Oct. 26, 1937. W. R. McKENNA 2,097,287

WIND-UP MANDREL

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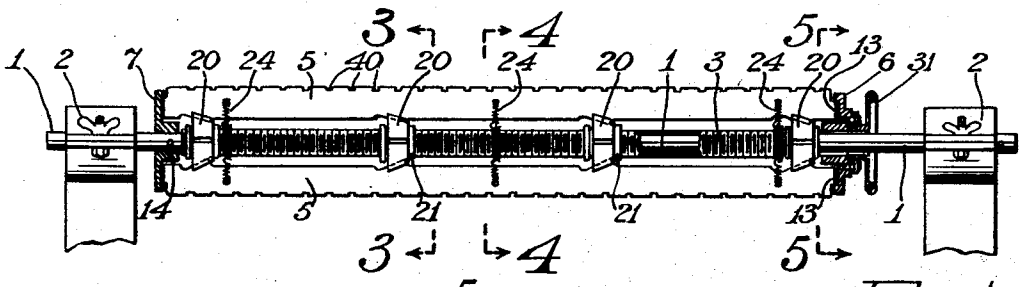


Fig. 1

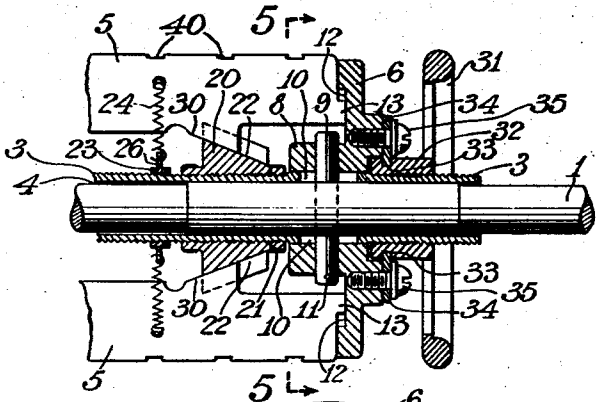


Fig. 2

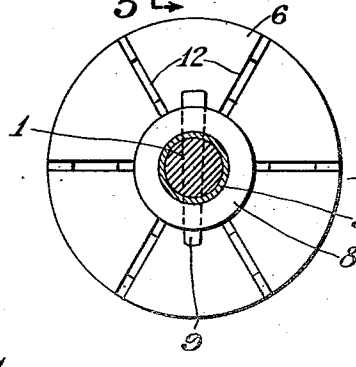


Fig. 5

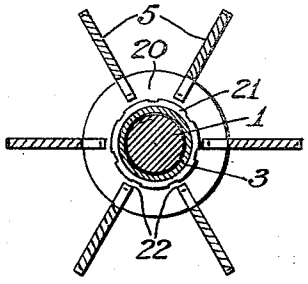


Fig. 3

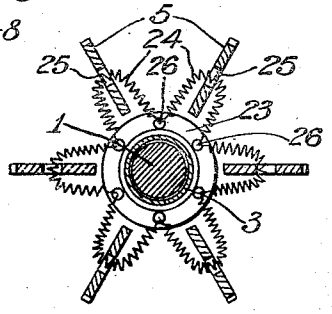


Fig. 4

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WIND-UP MANDREL

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6 Claims. (Cl. 242—72)

This invention relates to a wind-up mandrel and, more particularly, to an improved apparatus of this type in which the roll of material wound up may be readily removed from the mandrel.

Wind-up mandrels are commonly used for reeling or winding up webs of material made in continuous lengths. Such mandrels are used in the production of continuous webs of plastics for use as interlayers in safety glass, the production of continuous regenerated cellulose sheeting, photograph films, and the like. In winding any web of material on a mandrel it inevitably binds tightly on the mandrel; particularly is this true where the web is wound under some tension. The removal of the roll of material from the mandrel for shipping or transferring to some other location in the plant would be practically impossible if some means were not provided for reducing the effective circumference of the mandrel. Heretofore, no satisfactory wind-up mandrel has been devised that is relatively simple and economical to construct and, at the same time, comprises an easily operable mechanism permitting removal of a roll of material therefrom.

An object of the present invention is to provide an improved wind-up mandrel of simple and economical construction and which comprises means whereby the effective circumference of the mandrel may be easily reduced so that a roll of material may be slipped therefrom. Other objects of the invention will be apparent from the description given hereinafter.

The above objects are accomplished broadly according to the present invention by providing a wind-up mandrel comprising a shaft, a sleeve slidably mounted on the shaft, a plurality of wedge cones mounted in fixed position on the sleeve, a plurality of elongated wedge plates arranged radially about and parallel to the shaft and held in fixed position with respect to movement longitudinally along the shaft, resilient means for holding the inner edges of the wedge plates yieldingly against the wedge cones, the inner edges being tapered parallel to the taper of the wedge cones at the spaces where they bear against the wedge cones, and means for moving the sleeve and associated wedge cones longitudinally with respect to the shaft and the wedge plates whereby the wedge plates are moved to and from said shaft due to the relative motion between the wedge cones and the tapered inner edges of the wedge plates.

As has been usual heretofore, mandrels of this type are journaled in snap bearings so that the mandrel may be readily removed after the desired length of material has been rolled up. Ordinarily, the shaft of the mandrel is connected with some driving means to turn the mandrel automatically at the desired rate during the reeling step. It is also customary to wrap cardboard, or the like, around the mandrel to form a core on which the web of material is reeled. the cardboard being removed from the mandrel with the roll of material and forming a permanent core for the roll.

The invention will be more readily understood by the description given hereinafter in which reference is made to the accompanying drawing wherein:

Fig. 1 is a front elevation of a wind-up mandrel according to the present invention, parts being broken away and portions of the apparatus being shown in vertical section for purposes of illustration;

Fig. 2 is an enlarged vertical section of the right hand end of the mandrel shown in Fig. 1, illustrating certain of the mechanical details;

Fig. 3 is an enlarged section on the line 3—3 of Fig. 1 looking in the direction of the arrows;

Fig. 4 is an enlarged section on the line 4—4 of Fig. 1 looking in the direction of the arrows; and

Fig. 5 is an enlarged section on the line 5—5 of Fig. 1 looking in the direction of the arrows.

Referring to the drawing, and, more particularly, to Fig. 1 which illustrates the general assembly, the wind-up mandrel comprises the shaft 1 of steel, or the like, which is shown journaled in the snap bearings 2—2. Any means may be employed for connecting the shaft 1 with some driving means temporarily during the reeling step, such connection not being shown in the drawing as it forms no part of the present invention.

Slidably mounted on shaft 1 is externally threaded sleeve 3 preferably made of aluminum or other light weight metal. Structurally it is expedient to have the shaft 1 of slightly increased diameter for a short section adjacent the ends of sleeve 3 so that there is a sliding fit between sleeve 3 and shaft 1 at these sections while elsewhere there is a small clearance between sleeve 3 and shaft 1. The sleeve 3 is broken away for a short piece in Fig. 1 showing the clearance between the sleeve and the shaft. In Fig. 2 is illustrated clearly one section of shaft 1 of slightly increased diameter forming a sliding fit with the sleeve 3, whereas there is a

small clearance between the sleeve and the shaft beyond this section as indicated at 4.

The elongated wedge plates 5 are arranged radially about and parallel to shaft 1 and held in fixed position with respect to movement longitudinally along shaft 1 by means of the end flanges 6 and 7. The number of wedge plates 5 used is optional but six are preferred as shown in Figs. 3 and 4. In Figs. 1 and 2 all but two of the wedge plates have been eliminated to illustrate the construction better and in Fig. 5 the wedge plates are not shown at all.

Referring particularly to Figs. 2 and 5, the flange 6 is circular and comprises a hub 8, which forms a sliding fit with the sleeve 3. The hub 8 is locked in position with respect to shaft 1 by means of the key wedge 9 passing through oppositely disposed key ways in hub 8, oppositely disposed key slots 10 in the sleeve 3, and a key way in shaft 1, as illustrated in Fig. 2. The key wedge 9 is driven tight into the key ways in hub 8 and shaft 1, being held in place by cotter pin 11, but forms merely a snug sliding fit in the key slots 10 of sleeve 3; due to this construction, sleeve 3 may travel longitudinally along shaft 1 as far as permitted by the key slots 10. Closed end slots or grooves 12 are cut into but not through the face of flange 6 and the narrowed end 13 of each wedge plate 5 fits into a slot 12. As the wedge plates 5 abut against the flange 6 at one end and the generally corresponding flange 7 at the opposite end, movement of the wedge plates 5 longitudinally along shaft 1 is prevented, but their movement to and from the shaft 1 is permitted to the extent the narrowed portions 13 of each wedge plate 5 can travel in their respective closed end slots 12. The circumference of the circle defined by the outer edges of the wedge plates 5 is, of course, changed by moving the wedge plates to or from the shaft 1.

The construction of flange 7 is similar to that of flange 6 except that it is mounted directly on the shaft 1 beyond the end of sleeve 3, set screw 14 (see Fig. 1) holding flange 7 in fixed relation with respect to shaft 1 and no key wedge and key way construction as used with flange 6 being necessary. Since the ends of the wedge plates 5 must abut against the flanges 6 and 7, the relative lengths of the wedge plates 5 and the sleeve 3 must be such that flange 6 can be positioned on shaft 1 sufficiently beyond the end of sleeve 3 so as not to interfere with the travel of sleeve 3 along shaft 1 to the extent permitted by the key slots 10.

A plurality of wedge cones 20, four being shown in Fig. 1, are threadably mounted on the sleeve 3, each wedge cone 20 being locked in the position desired by its associated lock nut 21. As shown in Figs. 2 and 3, each wedge cone 20 is provided with a plurality of grooves 22, one for each wedge plate 5, the grooves all tapering toward one end of shaft 1. The wedge plates 5 pass through these grooves 12 and are held yieldingly against the wedge cones 20 by means of a plurality of spring nuts 23 (see Fig. 4) threadably mounted on sleeve 3 and the coil springs 24 which pass through perforations 25 in the wedge plates 5 and have their ends hooked in holes 26 drilled in the spring nuts 23. Fig. 1 shows three of these spring devices for holding the wedge plates against the wedge cones.

The inner edge of each plate 5 is tapered (indicated at 30) parallel to the taper of the grooves 22 at the sections which bear against the grooves 22 (see Fig. 2 particularly). Due to this arrangement, it will be apparent that, while the spring devices at all times hold the wedge plates 5 yieldingly against the bearing surfaces of the grooves 22, movement of the sleeve 3 and its associated wedge cones 20 to the left (looking at Fig. 2) while the wedge plates 5 are stationary with respect to movement longitudinally along shaft 1, will cause the tapered inner edges 30 of the wedge plates 5 to slide, in effect, down the tapered grooves 22 and hence cause the wedge plates 5 to approach shaft 1, thus effecting a diminution of the circumference of the circle defined by the outer edges of the wedge plates 5. Movement of the sleeve 3 and its associated wedge cones 20 to the right will cause the wedge plates 5 to move out away from shaft 1 and, of course, thus effect an increase of the circumference of the circle defined by the outer edges of the wedge plates 5. As shown in Fig. 2, the wedge plates 5 are in an intermediate position.

Movement of the sleeve 3 along the shaft 1 is effected by the hand wheel 31 threadably mounted on sleeve 3. The hub 32 of hand wheel 31 is provided with the external annular groove 33 in which slidingly fits the split thrust ring 34 carried by flange 6 by means of screws 35 (see Fig. 2). Hand wheel 31 thus may be turned while flange 6 and the wedge plates 5 are stationary but relative movement between hand wheel 31 and flange 6 longitudinally of the axis of shaft 1 is prevented; as flange 6 is in fixed position with respect to shaft 1, longitudinal movement of hand wheel 31 along shaft 1 is impossible. As a result of this construction, the effect of turning handwheel 31 is to move the sleeve 3 along shaft 1, whether to right or left, viewing Fig. 2, depending on the direction the hand wheel is turned.

It should be noted that the length of the oppositely disposed key slots 10 in sleeve 3, which slots control the distance of travel of sleeve 3 along shaft 1, should be great enough to permit sufficient relative movement between the wedge cones 20 and the tapered surfaces 30 of wedge plates 5 to move the wedge plates as far as the closed end grooves 12 of the flanges 6 and 7 will permit or, at least, to move the wedge plates 5 to and from the shaft 1 enough to effect the change desired in circumference of the circle defined by the outer edges of the wedge plates 5.

The operation of the wind-up mandrel will be more or less obvious to those skilled in the art. The cardboard core will be wrapped around the mandrel with the wedge plates 5 in extended position and the web of material will then be reeled on the cardboard core. After the material is reeled, particularly if it is reeled under tension as is usually the case, removal of the roll of material (after the mandrel has been taken out of the bearings 2) would be practically impossible as it would be bound on the wedge plates too tight. However, simply by turning the hand wheel 31 the wedge plates 5 are moved in toward the shaft 1 and the roll of material can be readily taken off the mandrel. The outer edges of the wedge plates 5 are notched (indicated at 40) to bite in the cardboard core and thus overcome the tendency for the core to slide longitudinally along the mandrel.

It will be understood that the drawing merely illustrates one specific embodiment of the invention and that the various mechanical equivalents of the different parts of the wind-up mandrel shown that will occur to those skilled in the art, come within the scope of the present invention.

The number of wedge plates, wedge cones, and spring devices employed will be varied to adapt the mandrel for specific uses. Naturally, the length of the mandrel will influence the number of wedge cones and spring devices while the size of the circle defined by the outer edges of the wedge plates will influence the number of wedge plates used to some extent.

The wind-up mandrel of the present invention is applicable for the reeling up of materials and is particularly adapted for the winding up of continuous lengths of interlayer plastic material for use in safety glass, regenerated cellulose sheeting, and the like.

An outstanding advantage of the present invention is that it provides a wind-up mandrel from which a roll of material, even though wound under great tension, may be removed with the utmost ease. A further advantage of the present invention is that it provides a wind-up mandrel which is not particularly expensive to construct nor complicated in its mechanical design. A further advantage is that the mandrel of the present invention is so constructed that its prolonged use without interruption from breakdowns or necessary adjustments is insured; there are no parts that would ordinarily be broken, worn out, or get out of adjustment, except after practically unlimited use of the device.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments thereof except as defined in the appended claims.

I claim:

1. A wind-up mandrel comprising a shaft, a sleeve slidably mounted on said shaft, a plurality of wedge cones mounted in fixed position on said sleeve, a plurality of elongated wedge plates arranged radially about and parallel to said shaft and held in fixed position with respect to movement longitudinally along said shaft, resilient means for holding the inner edges of said wedge plates yieldingly against said wedge cones, said inner edges being tapered parallel to the taper of said wedge cones at the spaces where said inner edges bear against the wedge cones, a hand wheel threadably mounted on one end of said sleeve beyond said wedge plates, and means holding said hand wheel in fixed relation with respect to said wedge plates longitudinally of said shaft but permitting said hand wheel to be rotated while said wedge plates are stationary whereby the said sleeve and associated wedge cones are moved longitudinally with respect to said shaft and said wedge plates to cause thereby movement of the wedge plates to and from said shaft.

2. A wind-up mandrel comprising a shaft, a sleeve slidably mounted on said shaft, a plurality of wedge cones mounted in fixed position on said shaft, an end flange mounted on said shaft beyond one end of said sleeve, a second end flange slidably mounted on said sleeve adjacent the other end thereof, a wedge key passing through oppositely disposed key ways in the h b of said second flange, oppositely disposed key slots in said sleeve, and a key way in said shaft whereby said second end flange is held in fixed position relative to said shaft but movement of said sleeve along said shaft for the length of the key slots in said sleeve is permitted, a plurality of elongated wedge plates arranged radially about and parallel to said shaft, the ends of said wedge plates abutting against said flanges whereby movement of said wedge plates longitudinally along said shaft is prevented, resilient means for holding the inner edges of said wedge plates yieldingly against said wedge cones, said inner edges being tapered parallel to the taper of said wedge cones at the spaces where said inner edges bear against said wedge cones, a hand wheel threadably mounted on one end of said sleeve beyond said second end flange, and means holding said hand wheel in fixed relation with respect to said second end flange longitudinally of said shaft but permitting said hand wheel to be rotated while said second end flange is stationary whereby said sleeve and associated wedge cones are moved longitudinally with respect to said shaft, said end flanges, and said wedge plates to cause thereby movement of the wedge plates to and from said shaft.

3. A wind-up mandrel comprising a shaft, a sleeve slidably mounted on said shaft, a plurality of wedge cones mounted in fixed position on said shaft, an end flange mounted on said shaft beyond one end of said sleeve, a second end flange slidably mounted on said sleeve adjacent the other end thereof, a wedge key passing through oppositely disposed key ways in the hub of said second flange, oppositely disposed key slots in said sleeve, and a key way in said shaft whereby said second end flange is held in fixed position relative to said shaft but movement of said sleeve along said shaft for the length of the key slots in said sleeve is permitted, a plurality of elongated wedge plates arranged radially about and parallel to said shaft, the ends of said wedge plates abutting against said flanges whereby movement of said wedge plates longitudinally along said shaft is prevented, resilient means for holding the inner edges of said wedge plates yieldingly against said wedge cones, said inner edges being tapered parallel to the taper of said wedge cones at the spaces where said inner edges bear against said wedge cones, a handwheel threadably mounted on one end of said sleeve beyond said second end flange, the hub of said hand wheel having an external annular groove concentric with said shaft, and a thrust ring mounted on said second end flange concentric with said annular groove and fitting in said annular groove in sliding relationship thereto whereby said hand wheel may turn while held in fixed position longitudinally of said shaft thereby causing said sleeve and associated wedge cones to travel along said shaft while said end flanges and associated wedge plates are held in fixed position with respect to movement longitudinally of said shaft.

4. A wind-up mandrel comprising a shaft, a sleeve slidably mounted on said shaft, a plurality of grooved wedge cones mounted in fixed position on said sleeve, the grooves in said wedge cones being parallel to said shaft and tapering toward one end thereof, a plurality of elongated wedge plates arranged radially about and parallel to said shaft and passing through the grooves in said wedge cones, a pair of end flanges mounted concentrically and in fixed position with respect to said shaft, the ends of said wedge plates abutting against said end flanges whereby movement of said wedge plates longitudinally along said shaft is prevented, spring means holding the inner edges of said wedge plates yieldingly against the grooves in said wedge cones, said inner edges being tapered parallel to the taper of the grooves in said wedge cones at the spaces where said inner edges bear against said wedge cones, a hand wheel threadably mounted adjacent one end of said sleeve beyond said wedge plates, and means hold-

ing said hand wheel in fixed relation with respect to said wedge plates longitudinally of said shaft but permitting said hand wheel to be rotated while said wedge plates are stationary whereby said sleeve and associated wedge cones are moved longitudinally with respect to said shaft and said wedge plates to cause thereby movement of said wedge plates to and from said shaft.

5. A wind-up mandrel comprising a shaft, an externally threaded sleeve slidably mounted on said shaft, means limiting the movement of said sleeve along said shaft, a plurality of grooved wedge cones threadably mounted on said sleeve, the grooves in said wedge cones being parallel to said shaft and tapering toward one end thereof, lock nuts holding said wedge cones in fixed predetermined position on said sleeve, a plurality of elongated wedge plates arranged radially about and parallel to said shaft and passing through the grooves in said wedge cones, a pair of end flanges mounted concentrically and in fixed position with respect to said shaft, the ends of said wedge plates abutting against said end flanges whereby movement of said wedge plates longitudinally along said shaft is prevented, spring means holding the inner edges of said wedge plates yieldingly against the grooves in said wedge cones, said inner edges being tapered parallel to the taper of the grooves in said wedge cones at the spaces where said inner edges bear against said wedge cones, a hand wheel threadably mounted adjacent one end of said sleeve beyond said wedge plates, and means holding said hand wheel in fixed relation with respect to said wedge plates longitudinally of said shaft but permitting said hand wheel to be rotated while said wedge plates are stationary whereby said sleeve and associated wedge cones are moved longitudinally with respect to said shaft and said wedge plates to cause thereby movement of said wedge plates to and from said shaft.

6. A wind-up mandrel as set forth in claim 1 wherein the outer edges of the wedge plates are notched.

WILLIAM R. McKENNA.