed on lowering.

The lowering of the ring rail is produced, as with the device according to Fig. 6, by the toothed segment plate 11 being rotated around the shaft 12, causing the guide pulley 10 to be lowered and thereby also the ring rail 1. The rotation of plate 11 is caused by the piston of the operating cylinder 29 being moved to the right as per Figs. 8 and 10. A suitable execution for the device transmitting the movement is shown in detail in Fig. 10. An arm 35 is attached to plate 11 and the arm's free end at 36 is connected by articulated joint with a fork 37 at one end of a rod 38, the other end of which is inserted and movable in a tube 40 and by means of a stop sleeve 39*a*, attached to rod 38 by two screws 39*a*, is prevented from being inserted beyond an adjustable stop position in the said tube. At the other end of tube 40 there is fixed a fork 41 which is connected by an articulated joint with the end of the piston rod 42 of the operating cylinder 29. It will be seen that in the position shown in Fig. 10 for the device, in which compressed air is delivered to the operating cylinder 29 through the pipeline 32, the piston rod 42 is kept by the action of the compressed air constantly pressed to the left, as per the figure, causing the ring rail always and in a reliable manner to be held in operating position without it being necessary to employ for this purpose any mechanical stop device working in conjunction with the plate 11. It will likewise be seen that movement of the piston rod 42 to the right causes lowering of the ring rail 1, while the speed of movement may be regulated by corresponding switching of the valve 34.

The device shown in Fig. 10 is also provided with means for automatic disconnection of the machine's driving motor M at a suitable stage, fixed in advance, of the lowering. These means comprise an operating lug 43 fixed to piston rod 42, which is arranged to work in conjunction with operating arm 44 on a circuit-breaker connected in the operating circuit of the motor. This circuit-breaker 45 is fitted on a bracket 46 parallel with the piston rod 42 and is arranged to be adjustable to and fixable in different positions on this bracket. For the operation of the machine the position of the circuit-breaker 45 is installed so that the lug 43 engages with operating lever 44 and disconnects the driving motor before the ring rail in the course of lowering reaches its lowest position. The position of the circuit-breaker on bracket 46 is chosen so that the spindles 19 of the machine rotate a suitable number of revolutions for winding the yarn after the ring rail has reached its lowest position.

Before the driving motor M of the machine is again started the rolled up part of chain 8 is unrolled from the chain wheel 17 and the tripping lever 27 of the servo-valve 26 is moved upwards to locking position as per Fig. 9. This causes compressed air to be passed through pipeline 32, so that the piston of the operating cylinder 29 is moved to the left as per Fig. 10 and the ring rail is raised to operating position. To enable the yarn threads in the machine to be held taut when the motor is started, the ring rail may if required be raised by hand. For this purpose the machine is provided, as with the device as per Fig. 6, with a gear rotated by a crank, which works in conjunction with the plate 11. When the crank is turned counter-clockwise as per Fig. 8 the guide pulley 10 is raised and with it the ring rail 1. With these movements the lever 35 is also moved but the piston rod 42 is not carried with it owing to rod 38 being pushed into tube 40. After the yarn threads have been tautened in this way the ring rail should, after the motor is started, be lowered as far as stop sleeve 39 on rod 38 allows.

It should be observed that the tripping lug 24 on control rod 20 is adjustable to and fixable in various positions along the control rod 20 to enable adjustment for any utilisation desired of the cop length. In the execution shown in Fig. 9 the holding arm 22 is moreover adjusted to an accurately correct position in relation to the tripping lever 27 by means of a set-screw 50 working in conjunction with a stop 49 on the holding arm 22, which screw also takes up the pressure to the right produced by the counterweight 23 and exercised by the holding arm 22, as per the figure.

With the device according to Figs. 11–13 the machine contains, as with the device according to Fig. 7, a ring rail 51 carried by a raising rod 52, which is connected by an articulated joint with the free end of a lifting arm 53. This lifting arm is fixed to a journalled shaft 54, to which there are also attached a counterweight arm 56 carrying the counterweight 55 and a chain arm 57, in the free end of which is fixed a chain 58 intended for driving the ring rail in its up and down movement. From the chain arm 57 the chain 58 is carried over a guide pulley 59 which is journalled on a fixed pivot shaft in the machine stand.

The actuating power transmitted to the ring rail 51 by means of the chain 58 is taken from an eccentric disc or cam 60 which is fixed on and driven by a shaft 61, which in turn, in a manner not shown, is driven from the driving motor of the machine. Against the eccentric disc lies an excentric roller 62 which is pivoted on a swing arm 52, which serves to operate the eccentric roller 62, causing this to have an up and down movement in a rather bent path. As is shown in more detail in Fig. 11*a* there is fixed on the swing arm 62*a* the guide 62*b*, in which a rack 62*c* is journalled to slide in the longitudinal direction of the swing arm 62*a*. The teeth of rack 62*c* are engaged by a worm gear 62*d* journalled on swing arm 62*a*, to which gear is attached a gear 62*e*, which is thereby caused to accompany the up and down movement of swing arm 62*a* and thus by working in conjunction with a tooth, pivoted in the machine stand and not shown, is turned one angle for each movement stroke and always in the same direction. Over the worm gear 62*d* the rack 62*c* is moved a small way in the direction of the shaft of swing arm 62*a* for each up and down movement of the swing arm 62*a*. The other end of the chain 58 is attached to the rack 62*c*, and this end of the chain will thereby be caused by each up and down movement of the eccentric roller 62 to move a short distance in the direction of the swing arm's pivoting axis. The chain 58 is given by this arrangement a forward and backward movement, with a progressively diminishing amplitude, which movement in a manner easily realised is transmitted to the ring rail 51, which is thus given a corresponding up and down movement for producing warp lay with progressively diminishing amplitude but with constant mean level in

relation to the fixed spindle bank **63**, the upward movement stroke being produced each time by the heavier counterweight. If weft lay or combined lay is to be produced there is journalled, in the same way as according to Fig. 8*a*, on the swing arm **62***a* a chain wheel which follows the up and down movement of the roller **62** and to which the other end of the chain **58** is attached in such a way that the chain in the course of the movement is wound on it step by step and thereby shortened step by step in its free end. These two fixing devices for the chain are interchangeable. Thus the device according to Figs. 11–13 allows of the production of warp lay, weft lay or combined lay as desired.

As with the previously described form of execution the machine according to Figs. 11–13 is provided with a device for automatic lowering, the main parts of which consist of a control device dependent on the winding executed and pneumatic operating device controlled by this and acting as servo-motor.

The control device, the main parts of which are shown on a larger scale in Fig. 12, comprises a mechanism driven by shaft **61**, intended to indicate the number of lays wound and to produce a control at a number of lays wound fixed beforehand. This mechanism consists of a plate **64** which rotates around a pivot pin **65** and which is provided round its circumference with driving teeth, the numbers of which are given on the plate. Plate **64** is rotated step by step by means of a driving pawl movable to and fro, which meshes with the driving teeth of the plate and is journalled on a swing arm **67**, one end of which rotates round the pivot pin **65** and the other end is connected at **68** by an articulated joint with one end of a driving rod **69**, the other end of which carries a roller **70** which is held in contact with a cam disc **71**. The cam disc **71** is attached to the shaft **61** which is journalled in an end piece belonging to the machine stand and also carrying the mechanism generally. For each revolution of shaft **61** one lay is wound on the spindles **73** of the machine and at the same time the shaft drives the operating rod **69** over the excentric disc **71** up and down, causing swing arm **67** and driving pawl **66** to swing once to and fro and the plate **64** to be turned one tooth clockwise as per Fig. 12.

A spring washer **74** is threaded on one end of the shaft pin **65**. This washer is intended to prevent by its braking action any unwanted rotation of plate **64**. Further, on the shaft pin there is threaded one end of the stop lever **75** which along with the spring washer can be fixed by means of a nut **76** in unturnable position on the shaft pin **65**. A pin **77** is also fixed in plate **64** and this is parallel with the shaft pin **65** and projects on both sides of plate **64** close to the circumference of the plate. The pin **77** is intended to work in conjunction with one of the arms of a two-armed locking lever **79** journalled to swing at **78**. When the plate **64** has rotated clockwise from the position shown in Fig. 12 until the driving tooth numbered 0 is opposite the driving pawl's point, the pin **77** engages the locking lever **79** and turns it counter-clockwise. This causes release of the meshing between the other arm of locking lever **79** and a stop **80** on a tripping lever **82** belonging to a pneumatic servo-valve **81**, which then under the action of a spring **83** is switched from a first to a second position.

The above described control device allows of convenient advance setting of the type of cop to be produced. When it has been decided how many lays the cop is to contain when fully wound, the driving pawl **66** is disengaged from the teeth of the plate **64**, and the plate is rotated counter-clockwise until the point of driving pawl **66** lies opposite the tooth with the number corresponding to the number of lays. The driving pawl is then caused to mesh with this tooth. After this the nut **76** is loosened and the stop lever **75** is turned clockwise until it lies against pin **77** in the position it now takes up and afterwards the nut **76** is tightened so that the stop lever **75** is fixed in this rotating position. For each subsequent lot of cops to be wound all that is required is to turn the plate counter-clockwise until the pin **77** comes into contact with the stop lever **75**. During winding the excentric **71** makes one revolution for each lay formed on the cop, and this drives the plate **64** one tooth counter-clockwise. When the plate has turned so much that the tooth numbered 0 is opposite the point of driving pawl **66**, release of the servo-valve **81** takes place in the manner already indicated.

The servo-valve **81** constitutes along with a double acting operating cylinder **84** the pneumatic operating device acting as servo-motor. This is fed with compressed air, conveyed to the servo-valve **81** through a pipe-line **85**. When the tripping lever **82** takes up its position as shown in Fig. 12 the compressed air is led through the servo-valve and a pipe-line **86** to the operating cylinder **84** right hand side as per Fig. 13, whereupon the piston of the operating cylinder is held by the compressed air in its left-hand end position in the operating cylinder. When the tripping arm **82** is liberated and takes up its second outside position, the compressed air is led through the servo-valve and a pipeline **87** to the left end of the operating cylinder **84**, causing the piston to be moved to the right to produce the lowering of the ring rail. When either of the pipe-lines **86** and **87** is not receiving compressed air it is instead connected in the servo-valve **81** with a return pipe-line through its regulating valve **88**, by means of which the velocity of the return air stream may be regulated. In the pipe-line **86** there is inserted also a separate regulating valve **89** for fine regulation of the return air stream velocity on lowering.

The lowering of the ring rail is caused with the above described device by the piston rod of the piston of operating cylinder **84** being moved to the right as per Figs. 11 and 13 and is transmitted through a movement transmitting device, shown in more detail in Fig. 13. This device comprises an extension rod **91** connected at one end by an articulated joint with the free end of the piston rod **90** and at the other end by an articulated joint with one end of a lever **92**, the other end of which is journalled to turn freely round a shaft **94** by means of a fixed bearing sleeve **93**. One end of a swing arm **95** is attached to the freely rotating shaft **94** and the other end is connected by an articulated joint with a guide rod **96**, which last is connected by an articulated joint with the free end of the chain arm **57**. As may be seen in Fig. 11 there can also be attached to shaft **94** a lifting arm **97** corresponding to lifting arm **53** and working in conjunction with another lifting arm **98** for the ring rail, as also a counterweight arm which carries a counterweight **100**. On the lever **92** there is fitted a set-screw **101** which, when the piston moves to the right as per Fig. 13 is moved to engage the swing arm **95** and as the piston continues to move to the right produces movement to the right also of the swing arm **95** and with it guide rod **96** and chain arm **57**. In their clockwise rotation thereby caused the arms **95** and **57** carry the lifting arms **97** and **53** downwards so that the ring rail is lowered. By appropriate setting of the set-screw **101** it is possible to fix any desired bottom position for the ring rail's lowering.

The device shown in Fig. 13 is also provided with an arrangement for automatic disconnection of the machine's driving motor at a predetermined stage of the lowering. This arrangement comprises an operating lug **102** fixed on piston rod **90**, which is arranged to work in conjunction with an operating arm **103** on a circuit-breaker **104** inserted in the driving motor circuit. This circuit-breaker is fitted on a bracket **105** parallel with the piston rod **90** and is arranged to be adjustable to and fixable in different positions on this bracket. For the operation of the machine the position of the circuit-breaker is set so that the lug **102** engages with the operating arm **103** and disconnects the driving motor before the ring rail when lowering has reached it lowest position. The position of

the circuit-breaker on the bracket **105** is so selected that the machine spindles **73** rotate a suitable number of revolutions for winding the yarn after the ring rail has reached its lowest position.

With machines of the kind specified it is obviously important that the time taken between the braking of the driving motor circuit and the stoppage of the machine, herein referred to as stopping time, can be kept comparatively short and moreover be made equally long for each stoppage. Particularly with machines operating with high spindle revolutions and rapid feeding of the yarn, difficulty is often encountered in ensuring sufficiently short stopping time. If in addition the lowering is executed quickly, which is desirable, one must resort to braking when lowering, to avoid excessive waste of yarn.

A suitable form of execution of the device according to the invention is in accordance with this characterised by the device being combined with a braking mechanism which, in connection with the servo-motor operation produced for the automatic lowering of the ring rail, is put into operation to produce the desired braking of the machine, in an adjustable manner and at the same time as the lowering, for a stopping time of suitable length.

A suitable execution in detail of this braking mechanism is shown in Figs. 14 and 15 in conjunction with the form of execution shown in Fig. 8.

On the main shaft of the machine, designated by **15** as in Fig. 8, there is fixed a brake drum **106** which works in conjunction with the braking mechanism's other parts arranged in a frame **107** which forms the end stand of the machine. Directly connected to the brake drum **106** is a brake lever **109** fitted with brake band **108** and connected in one end at **110** by an articulated joint with one side of the frame **107**. At the other end of brake lever **109** and connected to it by an articulated joint is the free end **111** of an operating rod **112**, by means of which the brake lever **109** can be moved in and out of braking position for the brake band **108**. In a bracket **113** fitted in the other side of the frame **107** there is fitted by position-fixing nuts **114** a pneumatic single-acting operating box **115**, in which the operating rod **112** is inserted and which contains a diaphragm connected with the operating rod's end and actuated by compressed air. Compressed air to the inside of the operating box for actuating the diaphragm is delivered through a pipe-line **116**. This pipe-line **116** is a branch from the pipe-line **31** which goes from the machine's servo-valve to its pneumatic operating cylinder **29** and which receives compressed air for producing the automatic lowering. As may easily be seen, the braking device will by this means receive compressed air through the pipe-line **116** at the same time as automatic lowering in started and will start the braking of shaft **15**. By means of the nuts **114** the braking action may be adjusted for any desired length of stopping time.

When the machine is to be started again there will be no compressed air present in box **115** and its diaphragm will be restored by means of a spring when the compressed air is cut off.

Having now particularly described the nature of my invention and the manner of its operation what I claim is:

1. A pneumatically operating device for causing automatic lowering in spinning and twisting machines having a fixed spindle bank and a movable ring rail comprising a driving mechanism for producing an up and down movement of the ring rail, a double acting cylinder having an operating piston mechanically coupled to the driving mechanism, a pneumatic servo-valve movable from a first to a second valve position and controlling the delivery of compressed air to one or the other side of the piston, and a control means controlled by the winding of the cop tubes and arranged in a predetermined adjustable position responsive to a fully wound or nearly fully wound cop tube for switching the servo-valve from a first to a second valve position so that the driving mechanism in the first valve position is retained in a ring rail up and down producing movement and in the second valve position is caused to produce automatic lowering of the ring rail.

2. A device as claimed in claim 1, wherein means is provided for adjusting the driving mechanism to change progressively the mean level of the ring rail for selectively producing weft lay and combined lay and wherein the control means includes a control rod, means for moving the control rod in a reciprocal to and fro movement in response to the operating movement of the ring rail, a stop adjustably secured on the control rod and switch means for the servo-valve actuated by the stop.

3. A device as claimed in claim 1, wherein said control means includes an element driven by the driving mechanism and arranged to actuate the servo-valve after the driving of the ring rail a predetermined number of movement strokes, each stroke corresponding to one lay.

4. A device as claimed in claim 1, wherein said control means includes a rotating plate having teeth on its peripheral edge, said plate being rotated one tooth at a time and each such rotative movement corresponding to each lay, means actuated by the driving mechanism for so rotating the plate and a tripping pin for actuating the servo-valve, said tripping pin being actuated by the teeth on the plate.

5. A device as claimed in claim 1, wherein said control means includes a pivoted member connected to the valve and normally held inoperative by a spring.

6. A device as claimed in claim 1, wherein said servo-valve includes regulating means for controlling the velocity of the return air stream from the two sides of the piston.

7. A device as claimed in claim 1, wherein conduit means connects the servo-valve and the cylinder for the inlet and outlet of compressed air to the cylinder and wherein regulating valve means is associated with said conduit means for regulating the velocity of the return air from the cylinder as the ring rail is lowered.

8. A device as claimed in claim 1, wherein an electric motor is provided for the driving mechanism, an electrical circuit for the motor, a circuit breaker in said circuit, means actuated by the piston for operating the circuit breaker as the ring rail is lowered so that the motor is automatically interrupted at a point during the lowering of the ring rail.

9. A device as claimed in claim 8, wherein said circuit breaker is adjustable relative to said means actuated by the piston so that the point of interruption of the motor is selectively adjustable.

10. A device as claimed in claim 1, wherein a motor means is provided for operating the driving mechanism, and drive transmission means connects the motor means and the driving mechanism, a braking mechanism for braking the drive transmission means as the ring rail is lowered and means operable in consort with the servo-valve for actuating the braking mechanism.

11. A device as claimed in claim 10, wherein said breaking mechanism includes a brake band, a pneumatic single-acting operating means for actuating the brake band and conduit means connecting said operating means with the servo-valve so that the cylinder and said operating means are controlled thereby.

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