

March 19, 1963

D. J. HOWE
ADJUSTABLE FILM SPOOL
Filed Aug. 24, 1960

3,081,960

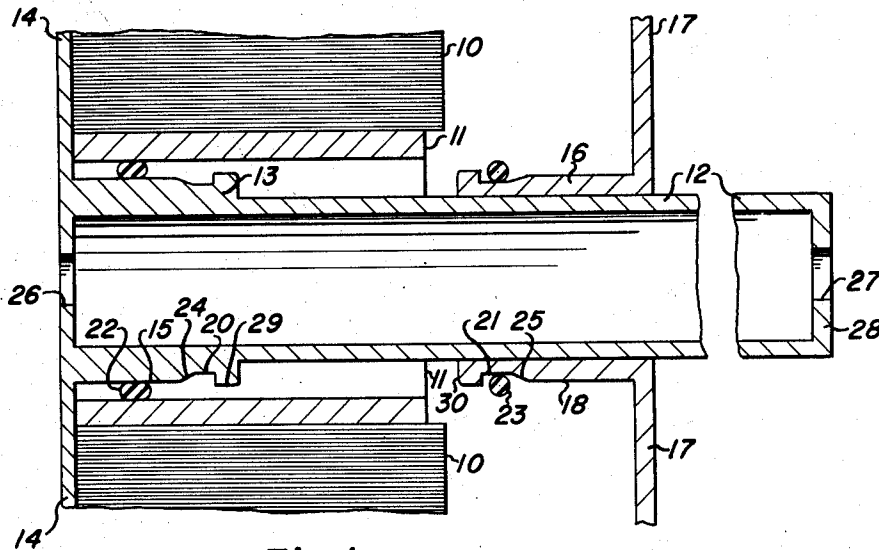


Fig. 1

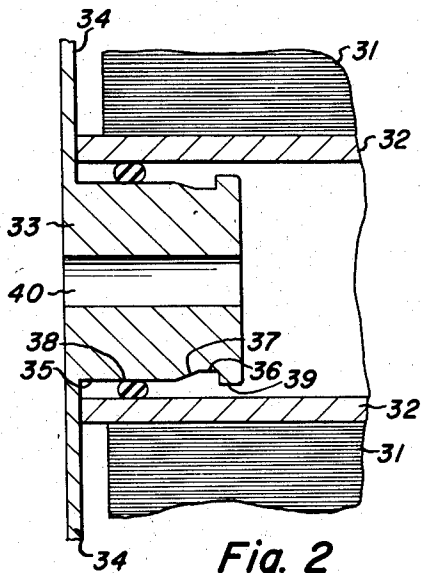


Fig. 2

DONALD J. HOWE
INVENTOR.

BY *R. Frank Smith*
Amin B. Pagel
ATTORNEYS

1

3,081,960

ADJUSTABLE FILM SPOOL

Donald J. Howe, Spencerport, N.Y., assignor to Eastman Kodak Company, Rochester, N.Y., a corporation of New Jersey

Filed Aug. 24, 1960, Ser. No. 51,551

1 Claim. (Cl. 242—71.8)

The present invention relates to a flange member adapted to be removably attached to the end of a tubular core upon which a roll of elongated material is wound or is to be wound, and more particularly relates to a reusable, separable, spool-forming device comprising two such flange members and adapted to support and provide spool-like flanges adjacent the ends of such a core.

This application is a continuation-in-part of my co-pending application Ser. No. 840,456, filed Sept. 16, 1959, and now abandoned.

Various forms of material such as photographic film, yarn, paper, wire, etc. are commonly wound on flangeless tubular cores formed of cardboard or other inexpensive material. Many applications, however, require that such materials be rewound onto a conventional spool before being utilized. This extra operation of rewinding the material onto a spool is costly and time-consuming. Likewise, many materials are customarily wound onto a conventional spool rather than onto a less expensive flangeless core because of the necessity of having flanges adjacent the ends of the roll during the winding operation, although once the material is wound, these flanges serve no necessary function. Furthermore, winding or rewinding the material onto conventional spools often necessitates maintaining a stock of spools of various widths to accommodate various materials.

The present invention eliminates these disadvantages by providing reusable flange members or a reusable separable spool-forming device comprising two such flange members, whereby spool-like flanges may be removably attached to a tubular core to provide a spool-like structure but may be removed from the core after they have served their purpose. Such flange members or devices will accommodate cores of various lengths having the same inside diameter thereby allowing cores to be cut to any desired length.

It is therefore a primary object of the invention to provide improved, interchangeable and removable flange members for cores upon which a roll of elongated material may be wound.

A further object of this invention is to provide removable flange members of a novel construction for use with tubular cores.

Another object of the invention is to provide a reusable, separable spool-forming device comprising a pair of cooperating flange members adapted to accommodate a tubular core upon which a roll of material is wound or is to be wound.

Another object of the invention is the provision of such flange members and spool-forming devices of simple construction and which are reusable and convenient to utilize.

Still another object of the invention is to provide such flange members or spool-forming devices with means whereby each flange thereof is maintained in resilient contact with the corresponding abutment surface defined by the end of the core and/or the axial end of the roll of material wound thereon.

These and other objects and features of the invention will be understood by reference to the following specification and the accompanying drawing in which:

FIG. 1 is a sectional front view of a reusable, separable spool-forming device according to the preferred embodiment of the invention, illustrating the device in partially

2

installed relation to a roll of web material wound on a tubular core.

FIG. 2 is a partial sectional front view of another embodiment of the invention, showing a flanged member mounted on one end of a tubular core having a roll of web material wound thereon.

Referring now to FIG. 1, which illustrates the preferred embodiment of the invention, a roll of web material 10 is shown wound upon a tubular web winding core 11. The axial ends of the roll and the ends of the core are hereinafter referred to as abutment surfaces. For purposes of illustration, one of the abutment surfaces of roll 10 is shown in FIG. 1 as projecting beyond the corresponding abutment surface of core 11, while the abutment surfaces defined by the other ends of the roll and core are shown in coplanar relation. It will be understood of course that either embodiment of the invention is also useful in the case where an abutment surface of the core projects beyond the corresponding abutment surface of the roll as illustrated in FIG. 2.

The reusable separable spool-forming device shown in FIG. 1 in partially installed relation to roll 10 and core 11 comprises a hollow shaft member 12 having at one end an enlarged hub 13, which is attached to a flange 14 and which has an external cylindrical surface 15. The device further comprises a second hub 16, which has a second external cylindrical surface 18 and an attached flange 17. Hub 16 is removably mounted in sliding relation on shaft member 12.

The two hubs 13 and 16 are provided with respective annular grooves 20 and 21, adapted to receive rings 22 and 23 respectively, which are formed of resilient material. Each ring is in the form of a torus generated by a circle. As used hereinafter, the terms "cross section," "inside diameter," and "outside diameter" as applied to each ring refer respectively to the imaginary surface defined by the generating circle, the diameter of the inner periphery of the torus that defines the shape of that ring, and the diameter of the outer periphery of the same torus. Rings 22 and 23 have outside diameters slightly greater than the inside diameter of core 11 and have inside diameters slightly greater than the diameter of the bottoms of the corresponding grooves 20 and 21 but less than that of the respective cylindrical surfaces 15 and 18. Prior to insertion of the hubs into the core, rings 22 and 23 are located loosely in their respective grooves, as illustrated at 23. An intermediate surface extends between each groove 20 and 21 and the corresponding adjacent cylindrical surface 15 or 18 as shown at 24 and 25 respectively, and is so shaped that rings 22 and 23 may be rolled out of their respective grooves and onto the adjacent cylindrical surfaces.

As hub 13 is axially inserted into core 11 to bring flange 14 into simultaneous engagement with the corresponding abutment surfaces of roll 10 and core 11 as shown in FIG. 1, the engagement of the inner surface of the core with the outer surface of ring 22 in groove 20 causes the ring to eversionally roll over the intermediate surface 24, out of groove 20 and along cylindrical surface 15. Since the diameter of cylindrical surface 15 is greater than the inside diameter of the ring in its normal state, the ring is uniformly radially compressed between the cylindrical surface and the inside surface of the core as illustrated at 22, thereby maintaining the core in concentric relation with the hub and preventing rotation of the core about the hub in order that the core may be rotatably driven by the hub or vice versa. After hub 13 has been inserted into the core as shown in the drawing, hub 16 is slid axially onto shaft member 12 and into the opposite end of core 11 to bring flange 17 into engagement with the corresponding abutment surface of roll 10, which in the illustration over-

hangs the corresponding abutment surface of the core. The configuration of hub 16 corresponds substantially to that of hub 13, and ring 23 performs the same function as does ring 22. With the device thus assembled the core is supported concentrically with respect to the co-axially aligned hubs, is prevented from rotating relative to the hubs, and is subjected to a minimum of distortion. The flanges 14 and 17 are maintained in mutually parallel relation by shaft member 12.

In the embodiment illustrated FIG. 1, holes 26 and 27 are provided in flange 14 and in the end 28 of hollow shaft member 12, respectively, to mount the device and the core or the core and roll carried thereby on an appropriate spindle. It is obvious, of course, that alternative means might be employed for this purpose. For example, the flanges may be provided with axial center pins adapted to support the spool-forming device in appropriate trunnions. It is also obvious that the maximum width of the core that may be accommodated by the device shown in FIG. 1 is limited only by the length of shaft member 12, and that the width is unlimited in the case where two substantially identical flange members (one of which is illustrated in FIG. 2) are employed rather than the device shown in FIG. 1.

As rings 22 and 23 are initially rolled out of grooves 20 and 21, respectively, during insertion of their respective hubs into core 11, the resilient self-restorative properties of the partially everted rings cause them to exert a reverse rolling force tending to roll them back into their respective grooves. This force tends to withdraw the hubs from the core. However, after the eversion of either ring 22 or 23 has rotated its cross section through 180 degrees, the ring tends to assume its original state by completing a rolling cycle, thereby drawing its associated hub further into the core. In general, when the cross section of either ring has been rolled in this manner through more than an odd number of half rotations but less than the next larger even number of half rotations a force is exerted on the associated hub tending to draw it further into the core. The resilient force exerted between the core and the hubs is utilized in the present invention to maintain each flange in resilient intimate engagement with at least one of the corresponding abutment surfaces. By properly choosing the dimensions of each hub and its corresponding ring relative to the inside diameter of the core, and by properly locating the corresponding groove relative to its associated flange depending upon the relation of the corresponding abutment surfaces of the core and roll so that the cross section of the corresponding ring is rotated through more than an odd number of half rotations but less than the next larger even number of half rotations when the hub member is fully inserted into the core, the restorative forces of the ring in deformed and partially everted condition can be employed to resiliently retain the associated flange in contact with its respective abutment surface, thereby yieldably holding the spool forming device together.

The utilization of a resilient toroidal ring for yieldably maintaining a cylindrical hub member within a cylindrical core may be employed in many applications other than that described, but is particularly applicable to this application because the resilient force exerted upon the core is sufficient to maintain each flange in intimate contact with at least one of its corresponding abutment surfaces but is not great enough to cause the ends of the core or the axial ends of the roll to be crushed by the flange or to prevent the hubs from being withdrawn by hand with a moderate force.

To remove the components of the spool-forming device from the roll, the two flanges are simply pulled away from their respective ends of the core. As each hub is pulled out of the core, its associated ring rolls back into its original loose position in its associated groove. The looseness of the ring in the groove is essential in allowing the ring to restore itself to its original state, in order

that each insertion of the hub into the core to a particular depth will cause the ring to be rolled, as described, through a predetermined angle.

Collars 29 and 30, having diameters somewhat larger than the cylindrical portions of hubs 13 and 16, respectively, but smaller than the inside diameter of the core 11, are provided on the ends of the respective hubs to prevent the accidental removal of the corresponding rings 21 and 22.

While the preferred embodiment of the invention, as illustrated in FIG. 1, employs a shaft member to maintain the two hubs in axial alignment and the two flanges in mutually parallel relation, this shaft member may be omitted and a separate flange member, as illustrated in FIG. 2, may be attached to each end of the tubular core for providing a spool-like structure. FIG. 2 illustrates such a flange member mounted at one end of a roll of web material 31 wound on a tubular core 32. The flange member comprises a hub 33 attached to a flange 34 and provided with a cylindrical surface 35, an annular groove 36, an intermediate conical surface 37, a resilient ring 38 and a collar 39, all of these elements corresponding in form and function to the similar elements of the preferred embodiment of the invention. An axial hole 40 through the flanged end member is illustrated as a means for mounting the assembled spool-like structure on a spindle although, as mentioned above, alternative mounting means might be employed.

While FIG. 2 illustrates the case where the flange 34 engages only the abutment surface of the core, it is obvious, as noted above, that the invention in either embodiment may be utilized with any of the three illustrated arrangements of corresponding abutment surfaces by properly choosing the dimensions of the hubs and rings, and spacing of the hub grooves from the flanges, as previously described.

An advantage of the embodiment of the invention shown in FIG. 2 is that there is no limitation on the width of the core that may be accommodated, whereas in the preferred embodiment this width is limited by the length of shaft member 12. The embodiment shown in FIG. 1 is preferred for most applications however, because shaft member 12 maintains the two hubs 13 and 16 in coaxial relation and the respective flanges 14 and 17 in mutual parallelism independently of the accuracy and rigidity of the core.

Having particularly described my invention, what I claim and desire to secure by Letters Patent of the United States is:

A flange assembly for use as a means to wind a roll of elongated material onto a flangeless, tubular core with corresponding ends of said core and roll forming abutment surfaces, comprising the combination of: a pair of hubs each insertable into an end of said core and having an outermost periphery along the entire length of said hub spaced from the inner surface of said core; a flange fixed to an end of each of said hubs to engage at least one of the corresponding abutment surfaces to limit the depth of insertion of the hub into the corresponding end of said core by a predetermined amount, each of said hubs along its outermost periphery defining an annular groove; a resilient toroidal ring loosely positioned in each groove prior to insertion in the core, said ring being eversionally deformable from a normally assumed uneverted state and having a tendency to return from an eversionally deformed state to said uneverted state, and frictionally engaging the inner surface of said core and the corresponding hub upon insertion of said hub into the core to eversionally roll said ring out of said groove onto the outermost periphery for a total amount of rotation more than an odd number of half rotations but less than the next largest even number of half rotations of the cross-section of said ring, said rotational amount being deter-

5

mined by the limit of depth of insertion of the hub in said core; a shaft member fixed to and extending axially from one of said hubs through said core; the other of said hubs having an axial hole by means of which the other said hub is slidably supported on said shaft member; said core being supported at its inner surface only by the said rings on both of said hubs; wherein a torque derived from the eversionally deformed state of said rings urges each flange into engagement with the corresponding said abutment surface, and further tensions the core section

5

10

6

intermediate the rings to increase rigidity of said intermediate core section.

References Cited in the file of this patent**UNITED STATES PATENTS**

770,751	Hull	Sept. 27, 1904
1,884,805	Moritz	Oct. 25, 1932
2,380,797	Severin	July 31, 1945
2,464,024	Carter et al.	Mar. 8, 1949
2,705,112	Baumgartner	Mar. 29, 1955