

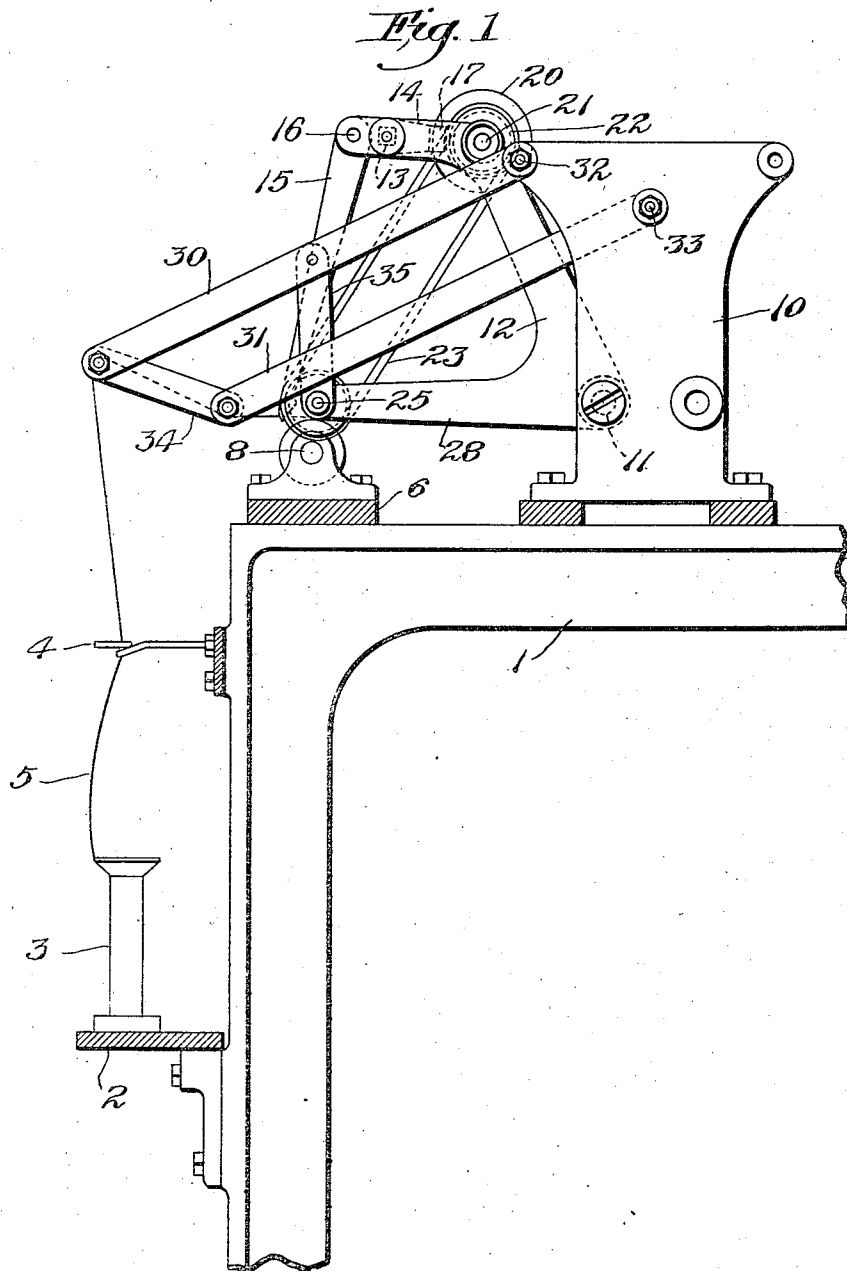
Dec. 23, 1924.

1,520,101

W. G. ABBOTT, JR
CONSTANT SPEED WINDER

Filed Nov. 7, 1919

2 Sheets-Sheet 1



Inventor:
William G. Abbott Jr;
by Robert Robert Cushman
his Atty's.

Dec. 23, 1924.

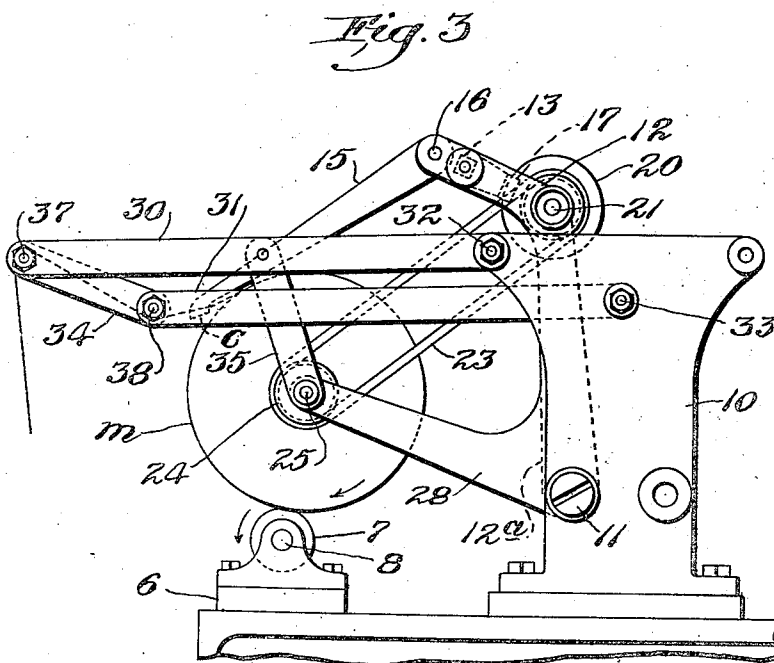
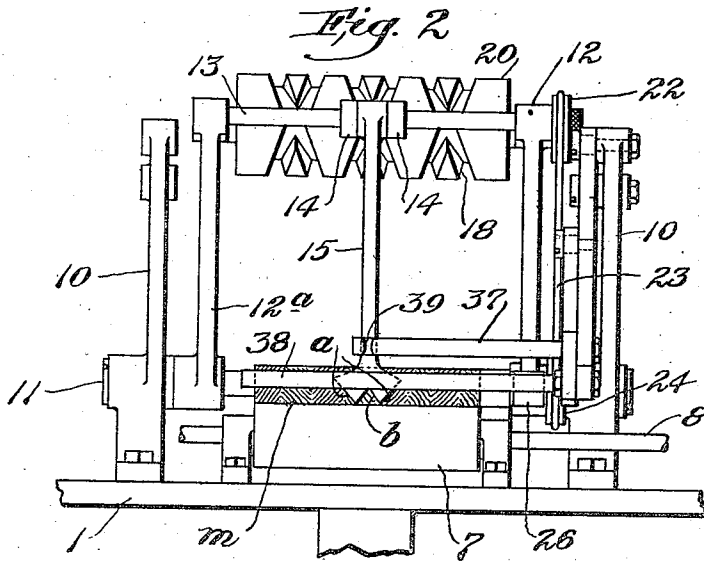
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CONSTANT SPEED WINDER

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

WILLIAM G. ABBOTT, JR., OF WILTON, NEW HAMPSHIRE.

CONSTANT-SPEED WINDER.

Application filed November 7, 1919. Serial No. 336,312.

To all whom it may concern:

Be it known that I, WILLIAM G. ABBOTT, Jr., a citizen of the United States, and resident of Wilton, in the county of Hillsborough and State of New Hampshire, have invented new and useful Improvements in Constant-Speed Winders, of which the following is a specification.

This invention relates to winders for yarns, cordage, wires, filaments or strips, and more especially relates to that class of machinery for this purpose of which the product is a wound package generally known as the Fiji cop or cheese, from its resemblance to the product of the ancient mode of packaging cordage practised by the Fijians and other Polynesian aborigines. Such cops, cheeses or packages are characteristically a self-sustaining mass, each layer comprising a plurality of spiral traverses of the thread, yarn or filament in nearly parallel relation and reversed in the planes at the end of the cop or package, the recurrent loops or bights of the winding at the reversal of the spiral traverses constituting end surfaces crosswise of the axis of the general mass. This structure of the wound mass and principle of winding is characteristic whether the wound mass is conical or cylindrical.

Packages, cops or cheeses of yarn and machinery for winding them according to the general characteristics above mentioned are of common knowledge and use, but so far as I am aware such machines are not organized upon principles permitting winding all of the layers of the wound package at a constant running speed of the yarn, cord, wire, strip or filament (hereinafter referred to as thread) from layer to layer. The arrangement common and usual in the art comprises winding upon a tube, cone quill or other wound-package carrier mounted on and driven by a spindle itself operated at a constant angular velocity, and therefore operated so as to increase the peripheral speed of the wound mass in proportion to the increase in the radius of the wound mass as the package grows. The consequences of this practice do not permit the most advantageous operation.

The average winding speed of machines so organized is necessarily limited by the maximum peripheral speed attained by the maximum-diameter cop or package; the maximum permissible running speed of the

thread sets a limit to this attainable rotary velocity depending upon the tensile strength and the behavior at different speeds with regard to tension at the guides, the stop-motion devices, the unsupported ballooning runs and the unwinding package, of the running thread. These factors limit the permissible linear speed to the lowest speed permitted by any one of them; the maximum peripheral velocity of the winding package can not exceed this limiting linear speed of the thread, or even approach it too closely, because of variations to be expected in the thread. As a consequence, at all points of the winding operation, except when winding the outer layer, the linear speed gradually increases toward a limit somewhat less than the normal maximum. It may be shown that the average winding speed of winding machines having constant-velocity spindles is less than half the permitted maximum which should normally be attained; such winding machines therefore do not reach an attainable winding efficiency.

Other detriments to the operation of the winding spindle at a constant angular velocity and consequent variable linear speed for the winding thread reside in the relation of the linear speed of the winding yarn to the tension, to the variable frictional drag on the thread due to ballooning, to heating of guides and other causes varying sharply in an increasing ratio with the increase in speed.

I am aware of sundry instances in the prior art of mechanism organized to make a wound package by driving the winding package by frictional contact with its freshly wound surface of a constant speed tractor roll or driving drum. But so far as I am aware these machines are not suitable to the production of the mechanically-laid Fiji package, in which a necessary feature is the relation of the winding speed to the traverse of the winding guide axially of the winding mass in such a manner as to provide an incremental advance or recession of the reversal bight of the traverse or culminating point of the reciprocation of the guide with respect to the angular position on the winding mass of this point. Otherwise the reversal bights at the end of the wound mass would come one over the other, or lie in such a position that a previously-laid spiral of the thread would not lie snugly against the last spirally-laid run of thread in the

same direction on the same layer. For a compact wound mass containing nearly the maximum amount of thread possible to its cubical contents, these relationships must be maintained, within limits.

This invention has for a principal object the provision of a new genus of winders adapted to operate at a constant linear speed of the winding yarn near the normal permissible maximum. Other objects are to provide improved mechanism for controlling the traverse of the winding guide to build up a Fiji-wound package, and to provide traverse mechanism for winders adapted to be driven by the winding spindles in turn driven through the winding mass of thread.

The invention will now be described in connection with a particular species illustrating one instance only of the genus of machines comprising the invention. In the accompanying drawings,—

Figure 1 is a vertical side elevation of a winding head and bobbin support comprising one unit of a winding machine embodying the invention;

Figure 2 is a front elevation of the devices shown in Fig. 1; and

Figure 3 is a view similar to Fig. 1 showing the relationship of the parts when the wound package is nearing completion.

Referring now to Fig. 1, the machine comprises any desired form of supporting frame 1, having thereon a suitable stand or bracket 2 for the unwinding bobbin 3, and having a suitable guide such as the pigtail 4 for the unwinding thread 5. Any desired form of creel or support may be provided instead of the support 2, and the unwinding or primary member of the unwinding and winding pair of packages may be a wound spindle, quill, cop or reel; the guide 4 may be of any other desired form and otherwise suitably positioned in relation to the unwinding package. The machine also may be provided with any form of breakage-, slub-, knot- or exhaustion-detecting stop-motion mechanism, such as any of the numerous forms of the prior art, not shown.

Fixed on shaft 8 mounted in suitable bearings 6 on the frames 1 a preferably knurled, roughened or covered tractor roll 7 is driven at a constant speed by suitable means such as a pulley fixed on shaft 8 and a belt, not shown. The roll 7 is the primary drive means of the machine, constituting the only direct connection to an exterior source of power.

The frame 1 also carries a standard 10 having therein a bearing for a pivot shaft 11 upon which rocker frames 12, 12^a, are hung at each side of the roll 7. The frames 12, 12^a are rigidly joined by suitable means such as a squared guide strut 13 parallel with the axis of a shaft 8 in all positions of

the frame 12, 12^a, which strut 13 may be employed as a guide for a sliding traverse bearing block 14 divided at its forward end to receive a traverse guide 15 pivoted between the divided ends of the block 14 at 16, and apertured to fit the strut 13. The rear end of the block 14 is provided with an anti-friction roll 17 for engagement with the reversed-spiral groove 18 of a traverse cam 20, preferably of the barrel form shown, fast on a shaft 21 in bearing holes in the frames 12, 12^a. The winding spindle 25 is carried by and preferably rotates in a bearing 26 in the frame 12. The winding spindle and its bearing and carrier-connector means may be of any desired type. Preferably the spindle is free, at its left hand end as shown, for ready placing of the quill or carrier and doffing of the wound package. For this purpose, the frame 12 comprises a lower radius arm 28 carrying the bearing 26 and spindle 25, but the frame 12^a is made without any arm 28.

Means for rotating the cam 20 in relation to motions of the spindle 25 may be arranged for carriage wholly by the frame 12, 12^a. Fast on the right hand end of the shaft 21, for instance, a belt pulley 22, preferably of any desired expansion-pulley construction having a slightly expandable radius for adjustment purposes may be provided to be driven by a belt 23 from a suitable driving pulley 24 fast on the winding spindle 25; but evidently some other form of rotary driving transmission between the spindle and the traverse cam might be employed.

The radius arm 28 and frame 12, 12^a, are free to yield upwardly about the pivot 11 in response to growing diameter of the winding mass *m* on spindle 25. At the start the spindle 25 is directly above the center of the roll 7, but as the winding mass grows the winding spindle moves upwardly and inwardly, carrying with it traverse cam 20, guide strut 13, traverse slide 14, and traverse guide 15.

Provision is made for substantially constant relation of the angle of the ingoing thread to the traverse guide effective to lay it upon the surface of the rotating mass *m* and to the running guides for the winding thread. Preferred means for this purpose is shown comprising a pantograph linkage having parallel members 30, 31, pivoted respectively at 32 and 33 on the standard 10 and joined together by the end-link 34, this system being lifted in response to the rise of spindle 25 by a radius-link 35 pivoted concentric with the spindle on arm 28. Projecting from the pivotal point between the end-link 34 and the respective parallel links 30, 31, are suitable guides 37 and 38, over and under which respectively the thread is carried. Preferably the guide 37 is pro-

vided with a notch 39 about central of the range of traverse, and preferably the guide 38 is a polished rod parallel with the winding-spindle 25.

5 Preferably the working end of the guide 15 is of the form best shown in Figs. 2 and 3, comprising end inclines *a*, *a*, and a central notch *b*, which extends around the smooth lower surface *c*, Fig. 3, which normally rests
10 in contact with the surface of the winding mass *m*. Guide 15 is free upon its pivot 16, and normally rests upon the surface of the winding mass with a pressure measured by its gravity or the tension of a spring, not
15 shown.

The operation will now be obvious. Motion of the roll 7, a carrier being in place on the spindle 25, the parts being in the position of Fig. 1, and the end of yarn 5 being led about the guides 37, 38, and placed upon the quill or carrier, will drive the carrier in the direction of the arrow Fig. 3, and hence through the belt 23 drive the traverse cam 20 to reciprocate the slide 14 and
20 guide 15. When one of the slopes *a* of the guide 15 passes over the end of the yarn, the yarn will take into the notch *b* and thereafter follow the motions of the bearing 14.

The adjustment of the pulley 22 may be such as to cause its effective diameter to exceed or be exceeded by that of pulley 24, so that the angular rotation of cam 20 will fall behind the angular rotation of the pulley 24 at the smallest diameter of the winding package by amounts substantially equivalent to the angular magnitude of the diameter of the thread at this least radius of the winding package. As the mass *m* rotates, the angular point with respect to the rotating package at which the guide 15 reaches maximum displacement to right or left will thus progressively vary by a slight increment. But the mean number of turns of the winding to each traverse will remain the same for
40 each revolution of the surface of the mass *m*, whatever the diameter of the mass *m*.

While that type of winder in which the winding guide is traversed is preferred and has been explained, the principle of operation is applicable without change to winders in which the winding carrier or spindle is traversed in respect to a winding guide held axially stationary in respect to the winding rotation.

55 The described mechanism is suitable for either single-spindle or multiple-spindle winders; any number of rolls 7, one at each winding head, may be carried upon a long shaft 8, for instance at each upper corner of a frame accommodating two such shafts, each driving winding members of the unwinding and winding pairs carried by spindles mounted on frames 12 at each side of standard 10, as indicated by the unoccu-

pied bearing holes at the right side of the standard 10, as shown.

I claim:

1. A winder having therein rotatable means for supporting the winding thread, means for contacting with and driving the surface of the winding thread mass at a constant velocity, whereby to rotate the supporting means in conformity therewith, a traverse guide for distributing the winding thread on the winding mass, and means for causing relative traverse between the guide and said rotatable supporting means in planes varying in position with the diameter of the winding mass and at a rate variable in response to the angular velocity of the rotary motion of said winding mass.

2. A winder having therein rotatable means for supporting the winding thread, means acting by frictional contact with the winding mass to rotate said supporting means, a traverse guide for distributing the winding thread on the winding mass, means for shifting the position of the traverse guide away from the center of rotation of the winding mass in accordance with its diameter, and means for causing relative traverse in each position of said guide between the guide and said rotatable supporting means at a rate constantly variable in response to the angular velocity of the rotary motion of said supporting means.

3. A winder having therein a spindle for supporting the winding thread, means acting by frictional contact with the winding mass to rotate said spindle, a traverse guide free to move with the growing diameter of the winding mass for distributing the winding thread on the winding mass, and means driven by the spindle for causing relative traverse between the guide and spindle at a rate variable in response to the angular velocity of the rotary motion of said spindle.

4. A winder having therein a winding spindle and a bearing therefor, means for driving the surface of the winding mass at a constant speed and the spindle at a rate variable inversely in response to the circumference of the wound mass, a traverse guide for distributing the winding thread, and means for reciprocating the guide driven by the spindle axially of the surface of the winding mass and at distances from the means for driving the surface of said mass varying with the diameter of said mass.

5. A winder having therein a winding spindle and a bearing therefor, means for driving the spindle by frictional contact with the winding mass thereon, a traverse guide for distributing the winding thread, means for supporting the traverse guide to follow the changing position of the surface of the winding mass, and means for reciprocating the guide driven by the spindle.

6. A winder having therein a winding spindle and a bearing therefor, means for driving the spindle by frictional contact with the winding mass thereon, a traverse
5 guide for distributing the winding thread, means for traversing the guide driven by the spindle, and means for supporting the spindle and traversing means for motion away from said driving means in response to
10 growth of the winding mass.

7. A winder having therein a tractor means for driving the wound mass adapted to be driven at a constant speed, a winding spindle adapted to support and to be driven
15 by the wound mass upon it, a traverse guide, and a rotatable traverse cam, in combination with a mounting permitting motion of said spindle, guide and cam together toward and away from said tractor means, and
20 means carried by the mounting for driving the traverse cam from the spindle.

8. A winder having therein a tractor means for driving the wound mass adapted to be rotated at a constant speed, a winding
25 spindle adapted to support and to be driven by the wound mass upon it, a traverse guide, and a rotatable traverse cam, in combination with a mounting permitting motion of said spindle, guide and cam together toward and
30 away from said tractor means, and variable means carried by the mounting for driving the traverse cam from the spindle at a rate incrementally differing from the rate of the spindle.

35 9. A winder having therein tractor means adapted to be driven at a constant speed, a frame movable toward and away from the tractor means having thereon a winding spindle, a traverse guide for the winding
40 yarn, means for traversing the guide, and means carried by the frame for transmitting the motion of the spindle occasioned by the tractor means to the guide traversing means.

45 10. A winder having therein tractor means adapted to be driven at a constant speed, a frame movable toward and away

from the tractor means having thereon a winding spindle, a traverse guide for the winding yarn, a rotatable cam for traversing
50 the guide, and means carried by the frame for transmitting the motion of the spindle occasioned by the tractor means to the guide traversing means, comprising a belt connection between the spindle and the traverse
55 cam including an expansible pulley on one of the parts.

11. A winder having therein a movable frame, a winding spindle mounted on the frame for motion therewith transverse to
60 the axis of the spindle in response to increased diameter of the winding mass, a traverse guide mounted to follow the surface of the winding mass, and a thread guide mounted on the frame for motion in re-
65 sponse to motion of the frame, whereby to maintain the angle of the thread at the traverse guide substantially constant for any diameter of the wound mass.

12. A winder having therein a winding
70 spindle movable transversely to its axis in response to the growth of a wound mass upon it, a traverse guide adapted to follow the surface of the growing mass, and a plu-
75 rality of guides movable conformably to the growth of the wound mass for the thread passing to the traverse guide, in combination with means for moving the said guides in response to the position of the spindle.

13. A winder having therein a winding
80 spindle movable transversely to its axis in response to the growth of a wound mass upon it, a traverse guide adapted to follow the surface of the growing mass, and a linkage having a plurality of guides thereon
85 for the thread passing to the traverse guide, in combination with means for moving the linkage and the guides thereon in response to the position of the spindle while maintaining the relative position to each other
90 of said guides.

Signed by me at Wilton, New Hampshire,
October, 1919.

WILLIAM G. ABBOTT, JR.