United States Patent

Lercher et al.

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[54] WINDING APPARATUS

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[51] **Int. Cl.** **B65h 17/02**

[58] **Field of Search** 242/68.1, 68.2, 68.3, 72.1, 242/72.2, 46.3, 46.4, 72

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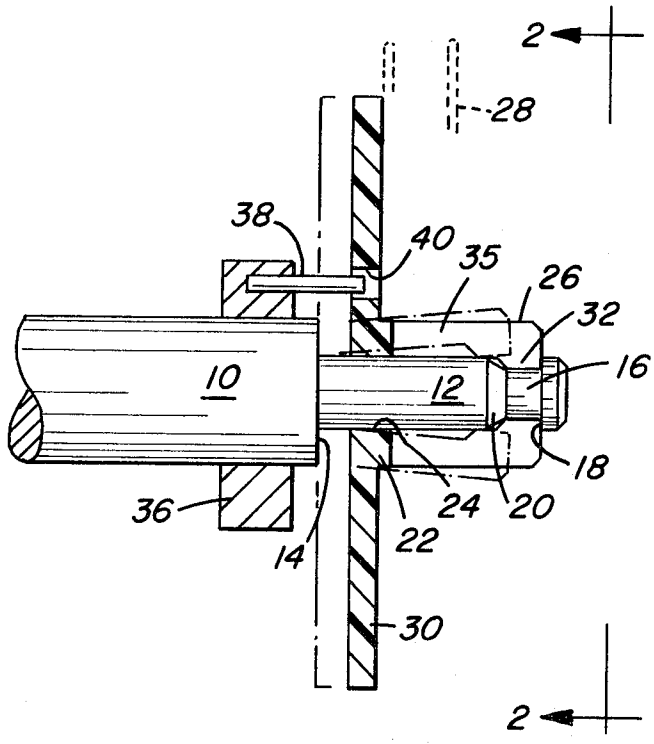
[57] **ABSTRACT**

A winding spindle or chuck for releasably gripping and driving a spool or reel and comprising a drive shaft having circumferential groove in the peripheral surface at the outer end thereof. A sleeve member is provided which has a centrally disposed axial opening with an inner diameter substantially equal to the diameter of the winding spindle. The sleeve member has a radially inwardly extending shoulder at the outer end and a plurality of radial slots formed along the major portion of the length thereof from the outer end thereby forming a plurality of finger members. The sleeve member is arranged to fit on said drive shaft in a first position with the inwardly extending shoulder portion of the finger members fitting in the groove with an outer diameter less than the reel center. In a second position of the sleeve, the finger members are no longer in the groove but are deflected outwardly whereby the outer diameter of said sleeve member is greater than the reel center thereby firmly holding it on the spindle. Means is provided for rotationally connecting the sleeve member to the drive shaft while permitting axial movement of the sleeve member therealong.

4 Claims, 2 Drawing Figures



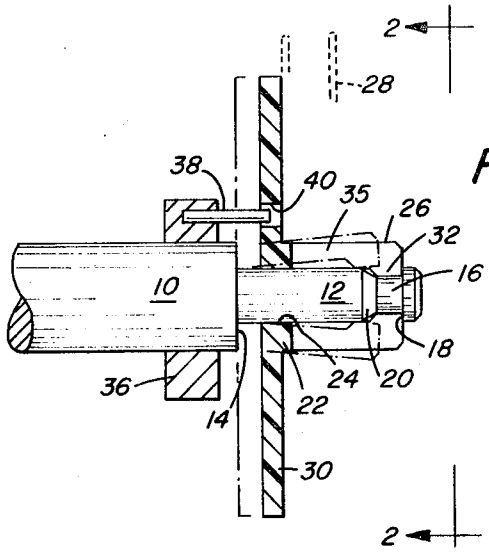


FIG. 1

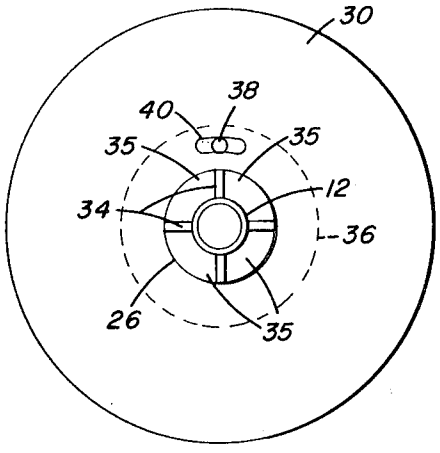


FIG. 2

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WINDING APPARATUS

BACKGROUND OF THE INVENTION

The present invention is directed to a novel construction of a releasable friction lock for affixing spools, reels, drums or the like on rotatable spindles. More particularly, the present invention is directed to a quickly and easily manipulatable friction lock which is simple, compact, inexpensive, easy to operate, and which permits rapid and easy securing of a spool or reel to a driven shaft in a manner which assures that the spool will be driven thereby. At the same time, the present construction assures that the spool or reel can be easily and simply removed from the shaft when desired.

This invention provides a compact, mechanically simple and easily manipulatable means for releasably gripping a reel on a spindle suitable for use in connection with various kinds of machines including removable spools, drums, reels, or the like which it is desired to detachably affix to rotatable spindles so that the same may be driven by the latter. An example of such an apparatus is an amateur motion picture film finishing and spooling machine wherein the finished film is supplied from the film processor wound on a master roll containing many individual, short strips of film which have been spliced together for more economical and simplified processing.

The spooling machine operator threads the end of the film onto a small reel which, for example, holds a 50 foot strip of film that ordinarily comprises amateur motion picture film products. The operator actuates the winder and, when the other end of that particular strip of film is reached, cuts it from the master roll and inserts the reel of film into an addressed container for return to the customer. Such an operation normally takes about 20 seconds per order. It will be apparent that for each reel that is wound, an empty reel is placed on the winder spindle and a full reel is removed. Thus, placing reels on and removing reels from the winder spindle comprises a significant portion of the operator's duties.

Heretofore, it has been common practice to utilize winder spindles that have a smooth, slightly tapered surface onto which an operator forces the empty reel. The tapered spindle frictionally grips the reel and drives it, winding the film thereon. When the reel is full, the winder stops and the operator must pull the reel from the spindle. It has been found that this method of mounting reels for winding purposes is not fully satisfactory. If the operator uses sufficient force to push the empty reel on the tapered spindle so that it will not slip during winding, then it is often difficult for the operator to remove the reel when it is full. Conversely, if the operator mounts the reel so that it is easy to remove, it will sometimes be so loose that it will not be driven by the spindle or it will even work its way off the spindle during the winding operation. It will be apparent that either of the foregoing situations is undesirable, contributing to operator fatigue and reduced productivity, as well as the risk of damage to the customer's film.

Various reel collets, retainer mechanisms and retaining flanges have been developed to alleviate the problem of effectively holding a reel on a spindle in such a manner that the reel is positively driven and yet is readily removable from the spindle. However, most such devices are either complex, and thus expensive, or utilize a separate member which fits over the end of the spindle after the reel has been placed thereon. Such separate members are generally unsatisfactory since they can be misplaced or dropped and generally decrease the operator's productivity. It will thus be seen that a simple, inexpensive, effective means of holding a reel on a spindle, while assuring ease of removal therefrom, and without requiring a separate member, would be economically advantageous and would contribute to operator productivity.

SUMMARY OF THE INVENTION

Accordingly, the present invention provides apparatus for releasably gripping a reel on a spindle comprising an expansible outer surface on the spindle. Means is provided which is responsive to the movement of a reel onto the spindle to expand the outer surface thereof to grip the reel. The responsive means is also responsive to the movement of the reel toward the end of the spindle to collapse the outer surface to release the reel.

Furthermore, the present invention provides a winding spindle comprising a drive shaft having a circumferential groove in the peripheral surface at the outer end thereof. A sleeve member is provided which has a centrally disposed axial opening with an inner diameter substantially equal to the diameter of the winding spindle. The sleeve member has a radially inwardly extending shoulder at the outer end and a plurality of radial slots formed along the major portion of the length thereof from the outer end thereby forming a plurality of finger members. The sleeve member is arranged to fit on the drive shaft in a first position with the inwardly extending shoulder portion of the finger members fitting in the groove. The sleeve member is arranged to be displaced axially on the drive shaft to a second position with the finger members deflected outwardly whereby the outer diameter of the sleeve member is greater than in the first position. Means is provided for rotationally connecting the sleeve member to the drive shaft while permitting axial movement of the sleeve member therealong.

In addition, the present invention provides a winding spindle wherein the sleeve member is provided with a radially extending flange member on the inner end thereof against which a reel may be pressed when it is fitted on the spindle to move the sleeve axially on the shaft to the second position whereby the reel is gripped by the expanded fingers. The flange may also be gripped by the operator when the spool is to be removed from the spindle, thereby moving the sleeve member to the first position to release the reel.

More specifically, the present invention provides a winding spindle comprising a drive shaft having a cantelevered end portion of reduced diameter with an annular shoulder connecting the shaft and the end portion. The reduced end portion has a circumferential groove in the peripheral surface at the outer end thereof with the outer edge of the groove having a radially extending shoulder and the inner edge of the groove having a tapered surface to the peripheral surface of the end portion. A reel engaging sleeve member is provided which has a centrally disposed axial opening having an inner diameter substantially equal to the diameter of the end portion of the winding spindle but less than the diameter of the drive shaft. The sleeve member has a radially outwardly extending flange portion at the inner end and a radially inwardly extending shoulder at the outer end. The sleeve member has a plurality of radial slots formed along the major portion of the length thereof from the outer end towards the flange thereby forming a plurality of finger members. The sleeve member is arranged to fit on the end portion of the drive shaft in a first position with the flange spaced from the annular shoulder and the inwardly extending shoulder portion of the finger members fitting in the groove. The outer diameter of the sleeve member in the first position is substantially equal to the inner diameter of a reel to be wound thereon. The sleeve member is arranged to fit on the end portion of the drive shaft in a second position with the flange abutting the annular shoulder and the finger members deflected outwardly whereby the outer diameter of the sleeve member is slightly greater than the inner diameter of the reel to be wound thereon. Means is provided for rotationally connecting the sleeve member to the drive shaft while permitting axial movement of the sleeve member along the reduced end portion.

The various features of novelty which characterize the present invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and the specific objects obtained by its use, reference should be had to the accompanying drawings and descriptive matter in which a preferred embodiment of the present invention is illustrated and described.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation view, partially in section, of a preferred embodiment of a winding spindle arrangement of the present invention; and

FIG. 2 is an elevation end view taken along line 2—2 of FIG. 1.

DESCRIPTION OF A PREFERRED EMBODIMENT

A preferred embodiment of a winding spindle according to the present invention is illustrated in FIGS. 1 and 2 and comprises a drive shaft 10 which is supported by a bearing member (not shown) and is driven by a power source, also not shown, in a manner well known in the art. The portion of the shaft 10 illustrated is cantelevered outwardly over the work space and permits easy access thereto by the operator. The drive shaft has an outer end portion 12 of reduced diameter forming an annular shoulder 14 therebetween. A circumferential groove 16 is formed in the surface of the outer end of the reduced end portion 12. The outer edge 18 of the groove 16 is substantially radially extending while the inner edge 20 of the groove tapers outwardly to the peripheral surface of end portion 12.

A reel engaging sleeve member 22 is provided with a centrally disposed axial bore 24 having a diameter substantially equal to the diameter of the reduced end portion 12 of the drive shaft. The sleeve has an axial length somewhat less than the length of the reduced end portion of the shaft. The outer diameter 26 of the sleeve member is normally slightly less than the central opening of the reel to be wound thereon. Such a reel is illustrated in dotted lines at 28. The sleeve member is provided at its inner end with a radially outwardly extending flange 30 which preferably has an outer diameter slightly less than the outer diameter of the reel to be wound thereon. The sleeve member 22 is also provided at the outer end with a radially inwardly extending shoulder portion 32 having a shape substantially similar to the cross-sectional shape of groove 16 which is formed in the outer end of the drive shaft. The sleeve member 22 is provided with a plurality of radial slots 34 formed therein along the major portion of the length thereof from the outer end toward the flange 30 thereby forming a plurality of flexible finger members 35.

The sleeve member 22 is arranged to fit on the reduced end portion 12 of the drive shaft in a first position with the flange 30 spaced from the shoulder 14 and with the inwardly extending shoulder 32 of the fingers 35 fitting within the circumferential groove 16. As previously noted, the outer diameter of the sleeve in this position is substantially equal to or slightly less than the central opening of the reel to be mounted thereon. As the operator slips the reel 28 over the sleeve member 22, it abutts flange 30 and, with further axial motion, causes the flange member 30 to move into abutting relationship with the shoulder 14 on the drive shaft. As the sleeve member is moved axially along the drive shaft, the radially inwardly extending shoulder portion 32 of the finger members 35 is forced outwardly by the tapered surface 20 on the inner edge of groove 16 (as shown in dot-dash lines in FIG. 1) thereby causing the outer diameter of the sleeve member to expand and to lightly grip the reel. After the reel has been wound and the reel is to be removed from the winding spindle, the operator grips the inner surface of flange 30 and exerts an outward force thereon, causing the sleeve member to move axially outward along the drive shaft until the radially inwardly extending shoulder 32 of the finger members 35 re-enter the circumferential groove 16 reducing the outer diameter of the sleeve member and releasing the reel, permitting the reel to be removed. When the finger member shoulder 32 is in the groove 16, the axial movement of the sleeve is stopped by radial shoulder 18 so that the sleeve member is not removed from the drive shaft.

A drive connection is provided between the sleeve member 22 and the drive shaft 10 which permits relative axial movement between the sleeve member and the drive shaft while assuring that the rotational movement of the drive shaft is transferred to the sleeve member and thus to the reel held thereby. In the embodiment illustrated, an annular collar member 36 is fixedly attached by any conventional means to the drive shaft 10 adjacent the annular shoulder 14. An axially extending pin member 38 extends outwardly from the collar member 36, parallel to the reduced end portion 12 and through a slot 40 formed in flange 30. Thus, as shaft 10 rotates, pin member 38 abutts one end of slot 40 and rotates the sleeve member. The slot 40 assures that the operator can slightly rotate the sleeve member during the introduction of the reel thereon so that the pin member 38 will not interfere with any portion of the reel. Alternatively, a circular opening could be formed in the collar 36 with the pin member being fixedly connected to the rear surface of the flange 30. Still further, the rotational driving connection can be formed by a simple key member in the end portion 12 of the drive shaft, which key engages an elongated keyway in the inner surface of the sleeve member, thereby assuring the transmission of the rotational force of the drive shaft while permitting axial movement between the sleeve member and the drive shaft.

While the preferred embodiment illustrates a sleeve member formed of a resilient plastic material, it will be appreciated that a resilient metallic sleeve member can also be utilized.

Accordingly, it will be seen that the present invention provides a compact, mechanically simple, easily operable and inexpensive winding spindle arrangement for releasably gripping a reel thereon. Moreover, the present invention provides a construction having few moving parts and no separable parts which may be dropped or misplaced thereby assuring increased operator productivity. At the same time, the present construction permits simple and easy operation with one hand, thereby substantially minimizing the operator effort required and at the same time assuring that the reel will be properly driven during the winding operation.

The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

We claim:

1. A winding spindle comprising a drive shaft having a circumferential groove in the peripheral surface at the outer end thereof, and a sleeve member having a centrally disposed axial opening having an inner diameter substantially equal to the diameter of the winding spindle, said sleeve member having a radially inwardly extending shoulder at the outer end thereof and a plurality of radial slots formed along the major portion of the length thereof from said outer end thereby forming a plurality of finger members, said inwardly extending shoulder having an inner diameter substantially equal to the diameter of said groove, said sleeve member arranged to fit on said drive shaft in a first position with the inwardly extending shoulder portion of the finger members fitting in said groove, said sleeve member arranged to be displaced axially on said drive shaft to a second position with the inwardly extending shoulder displaced out of said groove with the finger members deflected outwardly.

2. The invention according to claim 1 wherein the inner end of said sleeve member is provided with a radially outwardly extending flange member.

3. The invention according to claim 1 wherein means is provided for rotationally connecting said sleeve member to said drive shaft while permitting axial movement of said sleeve member therealong.

4. A winding spindle comprising a drive shaft having a cantelevered end portion of reduced diameter forming an annular shoulder between the end portion and the remainder of the shaft, said reduced end portion having a circumferential groove in the peripheral surface at the outer end thereof, the outer edge of said groove having a radially extending shoulder, the inner edge of said groove having a tapered surface to the peripheral surface of said end portion, a reel engaging sleeve

member having a centrally disposed axial opening having an inner diameter substantially equal to the diameter of the reduced diameter end portion of the shaft, said sleeve member having a radially outwardly extending flange portion at the inner end and a radially inwardly extending shoulder at the outer end, said sleeve member having a plurality of radial slots formed therein along the major portion of the length thereof from said outer end towards said flange end thereby forming a plurality of finger members, said sleeve member arranged to fit on said end portion of said drive shaft in a first position with the flange spaced from the annular shoulder of the drive shaft and the inwardly extending shoulder portion of the finger members fitting in said groove, the outer diameter of said sleeve member in said first position being substantially equal to the inner diameter of a reel to be wound thereon, said sleeve member arranged to fit on said end portion of said drive shaft in a second position with the flange abutting the annular shoulder of the drive shaft and the finger members deflected outwardly by the contact of said inwardly extending shoulder portion with said tapered surface whereby the outer diameter of said sleeve member is slightly greater than the inner diameter of the reel to be wound thereon, and means for rotationally connecting said sleeve member to said drive shaft while permitting axial movement of said sleeve member along said reduced end portion.

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