No. 647,256. Patented Apr. 10, 1900.

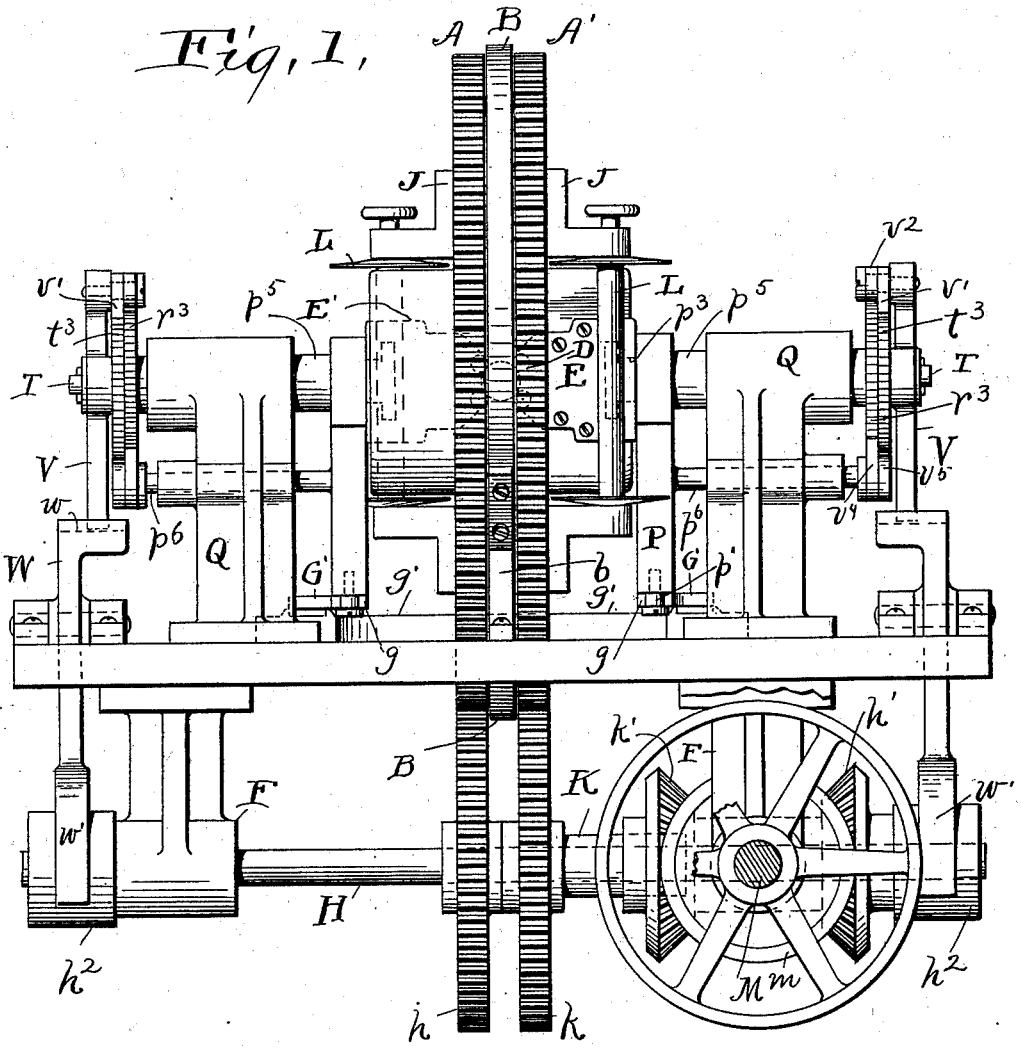
J. R. GAMMETER.

BALL WINDING MACHINE.

(Application filed Dec. 20, 1899.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 1.



Witnesses.
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P. E. Knowlton

Inventor.
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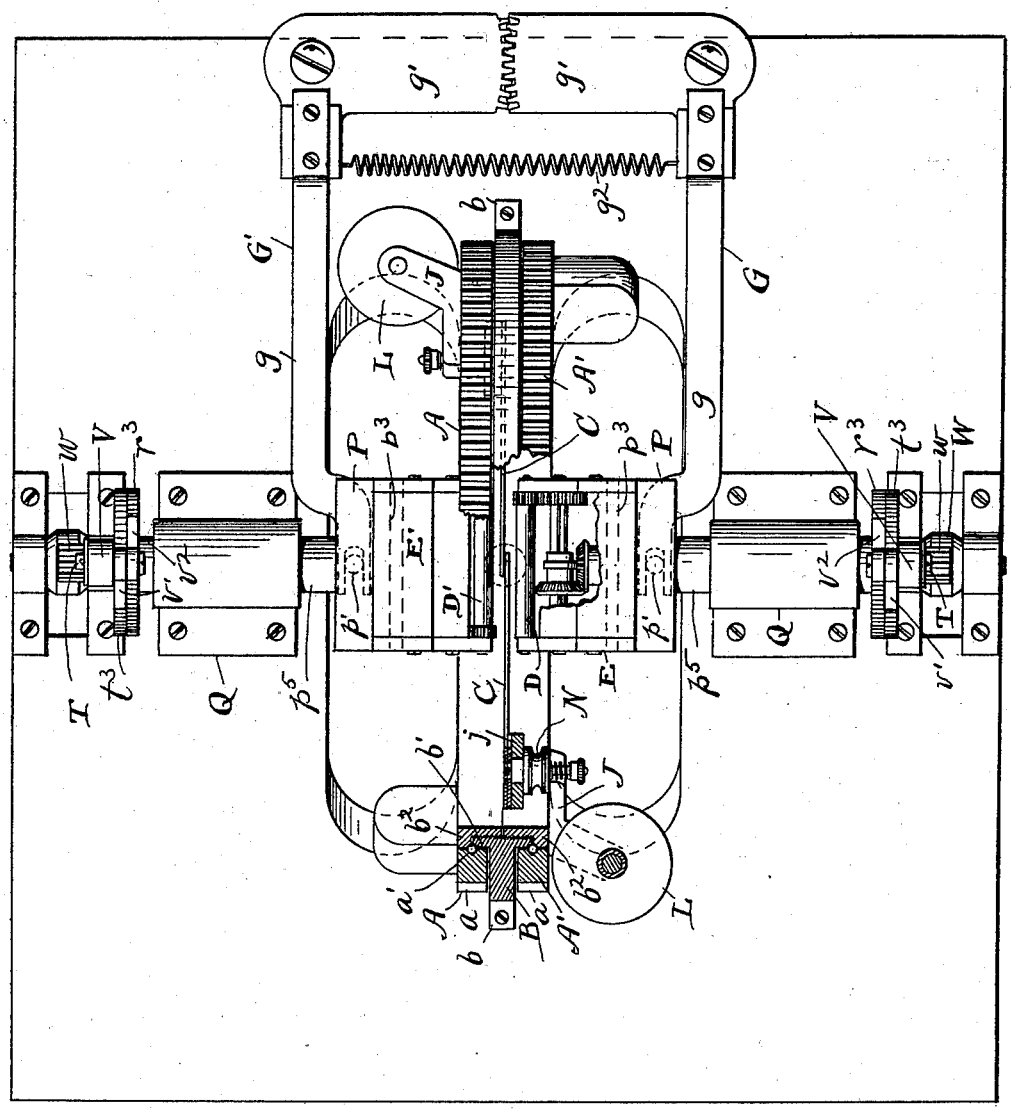

Fig. 2.

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(No Model.) 5 Sheets—Sheet 3.

Fig. 3.

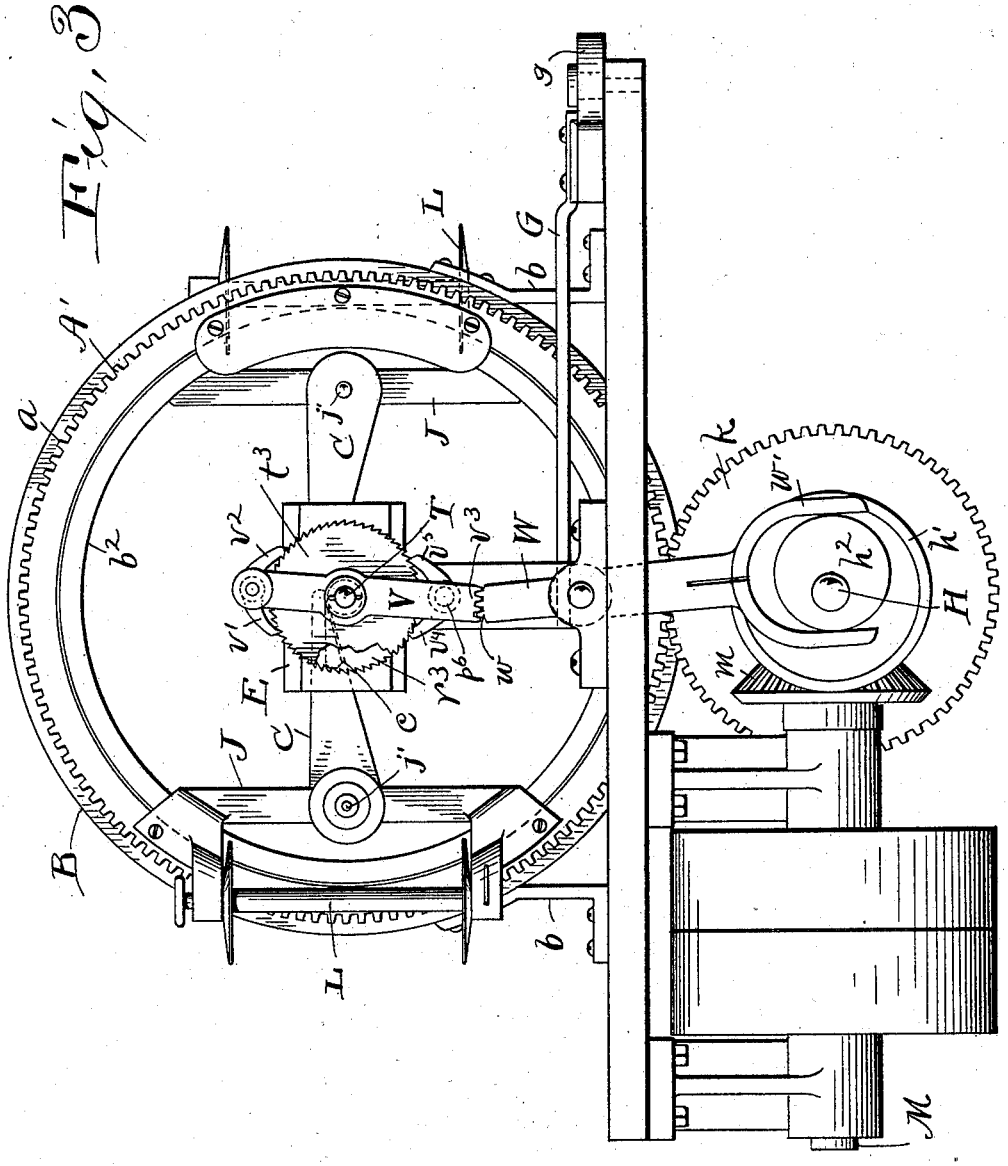

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Fig. 4.

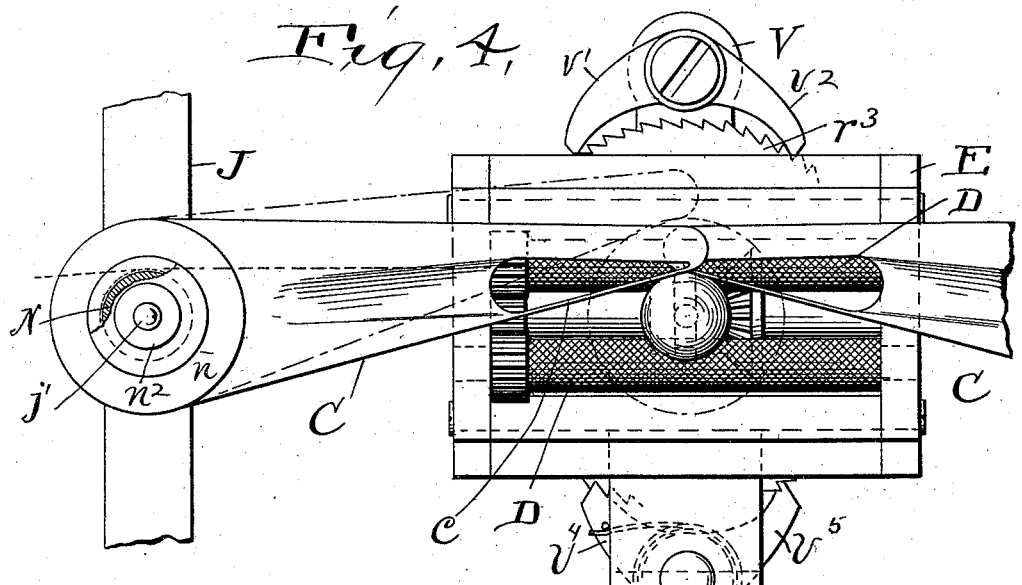
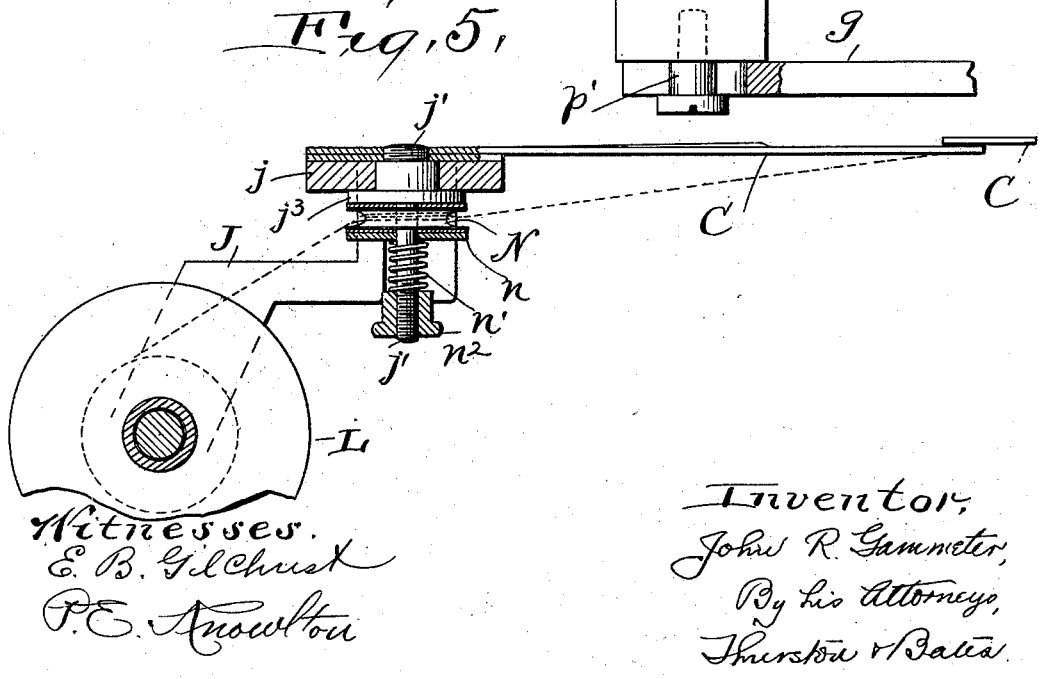


Fig. 5.



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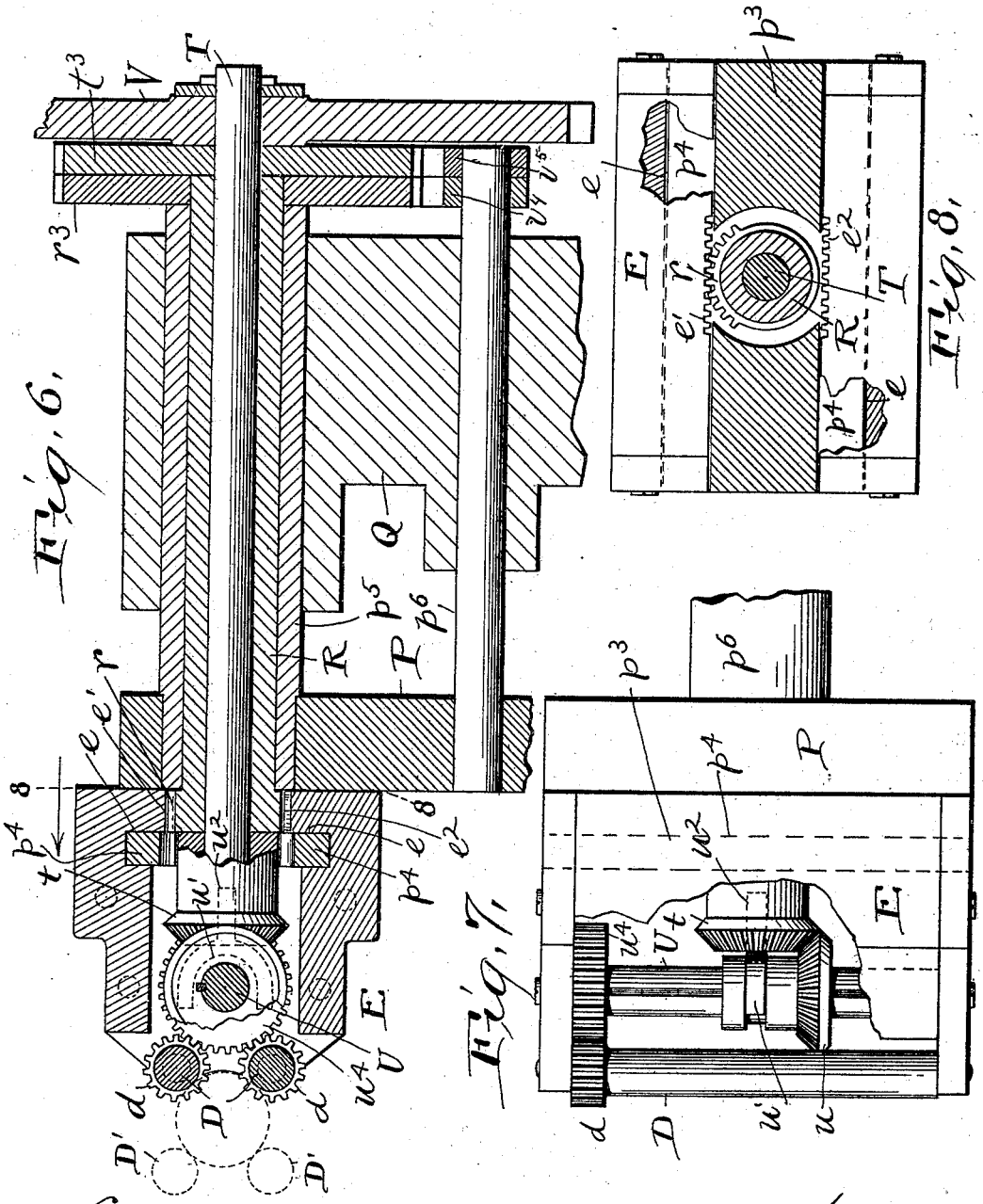

Witnesses,
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UNITED STATES PATENT OFFICE.

JOHN R. GAMMETER, OF AKRON, OHIO, ASSIGNOR TO THE B. F. GOODRICH COMPANY, OF SAME PLACE.

BALL-WINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 647,256, dated April 10, 1900.

Application filed December 20, 1899. Serial No. 741,001. (No model.)

To all whom it may concern:

Be it known that I, JOHN R. GAMMETER, a citizen of the United States, residing at Akron, in the county of Summit and State of Ohio, have invented a certain new and useful Improvement in Ball-Winding Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The object of the machine in which my invention is embodied is to wind cord, and especially vulcanized-rubber cord, upon a spherical core to form a compact spherical ball.

The invention consists in the construction and combination of parts hereinafter described, and pointed out definitely in the claims.

In the drawings, Figure 1 is a front elevation of the machine. Fig. 2 is a plan view of the same, partly in section. Fig. 3 is an end view thereof. Fig. 4 is an inside face view of one of the devices for holding the ball while it is being wound, and this view also shows the relative position of the two needles, which will be presently explained. Fig. 5 is an enlarged view, partly in section, of the spool, tension device, and needle carried by one of the rotary winders. Fig. 6 is a sectional front elevation of the holding mechanism on one side of the winding plane. Fig. 7 is a plan view of the holding device shown in Fig. 6, the same being partly in section; and Fig. 8 is a sectional view on line 8 8 looking in the direction of the arrow in Fig. 6.

The drawings show the best embodiment of my invention now known to me, and I will describe that machine in detail.

Referring to the parts by letters, A A′ represent two rotary cord-winders which in the form shown are rings having external gear-teeth *a*, and they are rotatably mounted on two concentric circular tracks. These tracks are formed on opposite sides of a circular frame B, which is secured in a vertical position to the bed-plate F by means of the legs *b b*. Each track consists of a cylindrical flange *b′*, which is integral with the frame B, and a ring b^2, which is screwed into the circular frame. The proximate edges of each flange *b′* and associated ring b^2 are beveled, whereby there is formed a circumferential V-shaped groove which serves as one part of a ball-race, the other part of said race being formed by a V-shaped groove *a′* in the inner periphery of one of the ring-shaped winders. These winders are therefore mounted concentrically upon ball-bearings upon the circular tracks referred to. These two geared winder-rings mesh with two pinions *h k*, which are respectively secured to the two concentric shafts H K. The shaft H is mounted in brackets F, which depend from the bed-plate, and the other shaft K is a hollow shaft which is rotatably mounted upon the shaft H. To these two shafts are respectively secured the beveled gears *h′ k′*, which engage with opposite sides of a beveled gear *m*, fast to the driving-shaft M. Through the described mechanism these two winder-rings are rotated in opposite directions. Each of these winder-rings carries a spool L, whereon the cord to be used is wound. A needle C is pivotally connected to each winder, and it extends inward a little to one side of the axis of the winder. The function of these needles is to guide the cord into what I term the "winding plane"—that is to say, the plane in which the cord is wound upon the ball and which intersects said ball in a great circle upon the ball. In the specific construction shown a spool, a needle, and a tension device are all supported on a frame J, which is attached one to each rotatable winder-ring. The needle is screwed onto a stud *j′*, which is rotatably mounted in a bar *j*, which forms a part of this frame. This needle is a flat metal plate having an elongated eye *c* in its free end. The free ends of both needles lie close together, resting upon the ball upon the same side thereof, where they are held as the ball grows in size by the pull of the two cords which are being wound upon the ball, each of which cords passes through the eye of its needle toward the other needle, whereby both cords are delivered onto the ball in substantially the same winding plane. The tension device, as shown, is a small grooved sheave N, rotatably mounted on said stud *j′*. It lies between a flange j^3 on the stud and a washer *n*, and it is subjected to more or less friction, tending to resist its rotation by means of a coiled spring *n′*, which surrounds the stud

and engages with said washer and is subjected to the proper amount of tension by means of a nut n^2, which screws onto the stud j.

The ball is held in the axial line of the two winders while the cord is being wound upon the ball, and it is turned to change its position relative to the winding plane by two holding devices which lie on opposite sides of said plane. Each of these holding devices consists of two parallel rollers D D, whose axes are parallel to said winding plane, and a movable support E for said rollers. The ball is held with its center in said winding plane between the four rollers D, which are mounted in pairs on said two supports. These two holding devices are automatically separable as the ball grows, and means are provided for compelling them to move, when they move at all, simultaneously and equally toward or from said winding plane. The holders are also capable of moving horizontally in paths parallel to the winding plane, and mechanism is provided for intermittently so moving them in opposite directions whereby the ball is turned upon its vertical axis without changing its position relative to the axis of the winders. Mechanism is also provided for rotating said rollers all in the same direction, whereby the ball is turned upon a horizontal axis parallel with the axis of the rollers. These two movements of the ball are alternated, and thereby the ball, while being held in the axial line of the winders, is constantly changing its position relative to said winding plane to bring different great circles thereon into said winding plane, with the result that the ball is wound into spherical form. I will now proceed to describe in detail the construction, as shown, of one of these holders and the parts associated with it, which description will answer for both, since both are alike.

A vertical standard P is supported upon one arm g of a bell-crank lever G, which is pivoted on a vertical pivot to the bed-plate F. The other arm g' of this bell-crank lever has a gear-segment on its end, which meshes with a gear-segment on a corresponding arm of the similar lever G', which supports a similar standard on the opposite side of said winding plane. A spring g^2 is connected with these two levers and acts to move them so that the standards are moved toward each other. The ends of the levers G G' upon which the standards rest are slotted, and pins p' p', which screw into the lower ends of the standards, project into these slots. It is obvious that any movement of one of these standards is necessarily accompanied by a simultaneous and equal movement of the other standard in the opposite direction.

Upon the inner face of the standard P near its upper end is a projection p^3, having on its horizontal top and bottom edges the vertical flanges p^4. These flanges enter grooves e in the support E, which support is in the form of a hollow box, with one open side—viz., that which faces the winding plane. This projection p^3 therefore serves to guide the support E in a path which is parallel to the winding plane. A horizontal tubular shaft R passes through a hole in the standard P and in the projection p^3 and into the support E, and it likewise passes through and finds its bearing in a sleeve p^5, which is fixed to the standard P and is capable of sliding through a fixed standard Q. A guide-rod p^6 is likewise secured to the standard P, and it is also capable of sliding loosely through a hole in the same standard Q. This sleeve and rod serve to guide the standard P, so that it must move in a path at right angles to the winding plane. On the inner end of this tubular shaft R a mutilated gear r is secured, and this gear is adapted to engage first with a rack e' on the support E above the shaft and then with a parallel rack e^2 on said support below the shaft. As this shaft and mutilated gear are revolved, therefore, the support E will be moved first backward a short distance and then forward a short distance, and so on back and forth indefinitely in a path parallel with the winding plane.

Another shaft T passes axially through and is mounted in the tubular shaft R. On its inner end inside the box-like support E a beveled gear t is fastened. This bevel-gear meshes with a bevel-gear u upon a shaft U, which is mounted in the ends of the box-like support E, said shaft being parallel to the rollers D. This bevel-gear u is connected with the shaft U by means of a tongue and groove, which permits relative longitudinal movement of said gear and shaft, but compels them both to rotate together. A fork u' engages with a circumferential groove in the hub of this bevel-gear, and a pin u^2 on this fork enters an axial hole in the shaft T. This holds the bevel-gear always in meshing relation with the bevel-gear t, while the support E moves backward and forward, as before described. A pinion u^4, secured to the shaft U, engages with pinions d d, secured to the rollers D. It is obvious that the rotation of the shaft T causes, through the intermediate mechanism described, a rotation of both rollers D D in the same direction, whatever may be the position of the support E. These two shafts R and T are turned alternately a short distance by the mechanism which I will now describe. A ratchet-wheel t^3 is attached to the shaft T, and a ratchet-wheel r^3, having teeth set in the opposite direction, is attached to the tubular shaft R. A pawl-carrier V is loosely mounted on the shaft T, and on its upper end are two pawls v' v^2 for engagement with said two ratchet-wheels. The lower end of this pawl-carrier is cut in the form of a gear-segment v^3, and it engages with a gear-segment w on the upper end of a rocking lever W, having a fork w' on its lower end, which engages with an eccentric h^2, attached to the shaft H. This gear-segment w is of such width that its engagement with the

gear-segment v^3 is maintained during the movement of said segment in unison with the standard P. The pawls v^4 v^5 are spring-actuated retaining-pawls which are mounted on the ends of the guide-rod p^6, and they engage, respectively, with the two ratchet-wheels r^3 t^3. As before stated, the other holder, which lies on the opposite side of the winding plane and its associated mechanism, are like the corresponding parts which have just been described. It should be noticed, however, that the ratchet-wheels r^3 and t^3 have their teeth so arranged that the rollers D′ D′ will be turned in the same direction as are the rollers D D, just described, and so that the support E′ for said rollers will be moved in the opposite direction to the other support E. It is obvious that during each revolution of the shaft H the rollers D D′ are turned so that the ball is turned upon a horizontal axis during about one half of the revolution, while for the other half of said revolution the supports E E for said rollers are being moved in opposite directions, as described, and these movements of these two supports causes the ball to turn upon its vertical axis.

To wind a ball in the machine described, a spherical core is placed within the grasp of the holders and in the axial line of the winders, as indicated by the dotted lines in Figs. 1 and 2 and by full lines in Fig. 4. The ends of the two cords are attached to the core-ball and the machine is started and the winding of these cords in opposite directions is begun. The rollers D D′ turn, then the supports therefor move, and so on in alternation, whereby the ball is all the time being turned first upon one axis and then upon another to bring different great circles of the ball into the winding plane. The ball therefore grows in a spherical form, the holders being automatically separated as the ball grows. The pull of the two cords in opposite directions acts to prevent the movement of the ball out of the axial line of the winders, and it also holds the needles against the growing ball.

The machine, as shown, is especially contrived for the purpose of forming the ball of vulcanized-rubber cord, which is stretched as it is wound approximately to the limit of safety; but the machine may be used to wind any kind of cord or yarn, and the tightness of the winding may be controlled by the tension devices.

It is obvious that many changes in the specific construction of the various parts shown may be made without departing from the invention, and it is not my intention to have the claims herein limited to the specific construction shown to any greater extent than is plainly expressed by the language employed therein.

Having described my invention, I claim—

1. In a ball-winding machine, the combination of a rotating winder, and a needle carried thereby for guiding the cord into the winding plane, with two separable holding devices which lie on opposite sides of said winding plane and are adapted to hold the ball between them, and means for moving said holding devices to turn the ball upon different axes to bring different great circles thereon into the winding plane, substantially as specified.

2. In a ball-winding machine, the combination of two concentric rotary winders, means for rotating them in opposite directions, and two needles one carried by each of said winders for guiding the cord into the winding plane, with two separable holding devices which lie on opposite sides of said winding plane, and are adapted to hold the ball between them, and means for moving said holding devices to turn the ball on different axes to bring the different great circles thereon into the winding plane, substantially as specified.

3. In a ball-winding machine, the combination of a rotary winder, a spool, a tension device, and a needle for guiding the thread into the winding plane, all carried by said winder, with two separable holding devices which lie on oppositie sides of said winding plane and are adapted to hold the ball between them, and means for moving said holding devices to turn the ball on different axes to bring different great circles thereon into the winding plane, substantially as specified.

4. In a ball-winding machine, the combination of two concentric rotary winders, means for revolving them in opposite directions, and a spool, a tension device, and a needle carried by each winder, and holding devices for holding the ball and turning it upon different axes to bring different great circles thereon into the winding plane, substantially as specified.

5. In a ball-winding machine, the combination of a rotary winder, of two separable holding devices adapted to hold the ball between them, each holding device consisting of two parallel rollers and a support for said rollers which is movable in a path parallel to the axis of the rollers, and mechanism for simultaneously turning all of said rollers in one direction, and mechanism for moving the two supports for said rollers in opposite directions, substantially as specified.

6. In a ball-winding machine, the combination of two separable holding devices, each consisting of two rollers, a support for said rollers which is movable in a path parallel to their axes and has two parallel racks, a tubular shaft carrying a mutilated gear for engagement with said racks, a shaft passing through said tubular shaft, and mechanism for transmitting motion from said inner shaft to the rollers, substantially as specified.

7. In a ball-winding machine, the combination of two standards, and mechanism for compelling said standards to move, if at all, equal distances in opposite directions, projections upon the inner face of said standards, roller-supports mounted upon said projections, rollers mounted in said supports, and

mechanisms for alternately turning all the rollers in one direction and for moving said two roller-supports in opposite directions, substantially as specified.

8. In a ball-winding machine, the combination of a standard having in its inner face a guiding projection, a box-like support mounted to slide upon said projection and having two parallel racks, two rollers mounted in said support and projecting through an open side thereof, with a tubular shaft which projects through the standard and into said box-like support, a mutilated gear thereon for engaging with said racks, a shaft passing through the tubular shaft, mechanism for transmitting motion from said inner shaft to said rollers, two ratchet-wheels secured to the inner shaft and tubular shaft E respectively, and having their teeth faced in opposite directions, a rocking pawl-carrier, and two pawls carried thereby for engagement with said ratchet-wheels, substantially as specified.

9. In a ball-winding machine, the combination of two pivoted bell-crank levers having meshing gear-segments on their adjacent ends, two standards connected respectively with the opposite ends of said levers, and movable holding devices supported by said standards, and mechanism for moving said holding devices to turn a ball held between them upon different axes to bring different great circles thereon into the winding plane, with a rotary cord-winder operating between said holding devices, substantially as specified.

10. In a ball-winding machine, the combination of a vertical open frame having on opposite sides two concentric circular tracks, two geared rings mounted upon said tracks, a spool mounted on each of said rings, a tension device and a needle carried by each of said rings, and pinions turning in opposite directions and meshing with said geared rings, with devices for holding the ball and for turning it to bring different great circles thereon into the winding plane, substantially as specified.

11. In a ball-winding machine, the combination of an open vertical frame having two circular tracks composed of two oppositely-extended cylindrical flanges which are integral with said frame, and rings which screw into said flanges, the proximate edges of said flanges and rings being beveled to form circumferential grooves, with two geared rings having internal grooves, and balls confined in said grooves between said rings and circular tracks, a spool, a tension device and a guide-needle carried by each of said geared rings, two separable holding devices which are adapted to hold the ball between them, and means for moving said holding device to turn the ball on different axes to bring different great circles thereon into the winding plane, substantially as specified.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

JOHN R. GAMMETER.

Witnesses:
HARRY A. COPE,
CHARLES J. CAREY.