

A. E. RHOADES.
TRAVERSE MOTION FOR YARN SPINNING APPARATUS.
APPLICATION FILED OCT. 8, 1908.

941,648.

Patented Nov. 30, 1909.

3 SHEETS—SHEET 1.

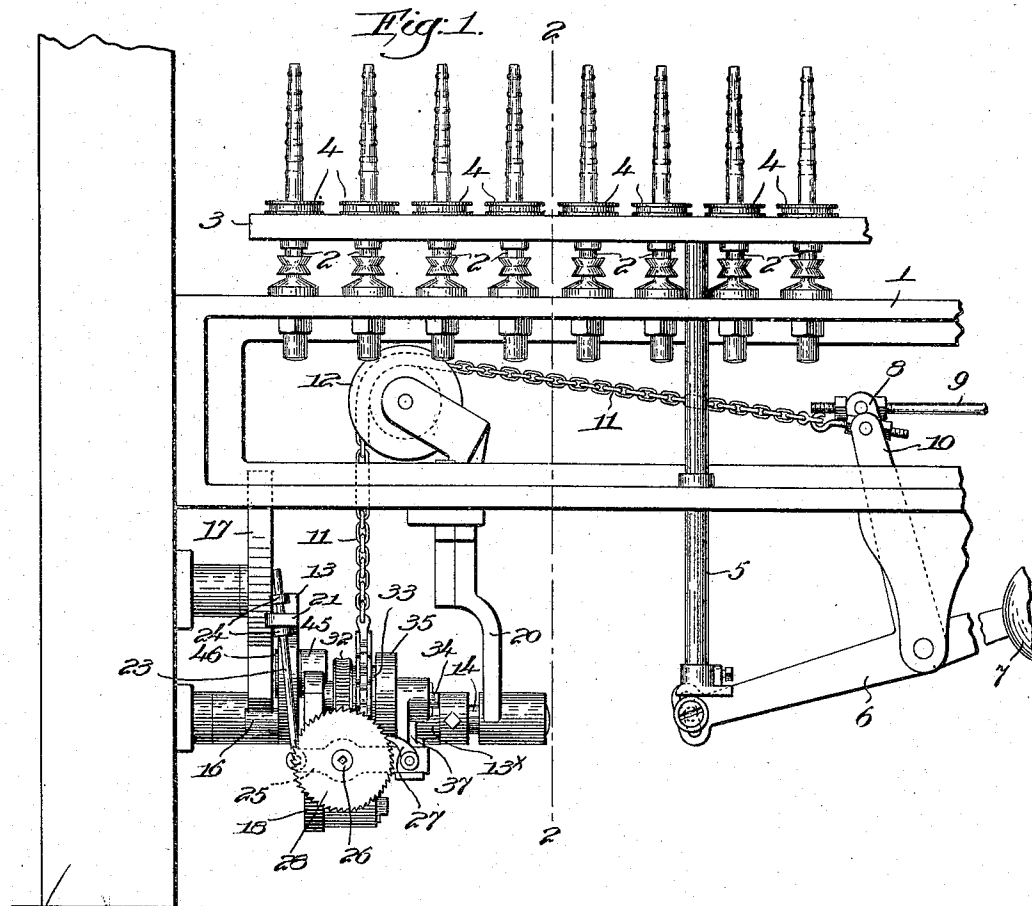
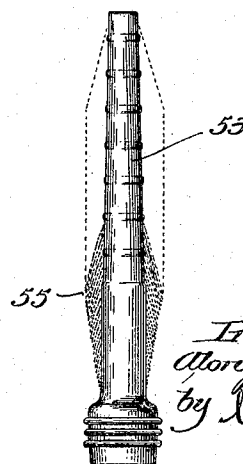


Fig. 9.



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Fig. 10.

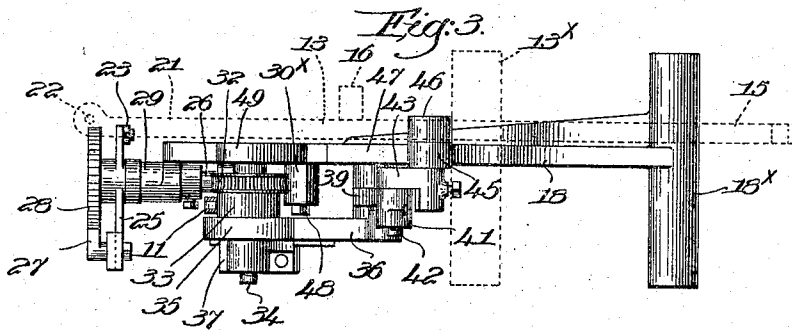
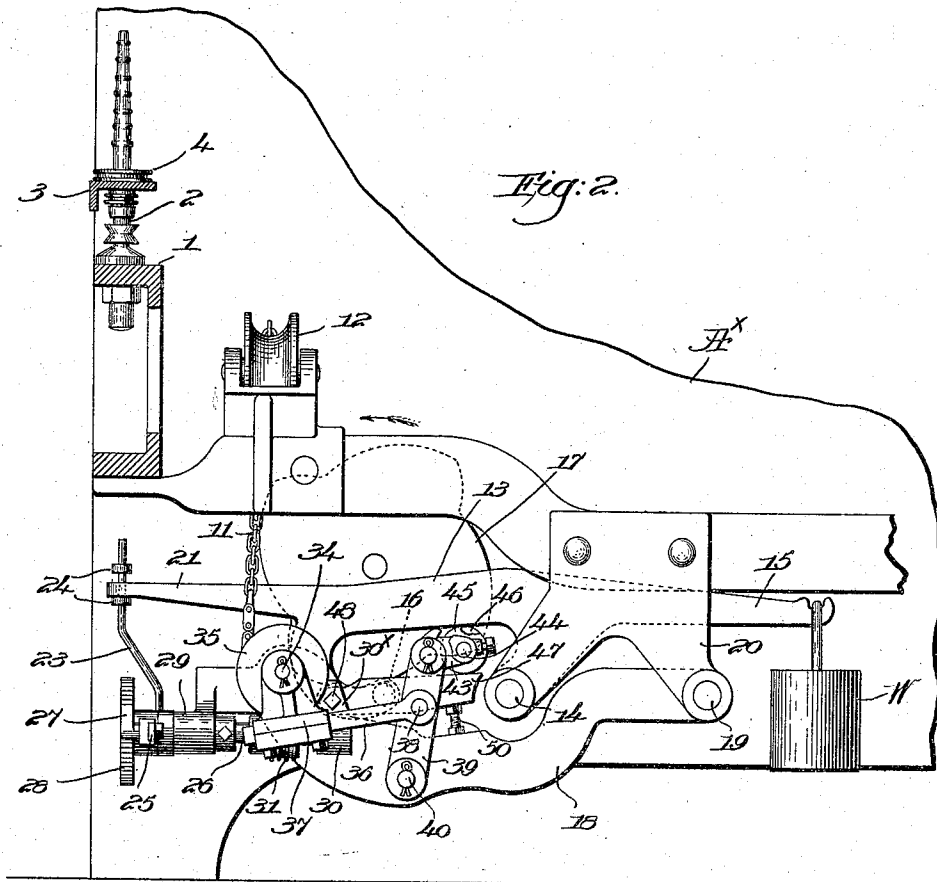


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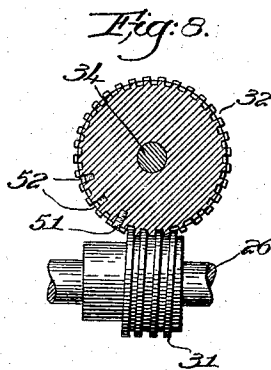
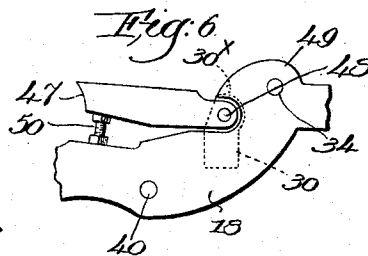
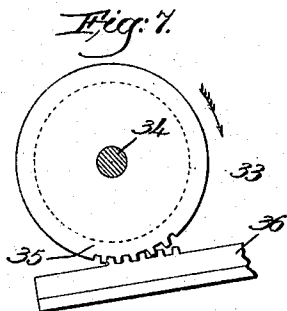
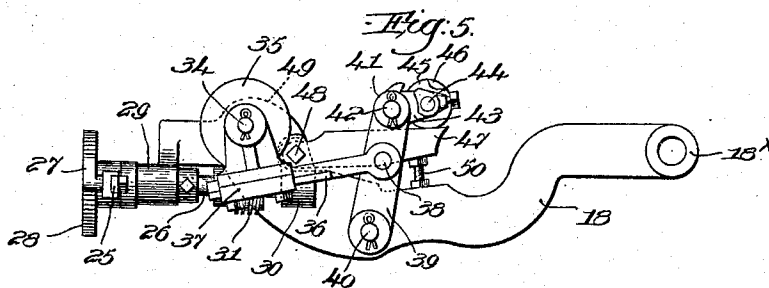
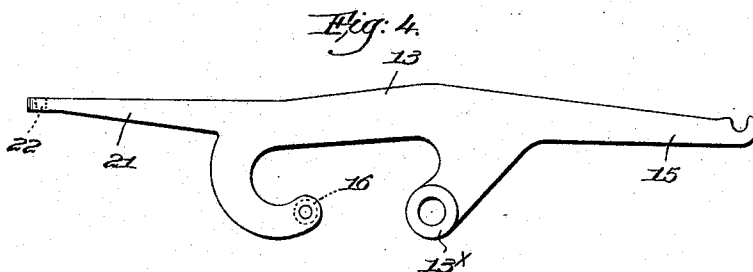
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

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TRAVERSE-MOTION FOR YARN-SPINNING APPARATUS.

941,648.

Specification of Letters Patent.

Patented Nov. 30, 1909.

Application filed October 8, 1908. Serial No. 456,716.

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 has for its object the production of a novel traverse motion for use in connection with yarn spinning apparatus, whereby the reciprocation of the ring-rail is so controlled that the yarn is laid upon a yarn-receiver or bobbin with a primary winding and thereafter with a main or service winding to complete the upbuilding of the yarn-mass.

Heretofore spinning apparatus has been devised to lay the primary winding in the form of a relatively well-defined bunch, for particular cooperation with a filling-feeler when such bobbins were used in an automatic filling-replenishing loom, as for instance in my prior United States patents Nos. 686,906, 722,145 and 798,704, and in a later form of spinning apparatus the winding is so governed and controlled that the distinctive "bunch" is modified to such a degree that certain practical objections thereto are overcome. This later apparatus forms the subject matter of United States Patent No. 882,793 granted to Jonas Northrop March 24, 1908 and by such apparatus a bobbin is built having a short traverse at the lower end or butt, lengthening into a normal or maximum traverse somewhere between the top and bottom of the bobbin, and continuing with the latter traverse until the yarn-mass is completed.

In my present invention I also start the winding with a short traverse and gradually increase the same up to a predetermined point, after which the winding is completed with a traverse of uniform length, but I accomplish the desired result by novel and very simple mechanism and my invention differs from that of Northrop in certain particulars to be pointed out hereinafter. Herein the speed of the traverse, during one reciprocation of the ring-rail, is uniform throughout the period of increasing traverse, as well as afterward, while in the Northrop structure the traverse, while in-

creasing in length, moves more slowly toward the upper end of the stroke of the ring-rail and lays more yarn at such part. This reduction in the speed is for the purpose of laying more yarn than would be laid otherwise, and to thereby obviate the building of a pear-shaped bobbin.

In apparatus of this general character it is well understood that whether the stroke of the ring-rail be longer or shorter it is effected in the same time, and a certain fixed amount of yarn is laid on the bobbin at each traverse, so that obviously the shorter the traverse the greater the number of superposed layers of yarn laid upon the bobbin. This must be corrected when the winding is begun with a short traverse, as in my present invention, or else too much yarn will be laid at the lower end of the bobbin, and I have corrected or avoided the objection in a novel and effective way, by varying the action of the so-called "pick mechanism". This mechanism governs the "gain" of the traverse, whereby the ring-rail gradually rises a little higher on the up stroke and descends not quite so low on the downstroke, as is well understood by those skilled in the art. Herein I vary the "gain" inversely to the length of the traverse, so that when the traverse is shortest the gain is greatest, the latter diminishing gradually from its maximum as the traverse increases from its minimum, until uniform or constant traverse is reached, at which point the gain becomes uniform and so continues until the winding is completed. This initial maximum gain, in connection with the initial minimum traverse, to prevent too much yarn being laid at the lower or butt end of the yarn-receiver or bobbin, is new so far as I am aware, as well as the mechanism for effecting the variations in the traverse and in the gain.

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 spinning-frame having one embodiment of my invention applied thereto, the ring-rail being shown at its lowest point and with the apparatus in readiness to begin the winding of a set of bobbins; Fig. 2 is a transverse sectional view on the line 2—2, Fig. 1, look-

ing toward the left; Fig. 3 is a top plan view of the major part of the builder-motion shown in Fig. 2, but with the actuating cam omitted and with the lever with which it
 5 directly coöperates indicated by dotted lines; Fig. 4 is a side elevation of the member or lever of the compound builder-motion which coöperates directly with the actuating cam and which has a constant stroke; Fig. 5 is
 10 a similar view of the other member or lever of the builder-motion which has a variable stroke, together with the parts carried by said member; Fig. 6 is a detail of a portion of the member having the variable stroke,
 15 viewed from the opposite side; Fig. 7 is an enlarged side elevation of a mutilated gear and coöperating rack forming a part of the traverse shifting or changing means, to be referred to; Fig. 8 is an enlarged detail of
 20 the worm and worm-gear forming a part of the builder-motion, the worm-gear being shown in section; Fig. 9 is a side elevation of a bobbin with a small portion of yarn wound thereupon, shortly after the begin-
 25 ning of the winding operation; Fig. 10 is a similar view but showing in section the winding with the increasing traverse finished, the completed or full bobbin being shown by dotted lines.

30 I have shown my invention as applied to a spinning apparatus wherein the ring-rail is raised by a lifting-weight and depressed by or through means actuated and controlled by the builder-motion, the winding mechanism thereof gradually letting off the chain
 35 from the barrel to effect the "gain" of the traverse as the winding proceeds, and after the maximum traverse is reached said winding mechanism operates substantially in the
 40 usual manner. Prior to such time, however, the winding mechanism operates in a novel manner, imparting the maximum gain at the beginning of the winding and gradually decreasing it to a constant amount by the
 45 time the gradually increasing traverse attains its maximum, as will be explained in detail.

The spindle-rail 1, spindles 2, vertically reciprocating ring rail 3 having suitable
 50 rings 4, the lifter-rods, as 5, rocker 6 co-operating therewith and provided with a lifting-weight 7, Fig. 1, to elevate the ring-rail, the rocker-arm 8 and transmitting link 9 may be and are all substantially of well
 55 known construction. Rocker 8 has a branch 10 to which is adjustably attached a flexible connection or chain 11 passing over a guide-sheave 12 and thence down to the winding drum of the builder-motion, as will appear
 60 hereinafter.

The builder-motion in accordance with my invention is compound and comprehends two separate members or levers 13 and 18, the member 13 having a fixed fulcrum 14 and
 65 being provided with an extension 15 on one

side of the fulcrum and with a roller or other stud 16 at the opposite side of said fulcrum, said stud constituting a follower to coöperate with a single actuator, shown
 in Fig. 2 as a traverse-cam 17 having four
 70 points, a weight W on the extension 15 keeping the follower in engagement with the cam. The other member 18 is also made as a lever, having a fixed fulcrum 19 behind but substantially in the same horizontal plane
 75 as the fulcrum 14, the said fulcrum being supported at one end on a bracket 20 rigidly secured to and depending from a part of the main framework of the apparatus, the opposite ends of the fulcrum being supported
 80 in the end A* of the main framework.

As shown in Fig. 3 the lever-members or arms 13 and 18 of the compound builder-motion have elongated transverse hubs 13*, 18* through which the fulcrum shafts extend, preventing any twisting of said mem-
 85 bers and affording a firm and steady support therefor, said members being arranged one above the other but offset laterally, see Fig. 3, so that they oscillate in parallel
 90 vertical planes. The member or arm 13 has a constant stroke, as will be apparent, due to coöperation of its follower 16 with the actuating cam 17, but the member or arm 18, while oscillated by or through the member
 95 13 has a variable stroke, as will be explained, said members 13 and 18 thus having a differential movement. The front end of member 13 is extended at 21 and has a hole 22 through which loosely passes a rod 23 provided above and below the extension 21 with
 100 fixed collars 24, the lower end of the rod being connected with a pawl-carrier 25 fulcrumed on the pick-shaft 26, the actuating or pick-pawl 27 coöperating with the pick-
 105 wheel 28 fast on said shaft 26 to rotate the same by rocking movement of the pawl-carrier.

The pick-shaft is mounted in bearings 29, 30 on the member 18 and has fast upon it the
 110 usual worm 31 meshing with the worm-gear 32 fixedly connected with the drum 33 of the winding mechanism, to which drum the end of the chain 11 is secured, the chain passing around the drum and being gradu-
 115 ally let off therefrom as the operation of laying the yarn on the bobbins proceeds, said drum and gear being rotatably mounted on a lateral stud 34 extended from the mem-
 120 ber 18.

It will be seen that in the present embodiment of my invention there is but a single transmitting connection, viz: the chain 11, between the builder-motion and the ring-rail, which greatly simplifies the
 125 structure, the control of the rail as to traverse and gain being located in the builder-motion and being transmitted through the connection 11.

A mutilated gear 35 is fixedly secured to 130

or forms a part of the drum at its outer end, said gear coöperating with the teeth of a rack-bar 36 longitudinally slidable in a guide-box 37 pivotally mounted on the stud 5 34 outside the mutilated gear. As the worm-gear, drum and mutilated gear 35 are rotated in the direction of the arrow, Fig. 7, the rack-bar 36 will be moved forward and such movement effects the change or shift 10 in the traverse, as will now be explained. The rear end of the rack-bar is pivotally connected at 38 with an upturned link 39 fulcrumed at its lower end on a lateral stud 40 on the member 18 of the builder-motion, 15 the upper end of the link having a lateral boss 41 forming a bearing for a pin 42 extended laterally from a short roll-carrying arm 43. Said roll-carrier has fixedly secured to it a horizontal stud 44 on which 20 are mounted rotatably side by side two like rolls 45, 46, Fig. 3, the latter extending beneath the member 13 and coöperating therewith, while the roll 45 bears upon a rest made as an arm 47 pivotally connected at 25 48 with the enlargement 49 of the member 18 and being sustained at its free end by an adjusting screw 50. The rest 47 is movable in unison with the member 18 at all times, the adjusting screw 50 being used to take 30 up any wear or undue looseness, and to keep said rest in proper position with relation to the rolls 45, 46 and the under side of the member 13 of the builder-motion, and to control the amount of yarn in the primary 35 winding.

It will be seen by reference to Fig. 3 that the rest is located directly above the top of the member 18, and in Fig. 6 the enlargement 49 of said member is shown as recessed 40 to receive the pivoted end of the rest, the stud-bolt 48 which connects the rest and the enlargement 49 being sustained in the built up portion 30* at the top of the bearing 30.

The winding-back operation is limited in 45 any suitable manner, as by a stop-screw 51 inserted between two of the teeth of the worm-gear 32, Fig. 8, which acts as would a blank portion of the gear when brought into engagement with the worm 31, and in 50 order to make some variation in the winding-back the gear is shown as provided with additional sockets 52 for the stop-screw.

The weight 7 acts through the chain 11 to lift the free end of the member 18 of the 55 builder-motion and press the rest 47 against the roll 45, and to keep the roll 46 pressed against the underside of the member 13, hence it will be apparent that when the latter member is depressed it will act 60 through the rolls 45, 46 and the rest 47 to depress the member 18. As said members have different fulcra it will be obvious that said members will not move in unison, and it will be equally obvious that this differential 65 movement will depend upon the position of

the rolls 45, 46 of the traverse-shifting means, such means comprising the said rolls, the roll-carrier 43 and the link 39. The stroke of the member 13 is constant, as it is 70 oscillated by direct coöperation with the actuating cam 17, and the nearer the shifter rolls 45, 46 are to the fulcrum 14 the shorter will be their path of movement, and consequently the stroke of the member 18 as it 75 oscillates about its fulcrum 19 will be at its minimum when said rolls are in their extreme right-hand position, as shown in Fig. 2, at the commencement of the winding of a set of bobbins, the two members 13 and 18 80 being shown in their lowest position. But as the fulcrum 19 is at a considerable distance behind the fulcrum 14 the member 18 will swing through a much shorter arc than that of the member 13, and hence on the up 85 stroke of the latter its free end will move the faster and away from the free end of the member 18, and on the down stroke the free ends of said members approach each other, this relative movement being at a 90 maximum at the beginning of the winding operation. Consequently the stroke of the pick-pawl 27 will be at its maximum at such time, as the separation of the members 13 and 18 sets the pawl while their approach 95 effects the operative stroke of the pawl, so that the amount of angular movement of the drum 33 will be greatest, letting off the maximum length of the transmitting connection 11. As this letting off of the chain im- 100 parts the "gain" to the traverse it will be manifest that the maximum gain is coincident with the minimum traverse, for the amplitude of the oscillation of the member 18 determines the length of the traverse.

The primary winding of yarn is now laid 105 upon the yarn-receiver or bobbin 53, as indicated at 54, Fig. 9, but the intermittent rotative movement of the pick-shaft 26 also acts through the worm and worm-gear to advance the mutilated gear 35 and gradu- 110 ally move the rack-bar 36 to the left, Fig. 2, gradually and of course very slowly swinging the link 39 of the traverse-shifting means in the same direction. This move- 115 ment of said shifting means gradually moves the shifter rolls 45, 46 away from the fulcra of the two members 13 and 18, the effect being to gradually increase the amplitude of movement of said rolls the farther they are removed from the fulcrum 14, and in conse- 120 quence of such shifting the amplitude of oscillation of the member 18 gradually increases, to thereby gradually lengthen the traverse.

The traverse attains its maximum when 125 the complete change in the position of the traverse-shifting means is effected, which occurs when the mutilated gear has moved the rack-bar 36 forward as far as it can, the rack-bar being held in such position, as will 130

be explained. During this gradual increase in the stroke of the member 18 the rolls 45, 46 have been gradually moving away from the fulcrum 19 of the member 18, and as a result the movement of the free ends of the members 13 and 18 toward and from each other has been gradually diminishing, with a corresponding diminution in the "gain", as the amount of chain let off from time to time has been gradually reduced.

The diminishing gain attains its minimum and becomes constant at the time that the increasing traverse reaches its maximum and becomes constant, the primary winding having been completed and presenting substantially the shape shown at 55 in Fig. 10, the secondary or main winding being continued thereafter with a constant traverse and gain.

After the traverse-shifting means has completed its movement there will still be enough relative movement of the oscillating members 13 and 18 to impart the requisite gain, which is constant as the relative movement of the oscillating members is constant.

The length of the initial traverse is determined by the position of the shifter rolls 45, 46 at the beginning of the winding, according to whether they are positioned as shown in Fig. 2 or to the right or left thereof, and as they cannot be changed without a corresponding change in the gain the two functions of the builder-motion will maintain always the proper relationship.

As the shifter rolls are freely and independently rotatable on the stud 44 there is practically no friction between them and the members 13 and 18 of the builder-motion during the oscillation and differential movements of said members.

Both the gain and the traverse are controlled by the builder-motion as a whole, the single connection 11 transmitting the proper changes to the ring-rail, and while the means which effects the gain governs the traverse-shifting means the latter, through the changes in the position of the shifter rolls, has a reciprocal action upon and control over the means which effects the gain.

By making the maximum gain when the traverse is at its minimum the yarn is laid upon the yarn-receiver in such manner that it gradually builds out to the maximum diameter of the yarn-mass, the latter being completed in substantially the form indicated by dotted lines Fig. 10, without an undue quantity of yarn at the lower end of the bobbin, so that the building of a pear-shaped mass of yarn is obviated.

By means of the adjusting screw 50 the angle between the top of the rest 47 and the under side of the arm or member 13 can be varied, and this variation regulates the amount of yarn in the primary winding by lengthening or shortening the time required to change from maximum to minimum gain.

The longer such time the larger the quantity of yarn laid with the gradually increasing traverse, and the shorter such time the less will be the quantity of yarn laid during the period of increasing traverse, as will be manifest.

It will be remembered that as the shifter-rolls 45, 46 move toward the left, Figs. 2 and 5, the movement of the members 13 and 18 toward and from each other gradually diminishes and becomes constant when the shift of said rolls is completed.

Now if the adjusting screw 50 be turned to separate the rear end of the rest 47 and the adjacent part of the member 18 the rest will be turned on its pivot 48, and the greater the separation the greater will be the angle between the top of the said rest and the bottom of the member 13 with which the roll 46 coöperates, said surfaces diverging toward the left, Fig. 2. That being so each forward movement of the shifter-rolls will permit an increased movement of the free end of the member 18 relative to the free end of member 13, as compared with such movement when the angularity of the rest is less, and hence the time when such relative movement becomes constant is hastened. In other words the time during which the gain and the traverse are changing will be shortened, and less yarn will be laid on the yarn-receiver. On the other hand, if the adjusting screw 50 is turned to drop the rear end of the rest 47 toward the member 18 the top of the rest and the roll engaging surface of member 13 will converge toward the left, Fig. 2, so that as the shifter-rolls are moved step by step to the left the time at which the relative movement of the free ends of members 13 and 18 becomes constant will be retarded. Such retardation manifestly increases the period of varying gain and traverse, so that more yarn will be laid upon the yarn-receiver during such period. By the means described the relative quantity of yarn laid in the primary and secondary windings is varied as may be desired. The untoothed or continuous portion of the mutilated gear 35 has a diameter substantially equal to that of a circle which would intersect the teeth half-way between their bases and points, in order to lock the rack-bar 36 in its forward position effected by the coöperation of the teeth of the mutilated gear. That is, during the period of increasing traverse and decreasing gain the rotation of the gear 35 acts to move the rack-bar 36 forward, as has been explained, and thereafter the continued rotation of the gear carries its teeth out of mesh with the teeth on the rack-bar, so that the latter could slide back, if not prevented, while the gear 35 rotates during the completion of the winding. Herein, by making the untoothed part of the gear 35 of greater diameter than the circle

on which the bases of its teeth lie, this un-toothed part is brought against the rear face of the rearmost tooth on the rack-bar after the two sets of teeth disengage, thereby positively preventing any retrograde movement of the rack-bar as the winding is completed.

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-motion including a member having a constant stroke and a member having a variable stroke, a reciprocating ring-rail, a connection between it and the builder-motion, and means coöperating with the said members of the builder-motion to act through said connection and effect reciprocation of the ring-rail with a gradually increasing traverse and gradually decreasing gain to a predetermined point, and thereafter to continue automatically the reciprocation of the ring-rail with a uniform traverse and gain.

2. In apparatus of the class described, a builder-motion including a member having a constant stroke and a member having a variable stroke, a reciprocating ring-rail, a single connection between it and the second-named member of the builder-motion, means whereby the first-named member acts through the second-named member to effect, through said single connection, reciprocation of the ring-rail with a gradually increasing traverse to a predetermined maximum, and thereafter to continue automatically the reciprocation of the ring-rail with a uniform traverse, and an instrumentality to impart the gain to the traverse, gradually decreasing from maximum to minimum during the period of gradually increasing traverse.

3. In apparatus of the class described, a compound builder-motion including two oscillating and differentially movable members, an actuator to oscillate one of said members with a constant stroke, means to vary the differential movement of said members and thereby gradually increase the stroke of the variable member from minimum to a predetermined maximum, a reciprocating ring-rail, a connection between it and said latter member to effect reciprocation of the ring-rail with a gradually increasing traverse to the maximum, and an instrumentality governed by the differential movement of said members to vary the gain inversely to the variation of the traverse.

4. In apparatus of the class described, a compound builder-motion including two oscillating and differentially movable members, an actuator to oscillate one of said members with a constant stroke, means on the other member to cause a gradual increase in the stroke thereof from minimum to maximum, a reciprocating ring-rail operatively connected with said member, whereby the ring-rail is first reciprocated with a

gradually increasing traverse and thereafter with a uniform traverse, and an instrumentality also carried by said variably-oscillating member to gradually and automatically diminish the gain from maximum to minimum during the period of gradually increasing traverse.

5. In apparatus of the class described, a compound builder-motion including two oscillating and differentially movable members, an actuator to oscillate one of said members with a constant stroke, means to vary the differential movement of said members and thereby gradually increase the stroke of the variable member from minimum to a predetermined maximum, a reciprocating ring-rail, a connection between it and said latter member to effect reciprocation of the ring-rail with a gradually increasing traverse to the maximum, and an instrumentality, including a pawl and ratchet actuated and governed by the differential movement of said oscillating members, to gradually diminish the gain of the traverse during the period of gradually increasing traverse.

6. In apparatus of the class described, a compound builder-motion including two oscillating members having fixed and different fulcra, an actuator to oscillate one member with a constant stroke, means acted upon by said member to effect oscillation of the other member with a stroke gradually increasing up to a predetermined maximum, a reciprocating ring-rail, a connection between it and the member having the variable stroke, and mechanism operated by the differential movement of said members to control said means and cause the same to effect the increase in the stroke of the second-named member.

7. In apparatus of the class described, a compound builder-motion including two adjacent, separately fulcrumed members, an actuator to oscillate one of said members with a constant stroke, shiftable means coöperating with said members whereby the other one is oscillated with a gradually increasing stroke up to a predetermined maximum, a reciprocating ring-rail, a connection between it and the member having the variable stroke, whereby the ring-rail is reciprocated with a traverse gradually increasing to a maximum, and an instrumentality to gradually diminish the gain of traverse while the traverse increases, said instrumentality also governing said shiftable means.

8. In apparatus of the class described, means to effect the winding of yarn upon a yarn-receiver with a traverse gradually increasing from minimum to maximum and to complete the winding with the maximum traverse, and means to impart gain to the traverse gradually decreasing from maximum to minimum and to continue the mini-

num gain during the period of maximum traverse, combined with an oscillating member upon which both of said means are mounted, and a connection between said separate means whereby the operation of each is governed by or through the operation of the other.

9. In apparatus of the class described, means, including a builder-motion, comprehending two differentially movable members to effect automatically the winding of yarn upon a yarn-receiver with a gradually increasing traverse to a predetermined maximum, and thereafter to complete the winding with such maximum traverse, an actuator for said means, coöperating directly with one of the said members of the builder-motion, and means to gradually and automatically reduce the gain of the traverse during the period of gradually increasing traverse and thereafter to maintain the gain constant.

10. In apparatus of the class described, means to effect the winding of yarn upon a yarn-receiver with a traverse gradually and uniformly increasing from minimum to maximum and to complete the winding with such maximum traverse, means to impart the gain to the traverse and an instrumentality to govern automatically the change from minimum to maximum traverse and contemporaneously therewith to gradually change the gain from maximum to minimum.

11. In apparatus of the class described, in combination, a builder-motion including a member having a constant stroke, means mounted independently of said member but actuated thereby to effect automatically the formation of a primary winding with a gradually increasing traverse, and thereafter a secondary winding with a uniform traverse, of yarn upon a yarn-receiver, the speed of the traverse throughout a stroke being uniform, and an instrumentality to effect automatically a gradual decrease in the the gain during the period of primary winding.

12. In apparatus of the class described, in combination, a builder-motion including an oscillating member, an actuating device to impart a constant stroke thereto, means mounted independently of but actuated and moved bodily by said member to effect automatically the formation of two successive windings of yarn upon a yarn-receiver, the first winding being laid with a gradually increasing traverse, and with a gradually decreasing gain, the second winding being laid with a uniform traverse and with a uniform gain, and an instrumentality having a bodily movement in unison with said means and directly connected therewith to control the variation in the gain.

13. In apparatus of the class described, in

combination, a builder-motion including an oscillating member having a constant stroke, two different means to effect, respectively, the formation of a winding of yarn upon a yarn-receiver with a traverse gradually increasing from minimum to maximum, and gain of such traverse gradually decreasing from maximum to minimum, one of said means being directly actuated by or through said oscillating member, and a controlling connection between said separate means whereby the operation of one is governed by or through the operation of the other.

14. In apparatus of the class described, in combination, a builder-motion including an oscillating member having a constant stroke, a second member oscillated thereby, two different means mounted on said second member, one of said means causing said second member to gradually increase its stroke to a predetermined point, to thereby effect the formation of a winding of yarn upon a yarn-receiver with a traverse gradually increasing from minimum to maximum, the other of said means being actuated by the differential movement of said oscillating members to gradually decrease the gain during the period of increasing traverse, and a connection whereby the last named means controls the operation of the first-named means.

15. In apparatus of the class described, a builder-motion including an oscillating member having a constant stroke, and means actuated by said member, and including a second oscillating member, to effect automatically the formation of two successive windings of yarn upon a yarn-receiver, the first winding with a gradually increasing traverse, combined with automatic means carried by the second oscillating member to gradually decrease the gain of the traverse during the first winding and to maintain the gain uniform during the second winding, and an instrumentality by which each of said means controls the operation of the other means.

16. In apparatus of the class described, a builder-motion including an oscillating member having a constant stroke, and means actuated by said member to effect automatically the formation of two successive windings of yarn upon a yarn-receiver, the first winding with a gradually increasing traverse, said means including a traverse-shifting device to determine the rate of such increase, combined with an instrumentality to govern the traverse-shifting device and to decrease the gain of the traverse as the traverse increases.

17. In apparatus of the class described, a builder-motion including an oscillating member having a constant stroke, and means actuated by said member to effect automatically the formation of two successive

windings of yarns upon a yarn-receiver, the first winding with a gradually increasing traverse, said means including an automatic traverse-shifting device to determine the rate of such increase, combined with an instrumentality actuated by said oscillating member to vary the gain of the traverse inversely to the variation of the traverse.

18. In apparatus of the class described, a builder-motion including an oscillating member having a constant stroke, and a second oscillating member having a variable stroke, and shiftable means intermediate said members to effect a gradual increase in the stroke of the second-named member up to a predetermined maximum, and thereafter to effect the oscillation of said member with a uniform stroke, a ring-rail operatively connected with and reciprocated by said latter member with first a gradually increasing, and then a uniform, traverse, combined with an instrumentality operated by or through the differential movement of said oscillating members to govern the operation of said shiftable means.

19. The combination, with a reciprocating ring-rail and a builder-motion including two oscillating members one of which has a constant stroke, of a connection between the other member and the ring-rail to control the movement of the latter, means whereby the member having a constant stroke oscillates the other member with a gradually increasing stroke, and then with a uniform stroke, to effect primary and secondary windings of yarn on a yarn-receiver, the first with a gradually increasing traverse, and an instrumentality to control said means and govern the rate of increase in the stroke of the variably-oscillating member.

20. The combination, with a reciprocating ring-rail and a builder-motion including two oscillating members one of which has a constant stroke, and an actuating cam to impart such constant stroke, of a single connection between the other member and the ring-rail to control the movement of the latter, means whereby the member having a constant stroke oscillates the other member, first with a gradually increasing stroke and then with a uniform stroke, to correspondingly vary the traverse of the ring-rail, and an automatically operated instrumentality to govern said means and also to gradually diminish the gain during the gradually increasing traverse of the ring-rail.

21. The combination, with a reciprocating ring-rail, a builder-motion including two oscillating members, and a connection between one of said members and the ring-rail, of means whereby said members are oscillated with a differential movement gradually decreasing from a maximum to a minimum, the member connected with the ring-rail thereafter being oscillated with

a uniform stroke, and means operated by the differential movement to gradually decrease the gain of the ring-rail from maximum to minimum as the differential movement decreases.

22. The combination, with a reciprocating ring-rail, a builder-motion including two oscillating members fulcrumed one behind the other, and an actuating cam to impart a constant stroke to one of said members, of a connection between the other member and the ring-rail, to control the movement thereof, traverse-shifting means including shifter-rolls interposed between and cooperating with said oscillating members, whereby the member having a constant stroke effects oscillation of the other member with a stroke varying in length according to the position of said rolls, and an instrumentality to operate said means and thereby shift the position of the rolls, to effect a primary winding of yarn upon a yarn-receiver, with a gradually increasing traverse, and thereafter a secondary winding with a uniform traverse, said instrumentality also controlling the gain and varying the same automatically inversely to the variation in the traverse.

23. The combination, with a reciprocating ring-rail, a builder-motion including two oscillating members fulcrumed one behind the other, and an actuating cam to impart a constant stroke to one of said members, of a connection between the other member and the ring-rail, to control the movement thereof, traverse-shifting means mounted on one member and cooperating with both, whereby the cam-actuated member effects oscillation of the other member with a stroke varying in length as determined by said means, an instrumentality mounted on the member having the variable stroke and actuated by or through differential movement of said members, to operate said traverse-shifting means and also to start the gain at the maximum and gradually decrease the same to a predetermined point, the oscillating member connected with the ring-rail during such period imparting a traverse thereto gradually increasing from minimum to maximum.

24. The combination, with a reciprocating ring-rail, a compound builder-motion including two members having fixed and independent fulcra located one behind the other, a cam cooperating with and to oscillate one member with a constant stroke, a single connection between the other member and the ring-rail, means whereby the latter member is oscillated by the first member with a gradually increasing stroke and then with a uniform stroke, to impart to the ring-rail first a gradually increasing traverse up to a predetermined maximum and thereafter a traverse of uniform length,

and an instrumentality connected with said means to determine therethrough the rate of variation of the traverse, said instrumentality also acting through the single connection with the ring-rail to impart a gradually decreasing gain while the traverse increases, and a uniform gain when the traverse is uniform.

25. In apparatus of the class described, means to effect the winding of yarn upon a yarn-receiver with a traverse gradually increasing from minimum to maximum and to complete the winding with the maximum traverse, means to impart gain to the traverse gradually decreasing from maximum to minimum during the period of gradually increasing traverse, and means to vary the length of such period of increasing traverse.

26. In apparatus of the class described, means to effect the winding of yarn upon a yarn-receiver with a traverse gradually increasing from minimum to maximum and to complete the winding with the maximum traverse, means to impart gain to the traverse varying in an inverse ratio to the variations in the length of the traverse, and manually adjustable means to vary the relative quantity of yarn laid during the periods of gradually increasing and maximum traverse.

27. In apparatus of the class described, in combination, a builder-motion including an oscillating member having a constant stroke, two different means to effect, respectively, the formation of a winding yarn upon a yarn-receiver with a traverse gradually increasing from minimum to maximum, and gain of such traverse gradually decreasing from maximum to minimum, one of said means being directly actuated by or through said oscillating member, a controlling connection between said separate means whereby the operation of one is governed by or through the operation of the other, and a manually adjustable device to increase or decrease the time during which said separate means cause varying traverse and gain.

28. In apparatus of the class described, a builder-motion including an oscillating member having a constant stroke, and means actuated by said member to effect automatically the formation of two successive windings of yarn upon a yarn-receiver, the first winding with a gradually increasing traverse, combined with automatic means to gradually decrease the gain of the traverse during the first winding and to maintain the gain uniform during the second winding, and an adjustable device to increase or decrease the time during which said automatic means gradually decreases the gain, to thereby increase or decrease the amount of yarn in the first winding.

29. In apparatus of the class described, in combination, a builder-motion including an oscillating member having a constant stroke, two different means to effect, respectively, the formation of a winding of yarn upon a yarn-receiver with a traverse gradually increasing from minimum to maximum, and gain of such traverse gradually decreasing from maximum to minimum, one of said means being directly actuated by or through said oscillating member, and including a mutilated gear rotated step by step throughout the winding operation, a rack-bar to cooperate with the said gear and connected with the means which effect the traverse, rotation of the gear when in mesh with the rack-bar moving the latter and thereby varying the traverse, and means on the gear to cooperate with and prevent retrograde movement of the rack-bar after its teeth have been disengaged from the teeth of said gear, the latter and the rack-bar constituting a controlling connection between said separate means whereby the operation of one is governed by or through the operation of the other.

30. The combination, with a reciprocating ring-rail and a builder-motion including two oscillating members, an actuating cam to impart a constant stroke to one of said members, and a winding drum on the other member having an attached mutilated gear, of a single connection between the drum and the ring-rail to control the movement of the latter, traverse-shifting means cooperating with the oscillating members, to cause oscillation of the drum-carrying member with a stroke the length of which is governed by said means, a rack-bar operatively connected with said means and adapted to cooperate with and be moved by the mutilated gear to effect through the said means a primary winding of yarn upon a yarn-receiver with a gradually increasing traverse, a locking device to prevent return movement of the rack-bar after its teeth have been disengaged from the teeth of the mutilated gear, and an instrumentality to effect rotation of the drum and gear and gradually decrease the gain from maximum to minimum during the period of gradually increasing traverse, continued rotation of the mutilated gear while the rack-bar is locked imparting uniform gain to the traverse with which the winding is completed.

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

ALONZO E. RHOADES.

Witnesses:

JESSE D. BROMLEY,
EDWARD DANA OSGOOD.