

Aug. 5, 1952

R. ATWOOD ET AL

2,605,980

SPOOL

Filed Dec. 12, 1947

2 SHEETS—SHEET 1

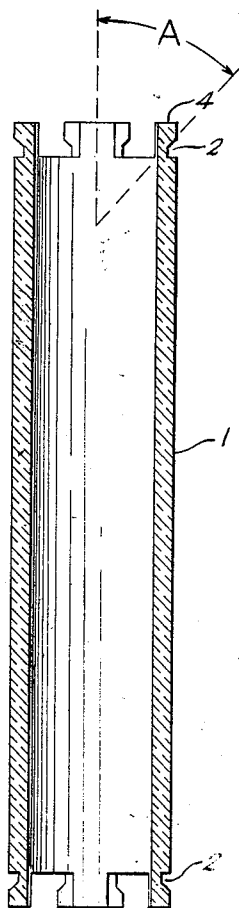


FIG. 1

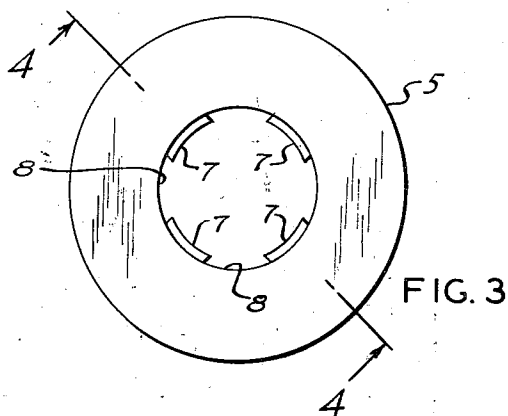


FIG. 3

FIG. 4

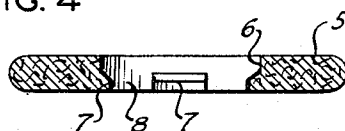


FIG. 5

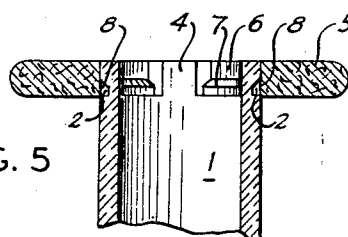


FIG. 6

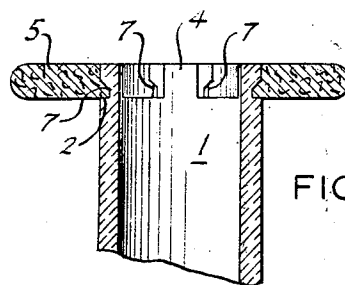
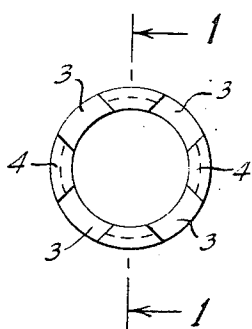


FIG. 2

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2 SHEETS—SHEET 2

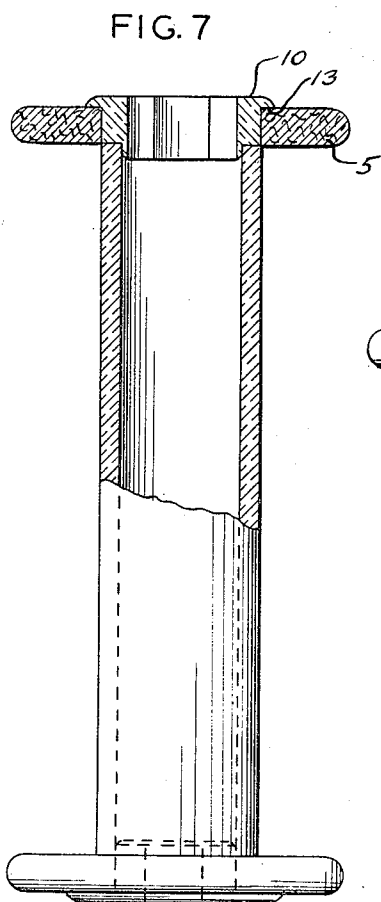


FIG. 7

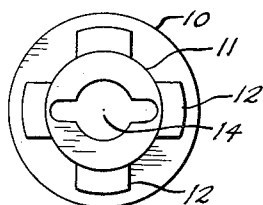


FIG. 8

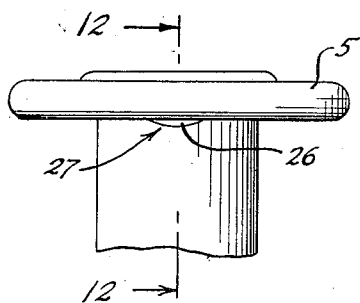


FIG. 11

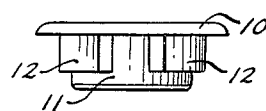


FIG. 8A

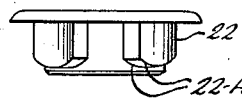


FIG. 9

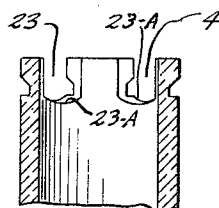


FIG. 10

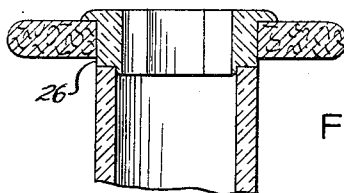


FIG. 12

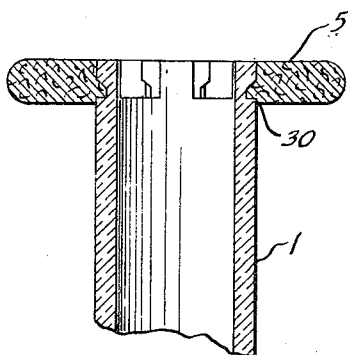


FIG. 13

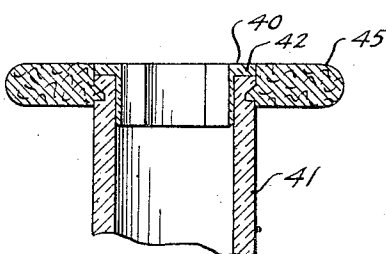


FIG. 14

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SPOOL

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Application December 12, 1947, Serial No. 791,220

9 Claims. (Cl. 242—122)

1

2

This invention relates to improvements in spools.

It is an object of the invention to provide a spool construction in which the parts are positively interlocked together.

The spool of the invention is intended primarily for use as a textile spool. Such spools have heretofore been made of metal such as steel or duraluminum, and other materials such as wood and cardboard, which materials are readily fastened together by welding, riveting, and other processes which involve the permanent deformation of the spool structural member or by means of screws and nails which will hold satisfactorily in such materials.

When it is attempted to construct textile spools from modern plastic materials and to utilize prior methods of construction, difficulty is encountered since such materials do not lend themselves readily to attachment by riveting or upsetting operations, or by turning over tabs or the formation of welded joints. Similar difficulties are encountered with otherwise desirable materials such as magnesium alloys.

It is a further object of the invention to provide a spool construction adapted to the joining of plastic components or metallic components of comparable brittleness.

A further object of the invention is to make improved provisions for avoiding thread trapping.

With these and other objects which will appear in the following full description in mind, the invention consists of the combinations and arrangements of parts and details of construction which will now first be fully described in connection with the accompanying drawing and then be more particularly pointed out in the appended claims.

In the drawing:

Figure 1 is a central longitudinal section through a barrel member constructed according to the invention, and is taken on the line 1—1 of Figure 2;

Figure 2 is an end view of the barrel of Figure 1;

Figure 3 is a plan view of a flange adapted for assembly with the barrel of Figure 1;

Figure 4 is a section on the line 4—4 of Figure 3;

Figure 5 is a central longitudinal section showing the flange of Figures 3 and 4 in an intermediate assembly position on one end of the barrel of Figures 1 and 2;

Figure 6 is a view similar to Figure 5 and showing a further step in the assembly;

Figure 7 is a view of a completed spool, partly

in elevation and partly in central longitudinal section;

Figure 8 is a plan view of an end plug member forming part of the spool of Figure 7;

Figure 8-A is a side elevation of this member;

Figure 9 shows a modified form of the plug member of Figure 8-A;

Figure 10 shows in central longitudinal section a modified form of barrel end adapted for use with the end plug of Figure 9;

Figure 11 is an elevation view of one end of an assembled spool utilizing the elements of Figures 9 and 10;

Figure 12 is a section on the line 12—12 of Figure 11;

Figure 13 is a view corresponding to Figure 5, showing a modification of the elements thereof; and

Figure 14 is a view similar to Figure 13 but illustrating a further modification.

The spool selected for illustration in Figures 1 to 8-A of the drawing comprises a barrel 1, end flanges 5 and end plug members 10. The barrel 1 is preferably formed from a tube of laminated plastic. A tube formed of a paper winding impregnated with a thermosetting plastic such as phenol-formaldehyde resin and properly cured and set under heat and pressure in accordance with known and conventional practice is satisfactory. Other laminated or unlaminated tubular elements may, however, be employed. The end flanges 5 may be formed from any suitable plastic, vulcanized fiber, magnesium alloy and other desired material. The end plugs 10 may be made of any of a number of materials and in particular, from a wide variety of thermosetting and thermoplastic synthetic resins, economy and ease of molding or casting being primary considerations. The following description will make clear the manner in which the spool structure is adapted to the use of the materials described as well as other materials which do not lend themselves readily to conventional methods of manufacture.

The spool chosen for illustration is a double flanged spool, and both ends of the barrel 1 are shaped for attaching an end flange 5. The shaping of the barrel end includes the cutting or otherwise forming of a peripheral groove 2 and slots 3. Where the forming is done by machining operations, it will be apparent that the groove 2 may be cut on a lathe and the slots 3 formed by two cuts across the end of the spool in a milling machine. The cutting of the slots 3 produces four circumferentially spaced projections 4 separated by the slots 3 and undercut by the peripheral groove 2. The number of projections 4 may be varied, where desired. For

example, three projections 4 separated by three slots 3 could be utilized or a larger number of projections than four could be used, the considerations determining the number of projections 4 to be used in any given construction being merely simplicity of manufacture and the most efficient proportions for providing the greatest strength with given material and dimensions.

The end flange 5 is formed with a central aperture. The outer part of this aperture (upper part of Figure 4) is in the form of a cylindrical bore 6 with a diameter equal to the outside diameter of the barrel 1. The inner part of the aperture wall (lower part of Figure 4) comprises projections or lugs 7, extending inwardly and separated by gaps 8 in which the bore wall 6 is continued. The lugs 7 occupy arcs corresponding to the slots 3 of the barrel end, so that the flange 5 may be slipped axially onto an end of the barrel 1, with the lugs 7 fitting within the slots 3 and the gaps 8 being in registry with the projections 4. When the flange 5 has been thus seated on an end of the barrel 1, as indicated in Figure 5, the lugs 7 will be circumferentially aligned with the grooves 2 of the projections 4 and the flange may now be turned one-eighth turn so as to bring the projections 7 into the grooves 2. The projections 7 preferably fit closely within the groove 2, only the minimum necessary clearance being provided axially of the spool. The turning of the flange puts the parts in the position of Figure 6, clearing the slots 3. End plug 10 may now be inserted. This plug comprises a generally cylindrical central projection 11 which is of a diameter equal to the inside diameter of the barrel 1 and around which are formed four projections or lugs 12, shaped to fit the slots 3. The member 10 extends radially outward beyond the projections 12, forming a flange 13 which seats against the outer surface of the spool flange 5, as indicated in Figure 7. The end plug 10, illustrated in Figures 7, 8 and 8-A, is formed with a keyhole shaped opening 14 to accommodate a spindle and driving lugs of a whorl or other spool driving bearing. Where the end of the spool in question is not to be driven, a round opening may be substituted for the keyhole shaped opening 14, as indicated in dotted lines at the lower end of the spool of Figure 7.

It will be noted that plug portion 11 which extends into the barrel end behind the projections 4, backs up the latter and prevents them from bending inwardly when a separating force is applied between the flange and spool barrel. This action is important. It has been found that where the projections 4 are not thus backed up and the flange is loaded until failure of the joint occurs, the projections 4 will break in shear. Where the plug 10 has a driving fit, however, and backs up the projections 4 effectively, failure occurs later and tends to occur in tension, the material being pulled apart at the undercut necks of the projections 4. Since the strength of plastic laminated materials is greatest when resisting stresses applied in alignment with the lamination fibers, the utmost utilization of the possibilities of the material is thus obtained. As will be obvious from the shape of the sections involved, similar advantages will be obtained with many non-laminated materials.

The beveling of the outer walls of the groove 2 as shown in the drawing is of importance in obtaining the greatest strength with parts of given size and material. The bevel angle is in-

dicated by the letter A in Figure 1, and making the angle less than 90° materially strengthens the construction. As will be apparent, if there is no bevel, which is a condition corresponding to a value of 90° for the angle A, a force tending to separate the flange and barrel will be exerted as a direct pull against the projection 4 overhanging the groove, tending to shear off this projection. Where the groove wall is beveled, a condition corresponding to a value of less than 90° for angle A, a force tending to separate the flange and barrel and exerted in the axial direction may be resolved into two components, at right angles to each other, one of which is normal to the beveled surface and tends to compress the projection 4 against the plug member 11, which backs it up, and both of which are smaller than the axial pull exerted on the flange. The best value for the angle A in any given construction is theoretically a compromise of opposing factors. As a practical matter, if the bevel angle A is made small enough so that failure does not occur by shearing off the projection 4 but by breaking the reduced section of the barrel under the groove 2 in tension, the bevel angle is satisfactory, and an angle of about 45° is generally satisfactory. Where the material used is such that this action is obtainable with a 90° angle, the groove 2 may be square and the groove may also be formed square wherever this is simpler from a manufacturing standpoint and sufficient strength is provided for the class of service in which the spool is to be used.

The end plug 10 locks the lugs 7 within the grooves 2 and by proper design of the relative dimensions of the lugs 7 of the slots 3 and projections 4, a positive interlock between flange and barrel for torque transmission may be obtained. The maximum locking effect will be obtained when the lugs 7 are made to fit the grooves 2 in the projections 4 exactly, and the lugs 12 are similarly made to fit the slots 3 exactly. Under these conditions, if it is attempted to turn the flange with relation to the barrel, lugs 7 will be forced against lugs 12 which, in turn, will be forced against the walls of slots 3, thus preventing any turning of the flange with relation to the barrel. Where relative turning through small angles of the flange is not objectionable, the spool may be manufactured more cheaply by providing circumferential clearance between the parts. Where such clearance is provided, the frictional holding against twisting of the flange on the barrel may be sufficient, and, where not sufficient, adhesives may be applied to the engaging surfaces of the parts before assembly so as to supplement the mechanical interlock with the holding power of the adhesive. Lugs 12 while preferably cast on the end plugs 10 may also be formed as separate pieces and inserted in the slots 3 before driving the plugs 10.

It will be observed that when the spool is completely assembled the end structure may be substantially solid, the slots and grooves in the barrel ends being filled by the lugs 7 and lugs 12.

In the construction just described, thread trapping may be minimized by providing a close fit of the parts so as to prevent thread from entering between projections 7 and the inner walls of grooves 2 or between the inner walls of slots 3 and the ends of lugs 12. Further prevention may be obtained by filling the cracks where trapping may occur with rubber cement or other seam filling material. In cases where such provision against thread trapping is not adequate or

5

economical, further provision may be made as illustrated in the modification of Figures 9 to 12. The spool there disclosed is identical with that previously described except that lugs 22 having convex inner ends 22-A are substituted for lugs 12, and slots 23 having correspondingly concave lower ends 23-A are substituted for the slots 3. The lugs 22 when seated in the slots 23 form ribs 26 extending inwardly from the inner face of the flange 5. Since a fiber wrapped circumferentially of the barrel will be disposed as a chord of the arc 27 of the joint between the lug 22 and slot 23, tendency of the thread to trap therein is minimized.

The flange 5 may also be formed with an annular groove 30 on its inner face so as to overlap the barrel, as indicated in Figure 13, which figure corresponds otherwise to Figure 6. The lug construction of Figures 9 to 12 inclusive may also be utilized with the flange structure of Figure 13.

Figure 14 illustrates a further modification of the invention in which the plug 40 may be flush with the outer surface of the flange 45. In this case, the end of the barrel 41, which is otherwise similar to the barrel 1 just described, is cut down slightly and the plug 40, otherwise similar to the plug 10, is formed with a flange or lip 42 to fit into the extra space thus created. The axial dimensions of the parts of Figure 14 may be varied as desired for obtaining the greatest mechanical strength.

What is claimed is:

1. In a spool and in combination, a tubular barrel having peripherally grooved and circumferentially spaced end projections extending axially therefrom with spaces separating the said projections, a flange member having an aperture adapted to accommodate the said projections and lugs extending inwardly and proportioned for axial insertion in the spaces between the said projections and fitting in the peripheral grooves of the said projections upon turning of the flange relative to said barrel, and a member inserted in the end of the barrel, preventing radially inward movement of the said projections and comprising lugs for filling the said spaces and thus locking the flange lugs within the said groove.

2. In a spool and in combination, a tubular barrel having peripherally grooved and circumferentially spaced end projections, a flange member having an aperture adapted to accommodate the said projections and lugs extending inwardly and proportioned for axial insertion in the spaces between the said projections and fitting in the peripheral grooves of the said projections upon turning of the flange relative to the barrel, and a member inserted in the end of the barrel for preventing radially inward movement of the said projections and having lugs filling the said spaces between the projections, and in which the flange lugs fit the grooves circumferentially without substantial clearance whereby the said flange lugs and lugs filling the barrel end spaces cooperate to provide a positive torque transmitting interlock between barrel and flange.

3. In a spool and in combination, a tubular barrel having peripherally grooved and circumferentially spaced end projections extending axially therefrom, a flange member having a central bore adapted to fit over an end of the barrel and lugs extending inwardly therefrom and proportioned for axial insertion in the spaces between the said projections and fitting

6

in the peripheral grooves of the said projections upon turning of the flange relative to said barrel, and means for filling the said spaces between the barrel projections for locking the flange lugs in the peripheral grooves.

4. A spool according to claim 3 in which the flange lugs fit the grooves circumferentially without substantial clearance whereby the lugs and means filling the spaces between projections provide a positive torque transmitting interlock between flange and barrel.

5. In a spool and in combination, a tubular barrel having peripherally grooved and circumferentially spaced end projections, a flange member having a central bore adapted to fit over an end of the barrel and lugs thereon proportioned for axial insertion in the spaces between the said projections and for fitting in the peripheral grooves thereof upon turning of said flange relative to said barrel, the said spaces between projections having concave bottom walls extending axially of the barrel beyond the flange, and means filling the said spaces to lock the lugs in the grooves and forming joints with the said concave bottom walls.

6. In a spool and in combination, a tubular barrel having peripherally grooved and circumferentially spaced end projections, a flange member having a central bore adapted to fit over an end of the barrel and lugs extending inwardly from the middle part of the bore wall and proportioned for axial insertion in the spaces between the said projections and fitting in the peripheral grooves of the said projections upon turning of the flange relative to said barrel, the flange bore inward of the lugs overlapping the barrel axially inwardly of the said spaces and the flange bore outwardly of the lugs surrounding the projections axially beyond the said peripheral grooves.

7. In a spool and in combination, a tubular barrel having peripherally grooved and circumferentially spaced end projections, a flange member having projections fitting in the grooves of the barrel projections and a member inserted in the end of the barrel and preventing radially inward movement of the said barrel projections, the outer walls of the grooves being beveled.

8. A spool according to claim 7, in which the angle of bevel of the groove walls is such that failure of the spool under excess pull on a flange occurs by breaking in tension of the barrel projections under the grooves rather than by shearing beyond the grooves.

9. A spool according to claim 7, in which the bevel angle is substantially forty-five degrees.

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