Nov. 26, 1935. G. METCALFE ET AL 2,022,379

APPARATUS FOR WINDING THREAD

Filed March 8, 1934

FIG_1_

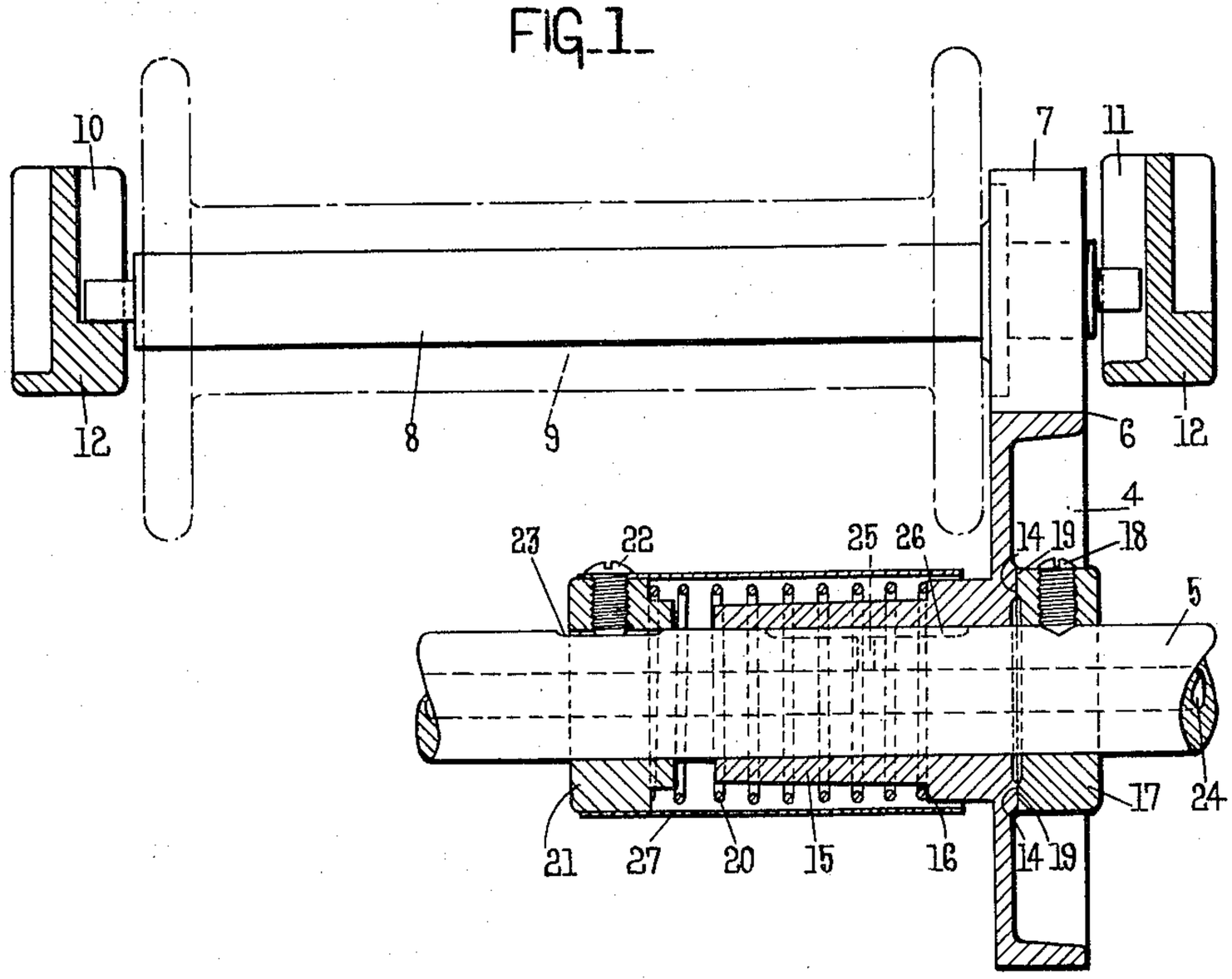


FIG_2_

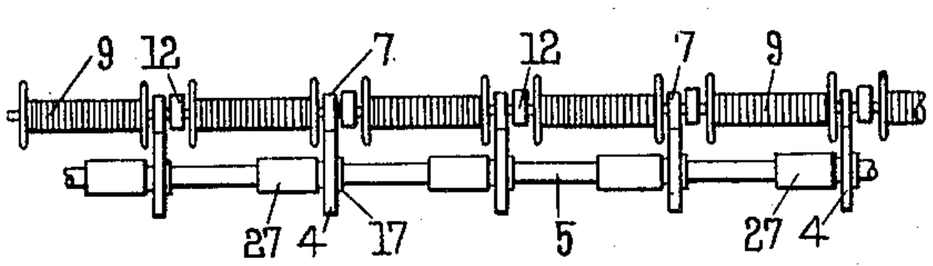
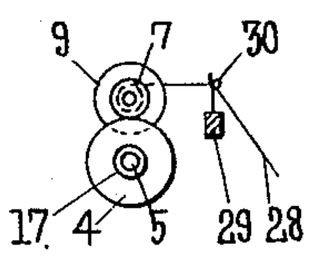


FIG_3_



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APPARATUS FOR WINDING THREAD

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9 Claims. (Cl. 242—18)

This invention relates to thread winding mechanisms and more particularly to winding apparatus for bobbins or like packages in which a thread or a number of threads are taken from a package or from a number of packages or other source of supply and are wound on to a bobbin or other support rotated by a driving member carried by a shaft or spindle and adapted to engage a driven member connected to the bobbin or other support. This type of winding apparatus has the great advantage that the thread upon the package is not engaged or touched in any manner by the bobbin rotating means, thus avoiding the risk of fraying or chafing the yarn by rubbing. To wind successfully, however, it has hitherto been essential that the thread or threads proceeding to the winding apparatus should be quite free to proceed thereto, since if the thread is held or retarded even momentarily, the continued rotation of the package strains or breaks the thread. This represents a serious limitation in the applicability of this type of winding apparatus in textile operations, where it is frequently required to wind thread which is continuously delivered independently of the winding operation. In view, moreover, of the increase in package diameter which takes place as winding proceeds, the thread is liable to be wound under excessive and increasing tension, which may strain or eventually break it.

The object of the present invention is to provide a bobbin-winding apparatus of the type mentioned, in which the winding rate is automatically adjusted in accordance with the rate of thread delivery without applying undue strain to the thread, when the delivery of the thread is reduced or even stopped.

With this object in view a bobbin winding apparatus according to the invention comprises a driving wheel, in frictional engagement with, and arranged co-axially with, a driving shaft, and adapted to engage at its periphery a driven member mounted upon the bobbin-supporting spindle so that on rotation of the driving wheel the bobbin is rotated and winds the thread proceeding to it. The amount of friction between the driving shaft and the driving wheel is such that the peripheral speed of the winding bobbin can automatically adjust itself to the rate at which the thread is delivered to it.

The friction drive from the driving shaft to the driving wheel may be transmitted by means of a collar or disc fixed to the shaft and having a smooth side adapted to contact with a smooth annular surface formed in the side of the driving wheel. Means such as a spring may be used to provide pressure between the contacting surfaces.

One form of apparatus according to the invention will now be described in greater detail with reference to the accompanying drawing, in which

Fig. 1 shows in part-sectional front elevation a winding device for the production of cylindrically wound bobbins;

Fig. 2 shows diagrammatically in front elevation a plurality of winding devices of the type shown in Fig. 1, while

Fig. 3 is an end elevation of the apparatus shown in Fig. 2.

Referring to Fig. 1 a driving wheel **4**, freely mounted on a driving shaft **5**, engages at its periphery **6** a driven wheel **7** mounted upon and fixed to a spindle **8**, which fits firmly in the bore of a bobbin **9** and rides at its extremities in slots **10**, **11** formed in supporting heads **12**. The driving wheel **4** is formed on the one side with a raised annular surface **14**, and on the other with a bush-like projection **15** which extends as a journal along the shaft **5** and is reduced in diameter to form an annular shoulder **16**.

A collar **17**, secured to the shaft **5** by a set screw **18**, is formed with a raised annular surface **19** which fits flush to the raised annular surface **14** of the driving wheel **4**, the two surfaces being pressed together by a spring **20** which is compressed between the annular shoulder **16** of the bushing **15** and a second collar **21**, secured to the shaft **5** by a set screw **22**. The collar **21** is adjustable lengthwise of the shaft **5** along the length of a "flat" **23** in order to allow of control of the force in the spring **20**, and consequently of the degree of friction between the opposing surfaces **14** and **19**.

The driving wheel **4** is caused to rotate with the shaft **5** by the frictional contact between the surfaces **14** and **19**, and between the ends of the spring **20** and the collar **21** and the shoulders **16** of the bushing **15**, respectively, and transmits drive from the shaft **5** through the driven wheel **7** to the bobbin **9**. The right hand extremity of the spindle **8** is not supported from beneath, the slot **11** being deeper than the slot **10**, in order that a large proportion of the combined weight of the driven wheel **7**, spindle **8** and the bobbin **9** is supported directly by the driving wheel **4**, to ensure non-slipping driving contact between the driving wheel and the driven wheel. The driven wheel **7** may be made of hard rubber, hard fibre composition, lignum vitæ or other hard material

having a high coefficient of friction, and if desired the driving wheel **4** may have a covering such as leather, rubber or the like, in order to prevent slipping between the two members.

The drive of the wheel **4** being by friction, the peripheral speed of the winding bobbin **9** can automatically adjust itself to the rate at which thread is delivered to it. Thus, as the amount of thread on the bobbin **9** increases the bobbin develops an increasing periphery, and consequently a tendency to increase the rate of take-up of the thread. This tendency is counter-balanced, however, by the driving wheel **4** slipping on the driving shaft **5**. In this manner the rate of rotation of the driving wheel **4** gradually decreases during the building of the thread on the bobbin.

The pressure between the friction surfaces is adjusted in accordance with the amount of tension which may safely be imparted to the thread, so that winding proceeds at the rate of thread delivery without danger of straining or breaking the thread. If the thread delivery is retarded the driving wheel **4**, which remains in contact with the driven wheel **7**, slips on the driving shaft **5** while continuing to drive the bobbin **9** at a reduced speed, and if the thread delivery stops completely, the driving wheel **4** becomes stationary upon the driving shaft **5**, which still rotates at its original speed. The driving shaft **5** is rotated so that the driving wheel **4** tends to be driven at a rate ensuring the bobbin periphery being rotated in excess of the normal rate of delivery of the thread. In this manner slack thread caused, for example, by piecing-up a new thread, or in starting-up the winding operation, is taken up by the package immediately.

The driving shaft **5** is drilled axially at **24** to form a conduit which may supply any number of winding units with grease or other lubricant. As shown in Fig. 1 a bore **25** connects the conduit **24** to a slot **26** formed in the surface of the driving shaft **5** beneath the bushing **15**. Lubricant from the conduit **24** is conducted through the bore **25** to the inside face of the bushing and lubricates the bearing surfaces of the bushing and the shaft. The driving wheel **4** can thus slip freely on the shaft **5**, the drive from the shaft to the wheel being transmitted through the contacting frictional surfaces, the pressure between which can be finely adjusted by varying the force in the spring **20** to ensure a very quick response to any change in tension in the thread being wound. A cylindrical dust shield **27** surrounds the spring **20** and is secured by the screw **22** to the collar **21**.

It is to be understood, of course, that only a slight driving effort is necessary to rotate the wheels **4** and **7** and the bobbin **9**, the effort being less than the maximum tension permissible in the thread. Therefore, on cessation or interruption of the thread feed, the pull of the thread acting at the periphery of the bobbin **9** overcomes the driving torque applied frictionally to the wheel **4**. Winding takes place at substantially uniform tension throughout the building of the package whatever the rate of winding, and the danger of strain or breakage of the thread experienced in ordinary positive winding apparatus is considerably lessened.

In order to make the winding device capable of use with very delicate threads the driving wheel **4** may be of light construction, preferably being hollow as shown in Fig. 1. In this way the inertia of the wheel is considerably reduced.

Thread traversing means such as a guide eye **30** attached to a reciprocating rod **29** (see Fig. 3) is arranged to operate in close relation to the bobbin **9**, or if desired, means such as those described in U. S. application S. No. 712,110 filed February 20, 1934, corresponding to British application No. 7304/33 filed 10th March, 1933, may be used to guide a plurality of threads side by side on to the package.

The apparatus according to the invention is suitable for application in a large number of textile operations; for example it may be used for winding artificial threads continuously with their production, e. g. continuously with the production of cellulose acetate threads or filaments produced by the dry or evaporative method. It is also of great advantage where a plurality of ends of thread are delivered from a common source and which are required to be wound on separate packages, and is particularly suitable for use where a plurality of threads of artificial material have been subjected to mass treatment, and are wound separately. Thus, as shown in Figs. 2 and 3 a plurality of winding units are arranged to be driven from a common shaft **5**, the ends of thread **28** (one shown) being traversed along the lengths of the winding bobbins **9** by the traverse rod **29** to which may be attached any number of guides **30**, the whole traversing unit being reciprocated by cam or crank means (not shown). As examples of processes in which a plurality of winding units may be employed, may be mentioned the stretching of artificial threads etc. as described in British Patent No. 371,461 and U. S. application S. No. 656,514 filed 11th February, 1933, wherein a plurality of threads stretched together while in warp form may be wound on to separate bobbins after stretching. A further example is the winding of artificial or other threads which have undergone such treatments as sizing, saponifications, or dyeing treatment in warp form and afterwards require to be wound on to bobbins. The winding apparatus above described enables each thread (or two or more threads together) to be rapidly applied to the bobbin **9**, and, the bobbin being slightly over-driven by the driving wheel **4**, any slack formed in transferring a thread from the continually delivered warp sheet is quickly taken up, after which winding proceeds at exactly the rate of delivery of the thread, so that the thread is evenly wound without danger of strain, slippage in the drive necessitated by the increase in the package diameter being automatically effected by the frictional mounting of the driving wheel.

What we claim and desire to secure by Letters Patent is:—

1. In a bobbin winding apparatus for thread or like material, a bobbin-supporting spindle, a wheel fixed on said spindle, a driving wheel in driving connection with said spindle wheel, and frictional means for rotating said driving wheel, said frictional means permitting the peripheral speed of the bobbin to adjust itself to the rate at which thread is delivered to the bobbin.

2. In a bobbin winding apparatus for thread or like material, a bobbin-supporting spindle, a wheel fixed on said spindle, a rotatable shaft, a driving wheel revolubly mounted on said shaft and in driving connection with said spindle wheel, and means making frictional driving contact between said shaft and said driving wheel, said frictional means permitting the peripheral speed

of the bobbin to adjust itself to the rate at which thread is delivered to the bobbin.

3. In a bobbin winding apparatus for thread or like material, a bobbin-supporting spindle, a wheel fixed on said spindle, a rotatable shaft, a driving wheel revolubly mounted on said shaft and in driving connection with said spindle wheel, means making frictional driving contact between said shaft and said driving wheel, and means to adjust the amount of friction between the driving wheel and the shaft.

4. In a bobbin winding apparatus for thread or like material, a bobbin-supporting spindle, a wheel fixed on said spindle, a rotatable shaft, a driving wheel revolubly mounted on said shaft and in driving connection with said spindle wheel, a member with an annular surface rotatable with said shaft and disposed in contact with an annular surface on said driving wheel, and means to press said contacting surfaces together so that said shaft transmits to said driving wheel a torque which is limited to permit the peripheral speed of the bobbin to adjust itself to the rate at which thread is delivered to the bobbin.

5. In a bobbin winding apparatus for thread or like material, a bobbin-supporting spindle, a wheel fixed on said spindle, a rotatable shaft, a driving wheel revolubly mounted on said shaft and in driving connection with said spindle wheel, a member with an annular surface rotatable with said shaft and disposed in contact with an annular surface on said driving wheel, means to press said contacting surfaces together so that said shaft transmits to said driving wheel a torque which is limited to permit the peripheral speed of the bobbin to adjust itself to the rate at which thread is delivered to the bobbin, and means for adjusting the degree of pressure between said surfaces so as to control the applied torque.

6. In a bobbin winding apparatus for thread or like material, a bobbin-supporting spindle, a wheel fixed on said spindle, a rotatable shaft, a driving wheel revolubly mounted on said shaft and in driving connection with said spindle wheel, a member with an annular surface rotatable with said shaft and disposed in contact with an annular surface on said driving wheel, spring means adapted to press said contacting surfaces together so that said shaft transmits to said driving wheel a torque which is limited to permit the peripheral speed of the bobbin to adjust itself to the rate at which thread is delivered to the bobbin, and means for adjusting the degree of pressure between said surfaces so as to control the applied torque.

7. In a bobbin winding apparatus for thread or like material, a bobbin-supporting spindle, a wheel fixed on said spindle, a rotatable shaft, a driving wheel journalled and freely rotatable about said shaft and in driving connection with said spindle wheel, means making frictional contact between said shaft and said driving wheel adapted to transmit from said shaft to said driving wheel a torque which is limited to permit the peripheral speed of the bobbin to adjust itself to the rate at which thread is delivered to the bobbin, and means for lubricating the journal surface so as to allow of relative rotary motion between said shaft and said driving wheel and at the same time to permit of sensitive adjustment of the torque applied from said shaft through said friction means to said driving wheel.

8. In a bobbin winding apparatus for thread or like material, a bobbin-supporting spindle, a wheel fixed on said spindle, a driving wheel beneath said spindle wheel, journals for said spindle adapted to allow at least part of the weight of said spindle and said spindle wheel to be borne by said driving wheel so as to maintain driving connection between said wheels, and frictional means for rotating said driving wheel, said frictional means permitting the peripheral speed of the bobbin to adjust itself to the rate at which thread is delivered to the bobbin.

9. In a bobbin winding apparatus for thread or like material, a bobbin-supporting spindle, a wheel fixed to said spindle near one end thereof, a rotatable shaft disposed parallel to said bobbin-supporting spindle, a driving wheel revolubly mounted on said shaft and in driving connection with said spindle wheel, and means making frictional driving contact between said shaft and said driving wheel, said frictional means permitting the peripheral speed of the bobbin to adjust itself to the rate at which thread is delivered to the bobbin.

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