No. 822,482. PATENTED JUNE 5, 1906.

A. T. & G. H. SAUNDERS.

BALL WINDING MACHINE.

APPLICATION FILED FEB. 11, 1905.

5 SHEETS—SHEET 1.

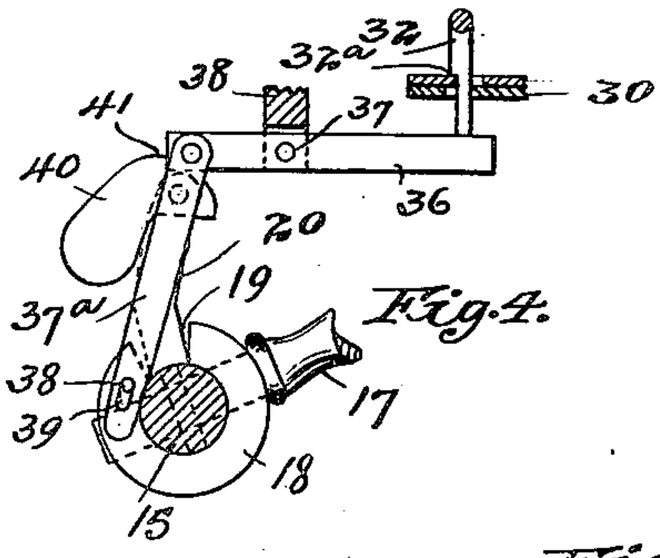

Fig. 4.

Fig. 1.

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5 SHEETS—SHEET 2.

Fig. 2.

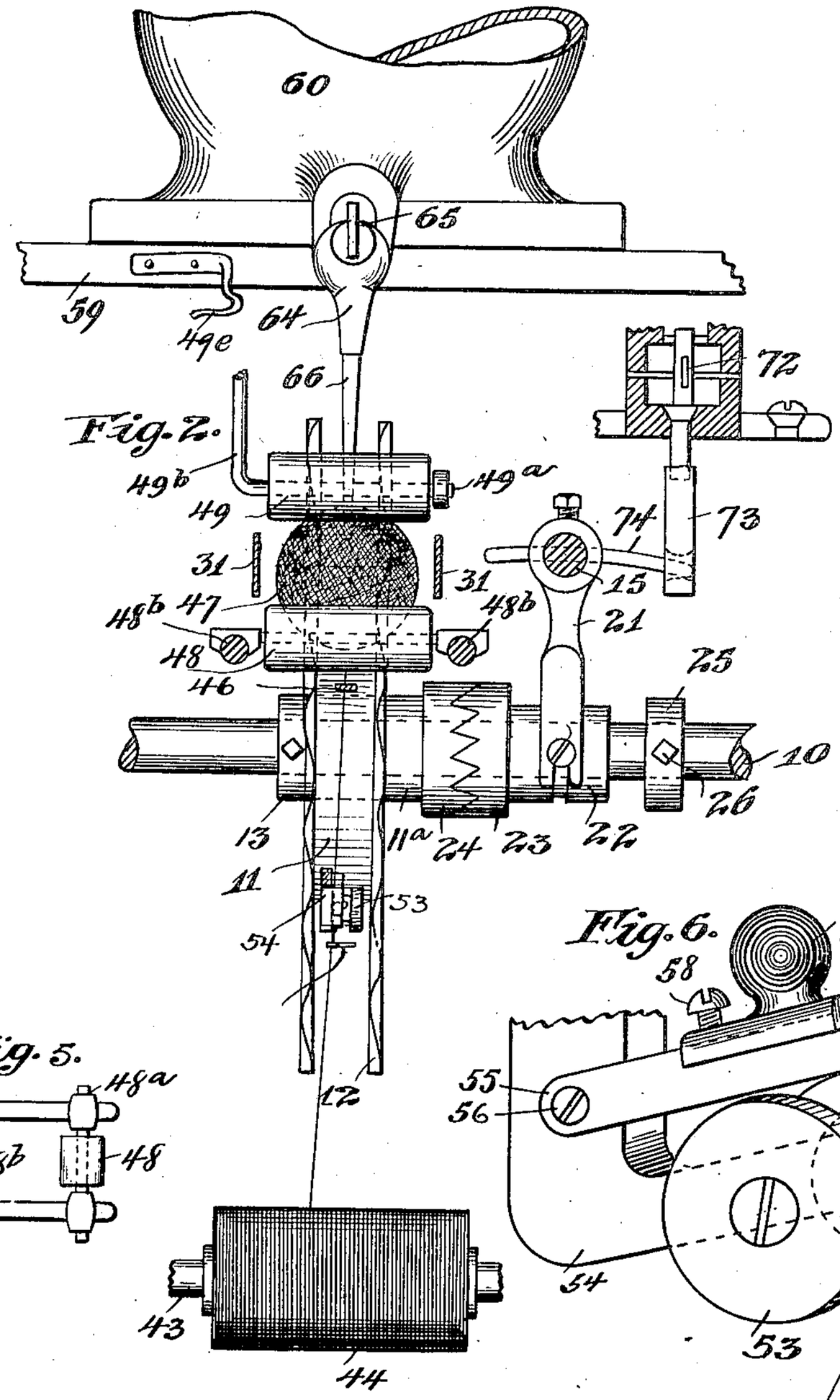

Fig. 5.

Fig. 6.

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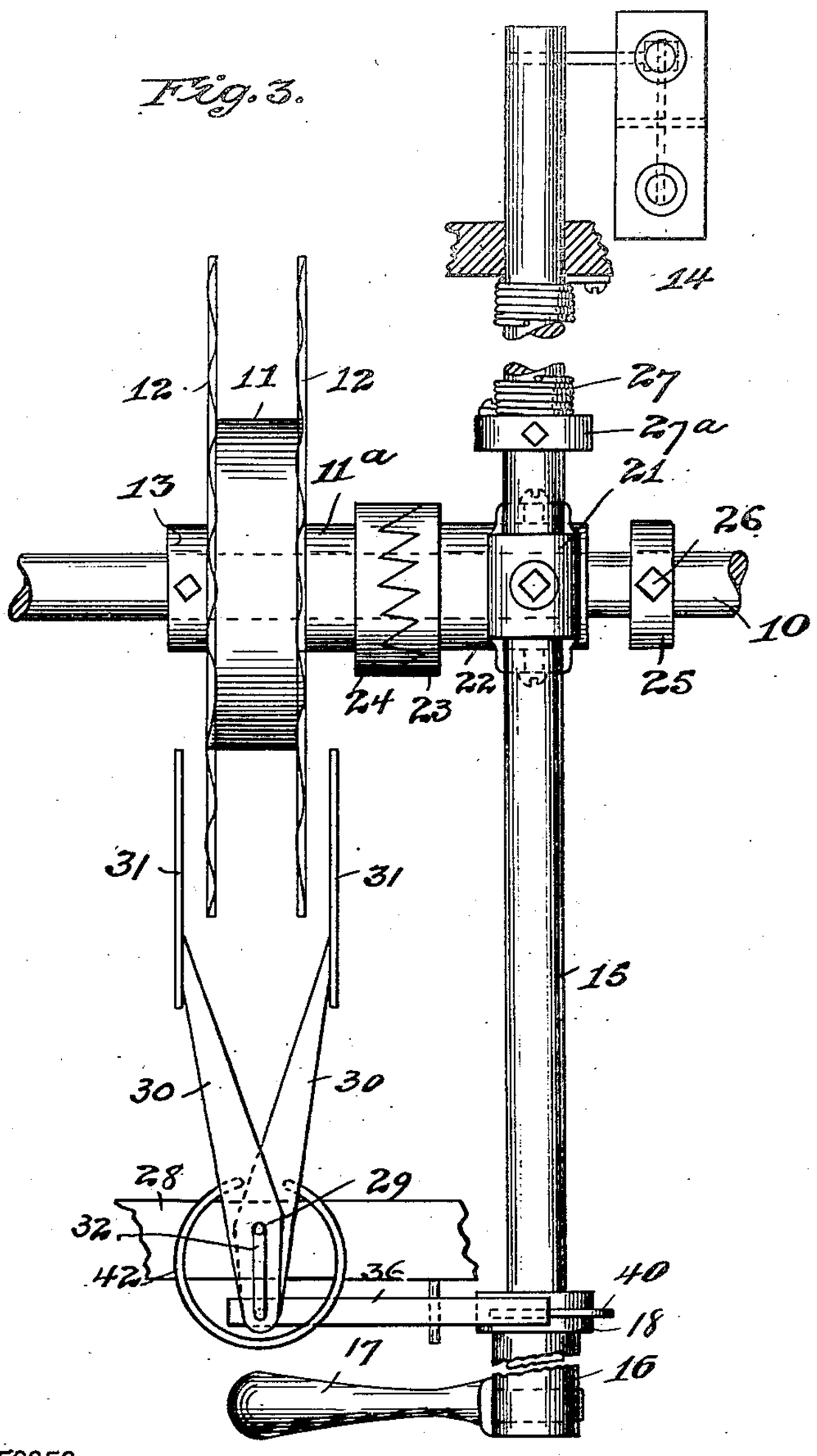
5 SHEETS—SHEET 3.

Fig. 3.



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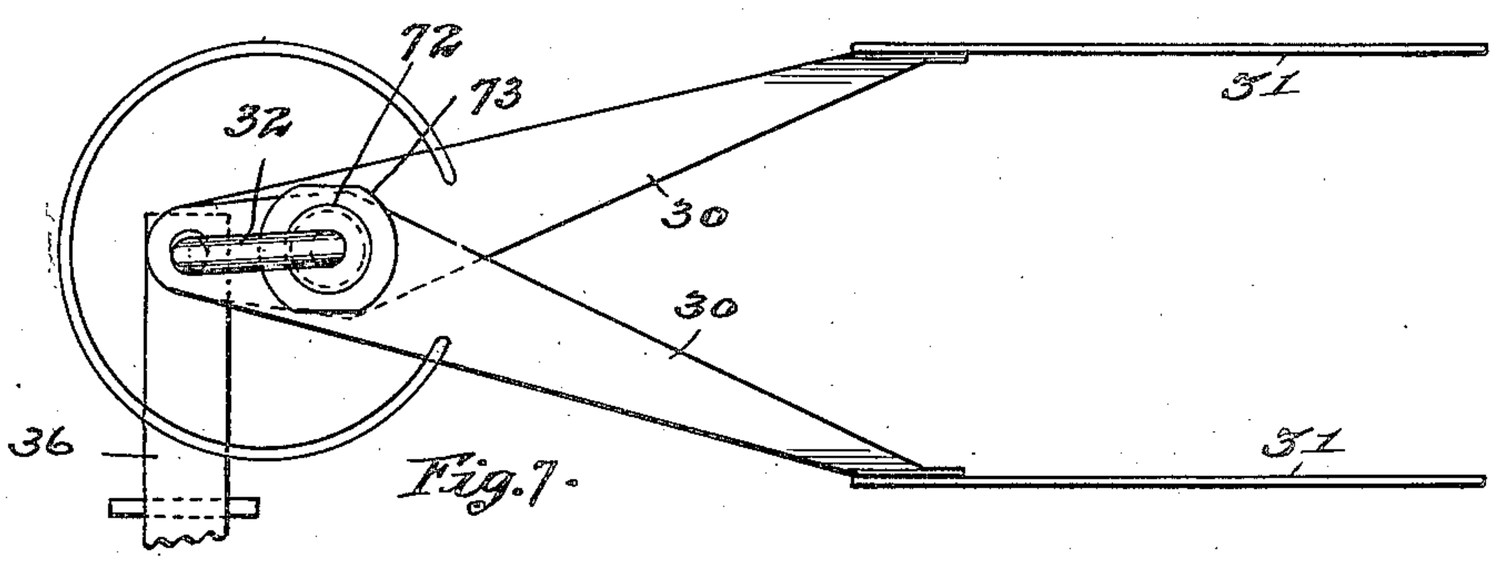


Fig. 7.

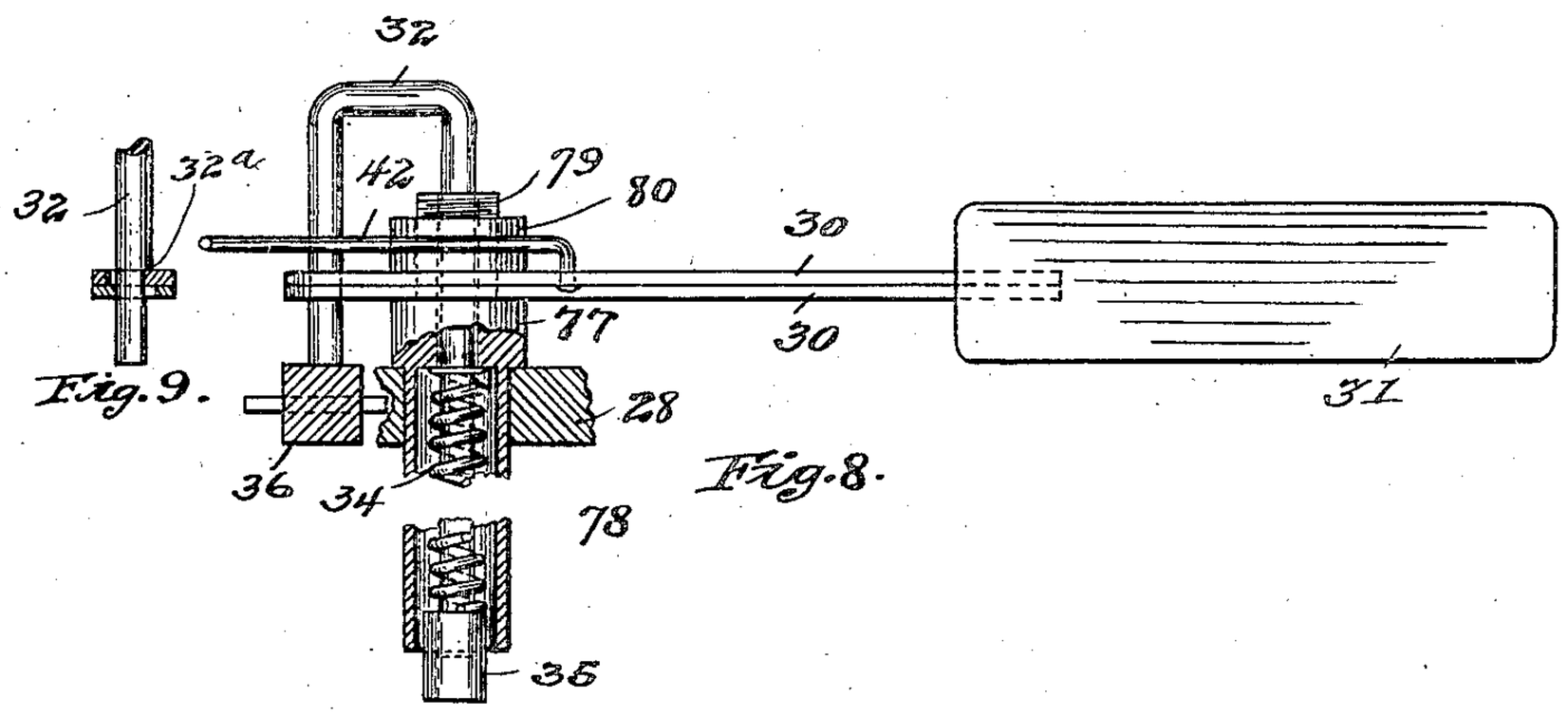
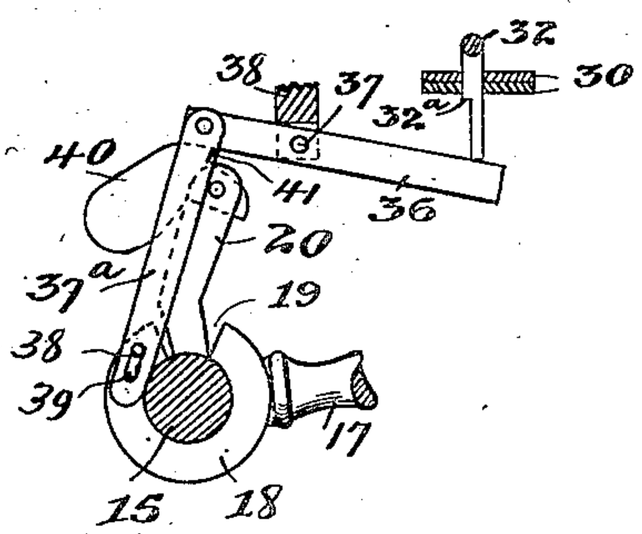


Fig. 9.

Fig. 8.

Fig. 10.



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5 SHEETS—SHEET 5.

Fig. 11.

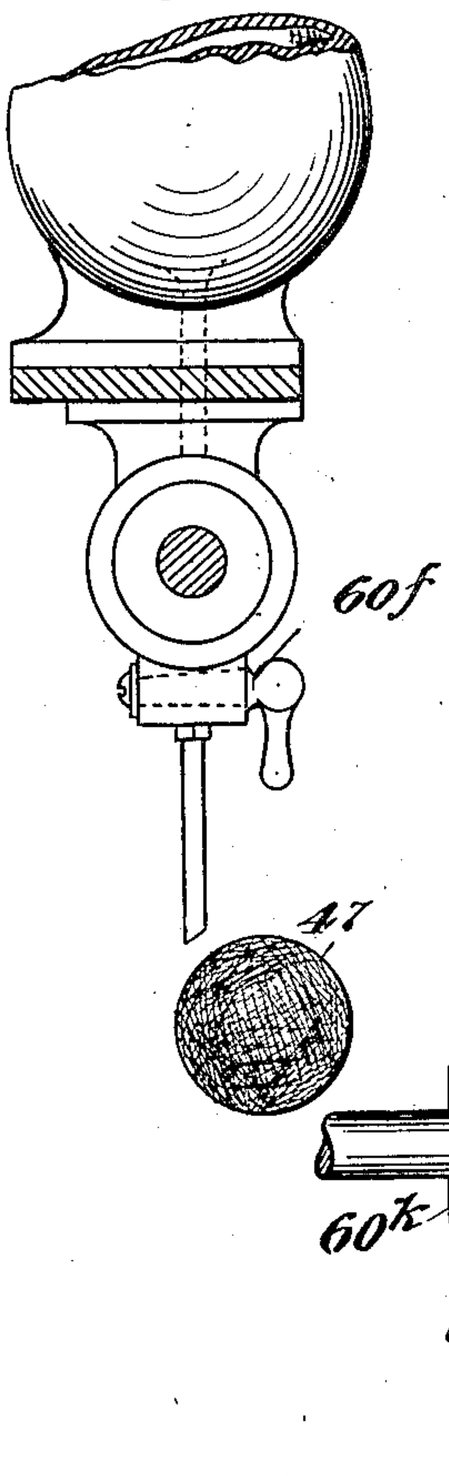
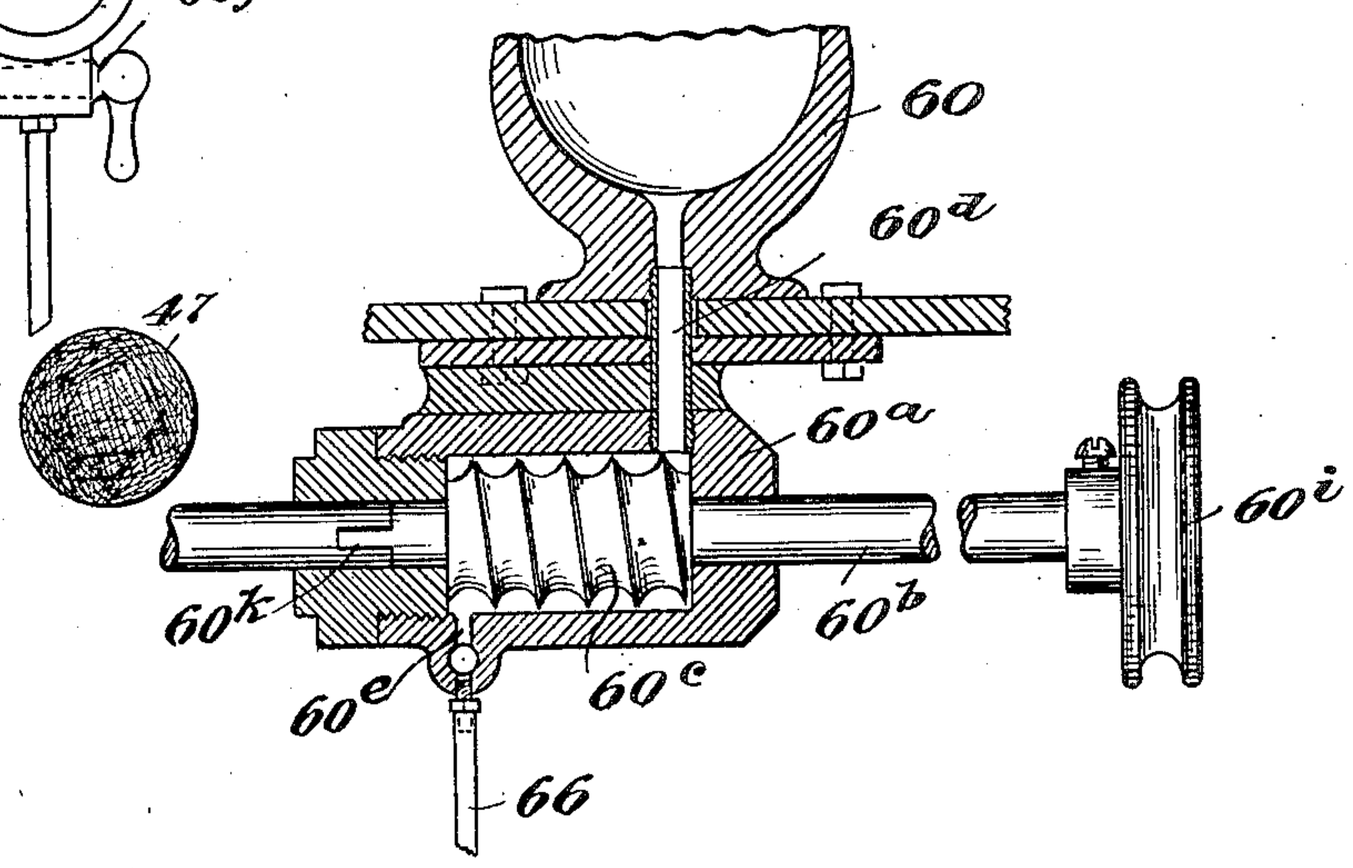


Fig. 12.



Witnesses,
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UNITED STATES PATENT OFFICE.

ADDISON T. SAUNDERS AND GEORGE H. SAUNDERS, OF AKRON, OHIO.

BALL-WINDING MACHINE.

No. 822,482. Specification of Letters Patent. Patented June 5, 1906.

Application filed February 11, 1905. Serial No. 245,272.

To all whom it may concern:

Be it known that we, ADDISON T. SAUNDERS and GEORGE H. SAUNDERS, citizens of the United States, residing at Akron, in the county of Summit and State of Ohio, have invented certain new and useful Improvements in Ball-Winding Machines, of which the following is a specification.

Our invention relates to machines for winding playing-balls—that is, to machines which are employed in the manufacture of various kinds of playing-balls which possess as an element of their construction a layer of thread or the like wound thereon.

Our invention has been designed more particularly for use in the manufacture of golf-balls having a part of the body portion composed of a layer of fibrous material formed by a series of windings of yarn or thread interlaid with an adhesive substance; but it will be evident from the subsequent description of our invention that the main features thereof are equally applicable in applying a layer of wound yarn or thread to other kinds of playing-balls, such as base-balls, hand-balls, tennis-balls, &c.

Our invention has for its primary object to provide a simple and efficient machine which shall effect a uniform and even winding of the ball in such a manner as to avoid parallelism and insure its sphericity during all stages of the winding, other minor objects of the invention being to effect the simultaneous application of an adhesive substance during the winding operation, and to effect the automatic stopping of each winder (where a group of the latter are arranged to be operated from a single driving-shaft) when the wound ball has attained the desired dimensions.

Still other minor objects of the invention will appear in connection with the subjoined description of the mechanism.

To these ends our invention consists in a winding-machine for the purposes stated, characterized by the novel features of construction and operation substantially as hereinafter described and more particularly pointed out in the claims.

Referring to the accompanying drawings, which illustrate the principle of our invention in the best form in which we have as yet embodied the same, Figure 1 is a side elevational view with certain portions of the frame and other parts in vertical section of our improved machine. Fig. 2 is a front elevational view of the same with some parts omitted and others shown in vertical section. Fig. 3 is a top plan view with certain upper parts of the machine removed for the sake of clearness. Fig. 4 is a detail view of a catch mechanism controlling the automatic stopping of the machine and its actuating device. Fig. 5 is a detail plan view of a roller which coöperates with the ball being wound. Fig. 6 is a perspective view of a tension mechanism operating upon the thread in its passage from the delivery-spool to the ball being wound. Figs. 7 and 8 are plan and side elevational detail views, enlarged, of a modified type of the catch-operating devices. Fig. 9 is a detail vertical section through a part of the mechanism shown in Fig. 8. Fig. 10 is a view similar to Fig. 4, illustrating the catch mechanism in its idle or inactive position. Figs. 11 and 12 illustrate in end view and longitudinal section, respectively, a mechanical feed device for the adhesive substance that may be employed.

Referring to the drawings, 10 designates a main driving-shaft around and above which there may be grouped a series of winders, all actuated thereby and all designed to be manually or automatically thrown into and out of operative connection with said shaft. Inasmuch as said winding mechanisms, where a group thereof are employed, are all duplicates, the present description will be confined to an explanation of the construction and operation of a single mechanism.

Loosely mounted on the shaft 10 is the hub 11 of a pair of winding or tumbling disks 12, which abut against a fixed collar 13 on one side thereof, and on their opposite side are provided with a lateral extension 11ª of the hub terminating in a clutch member 24, as hereinafter more particularly described. These disks, which constitute functionally one of the principal elements of the machine, are preferably peripherally toothed or serrated, as best shown in Fig. 1, and have their peripheral portions varied in distance from the center and bent into wavy and irregular formation laterally, so as to effect a tumbling of the ball supported on their peripheral edges as it is being wound, but without moving the ball bodily in any direction to any considerable extent. To describe these disks and their relation to each other more particularly, it may be stated that the higher parts of one disk of a pair are mounted opposite the lower parts of the other, and the higher por-

tions are bent outward and the lower portions inward on each disk; also where one disk is bent outward its mate is bent inward at the point opposite thereto, and, in short, variations of one disk are balanced by variations of the opposite character, but of like degree, in the mate, and the result of this is that the location of the ball is maintained approximately constant in space, while its axis of rotation is constantly altering.

Rotatably mounted in a pair of longitudinal supports disposed parallel with the main shaft 10, one of which supports is shown at 14, is a shaft 15, disposed transversely of and above the main shaft 10. This shaft at one end bears a sleeve 16, having a transverse operating-handle 17 and a collar 18 on its inner end, which collar is notched, as shown at 19, Fig. 4, to accommodate an arm 20, rigid with and disposed radially of the shaft 15. The shaft 15 at a point directly above the shaft 10 carries a depending clutch-operating fork 21, the arms of which embrace and actuate a sleeve 22, that is splined on the shaft 10 and carries at one end a clutch member 23, adapted to be thrown into and out of driving engagement with the companion clutch member 24, carried by the lateral extension 11ª of the disk-hub 11, a collar 25 adjustably fixed on the shaft 10, as by a set-screw 26, constituting a stop for the slidable clutch member to limit its disengaging movement. Surrounding the transverse shaft 15 between the fork 21 and the support 14 is a torsion-spring 27, one end of which is secured to the shaft through a collar 27ª, while the other end is secured to the support 14. The tendency of this spring is to turn and maintain the shaft in a position in which the shaft-actuating handle 17 is substantially horizontal, as shown in the detail view, Fig. 10. Before and during the winding operation the shaft 15 is maintained against the action of the spring 27 in a position wherein the handle 17 is inclined, as shown in Figs. 1 and 4, to keep the clutch members in engagement, through a novel catch mechanism automatically released by ball-gaging devices, next to be described.

28 designates a horizontal support disposed transversely of and in front of the winding or tumbling disks 12, and having pivotally supported on its upper surface, as indicated at 29, a pair of caliper-arms 30, provided at their inner ends with blades 31, disposed in vertical planes and occupying a substantially parallel relation to each other throughout the winding operation. The rear ends of the caliper-arms 30, behind the pivot 29, are vertically apertured to permit the movement therethrough of the rear vertical end portion of a bent U-shaped tripper-rod 32, the inner and longer vertical member of which passes through an aperture in the underlying support 28 and constitutes the pivotal axis of the caliper-arms, as indicated at 29. The underlying portion of said tripper is surrounded by a coiled compression-spring 34, acting between the under side of the support 28 and a head or nut 35 on the lower end of the tripper-rod 32, thereby tending to draw the latter downwardly relatively to the caliper-arms and the support 28. That vertical member of the tripper which passes through the apertures in the rear ends of the caliper-arms has a shoulder 32ª, adapted to engage and overlie one margin of the aperture in the upper caliper-arm, as clearly shown in Fig. 4, and the said apertures are so positioned and related to each other as to be automatically brought into perfect registration and coincidence when the caliper-blades 31 have been spread apart by the growing ball as the winding proceeds to a distance equal to the desired diameter of the wound portion of the ball, the result of such registration of the apertures being to release the engagement of the shoulder 32ª with the margin of the upper aperture, and permit the tripper to be drawn by the action of the spring 34 through said apertures, as shown in Fig. 10, for the purpose next to be described.

36 designates a lever pivotally mounted at 37 in a suitable support 38 of the machine-frame, said lever having the end of its longer arm underlying and contacting the lower end of the shouldered member of the tripper 32, while pivotally hung from the end of its other arm is a link 37ª, connected, through a pin 38 and slot 39, with the face of the collar 18. The upper end of the arm 20 is forked and has pivotally mounted therein a counter-weighted catch-piece 40, said catch-piece being provided directly above its pivotal point with a notch forming a vertical shoulder 41, which when the catch mechanism is set in its normal operative position, as shown in Fig. 4, engages and abuts against the end of the lever 36, being stopped by the latter and prevented from moving inward under the torsional impulse of the spring 27.

42 designates a delicate bow-spring connecting the caliper-arms 30 and offering a light resistance to their separation. Since it is desirable that the ball shall not contact with the two blades 31 of the caliper-arms 30 until it approaches its full size, said arms are set at such a width that the ball does not fill the space between them until it has almost reached its full size.

43 designates a shaft disposed below and in front of the disks 12, on which is loosely mounted a spool of thread or yarn 44, the free end of which is carried up and guided through a bent wire guide 45, around a tension-drum 52, hereinafter described, through an eye 46, (open for convenience in threading,) to the ball 47, which ball is supported upon and between the peripheries of the winding and tumbling disks 12 in such a position

as to lie directly between the caliper-blades 31, as clearly shown in Figs. 1 and 2. The ball 47 is guided and confined upon the peripheries of the disks 12 through the agency of a pair of rollers 48 and 49.

As shown in Fig. 5, the roller 48 is mounted on an axle 48^a, which is slidably mounted in bearings on a pair of arms 48^b. It turns freely on the rod 48^a, constituting its axle, and has considerable end shake or play thereon. The roller 49, as shown in Fig. 2, is mounted on a rod or axle 49^a, constituting a horizontally-bent extension of an arm 49^b, pivotally supported from a lug on the under side of the tank or vessel 60. The roller 49 turns freely on its axle and also has considerable free end shake or movement, this characteristic of the mounting of the rollers 48 and 49 permitting of the free turning of the ball in various directions conformably to the impulse given by the disks. The roller 49 is lightly pressed upon the ball through the agency of a spring 49^c, acting upon the lower end of an arm 49^d, connected to the pivot of the arm 49^b. A spring-catch 49^e, attached to the base of tank 60, engages and holds the arm 49^b when the upper roller 49 is lifted, as when changing balls, being disengaged therefrom by simply pulling or pressing down on the arm 49^b when the roller is to be let down on a new ball.

50 designates a counterweighted lever pivotally mounted on a shaft 51 beneath the machine and bearing with adjustable friction contact against the spool 44 to prevent the spool of thread or yarn from running too freely or when the winder stops. A similar spring-pressed brake 12^a acts on the periphery of hub 11 to prevent running on of disks 12 when thrown out of gear.

The tension device hereinabove referred to and shown in detail in Fig. 6 consists, essentially, of a short spool or drum 52, having end flanges 53 and mounted by its axle at one end on a supporting-arm 54, the other end being free in order to allow the thread to be more easily carried over the spool. The supporting-arm 54 may be attached to the frame of the machine at a suitable point. The spool or drum 52 is preferably covered with rubber or other similar substance upon which the thread will not slip when drawn around it. Upon the periphery of the flange 53 adjacent the supported end of the axle is a brake-bar 55, pivoted at one end at 56 to the supporting-arm 54 and pressed upon one of the flanges 53 by a spring or weight, preferably the latter, as shown at 57, which weight may be adjustably attached to the arm by a set-screw 58 to allow of varying its position along the arm, and thus adjusting the tension. It is evident that the bearing of the brake on the periphery of the flange affords a uniform and even resistance to the turning of the spool. The guide 45 consists of a stiff wire bent to form parallel guides lying horizontally at right angles to the axis of the tension-drum and just below it. The guide is attached to the framework of the machine, extends inward therefrom, and its office is to direct the thread to the center or at least the face of the drum and to keep its direction thereon constant against the variations in delivery occasioned by the unwinding of the thread from the various parts of the spool's length.

The machine as thus far described is practically complete for the purposes of effecting the winding of the thread upon the ball. In the manufacture of many playing-balls having a layer of wound thread or yarn it is desirable to effect the winding in connection with the application of an adhesive substance to unite the overlying threads more permanently and solidly and sometimes, also, in connection with the application of a weight-giving substance, to secure the proper specific gravity of the finished article.

In the application of our invention to the manufacture of golf-balls we contemplate the employment of such auxiliary devices and will next describe a simple and efficient mechanism which we have successfully employed for this purpose. On a horizontal support 59, disposed above and transversely of the winding and tumbling disk 12 rests a tank or vessel 60, provided with a lid 61 and means, as a yoke 62 and screw 63, for securely fastening the lid upon the tank to effect a tight closure against the resistance of internal pressure. The tank 60 is further provided with a nozzle 64, having a controlling-cock 65, from which nozzle a depending flexible hose 66 conducts the material contained in the tank to the surface of the ball 47. The tank 60 is tapped in the rear by an elbow-pipe 67, leading into a valve box or casing 68, which latter is further tapped by a pipe 69, leading from a compressed-air main or reservoir. (Not shown.) The communication of the pipe 69 with the interior of the valve-box 68 is controlled by a puppet-valve 70, and an air-exhaust aperture from the valve-casing 68 is similarly controlled by a puppet-valve 71. The stems of said puppet-valves 70 and 71 both extend across the chamber of the valve-casing and are connected for simultaneous operation by an intermediate pivoted lever 72. The stem of the valve 71 extends below and outside of the valve-casing and has an extension 73, which is transversely slotted at its lower end to receive the outer end of an arm 74, projecting from the shaft 15.

From the foregoing it will be seen that when the parts are in the relative positions shown in Figs. 1 and 2 the compressed air from the reservoir is passing through pipe 69, around the valve 70 and its supporting-stem into the chamber of the casing 68, and from thence around the stem of the valve 71

into the pipe 67, while when the valve 71 is raised by the arm 74, due to partial rotation of the shaft 15, which stops the winding mechanism, the valve 70 is closed, the valve 71 opened, and the pressure existing in the upper portion of tank 60 is free to vent to the atmosphere through pipe 67, the valve-chamber, and the exhaust-opening controlled by valve 71.

In some instances where the compound used is not of an easily-flowing consistency or is more or less lumpy in character it is liable to clog the discharge nozzle and tube in spite of the air-pressure and in yielding thereto flow irregularly. To remedy this, we provide the machine in some cases with a positive feed mechanism, consisting, as herein shown, of a worm-chamber and a worm interposed between the discharge-orifice of the tank and the tube 66, which delivers the compound onto the surface of the ball. Where this mechanism is designed to be interchangeably used, it is preferably interposed in and transversely of the discharge-spout 64, constituting, in effect, a part thereof, as shown in Fig. 1, so that the simple discharge-nozzle shown in Fig. 2 can be removed and the positive feed-discharge nozzle shown in Fig. 1 substituted, and vice versa, according as the character of the compound does or does not require the positive feed mechanism. In machines designed to use only a thick and irregularly-flowing compound such positive feed mechanism instead of constituting a part of a removable discharge-spout may be made a permanent part of the machine and disposed beneath the tank in the manner indicated in the detail views, Figs. 11 and 12, which latter views illustrate the construction of feed mechanism and its driving means in whichever location or relation employed. Referring to Figs. 11 and 12, 60^a designates the casing of the feed-chamber, within and longitudinally of which is rotatably mounted a shaft 60^b, on which, within the chamber, is fixedly mounted a worm-spiral 60^c. The receiving end of the worm communicates through a duct or passage-way 60^d through the wall of the chamber and the parts connecting the same to the tank 60 with the interior of the latter, and through a port 60^e, controlled by a stop-cock 60^f at the opposite or discharging end of the chamber, with the tube 66. The shaft 60^b is driven from a pulley 60^g, Fig. 1, on the main driving-shaft 10, through a belt 60^h, engaging the pulley 60^i on the shaft 60^b. The worm-shaft 60^b is illustrated as jointed at 60^k in Fig. 12, where it passes through the removable head of the casing 60^a, such a construction being applicable where a series of worms are placed on the shaft 60^b or any extension thereof and are run from the single driving-pulley 60^g on the main driving-shaft 10, the tongue-joint 60^k making possible the removal of any of the worms singly when desirable or necessary for purposes of cleaning or repair.

The compound which is fed from the tank 60 is of a gummy nature, and consequently tends to adhere to the teeth of the disks. The evaporation of the vehicle from the compound which adheres to the disks leaves the compound tough and unfit to enter into the wall of the ball in that condition, as it would be in lumps and shreds. It therefore becomes necessary to remove it before it can adhere to the ball. This compound is easily stripped or picked from the disks as the vehicle leaves it, which is very quickly, and we have found that it itself in the form of a ball constitutes an excellent means for cleaning the later accumulations from the disks. We therefore preferably use a mass of this rubber compound in the form of a ball (designated by 75) as the cleaner-ball, which ball may be confined in an inclined trough 76 in such a manner as to cause it to be tumbled by the rotation of the disks engaging the same in opposition to the action of gravity tending to maintain the ball in contact therewith, the ball picking and stripping the drying compound as it forms in a toughening film from the disks, these additions thus becoming a part of the cleaner-ball, which may be removed to be trimmed down, being replaced by another meanwhile when it has become by accumulation too large or irregular.

It will be here stated that while the mechanism already shown and described for mounting the calipers 30 and the catch-operating mechanism is perfectly satisfactory we sometimes prefer to employ other mechanism, which is illustrated in detail in Figs. 7, 8, and 9 of the drawings, wherein the parts already described and their reference-numerals are repeated in order that the operation of this modification of our device may be more fully understood. Referring thereto, 77 designates an axially-cored block or collar seated upon the support 28 and having a depending sleeve 78 passed through said support, and an externally-threaded sleeve 79, extending upwardly therefrom, said sleeve or boss 79 having an axial bore constituting a continuation of the bore of the block 77. Through these parts is passed the longer member of the tripper 32, having the coil-spring 34 housed within the sleeve 78 and confined between the lower face of the block 77 and the adjusting-nut 35 on the lower end thereof. The caliper-arms 30 are pivoted upon the threaded boss 79, being confined thereon, but with freedom of pivotal movement by a nut 80. The rear ends of the caliper-arms are apertured to receive the notched shorter member of the tripper and to coöperate therewith in actuating the lever 36 in the manner already described.

The operation of the machine will be fairly

evident from the foregoing description of its construction and coöperating parts, but may be briefly explained as follows: Assuming that it is to be employed in winding a layer constituting a part of the body portion of a golf-ball, which is the primary purpose for which the machine has been designed, the tank 60 is first partly filled with an adhesive substance, which may consist of rubber and benzin, having commingled therewith a percentage of litharge or other mineral, and the lid 61 is securely clamped in operative position thereupon. A nucleus or core for the ball to be wound is then laid upon the periphery of the winding and tumbling disks 12 between the caliper-blades in the relative positions shown in the drawings, the thread from the spool 44 having been previously carried up over and through its guides and tension and given a few turns by hand around the core or nucleus to connect it with the latter. The handle 17 is then turned upwardly from the horizontal to the inclined position, which automatically sets the catch mechanism to the position shown in Fig. 4, at the same time raising the tripper 32 and permitting the caliper-blades 31, under the action of the bow-spring 42, to approach the sides of the ball at diametrically opposite points thereof. This elevation of the handle 17 against the torsional action of the spring 27 at the same time throws the two clutch members 23 and 24 into coöperative engagement, thereby setting in rotation the winding and tumbling disks 12. At the same time also the same rocking movement of the shaft 15 through the arm 74 closes the exhaust-valve 71 and opens the air-inlet valve 70, thereby permitting air-pressure to enter the upper portion of the tank 60 and exert a discharging effect upon the upper surface of the material therein. As soon as the winding is thus far under way the cock or valve 65 is opened more or less, thereby permitting the semi-viscous material in the tank 60 to ooze down through the nozzle and spout 66 and distribute itself upon the thread or yarn as it is laid upon the ball.

In machines employing the described worm or other feed mechanism of course the compound is positively fed in regulated quantities to the surface of the ball, in which connection it may be noted that the positive compound feed mechanism has another advantage in that any variation in the speed of the tumbling-disks is accompanied by a like variation in the speed of the feed mechanism, thus rendering the amount of compound delivered upon the ball proportional to the amount or rate of thread deposit or winding. The disks 12 by virtue of their rotary movement obviously impart to the ball 47 a rapid turning movement in an opposite direction, under which the thread or yarn is rapidly wound thereon, while the radial and lateral undulations of the peripheries of the disks impart to the ball a rotative movement in directions transverse and oblique to the planes of the disks 12, whereby there is imparted to the ball a practically universal tumbling movement, under which the yarn or thread is evenly and uniformly distributed thereupon and the ball grows in diameter equally in all directions. As this growth proceeds the caliper blades and arms are gradually spread until when the ball has reached the predetermined size the caliper-arms have been spread to an extent just sufficient to bring the apertures in their rear ends into perfect registration, thereby permitting the tripper 32 to be drawn therethrough under the action of the spring 34. This tilts the lever 36 by a quick action, which releases the engagement of the counterweighted catch 40 with the end of the lever 36, thereby permitting the spring 27 to exert itself, thus oscillating the shaft 15, throwing the catch mechansim to the position shown in Fig. 10, separating the clutch members 23 and 24, thereby stopping the winding operation, and opening valve 71 and closing valve 70, thereby cutting off the compressed-air supply to the tank and venting the latter of the pressure already existing therein. During the winding operation the application of the adhesive material is regulated as desired by means of the cock 65 or 60^f controlling the spout 64, while the ball 75 automatically cleans the teeth of the winding and tumbling disks, maintaining their action upon the ball uniform and effective. The automatic stopping of the machine notifies the attendant that the winding of the ball is complete, whereupon the ball is removed, the broken end of the thread attached to a new core, the handle 17 raised, restoring the several parts to operative position, and the described operation of the parts repeated.

In practice it will be found convenient and economical where the exigencies of manufacture demand the service of a number of machines such as herein illustrated and described to group a plurality of such machines side by side along and over the main longitudinal shaft 10. In such case the machines may be arranged as closely together as they can be conveniently operated, and various elements thereof in addition to the driving-shaft 10—such as the brake-shaft 51, the support 59, the air reservoir or main, (not shown,) &c.—may be made common to the several machines.

While the automatic mechanism shown and described for gaging the ball and stopping the winding when the ball reaches full size constitutes a valuable and important feature of the present machine, yet it is not to be regarded as an absolutely essential part

thereof, since we have found in practice that skilled operators learn to gage quickly with hand-calipers the maximum diameter to which the ball is to be wound, and hence the automatic gage and stop mechanism may sometimes be dispensed with. When such is the case, the handle 17 at the front of the machine attached to the rocking shaft 15, that throws the disk-clutch into gear, is manually manipulated not only for that purpose, but also in the reverse direction to separate the clutch and throw the winding and tumbling disks out of gear. In such case the handle is provided with a simple form of spring-catch (not shown) for holding it in either position.

It is obvious that changes in the details of the mechanism hereinabove described might be made without affecting or departing from the principle of operation of the machine, and we do not, therefore, limit our invention to the particular forms herein shown and described except to the extent indicated in specific claims.

We claim—

1. A ball-winding machine, comprising a pair of oppositely-disposed ball-tumbling disks rotatably mounted, having their peripheries formed upon alternating convex and concave lines, the concavities of one disk alternating in position with respect to the position of the concavities of the other disk, and means for retaining a ball on said peripheries during the winding operation.

2. A ball-winding machine, comprising a pair of oppositely-disposed ball-tumbling disks rotatably mounted, with their peripheries so formed that adjacent portions thereof have different radii, the portions of one disk with the greatest radii alternating in position with respect to similar portions of the other disk, and means for retaining a ball on said peripheries during the winding operation.

3. In a ball-winding machine, the combination of a pair of ball-tumbling disks rotatably mounted side by side and having radially-undulating peripheries, and means for loosely confining a ball on the peripheries of said disks during the winding operation.

4. In a ball-winding machine, the combination of a pair of oppositely-disposed ball-tumbling disks rotatably mounted, having radially and laterally undulating peripheries, the lateral undulations of said peripheries being parallel, and means for confining a ball on the peripheries of said disks all of said parts being arranged to simultaneously coact whereby the axis of rotation of said ball is constantly changing.

5. In a ball-winding machine, the combination of a pair of ball-tumbling disks rotatably mounted side by side and having radially and laterally undulating peripheries, and means for loosely confining a ball on the peripheries of said disks during the winding operation.

6. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side and having radially-undulating peripheries, the convex peripheral portions of one disk being opposite the concave peripheral portions of the other, and means for loosely confining a ball on the peripheries of said disks during the winding operation.

7. In a ball-winding machine, the combination of a pair of ball-tumbling disks rotatably mounted side by side and having laterally-undulating peripheries, the outwardly-bent peripheral portions of one disk being located opposite the inwardly-bent peripheral portions of the other, and means for loosely confining a ball on the peripheries of said disks during the winding operation.

8. In a ball-winding machine, the combination of a pair of ball-tumbling disks rotatably mounted side by side and having radially and laterally undulating peripheries, the convex peripheral portions of one disk being opposite the concave peripheral portions of the other and the outwardly-bent peripheral portions of one disk being located opposite the inwardly-bent peripheral portions of the other, and means for loosely confining a ball on the peripheries of said disks during the winding operation.

9. In a ball-winding machine, the combination of a pair of oppositely-disposed ball-tumbling disks rotatably mounted, having their peripheries formed upon radially-undulating lines, the concavities in the periphery of one disk being alternately arranged in position with respect to the positions of the concavities of the other disk, means for confining a ball on said peripheries during the winding operation, and means automatically set in operation by the ball when it has reached its maximum diameter for stopping the rotation of said disks.

10. In a ball-winding machine, the combination of a pair of ball-winding disks rotatably mounted side by side, means for loosely confining a ball on the peripheries thereof during the winding operation, gage mechanism engaged by the ball as it approaches its maximum diameter, and means for stopping the rotation of said disks normally restrained but released by said gage mechanism when the ball reaches its maximum diameter.

11. In a ball-winding machine, the combination of a pair of clutch-controlled ball-winding disks rotatably mounted side by side, means for loosely confining a ball on the peripheries thereof during the winding operation, caliper-gage mechanism engaged by the ball as it approaches its maximum diameter, a clutch to control the rotation of said disks and means for separating the members of said

clutch normally restrained but released by said caliper-gage mechanism when the ball reaches its maximum diameter.

12. In a ball-winding machine, the combination with a driving-shaft, of a pair of clutch-controlled ball-winding disks loosely mounted thereon side by side, means for loosely confining a ball on the peripheries of said disks during the winding operation, a clutch to control the rotation of said disks, a clutch-shifting mechanism including a spring normally tending to separate the members of the clutch, catch mechanism adapted to maintain such clutch members in engagement in opposition to said spring, and gage mechanism engaged by the ball during the winding operation and serving to release said catch mechanism when the ball has reached its maximum diameter.

13. In a ball-winding-machine, the combination with a driving-shaft, of a pair of clutch-controlled ball-winding disks loosely mounted thereon side by side, means for loosely confining a ball on the peripheries of said disks during the winding operation, a clutch to control the rotation of said disks a clutch-shifting mechanism including a spring normally tending to separate the members of the clutch, catch mechanism adapted to maintain said clutch members in engagement in opposition to said spring, a pair of pivoted caliper-arms engaging the ball as it approaches its maximum diameter, and a spring-actuated catch-tripping device restrained by said caliper-arms during the winding of the ball but permitted to act when the ball has reached its maximum diameter.

14. In a ball-winding machine, the combination with a driving-shaft, of a pair of clutch-controlled ball-winding disks mounted thereon side by side, the peripheries of said disks being formed upon undulating lines, the concavities in the periphery of one disk alternating in position with respect to the position of the concavities of the other disk, a clutch to operate said disks, means for confining a ball on the peripheries of said disks during the winding operation, and means for engaging and disengaging the members of the clutch to start and stop the rotation of said disks respectively.

15. In a ball-winding machine, the combination with a driving-shaft, of a pair of clutch-controlled ball-winding disks loosely mounted thereon side by side, means for loosely confining a ball on the peripheries of said disks during the winding operation, a clutch to control said disks a rock-shaft disposed transversely of said driving-shaft, a clutch-shifting device carried by said rock-shaft, and a handle on said rock-shaft whereby said clutch may be shifted.

16. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side, and means for loosely confining a ball on the peripheries thereof during the winding operation, of means for applying an adhesive substance to said ball as it is wound.

17. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side, and means for loosely confining a ball on the peripheries thereof during the winding operation, of a superposed tank having a discharge-nozzle overhanging said ball and adapted to supply an adhesive substance thereto as the ball is wound.

18. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side, and means for loosely confining a ball on the peripheries thereof during the winding operation, of a superposed tank having a discharge-nozzle overhanging said ball and adapted to supply an adhesive substance thereto, and means for introducing fluid-pressure to the interior of said tank to promote the flow of said adhesive substance.

19. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side, and means for loosely confining a ball on the peripheries thereof during the winding operation, of a superposed tank having a discharge-nozzle overhanging said ball and adapted to supply an adhesive substance thereto, means for introducing fluid-pressure to the interior of said tank to promote the flow of said adhesive substance, and mechanism for stopping the rotation of said disks and simultaneously cutting off the supply of fluid-pressure to said tank.

20. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side, and means for loosely confining a ball on the peripheries thereof during the winding operation, of a superposed tank having a discharge-nozzle overhanging said ball and adapted to supply an adhesive substance thereto, means for introducing fluid-pressure to the interior of said tank to promote the flow of said adhesive substance, and mechanism serving to automatically stop the rotation of said disks when the ball has been wound to predetermined size and to simultaneously cut off the supply of fluid-pressure to said tank.

21. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side, and means for loosely confining a ball on the peripheries thereof during the winding operation, of a superposed tank having a discharge-nozzle overhanging said ball and adapted to supply an adhesive substance thereto, means for introducing fluid-pressure to the interior of

said tank to promote the flow of said adhesive substance, and mechanism serving to automatically stop the rotation of said disks when the ball has been wound to predetermined size and to simultaneously cut off the supply of fluid-pressure to said tank and vent the latter to the atmosphere.

22. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side, of means for loosely confining a ball on the peripheries of said disks during the winding operation, means for supplying an adhesive substance to the ball as it is tumbled on said disks, and means for stripping and cleaning the peripheries of said disks during the operation of the machine of surplus adhesive substance collecting thereon.

23. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side and having toothed peripheries, of means for loosely confining a ball on the peripheries of said disks during the winding operation, means for supplying an adhesive substance to the ball as it is tumbled on said disks, and means for stripping and cleaning the peripheries of said disks during the operation of the machine of surplus adhesive substance collecting thereon.

24. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side, of means for loosely confining a ball on the peripheries thereof during the winding operation comprising one or more rollers so disposed as to lightly contact the surface of the ball during the winding and mounted to have endwise play to accommodate lateral play of the ball as it is wound.

25. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side, of means for loosely confining a ball on the peripheries thereof during the winding operation comprising a roller suitably mounted to yieldingly contact the surface of the ball under spring-pressure during the winding thereof and to accommodate lateral play of the ball as it is wound.

26. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side and having laterally-undulating peripheries, of means for loosely confining a ball on the peripheries of said disks during the winding operation comprising a roller suitably mounted to yieldingly contact the surface of the ball during the winding thereof and to accommodate lateral play of the ball as it is wound.

27. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side, and having radially and laterally undulating peripheries, of means for loosely confining a ball on the peripheries of said disks during the winding operation comprising a roller suitably mounted to yieldingly contact the surface of the ball during the winding thereof and to accommodate lateral play of the ball as it is wound.

28. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side, and means for loosely confining a ball on the peripheries thereof during the winding operation, of a superposed tank having a discharge-duct leading to a position above the ball and adapted to supply an adhesive substance thereto, and a mechanical feed device interposed in said discharge-duct.

29. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side, and means for loosely confining a ball on the peripheries thereof during the winding operation, of a superposed tank having a discharge-duct leading to a position above the ball and adapted to supply an adhesive substance thereto, means for introducing fluid-pressure to the interior of said tank above the adhesive substance, and a mechanical feed device interposed in said discharge-duct.

30. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side, and means for loosely confining a ball on the peripheries thereof during the winding operation, of a superposed tank having a discharge-nozzle overhanging said ball and adapted to supply an adhesive substance thereto, and a worm feed mechanism interposed in and constituting a part of said discharge-nozzle.

31. In a ball-winding machine, the combination with a pair of ball-tumbling disks rotatably mounted side by side, and means for loosely confining a ball on the peripheries thereof during the winding operation, of a superposed tank having a discharge-nozzle overhanging said ball and adapted to supply an adhesive substance thereto, means for introducing fluid-pressure to the interior of said tank above said adhesive substance, and a worm feed mechanism interposed in and constituting a part of said discharge-nozzle.

32. A ball-winding machine, comprising a pair of oppositely-disposed ball-tumbling disks rotatably mounted, with their peripheries formed upon laterally-parallel curvilinear lines, and means for retaining a ball on said peripheries during the winding operation.

33. A ball-winding machine, comprising a pair of oppositely-disposed ball-tumbling disks rotatably mounted side by side, undulating peripheries on said disks to alternately tumble a ball confined thereon, whereby its axis of rotation will constantly alter, and means for confining a ball on said disks.

34. In a ball-winding machine, the combi-

nation of a pair of oppositely-disposed ball-tumbling disks rotatably mounted, having their peripheries formed upon radially-undulating lines, means for confining a ball on said peripheries during the winding operation, and means automatically set in operation by the ball when it has reached its maximum diameter for stopping the rotation of said disks.

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