Jan. 31, 1967 S. FURST 3,301,496

YARN WINDING MACHINE

Filed March 23, 1964 2 Sheets-Sheet 1

FIG. 1

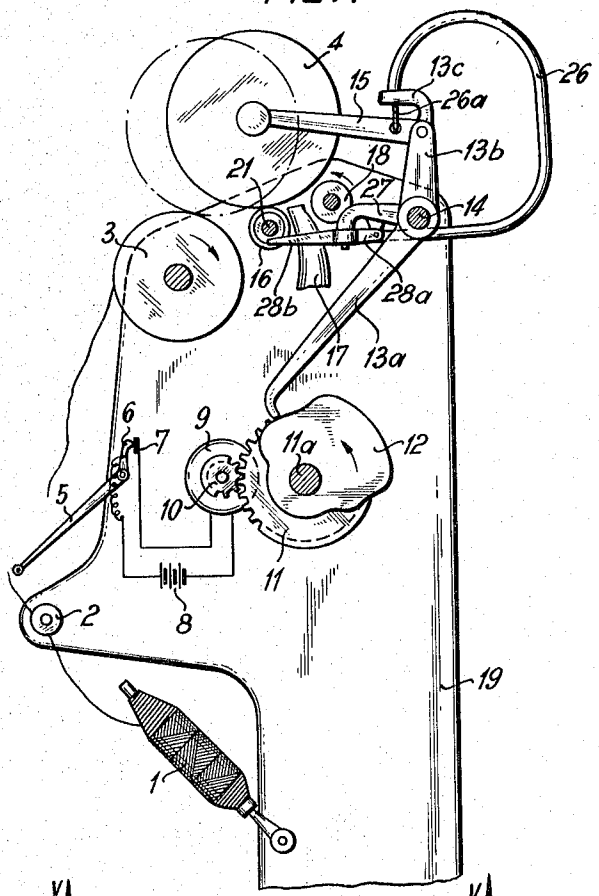


FIG. 2

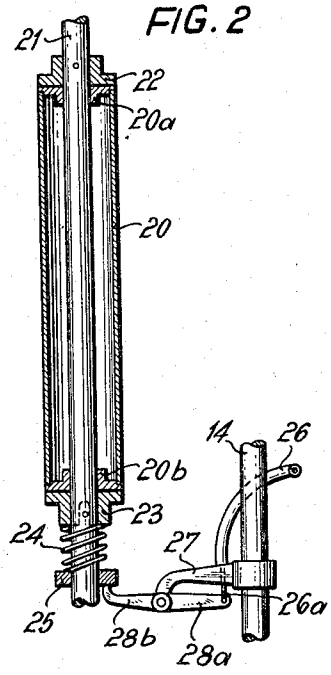


FIG. 3

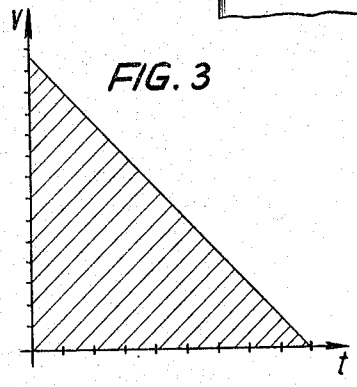
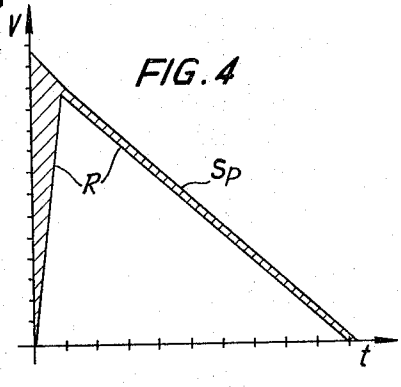


FIG. 4



INVENTOR

Stefan Fürst

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YARN WINDING MACHINE

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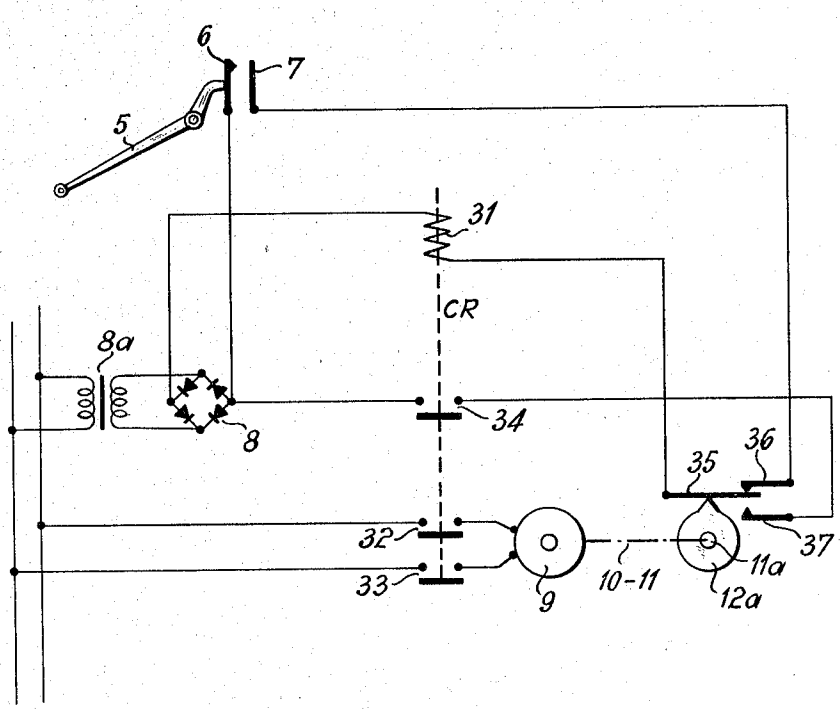
FIG. 5



INVENTOR

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3,301,496

YARN WINDING MACHINE

Stefan Furst, Monchen-Gladbach, Germany, assignor to Walter Reiners, Monchen-Gladbach, Germany

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12 Claims. (Cl. 242—37)

My invention relates to an automatic yarn winding machine in which a rotating take-up spool is brought into engagement with a stationary roller or oppositely rotating roller or both for the purpose of braking or reversing the rotation of the take-up spool as the case may be.

In winding machines, and particularly automatic machines for winding cross-wound yarn packages, after a break in the yarn occurs or the supply coil is depleted, the rotating wound package or take-up spool is braked in order to repair the yarn break or substitute a new supply coil, respectively, and is driven in the opposite direction for a short time in order to seize the broken yarn end with a suction device and thereafter to knot that end with the other end of the broken yarn or of the new supply coil, as the case may be.

There are various possible ways of braking and of reversing the rotation of the take-up spool. Either the rotating yarn-guiding drum for the take-up spool is braked and oppositely rotated for a short time so that the take-up spool follows this reversed rotation due to frictional engagement therewith, or the position of the take-up spool is altered in such a manner that it is transferred from frictional engagement with the forwardly rotating yarn-guiding drum directly to a reversely rotating roller or first intermediately to a stationary braking member. Independently of whether the take-up spool is transferred directly to the oppositely rotating roller or first transferred to a stationary braking member, in either case, there arises the disadvantage that the upper surface of the take-up spool is damaged because of friction when it runs up against the stationary member or even more so when it comes into contact with the roller rotating in the opposite direction.

It is accordingly an object of my invention to provide a winding machine which avoids the aforementioned disadvantages of the known machines and, particularly, damage to the yarn of the take-up spool due to friction.

To this end and in accordance with a feature of my invention, I provide a yarn winding machine with braking and/or oppositely rotating rolls having a friction clutch or brake. In accordance with another aspect of my invention, the friction value of the friction clutch is made adjustable. The friction value of the clutch is selected so that the braking moment of the stationary or oppositely rotating rollers against the clutch is somewhat smaller than the braking moment resulting from the friction of the take-up spool against the rollers. Consequently, during the braking or counter-rotation of the take-up spool, the surface of the braking roller or the roller for driving the take-up spool in the opposite rotary direction respectively, is brought up to nearly the same peripheral speed as that of the take-up spool surface after only a slight sliding or slippage at the take-up spool surface. Thus the yarn surface essentially rolls up on the braking or counter-rotating member, since with the exception of the slippage in the first moment of engagement until the roller is accelerated to the rotational speed of the take-up spool, the sliding friction is absorbed in suitable wear-resistant elements. The friction between the take-up spool and the roller is proportional to the weight or diameter of the take-up spool. In order to

make allowance for this friction, the friction value of the friction clutch is adjustable in accordance with the weight or diameter of the spool. It is a relatively simple matter to apply my invention to winding machines of the type in which the pressure of the take-up spool against the roller is maintained at constant value independently of the weight of the spool.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention has been illustrated and described as embodied in a yarn-winding machine, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalence of the claims.

The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a partly diagrammatic side elevational view of a yarn-winding machine station according to the invention, some of the components being omitted for the purpose of clarity;

FIG. 2 is a fragmentary plan view, partly in section, of several coacting components of the machine shown in FIG. 1;

FIG. 3 is a graph showing the relationship of the peripheral speed of the take-up spool to the duration of braking when the braking member is not provided with a clutch;

FIG. 4 is a graph showing the peripheral speed of the braking roller which is provided with a clutch in accordance with my invention with respect to the duration of braking and its relationship to the peripheral speed of the take-up spool during the same period; and

FIG. 5 is a circuit diagram showing the electrical connections between the yarn guard or feeler and the take-up spool braking mechanism.

Referring now to the drawings and particularly to FIG. 1, there is shown schematically a winding machine station in which yarn is supplied from a supply coil or cop **1** over a yarn tensioner **2** and a yarn guide drum **3** and is wound on a take-up spool **4**. A yarn guard or feeler **5** is also provided which, in the case shown in FIG. 1, swings out when the yarn is broken or the supply coil **1** is depleted and connects the electrical circuit to a power source **8** by means of the contacts **6**, **7** so that a motor **9** is energized to drive the cam **12** in the direction of the arrow through the agency of the meshing gear pair **10**, **11**. A rotary switch mechanism shown in FIG. 5, is provided on the shaft **11***a* of the gear **11** or the cam **12** to shut off the motor **9** after a single turn of the gear **11** on the cam **12**. As shown in FIG. 1, the lever or follower arm **13***a* of a bell-crank or double-arm lever slides on the peripheral surface of the cam **12** and when the bell-crank lever swings about the shaft **14**, the other lever arm **13***b* thereof swings the take-up spool **4** by means of the arm **15**, which is secured to the shaft on which the take-up spool is mounted, from the broken-line position of the take-up spool to the solid-line position in which it engages the braking roller **16**. When the rotary speed of the take-up spool **4** has been slowed almost to zero, then the cam **12** causes the lever arms **13***a*, **13***b* again to swing slightly in a clockwise direction so that the take-up spool **4** comes into contact with the roller **18** which is rotating in the opposite direction. When the rotary direction of the take-up spool **4** is reversed, the yarn from the surface of the take-up spool **4** is unwound slightly and can be gripped by means of a vacuum nozzle **17**, shown only

fragmentarily in FIG. 1 to avoid obscuring other details. A representative vacuum nozzle yarn seizing device of this general type is shown in my Patent No. 3,077,312. All of the relatively stationary components, for example the mounting peg of the supply coil or cop **1**, the yarn tensioner **2**, the shaft of the yarn guard **5**, the yarn guide drum **3**, the counter-rotating roller **18** as well as the shafts **11***a*, **14**, **21** and the motor **9** are mounted in a suitable manner on the winding machine frame **19** in substantially similar relationship to each other as that shown in my Patent Nos. 3,003,478 and 3,092,340.

In order to avoid large frictional losses between the take-up spool **4** and the braking roller **16**, the roller has a hollow construction and is consequently of relatively small mass, for example as shown in FIG. 2. The surface **20** of the roller **16** comes into contact with the take-up spool **4** and is freely rotatable on the bearings **20***a* and **20***b* about the shaft **21** which is suitably mounted on the frame **19**. The bearing **20***a* is supported against a fixed abutment **22** connected to the shaft **21**, while the bearing **20***b* faces a counter bearing **23** which, though connected with the shaft **21** is nevertheless axially displaceable thereon by the well-known pin and groove arrangement such as is illustrated in FIG. 2. This counter bearing **23** is biased into engagement with the bearing **20***b* by means of a compression spring **24** and a set collar or adjusting ring **25**.

When the take-up spool **4** is transferred into engagement with the surface **20** of the braking roller **16**, the latter is first of all taken along or entrained therewith so that sliding occurs between the bearings **20***a* and **20***b* on the one hand and the counter bearings or abutments **22** and **23** on the other hand. The amount of backlash or sliding depends upon the frictional force which exists between the components **20***a* and **22** or **20***b* and **23**. This frictional force can be adjusted with the adjusting ring **25**. After sliding between the components **20***a* and **22** as well as **20***b* and **23** has ceased, the roller **20** and and shaft **21** act together as a rotating unit.

The frictional force can be adjusted by hand, and it is possible to lock the adjusting ring **25**, for example, with a tightened screw (not shown) on the shaft **21**. It is, however, also possible to automatically alter the position of the adjusting ring **25** and thereby the amount of frictional force between the roller bearings **20***a*, **20***b* and the abutments **22**, **23**, respectively, in proportion to the diameter of the wound take-up spool **4**. In the embodiment shown in FIGS. 1 and 2, there is provided a flexible adjusting member or Bowden wire whose tubular sheath **26** is secured at one end to a curved arm **13***c* of the bell crank lever **13***a*, **13***b* and at the other end to an arm **27** fixed to the shaft **14**. The position of the flexible wire push-pull member **26***a*, connected at one end to the lever arm **28***a* and at the other end to the spool-carrying arm **15**, within the sheath of the Bowden wire **26** depends upon the location of the arm **15**. The more fully wound the take-up spool **4**, the farther will the member **26***a* extend from the arm **15** into the tubular adjusting member **26** and exert pressure on the arm **28***a* of the double lever **28***a*, **28***b* and cause it to pivot clockwise as viewed in FIG. 2. The arm **28***b* of this double lever then presses against the adjusting ring **25**, if necessary through the intermediary of a compression bearing (not shown), so that the spring **24** is placed under greater compression, the larger the diameter of the take-up spool **4**. The frictional force for braking the surface **20** of the roller **16** thereby also varies with the diameter of the take-up spool **4**.

FIG. 3 shows a graph in which the peripheral speed *v* of the take-up spool decreases gradually to zero during the braking interval *t*. The entire hatched area represents backlash or sliding at the yarn surface of the take-up spool which occurs due to the fact that the braking roller is not provided with a clutch for reducing the sliding friction.

In FIG. 4 there is shown the relationship of the peripheral speed *v* to the time *t* of braking, in which the curve

Sp represents the peripheral speed of the take-up spool **4** and the curve R represents the peripheral speed of the roller **16**. Immediately after instituting the braking action the rotational speed of the braking roller which is provided with a clutch in accordance with my invention, increases to at least approximately the speed of the take-up spool and then either together with the spool or with a very slight mutual sliding, is slowed down with the spool to a speed of zero. The sliding between the take-up spool **4** and the braking roller **16** occurring in this case is only the relatively smaller hatched area of FIG. 4 as compared to FIG. 3. Since the braking moment of the friction clutch is somewhat smaller than the braking moment resulting from the peripheral friction between the take-up spool and the braking roller, the braking curve in its entirety follows a slightly flatter course so that, as is shown in FIG. 4, the braking process consumes a longer period of time.

Although the clutch has been described herein as a friction clutch, other types of clutches such as a magnetic clutch for example, are intended to be and are included within the scope of my invention.

Furthermore, the clutch can be provided for the counter-rotating roller **18** in the same manner instead of, or in addition to, being provided for the roller **16**.

In my Patents Nos. 3,033,478 and 3,092,340, I describe a winding machine in which a yarn take-up spool is rotated in one direction and then oppositely rotated indirectly through the yarn guide drum by means of an intermediate friction roller or idler which is pivotable into engagement simultaneously with the yarn guide drum and with the one and then the other of the counter-rotating rollers. In the present invention, on the other hand, the take-up spool **4** is rotated in a forward direction only by the yarn guide drum **3** which is independently rotated clockwise, as shown in FIG. 1, by any suitable means, and is directly placed in engagement successively with the braking roller **16** and the counter-rotating roller **18**.

In my aforementioned Patent No. 3,033,478, I have provided a completely mechanical device for effecting a single turn of the cam so that the take-up spool is rotated in reverse to permit the yarn end to be seized. Such a device can, of course, also be employed in the present invention for causing the take-up spool **4** to engage the counter-rotating roller **18** so as to reverse its rotation during one turn of the cam **12**.

In the embodiment of this invention, however, I utilize an electromechanical device for effecting the single turn. As shown diagrammatically in FIG. 5, alternating current from a main power line is stepped down by the transformer **8***a* and converted to direct current by the rectifier **8**. Upon the breakage of yarn or depletion of the supply coil **1**, the yarn guard or feeler **5** swings outwardly and closes the contacts **6**, **7**, applying voltage to a coil **31** of a relay CR which actuates the contacts **32**, **33** to close the circuit that energizes the motor **9** from the main power line. Simultaneously therewith, a self-holding contact **34** is closed. As the motor **9** begins to rotate the control cam **12** (FIG. 1), a switching cam **12***a* of the single-turn mechanism, suitably mounted for example coaxially with the control cam **12**, opens a contact **36** and closes a contact **37**. The yarn guard contacts **6**, **7** are now rendered inactive, and the relay coil **31** remains energized until the single turn is completed. Then the cam **12***a* opens contact **37** and closes contact **36** thereby interrupting the self-holding circuit of relay CR so that the motor stops.

I claim:

1. In a yarn winding machine, a rotating take-up spool, braking roller means, means for bringing said rotating take-up spool and said braking roller means into mutual engagement so as to brake said rotating take-up spool, and clutch means cooperating with said braking roller means for reducing sliding friction between said take-up spool and said braking roller means.

2. In a yarn winding machine, a rotating take-up spool, braking roller means, means for bringing said rotating take-up spool and said braking roller means into mutual engagement so as to brake said rotating take-up spool, and friction clutch means frictionally engaging said braking roller means for reducing sliding friction between said take-up spool and said braking roller means.

3. In a yarn winding machine, a rotating take-up spool, braking roller means, means for bringing said rotating take-up spool and said braking roller means into mutual engagement so as to brake said rotating take-up spool, friction clutch means frictionally engaging said braking roller means for reducing sliding friction between said take-up spool and said braking roller means, and means for adjusting the frictional force between said clutch and said braking roller means.

4. In a yarn winding machine, a rotating take-up spool, braking roller means, means for bringing said rotating take-up spool and said braking roller means into mutual engagement so as to brake said rotating take-up spool, friction clutch means frictionally engaging said braking roller means for reducing sliding friction between said take-up spool and said braking roller means, and means for adjusting the frictional force between said clutch and said braking roller means in proportion to the weight of said take-up spool.

5. In a yarn winding machine, a rotating take-up spool, braking roller means, means for bringing said rotating take-up spool and said braking roller means into mutual engagement so as to brake said rotating take-up spool, friction clutch means frictionally engaging said braking roller means for reducing sliding friction between said take-up spool and said braking roller means, and means for adjusting the frictional force between said clutch and said braking roller means relative to the diameter of said take-up spool.

6. In a yarn winding machine, a rotating take-up spool, a stationary idler roller spaced from said rotating take-up spool, means for bringing said rotating take-up spool and said idler roller into mutual engagement so as to brake said rotating take-up spool, and clutch means cooperating with said idler roller for reducing sliding friction between said take-up spool and said idler roller.

7. In a yarn winding machine, a rotating take-up spool, braking roller means comprising a stationary idler roller and a counter-rotating roller rotating in the same rotary direction as said rotating take-up spool, said rollers being spaced from one another and from said rotating take-up spool, means for bringing said rotating take-up spool into successive mutual engagement with said rollers so as to brake said rotating take-up spool and reverse its direction of rotation, and clutch means cooperating with at least one of said rollers for reducing sliding friction between said take-up spool and said one roller.

8. In a yarn winding machine, a rotating take-up spool, braking roller means including means for reversing the rotary direction of said take-up spool spaced therefrom, means for bringing said rotating take-up spool and said braking roller means into mutual engagement so as to brake said rotating take-up spool and reverse its rotary direction, and clutch means cooperating with said braking roller means for reducing sliding friction between said take-up spool and said braking roller means.

9. In a yarn winding machine, a freely rotating take-up spool, braking roller means comprising a shaft, a stationary idler roller mounted on said shaft and freely rotatable with respect to said shaft, means for bringing said rotating take-up spool and said idler roller into mutual engagement whereby said idler roller is entrained by said rotating take-up spool and is rotated about said shaft so as to brake said rotating take-up spool, and clutch means comprising at least one abutment member mounted on said shaft, said abutment member being frictionally engageable with said idler roller so as to reduce sliding friction between said take-up spool and said idler roller.

10. A yarn winding machine according to claim **9** including means for adjusting the frictional force between said abutment member and said roller.

11. A yarn winding machine according to claim **10**, wherein said adjusting means comprises a compression spring biasing said abutment member into engagement with said idler roller and a linkage system applying pressure to said spring for varying the biasing force of said spring in relation to the diameter of said take-up spool.

12. A yarn winding machine according to claim **10** wherein said braking roller means includes a counter-rotating roller spaced from said idler roller and said take-up spool, said means for bringing said take-up spool and said idler roller into mutual engagement comprising a single-turn mechanism including a cam, means for giving said cam a single turn and follower means operatively connected to said take-up spool, said follower means being guided by said cam to operatively bring said take-up spool into engagement with said counter-rotating roller for reversing the original direction of rotation of said take-up spool during a single turn of said cam.

References Cited by the Examiner

UNITED STATES PATENTS

474,381	5/1892	Hagadorn et al.	242—155
594,688	11/1897	Gue et al.	188—25
2,992,785	7/1961	Pitts	242—35.6
3,081,046	3/1963	Barnes et al.	242—36

STANLEY N. GILREATH, *Primary Examiner.*

MERVIN STEIN, W. S. BURDEN,
Assistant Examiners.