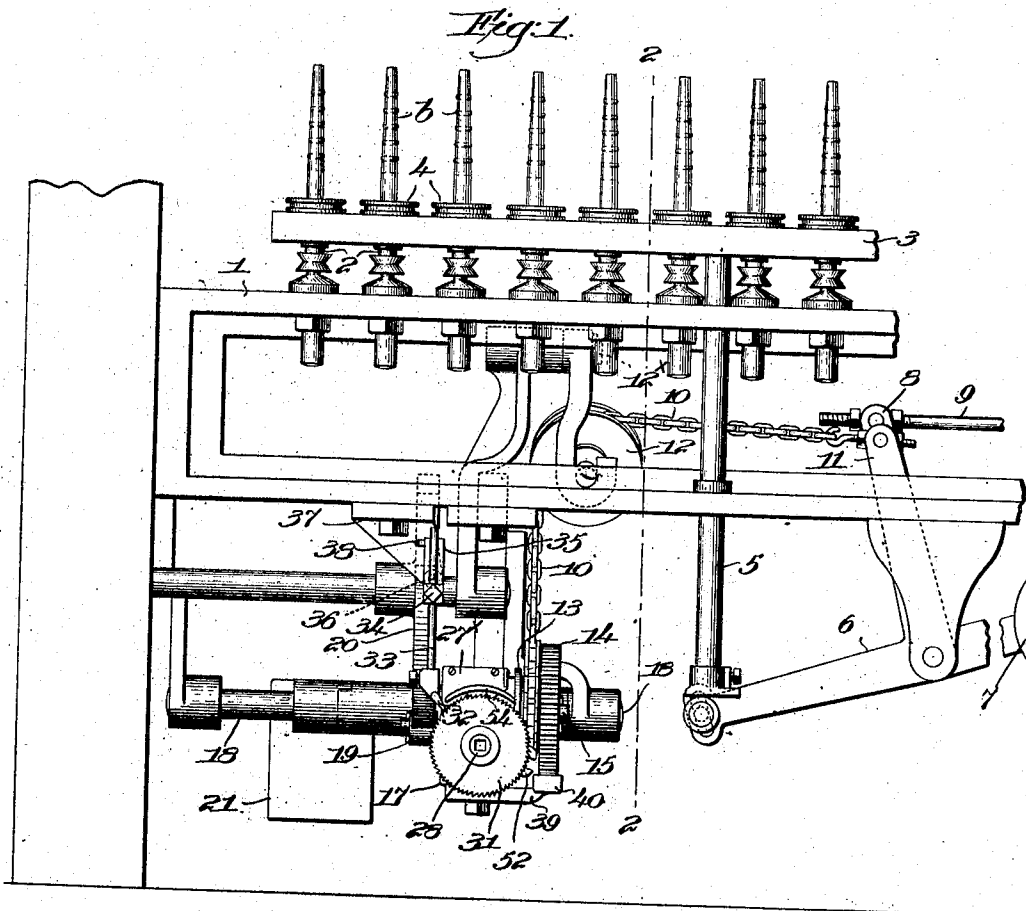


A. E. RHOADES.
 TRAVERSE MOTION FOR YARN SPINNING APPARATUS.
 APPLICATION FILED FEB. 13, 1909.

941,649.

Patented Nov. 30, 1909.
 3 SHEETS—SHEET 1.



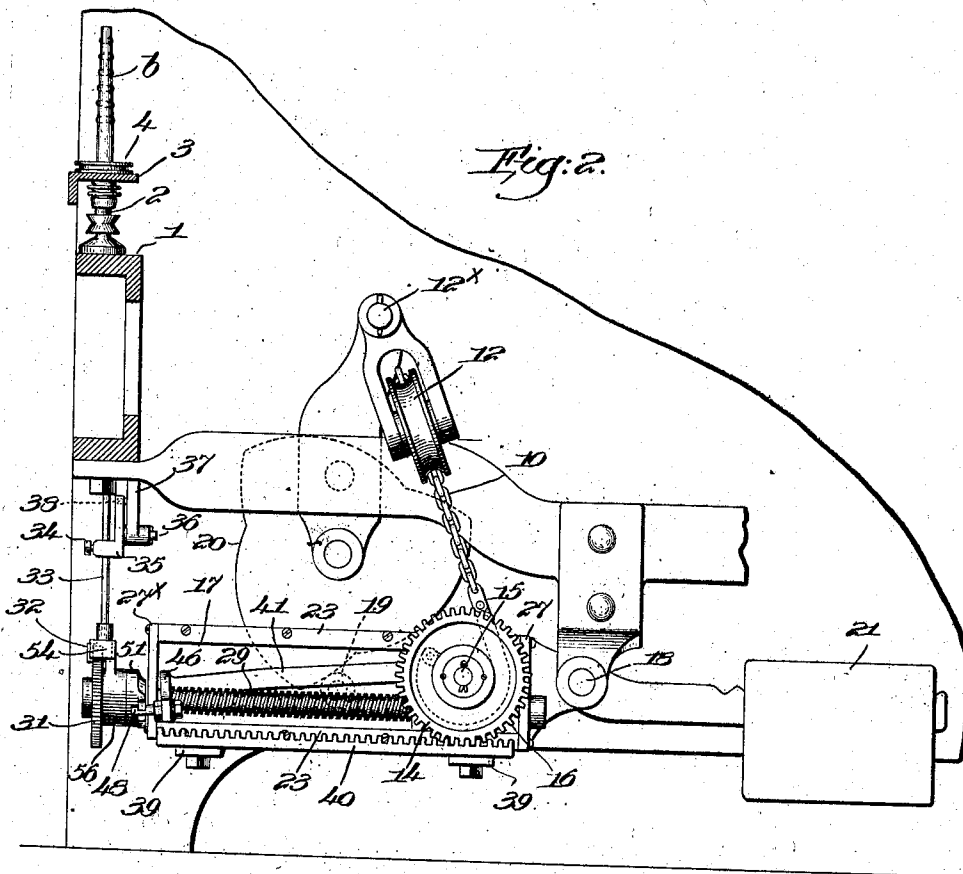
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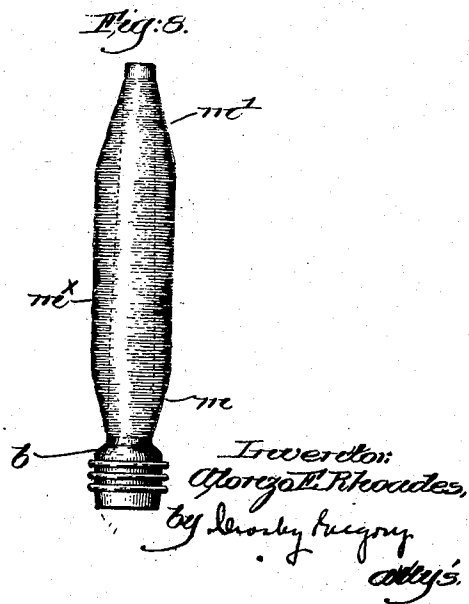
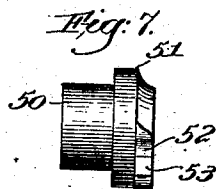
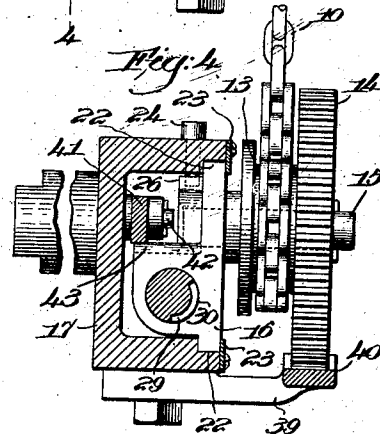
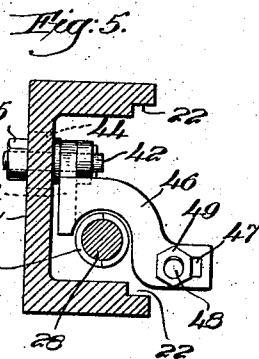
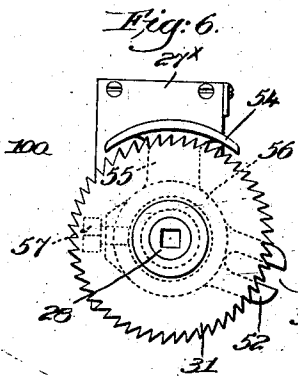
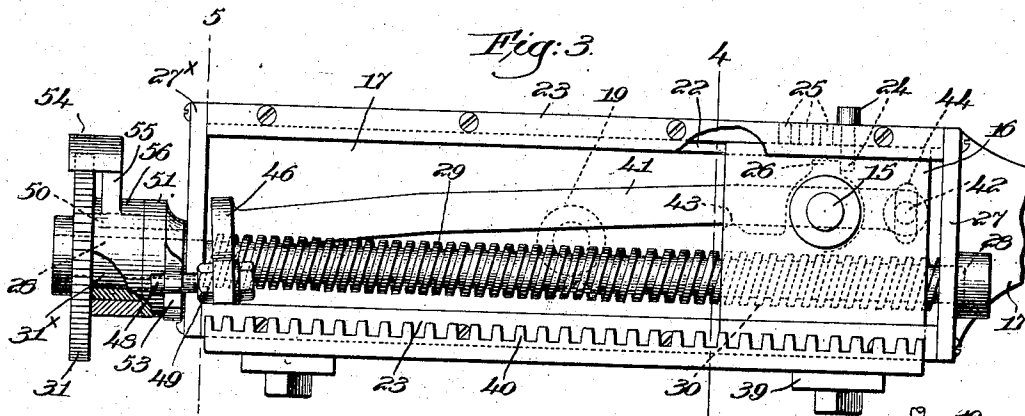
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

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TRAVERSE-MOTION FOR YARN-SPINNING APPARATUS.

941,649.

Specification of Letters Patent.

Patented Nov. 30, 1909.

Application filed February 13, 1909. Serial No. 477,532.

To all whom it may concern:

Be it known that I, ALONZO E. RHOADES, a citizen of the United States, and resident of Hopedale, county of Worcester, State of Massachusetts, have invented an Improvement in Traverse-Motions for Yarn-Spinning Apparatus, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to apparatus for spinning yarn, and it has for its object the production of a novel traverse motion for use in connection with such apparatus, to control the reciprocatory movement of the ring-rail and thereby govern the laying of yarn upon a yarn-receiver or bobbin in a novel and effective way.

In my present invention the traverse motion is of very simple construction, there being but a single connection between the builder-motion and the usual rocker through which the vertical movement of the ring-rail is controlled.

The construction and operation of the builder-motion herein are such that the yarn is laid at the beginning of the winding with the minimum traverse, and such traverse increases automatically and gradually throughout the winding operation, but in order to give the proper and desired conformation to the yarn mass on the receiver or bobbin the "gain" starts at the maximum and gradually decreases throughout the winding.

It is well known to those skilled in the art that the same quantity of yarn is laid at each traverse, hence a shorter traverse lays the yarn much more closely than a longer traverse does, so that at the beginning of the winding, when the traverse is short, there is a tendency in the yarn laid on one traverse to roll over the yarn laid on the previous traverse, particularly at the lower end of the traverse, so that there is more or less interference between the two portions of the yarn, causing it to draw off improperly and unevenly in the shuttle.

With a gradually increasing traverse the increment of increase on successive strokes of the ring-rail is so small that such rolling over or crowding of the yarn cannot be obviated by the traverse alone, and in my present invention I overcome the objection noted by starting the winding with a maximum "gain". By so doing I carry the ends of

successive layers of yarn far enough to extend beyond those immediately preceding, and thereby lay each layer properly and evenly upon the yarn-receiver, without any rolling over or crowding of the turns of one layer into the turns of the layer beneath, and the yarn in consequence draws off evenly and without obstruction, in the shuttle, down to the very beginning of the winding if need be. The completed yarn-mass tapers gradually up to the body portion, at its lower end, and tapers gradually in the opposite direction at the top of the body portion, obviating the formation of a pear-shaped yarn-mass, which shape, is highly objectionable. While the maximum gain at the beginning of the winding obviates the fault referred to it is necessary to effect a gradual decrease of the gain during the winding, and I have made provision therefor, as will appear hereinafter. Were it not for such gradual decrease of the gain the structure embodying my invention would so operate that the winding would be completed with relatively a very small quantity of yarn laid.

The various novel features of my invention will be fully described in the subjoined specification and particularly pointed out in the following claims.

Figure 1 is a front elevation of a sufficient portion of a spinning-frame with one practical embodiment of my invention applied thereto, the ring-rail being shown somewhat above its lowest point, but otherwise the mechanism is in readiness to begin the winding of a set of bobbins; Fig. 2 is a transverse section on the line 2—2, Fig. 1, looking toward the left, showing the builder-motion and the actuating cam therefor in side elevation; Fig. 3 is an enlarged detail, partly broken out, of the builder-arm and parts carried thereby, but with the winding-drum and its gear removed; Fig. 4 is a transverse section on the line 4—4, Fig. 3, looking toward the right, but with the winding-drum and its gear in place; Fig. 5 is a similar view on the line 5—5, also looking toward the right; Fig. 6 is a left-hand elevation of the builder-arm, showing the ratchet by means of which the traverse is varied, and the shield to govern the change in the gain; Fig. 7 is a detail in side elevation of the angularly movable support for the shield; Fig. 8 is a view in elevation of the yarn-receiver or bobbin with the completed yarn-mass thereon.

In the present embodiment of my invention the ring-rail is raised by a suitable lifting-weight and depressed by or through the builder-motion, the winding mechanism letting off the chain from the winding drum or barrel to govern the "gain" of the traverse, while the traverse itself is gradually increased by a gradual bodily movement of the drum from the fulcrum of the builder-arm.

Referring to Figs. 1 and 2, the spindle-rail 1, rotatable spindles 2, the vertically-reciprocating ring-rail 3 provided with usual rings 4, the lifter-rods 5 (one being shown in Fig. 1) the rocker 6 cooperating with the foot of the lifter-rod and provided with a weight 7 to elevate the ring-rail, and the rocker-arm 8 rigidly attached to the rocker and transmitting reciprocating movement to the other lifter-rods through the link 9, may be and are all substantially of well known or usual construction in spinning or similar apparatus.

A flexible connection, preferably a chain 10, as herein shown, is connected at one end to the branch 11 of the rocker 6 and is led over a guide-sheave 12 mounted in a swinging support fulcrumed at 12* on the main frame and thence to a winding-drum or barrel 13, and attached thereto, said drum having attached to or forming part of it a concentric gear 14, said drum and gear being rotatably mounted on a laterally extended stud 15 fixed on a traveler 16, to be referred to again, which acts as a traverse-changer.

The builder-motion herein shown includes a builder-arm 17 fulcrumed at 18 on the main frame and provided with a roller or other stud 19 constituting a follower to cooperate with an actuator, shown as a traverse-cam 20 having three points, Fig. 2, the weight 21 connected with the builder-arm counter-balancing the weight of the parts thereon and maintaining the follower in engagement with the cam.

As shown in Figs. 2, 3-5, the builder-arm for the greater portion of its length is C-shaped in cross-section, the upper and lower parallel flanges being longitudinally grooved at 22 to form guideways for the top and bottom of the traveler or traverse-changer 16, as clearly shown in Fig. 4, retaining plates 23 maintaining the traveler in position while permitting movement thereof longitudinally of the builder-arm. Manifestly the builder-arm has a constant stroke, hence it follows that the farther away the traverse-shifter 16 is moved from the fulcrum 18 the greater the amplitude of movement of the ring-rail, and vice versa, so that if the winding operation starts with the traverse-changer at its extreme inward position, Figs. 2 and 3, the minimum traverse will be given to the ring-rail.

The starting point for the traverse-changer

16 is determined by means of a headed stop-pin 24 adapted to be inserted in any one of a series of holes 25 (see dotted lines Fig. 3,) in the top flange of the builder-arm, the lower end of the pin being adapted to engage an abutment 26 on the traverse-changer and thereby limit its movement when winding-back is effected.

By placing the stop-pin in one of the holes more to the left, Fig. 3, the starting point of the ring-rail will be raised more or less with relation to the butt or head of the yarn-receiver or bobbin, to thereby adjust the beginning of the winding of yarn thereupon, and after the stop-pin has been properly set the starting point of the winding will remain the same as one set of bobbins after another is wound, the traverse-changer 16 being stopped at the same point upon winding back.

Inasmuch as the traverse-changer moves outward along the builder-arm throughout the winding the guide-sheave 12 is pivotally mounted to avoid any cramping or twisting of the chain 10.

Referring to Fig. 2 it will be seen that the chain 10 leads tangentially from the periphery of the drum 13 up to the sheave 12, which swings on the stud 12*, and as the traverse-changer moves outward the chain will gradually approach a vertical line intersecting the stud, so that as the angle between the chain and such vertical line gradually decreases there will be a slight decrease in the distance between the sheave 12 and the point on the drum at which the chain leaves it. So, too, as the traverse-changer continues its outward movement beyond the vertical line through the stud 12* the distance between the sheave 12 and the point at which the chain 10 leaves the drum will slightly increase. Hence, during the gradual decrease in such distance there will be a gradual increase in the gain, and thereafter a gradual decrease in the gain as the distance referred to increases, but in each case in actual practice such variations in the gain are so small as to be hardly appreciable.

As the gain in the apparatus forming the subject-matter of this application is started at a maximum, and gradually decreased throughout the winding, as will be explained hereinafter, it is only necessary to make the initial maximum gain large enough to compensate for the variations just pointed out, so that the change in the position of the traverse-changer with relation to the stud 12* can in practice be disregarded.

The builder-arm has transverse end-plates 27, 27* secured fixedly to the upper and lower flanges, which plates provide bearings for an elongated shaft 28 spirally threaded at 29 to pass through and engage a threaded hole 30, Fig. 4, in the traverse-changer. so

that rotation of said shaft will slide said traverse-changer longitudinally along the builder-arm.

At its outer end, beyond the plate 27*, a ratchet 31 is secured to the shaft 28, the ratchet being intermittingly engaged and rotated step-by-step by a pick-pawl 32 fixedly connected with the lower end of an upright rod 33 held adjustably by set-screw 34 in a holder 35 pivoted at 36 to a bracket 37 secured to the main frame, Figs. 1 and 2.

On each up-stroke of the builder-arm the pick-pawl engages and advances the ratchet, and thereby turns the shaft 28 to effect a slight outward movement of the traverse-changer 16 along the builder-arm, but as the pawl is arranged to impart a gradually decreasing advance movement to the ratchet it is pivotally hung, as has been described, for reasons which will appear hereinafter.

A stop 38 on the bracket 37 is arranged to cooperate with the holder 35 and prevent movement of the pick-pawl 32 to the right, viewing Fig. 1, while said pawl can move in the opposite direction about the fulcrum 36 as a center.

The builder-arm has rigidly attached to it by lateral brackets 39 a longitudinal rack-bar 40 offset far enough to bring its teeth into mesh with the drum-gear 14, so that as the traverse-changer 16 gradually moves the winding-drum 13 toward the free end of the builder-arm the cooperation of the rack-bar and said gear 14 will slowly rotate the drum to let off the chain 10 and effect the principal "gain" of the traverse. Thus the angular movement of the drum about its pivotal support 15 determines, in the main, the amount of gain, such movement of the drum overcoming or compensating for the slight variations in the gain due to the change in the position of the drum relatively to the stud 12*, hereinbefore referred to, and the amplitude of angular movement of the drum upon the support 15 is directly dependent upon the extent of each advance of the traverse-changer 16 away from the fulcrum 18 of the builder-arm. So, too, such advance will depend directly upon the rotative movement of the threaded shaft 28 imparted to it by each operative engagement of the pick-pawl and the ratchet 31, and by making the initial or maximum action of the pawl and ratchet large enough the gain as a whole will be controlled absolutely by or through the angular movements of the drum.

Now the length of the traverse depends upon the position of the traverse-changer with relation to the fulcrum of the builder-arm, and as the traverse-changer is moved step-by-step away from such fulcrum from the beginning to the end of the winding operation it will be obvious that the traverse gradually increases in length, but of course with a very small increment. This incre-

ment is not of itself sufficient, with the slow letting off of the chain, ordinarily resulting from the action of the winding mechanism to lay the yarn properly at the beginning of the winding, as has been stated, and therefore I have provided means to start the winding with the maximum gain and gradually to decrease the gain automatically as the winding proceeds at the same time overcoming or compensating for the slight irregularity or variation in the gain previously noted.

A slightly bent lever 41 is adjustably fulcrumed at 42 on the builder-arm between its upper and lower flanges and near the plate 27, the under edge of said lever resting upon a rounded and rearwardly extended cam-rib 43 on the traverse-changer 16, the fulcrum-stud 42 being fixed in position in the vertical slot 44 by a nut 45, see Fig. 5. Said lever 41 extends along the builder-arm nearly to the end plate 27* and is then turned laterally to present a foot 46, which is arched to extend across and clear the threaded shaft 28, as clearly shown in Fig. 5, the extremity of the foot having a slot 47 in which is secured a headed stud 48, held in adjusted position in the slot by a check-nut 49. The foot 46 is long enough to bring the stud beyond the edge of the end plate 27*, as shown in Fig. 3.

The ratchet 31 has an elongated hub 31*, Fig. 3, embracing the projecting end of shaft 28, and upon said hub is rotatably mounted a collar 50, separately shown in Fig. 7, having a head 51 provided with a radial extension 52 having a slot 53 into which the stud 48 extends, the headed collar forming a support for the shield.

The shield 54 is shown as curved and overhanging the ratchet 31 at the right of the pick-pawl 32, Fig. 1, the shield being mounted on an arm 55 secured to or forming part of a hub 56 which embraces the collar 50 between the head thereof and the ratchet, said hub carrying a set-screw 57, see dotted lines Fig. 6, by means of which the hub and the collar are fastened together to turn as a unit.

In Figs. 1, 3 and 6 the shield is shown in the position assumed at the beginning of the winding operation, the traverse changer 16 then being at the right-hand end of its stroke, nearest the fulcrum of the builder-arm, and the lever 41 has its foot 46 and the stud 48 in their lowest positions.

Referring to Figs. 1 and 6 it will be apparent that when the shield is in the position shown the pick-pawl 32 will exert its greatest effect upon the pawl 31 and will effect the greatest angular movement thereof on the up-stroke of the builder-arm, because the maximum number of ratchet teeth are exposed to the action of the pawl as the builder-arm oscillates. If, however, the

shield 54 be gradually moved to the left, Figs. 1 and 6, the number of ratchet teeth exposed to the action of the pawl will be decreased, and consequently the pawl will effect a gradually decreasing angular movement of the ratchet and connected parts. That is, the shield will be brought into engagement with the pick-pawl and will push the latter away from a vertical line through the axis of the shaft 28, so that the pawl can take up a less number of teeth of the ratchet 31, and such movement of the pawl by the shield is permitted by mounting the pawl-rod 33 to swing about the pivot 36 as a fulcrum. As the shield may be set by hand, through the medium of the set-screw 57, the angular movement of the ratchet at the beginning of the winding can be increased or decreased at will, according to circumstances, and to properly compensate for the variation in the gain due to outward movement of the drum, but whatever the initial set of the shield there will be a gradual diminution in the step-by-step movement of the ratchet from the maximum.

Inasmuch as the rotation of the ratchet controls not only the advance of the traverse-shifter 16 but the rotation of the drum 13 to effect the desired "gain" of the traverse the operation will be understood with a brief description of the winding, starting at the commencement thereof.

On the up-stroke of the builder-arm 17 the ring-rail rises and the ratchet 31 is advanced the maximum amount and turns the threaded shaft 28 correspondingly, so that the maximum linear feed of the traverse-changer is effected, and thereby the coöperation of the gear 14 and Tack 40 will impart the maximum rotative movement of the drum 13, to let off the chain 10 and impart the maximum "gain" to the traverse. At the same time the traverse is increased because of the feed of the traverse-changer away from the fulcrum of the builder-arm, but as the cam-rib 43 is thereby moved to the left, Fig. 3, the lever 41 will be acted upon and its foot 46 will be given a slight rise. This causes the stud 48 to impart a small angular advance to the collar or shield-support 50 in the direction of the arrow 100, Fig. 6, and the shield 54 is moved in the same direction, to uncover a smaller portion of the ratchet 31 to the action of the pick-pawl 32. Consequently the angular movement of the ratchet will gradually decrease in amplitude as the winding proceeds, and as the intermittent rotation of the threaded part 29 of the shaft 28 is correspondingly decreased the feed movement of the traverse-changer 16 gradually decreases.

The shorter the feed of the traverse-changer the less amount of chain given off from the winding drum 13, and therefore the less the "gain", so that while the gain

starts at its maximum it is gradually decreased as the winding progresses, notwithstanding the change in the position of the drum relatively to the stud 12*, and the traverse gradually increases, due to the feed of the traverse-changer away from the fulcrum of the builder-arm. The diminishing "gain" thus acts in connection with the increasing traverse to lay the yarn upon the yarn-receiver or bobbin *b*, Fig. 8, with a taper from the lower end of the yarn-mass upward, as at *m*, to the substantially cylindrical body portion *m** of the yarn-mass, with an inward taper *m'* at the upper end thereof. A full winding of yarn is secured with the yarn-mass of the desired shape, and so laid that the yarn draws off smoothly and evenly down to the very beginning of the winding, the layers at the beginning of the winding being laid smoothly one over the other by reason of the greater gain at the beginning.

When the traverse-changer 16 is set farther to the left at the beginning of the winding, Fig. 3, by shifting the stop-pin 24 to one of the holes 25 more to the left, the cam-rib 43 will be changed in position with relation to the lever 41, and to preserve the proper relation between such parts the fulcrum 42 of the lever will be slightly raised in the slot 44.

By setting the stud 48 toward or away from the center of the shaft 28 the angular movement of the shield 54 will be increased or diminished, respectively, for a given rise of the stud as the lever 41 is swung up about its fulcrum by the feed of the traverse-changer, to thereby retard or hasten the rate of change in the "gain".

As to the traverse, while it is gradually increasing throughout the winding, its rate of increase is gradually decreasing, for it must be remembered that the steps by which the traverse-changer is fed toward the outer end of the builder-arm are greatest at the beginning of the winding and gradually decrease in length as such winding proceeds.

In view of the foregoing description and explanation of the operation of certain parts of the apparatus, having more particular reference to the "gain" of the traverse and its control, it will be manifest that the gain is controlled, broadly, by means mounted on the builder-arm and acting upon the ring-rail through the connection between the latter and the builder-arm.

This apparatus does not wind what is technically known as a "bunch" by a preliminary winding of the yarn, as is done by some other builder-motions, the yarn-mass being completed by a main or service winding, but in actual practice the first few layers of yarn laid upon the yarn-receiver by the present apparatus can in practice be utilized in a "feeler" loom to perform the func-

tions of the "bunch" so far as the coöperation with the feeler is concerned, and without the objections sometimes attendant upon the true bunch formation.

5 Various changes or modifications may be made by those skilled in the art without departing from the spirit and scope of my present invention as set forth in the claims annexed hereto.

10 Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In apparatus of the class described, a builder-arm having a constant stroke, a reciprocating ring-rail, a connection between it and the builder-arm, and controlling means acting through such connection to effect reciprocation of the ring-rail with a gradually increasing traverse and to gradually decrease the gain, said controlling means being mounted on the builder-arm and including a member movable longitudinally thereof.

2. In apparatus of the class described, an oscillating builder-arm having a constant stroke, a winding-drum carried by and movable longitudinally of the builder-arm, a reciprocating ring-rail, a connection between it and the drum, to effect the reciprocation of the rail by or through oscillation of the builder-arm, means to move said drum gradually away from the fulcrum of said builder-arm to thereby gradually increase the traverse, and means to effect rotation of the drum by a series of angular movements gradually decreasing in amplitude, to thereby control and gradually decrease the gain of the traverse.

3. In apparatus of the class described, a reciprocating ring-rail, an oscillating builder-arm having a constant stroke, a winding-drum, means to move it bodily step-by-step along the builder-arm away from the fulcrum thereof, to gradually increase the traverse of the ring-rail, means to effect an angular movement of the drum at each bodily advance thereof proportional to the length of the bodily advance, a connection between the drum and the ring-rail, and an instrumentality to cause the bodily advances of the drum to decrease in length gradually from the beginning of the winding, whereby the angular movements of the drum are gradually decreased and the gain of the traverse is controlled and correspondingly diminished from the beginning of the winding.

4. In apparatus of the class described, in combination, an oscillating arm, a reciprocating ring-rail, means to control its reciprocation to effect a winding of yarn upon a yarn-receiver with a traverse gradually increasing from the beginning to the end of the winding, and means to start the winding with the maximum gain and to decrease the

gain gradually thereafter until the winding is completed, one of said means including a member movable longitudinally of said arm and the other of said means including a member coöperating with the first-named member and having imparted to it thereby a swinging movement on the arm, the coöperation of said members causing the operation of one means to effect the operation of the other means.

5. In apparatus of the class described, a builder-arm having a constant stroke, means carried by the builder-arm and controlled by oscillation thereof to effect automatically the winding of yarn upon a yarn-receiver with a traverse gradually increasing until the winding is completed, and means to start the winding with the maximum gain and gradually and automatically decrease the gain until the winding is completed.

6. In apparatus of the class described, means to effect the winding of yarn upon a yarn-receiver with a traverse gradually increasing from the minimum, means acting contemporaneously to control and gradually decrease the gain from its maximum, and a common actuator for said means, combined with an oscillating builder-arm on which both of said means and the actuator are mounted.

7. In apparatus of the class described, an oscillating builder-arm having a constant stroke, a traverse-changer longitudinally movable upon the arm, a drum and attached gear rotatably mounted on the traverse-changer, a rack in mesh with the gear and fixed on the builder-arm, to effect rotation of the drum when the traverse-changer is moved longitudinally of the arm, a reciprocating ring-rail, means including a flexible member, connecting it with the drum, to govern reciprocation of the ring-rail, and means to intermittently move the traverse-changer away from the fulcrum of the builder-arm and thereby gradually increase the traverse of the ring-rail, combined with an instrumentality coöperating with said means to gradually decrease the length of the intermittent movements of said traverse-changer and thereby decrease gradually the angular movements of the drum, whereby the gain of the traverse starts at the maximum and gradually decreases.

8. In apparatus of the class described, an oscillating builder-arm having a constant stroke, winding mechanism bodily movable longitudinally upon the builder-arm, a chain connecting said mechanism with the ring-rail to govern its movement, a reciprocating ring-rail, means to cause the winding mechanism to let off the chain proportionately to the length of bodily movement of said mechanism upon the builder-arm, and govern the gain of the traverse, and means to effect such bodily movement of

said mechanism by a series of successive steps gradually decreasing in length, whereby the traverse is gradually increased and the gain gradually decreased.

5 9. In apparatus of the class described, an oscillating builder-arm having a constant stroke, winding mechanism bodily movable longitudinally upon the builder-arm, a chain connecting said mechanism with the
10 ring-rail to govern its movement, a reciprocating ring-rail, means to cause the winding mechanism to let off the chain proportionately to the length of bodily movement of said mechanism upon the builder-arm, to
15 govern the gain of the traverse, and means to effect such bodily movement of said mechanism by a series of successive steps gradually decreasing in length, whereby the traverse is gradually increased and the gain
20 gradually decreased, said latter means including a ratchet and an actuating pawl, and an instrumentality acting automatically to gradually diminish the effective cooperation of the pawl and ratchet, the extent to
25 which the chain is let off compensating for variation of the gain due to a change in the position of the winding mechanism on the builder-arm.

10. In apparatus of the class described,
30 an oscillating builder-arm having a constant stroke, winding mechanism bodily movable longitudinally upon the builder-arm, a chain connecting said mechanism with the ring-rail to govern its movement, a reciprocating ring-rail, means to cause the winding
35 mechanism to let off the chain proportionately to the length of bodily movement of said mechanism upon the builder-arm, to govern the gain of the traverse, and means to effect such bodily movement of said mechanism by a series of successive steps
40 gradually decreasing in length, whereby the traverse is gradually increased and the gain gradually decreased, said latter means including a ratchet and an actuating pawl therefor, a shield to control the number of ratchet teeth taken up by the pawl, and a device to position said shield automatically and gradually reduce the number of ratchet
45 teeth to be taken up by said pawl.

11. In apparatus of the class described, a reciprocating ring-rail, a builder-arm, a winding drum bodily movable longitudinally along the builder-arm and also axially
55 movable, a chain attached to the drum and operatively connected with the ring-rail, means to effect intermittent bodily movement of the drum step-by-step along the builder-arm, away from its fulcrum, to
60 gradually increase the traverse of the ring-rail, other means to cause intermittent axial movement of the drum and let off the chain, to thereby effect the gain of the traverse, an instrumentality acting through the first-named means to cause the second-named

means to gradually decrease the axial movements of the drum and thereby gradually decrease the gain, the amplitude of the axial movements of the drum compensating for variation in gain due to changes in the position of the drum upon the builder-arm. 70

12. In apparatus of the class described, in combination, a reciprocating ring-rail, means to control its reciprocation to effect a winding of yarn upon a yarn-receiver with a traverse gradually increasing from the beginning to the end of the winding, and means controlled by or through the operation of the first-named means to start the winding with the maximum gain and to gradually decrease
75 the gain as the traverse increases. 80

13. In apparatus of the class described, a reciprocating ring-rail, a builder-motion including a builder-arm and a winding mechanism longitudinally movable thereon and operatively connected with and to control the reciprocation of the ring-rail, and means controlling the winding mechanism to effect automatically a gradual increase of the traverse, and a gradual decrease of the gain of the traverse, from the beginning to the end of the operation of winding yarn upon a yarn-receiver. 85 90

14. In apparatus of the class described, a reciprocating ring-rail, a builder-motion including a winding mechanism operatively connected with and to control the reciprocation of the ring-rail, and means controlling the winding mechanism to effect automatically a gradual increase of the traverse, and to cause a gradual decrease of the gain of the traverse, from the beginning to the end of the operation of winding yarn upon a yarn-receiver, and manually adjustable means to increase or decrease the rate of change in the traverse and gain. 95 100 105

15. In apparatus of the class described, a reciprocating ring-rail, a builder-motion including an oscillating builder-arm and a winding mechanism thereon bodily movable
110 lengthwise of the arm and operatively connected with and to control the reciprocation of the ring-rail, means to move said mechanism intermittently away from the fulcrum of the builder-arm to gradually increase the traverse, means governed by such bodily movement to cause the winding mechanism to control and gradually decrease the gain of the traverse, and a manually adjustable instrumentality to vary the rate of change in the traverse and thereby to vary proportionately the rate of change in the gain. 115 120

16. In apparatus of the class described, an oscillating builder-arm having a constant stroke, a threaded shaft thereon having an attached ratchet, a winding drum moved longitudinally of the builder-arm by rotation of the shaft, a reciprocating ring-rail, operating connections, including a flexible member, between it and the drum, to control
125 130

the reciprocation of the ring-rail, means to rotate the drum when it is moved bodily, to let off said flexible member, a pawl to co-operate intermittingly with and effect angular movement of the ratchet, to thereby turn the shaft and effect bodily feed of the drum away from the fulcrum of the builder-arm, and an instrumentality governed by such bodily feed to gradually decrease the angular movements of the ratchet and threaded shaft, whereby the intermittent rotative movements of the drum are gradually decreased and the gain of the traverse is gradually diminished, gradual bodily feed of the drum correspondingly increasing the traverse.

17. In apparatus of the class described, an oscillating builder-arm having a constant stroke, a threaded shaft thereon having an attached ratchet, a traverse-changer engaged by said shaft and moved intermittingly by rotation thereof along the builder-arm away from its fulcrum, to gradually increase the traverse, a winding drum rotatably mounted on the traverse-changer, operating connections, including a flexible member, between the drum and the ring-rail to control the reciprocation of the latter, means to rotate the drum when the traverse-changer is moved along the builder-arm, to let off the flexible member and effect the gain of the traverse, a pawl to co-operate intermittingly with the ratchet and rotate the shaft, a shield to determine the effective co-operation of the pawl and ratchet at each engagement thereof, and a lever fulcrumed on the builder-arm and operatively connected with the shield to position the latter, the traverse-changer engaging and rocking the lever to gradually advance the shield and thereby decrease the action of the pawl upon the ratchet.

18. In apparatus of the class described, means to effect the winding of yarn upon a yarn-receiver with a traverse gradually increasing from minimum at the beginning to maximum at the end of the winding, means to gradually decrease the gain of the traverse throughout the winding, a common actuating instrumentality for both of said means, and a device manually adjustable to vary the rate of change of the traverse and the gain.

19. In apparatus of the class described, means to effect a winding of yarn upon a yarn-receiver with a traverse gradually increasing from the beginning of the winding to the end thereof, means to govern the gain of the traverse, and mechanism controlled by the operation of the first-named means to effect the operation of the second-named means and cause latter to gradually diminish the gain from maximum at the beginning, to minimum at the end, of the winding.

20. In apparatus of the class described, means to effect the winding of yarn upon a yarn-receiver with a traverse gradually increasing from minimum at the commencement, to maximum at the completion, of the winding, means to impart gain to the traverse gradually decreasing from maximum to minimum throughout the winding, and manually adjustable means to increase or decrease the rate of change in the traverse and gain.

21. In apparatus of the class described, means to effect the winding of yarn upon a yarn-receiver with a traverse gradually increasing from the commencement to the completion of the winding, and means acting contemporaneously with said first named means and controlled by the operation thereof to impart gain to the traverse varying in an inverse ratio to the variations in the length of the traverse throughout the winding operation.

22. In apparatus of the class described, means, including a builder-arm, and a member movable longitudinally thereon to effect automatically the winding of yarn upon a yarn-receiver with a traverse gradually increasing throughout the winding, an instrumentality to gradually and automatically reduce the gain of the traverse as the traverse gradually increases, and an actuator co-operating with the builder-arm and imparting thereto a constant stroke.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

ALONZO E. RHOADES.

Witnesses:

LELAND K. WHITING,
E. D. OSGOOD.