July 31, 1951 G. M. BONEBRAKE 2,562,658

EXPANDING HUB

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FIG. 1

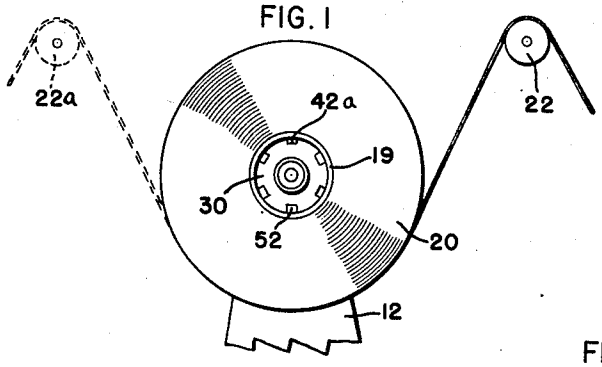


FIG. 2

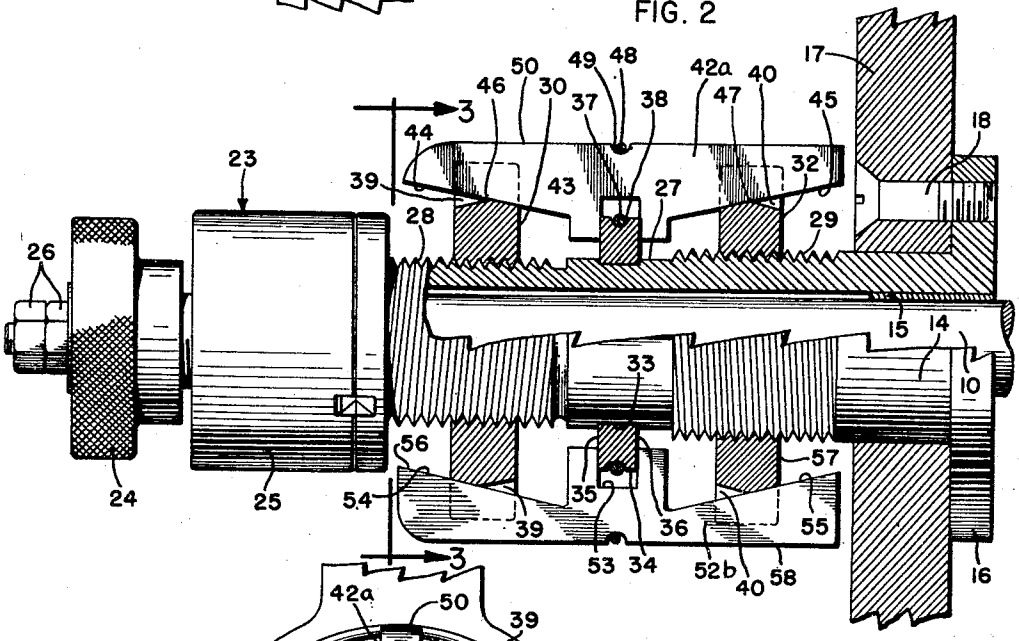
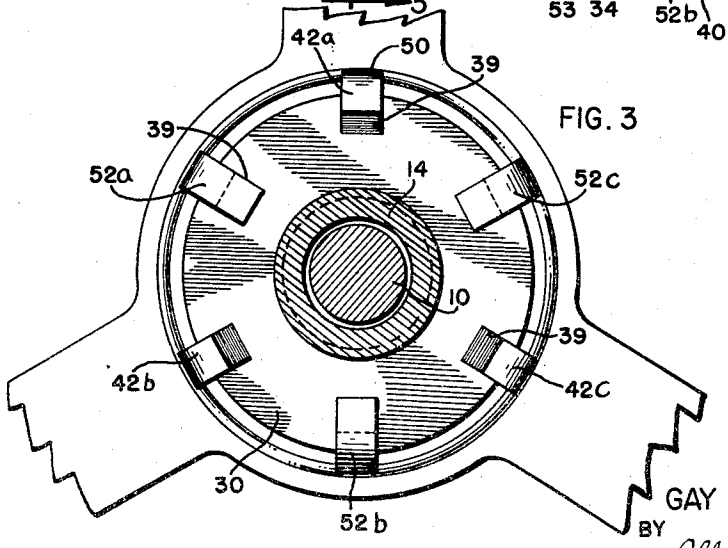


FIG. 3



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FIG. 4

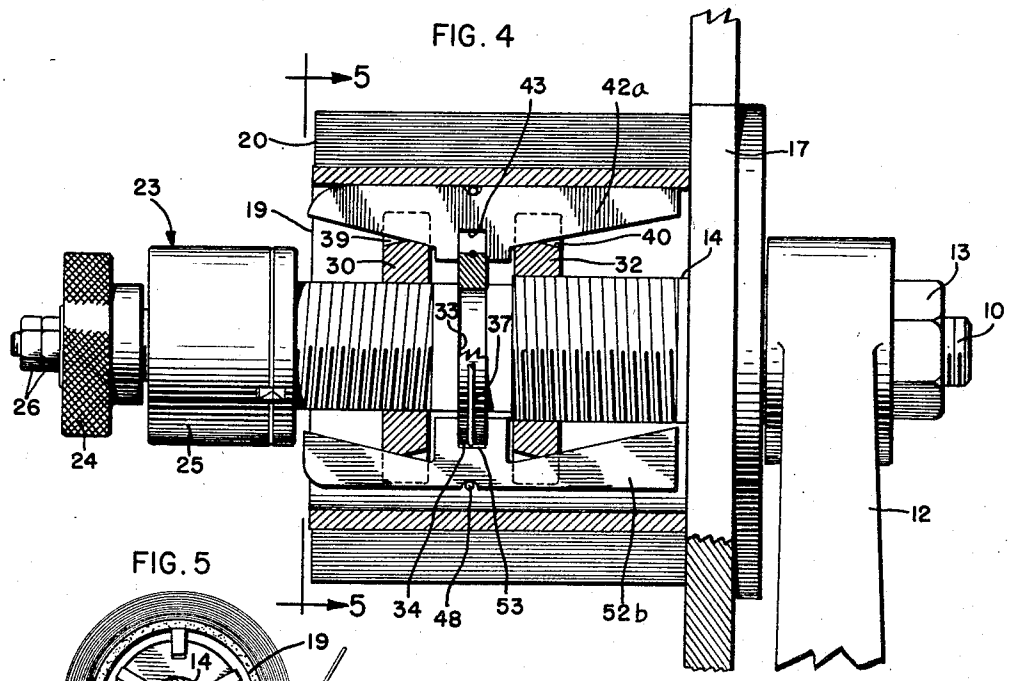


FIG. 5

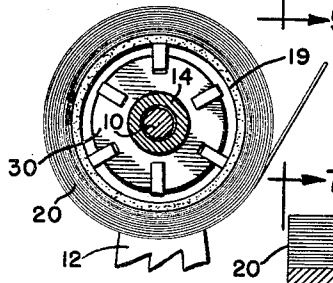


FIG. 6

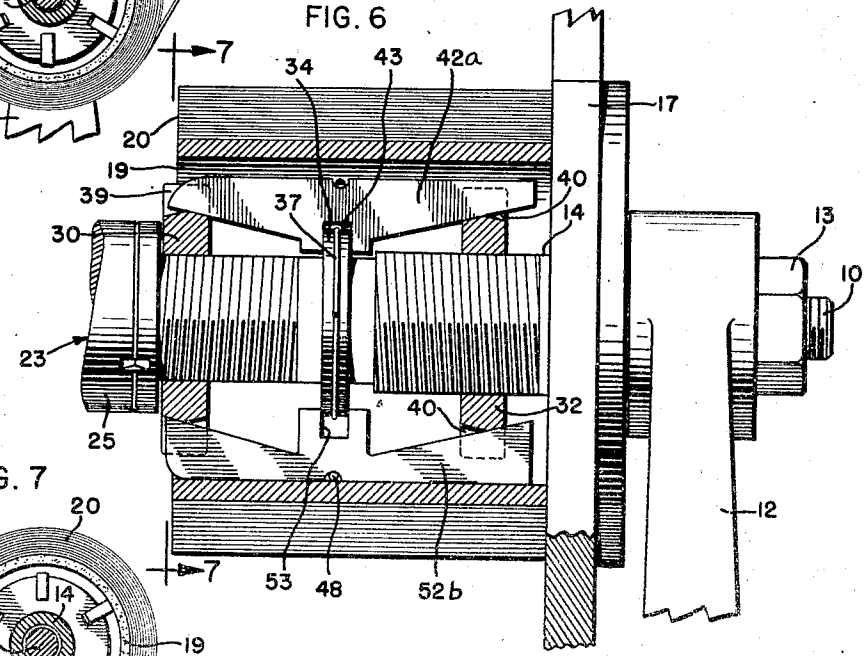
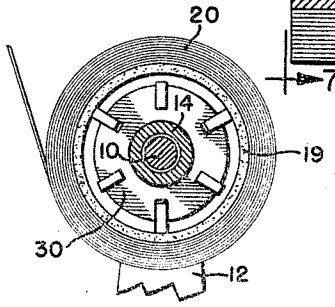


FIG. 7



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Patented July 31, 1951 2,562,658

UNITED STATES PATENT OFFICE

2,562,658

EXPANDING HUB

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Application January 10, 1947, Serial No. 721,323

6 Claims. (Cl. 242—72)

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This invention relates to expanding hubs, and particularly to a class of such hubs which is well suited, among other things, to the quick and easy exchange or replacement of supply roll reels and the like.

One of the objects of my invention is to provide an expanding hub adapted internally to grip and hold, as well as rotatably to support, reels, spools and the like in concentric relationship to a central axis.

As another object my invention comprehends the provision of an expanding hub suited to the quick and easy mounting or removal of a load without the use of wrenches or special tools.

A further object of the invention is to provide a rotatably supported expanding hub structure suited to the carrying of wound material and so constructed and arranged that the tensile force of unwinding the material tends to expand the hub, thereby maintaining its hold upon the material.

My invention has for another object the provision of a rotatably supported expanding hub adapted to expand from a predetermined minimum size when turned in either direction.

Another object of this invention is to provide an expanding hub which is relatively easy to assemble and disassemble.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings in which similar characters of reference indicate similar parts throughout the several views.

In the two sheets of drawings:

Fig. 1 is a fragmentary front elevational view illustrating an adaptation of my expanding hub to a revoluble spindle for carrying rolled or wound material;

Fig. 2 is a fragmentary side elevational view partially in section and having parts cut away to illustrate the structure of a preferred embodiment of my expanding hub;

Fig. 3 is a fragmentary end sectional view of the expanding hub shown in Fig. 2 and wherein the section is taken substantially on a line 3—3 of Fig. 2;

Figs. 4 and 6 are fragmentary side views partially in section wherein the parts are depicted in different gripping relationships for holding cylindrical spool carrying material wound in opposite directions; and

Figs. 5 and 7 are front sectional views drawn to a reduced scale and taken substantially on a line 5—5 of Fig. 4 and a line 7—7 of Fig. 6, respectively, to indicate the directions in which the

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material is wound on the spools in Figs. 4 and 6.

In the exemplary embodiment of my invention which is disclosed herein for illustrative purposes, my expanding hub is depicted as being adapted to the provision of a revoluble carrier suited to use as a support for interchangeable spools of wound material. Although not limited thereto, the expanding hub, in this adaptation, is carried by a stationary spindle shaft 10 supported at one end by a stationary support member 12 and projecting in perpendicular relationship to one face thereof; said spindle being secured in place by fastening means such as a nut 13 threaded onto the end thereof, as shown in Figs. 4 and 6. A hollow spindle 14 is rotatably carried by the spindle shaft 10 and desirably is supported thereon by journal bearings, such as 15 (Fig. 2), which bearings are longitudinally movable along the shaft, as well as rotatable thereon. At the end adjacent the supported end of the spindle shaft 10, the hollow spindle has an integral radially projecting flange 16, to which a face plate 17 is secured by fastening means, such as screws 18 (Fig. 2).

To effect the alignment axially of the spindle shaft of a part carried by the hub, such as a cylindrical spool 19, shown in Figs. 4, 5, 6 and 7, so as properly to align wound material 20 carried by the spool with guide rolls or the like 22, or 22a as shown in Fig. 1, an adjusting mechanism 23 is carried on the end of the hollow spindle remote from the support 12 and is adjustable by a manually operable thumb nut 24 to move the spindle axially of the shaft. The adjusting mechanism is enclosed within a spindle cap 25. The thumb nut 24 is readily applied to and removed from the adjusting mechanism by the application and removal of suitable holding means, such as nuts 26. Also, the spindle cap 25 and the adjusting mechanism are readily removable from the end of the hollow spindle 14 so that the end of the spindle is exposed for the assembly and disassembly of my expanding hub.

The hollow spindle 14 has at the mid-portion of its outer surface a cylindrical portion 27, on opposite sides of which are reversely threaded portions 28 and 29. Although the portions 28 and 29 are reversely threaded, the lead of the threads is desirably equal so that a predetermined rotary motion on the threads produces equal axial motion along both threads. Expander nuts 32 and 30 are threadedly mounted on the threaded portions 29 and 28, respectively; the expander nut 32 in the disclosed embodiment being nearer the supported end of the spindle

shaft than the expander nut 30. In order to facilitate the assembly and disassembly of the expanding hub without having both ends of the hollow spindle completely threaded and exposed or without removal of the spindle from the supported end of the spindle shaft, the threads on the portion 29 are of larger diameter than the cylindrical portion 27 and the threads of the portion 28; the difference in diameter being sufficient that the expander nut 32 passes freely over the threaded portion 28 and the cylindrical portion 27.

The cylindrical mid-portion of the hollow spindle not only serves as a spacing division between the threads but also is utilized in the disclosed structure as a centering or aligning division for the hub parts. That is, in the mid-portion of the cylindrical surface of the portion 27 is a circumferential channel 33 which, by preference, is of rectangular section. Mounted in and located by the channel 33 is a centering ring 34 having substantially parallel end surfaces 35 and 36. For ease of installation and removal, the centering ring 34 is preferably split across a diameter and held in place on the spindle by a resilient snap ring 37 which seats in a circumferential groove 38 on the periphery of the ring parts.

As shown in Figs. 2 and 3, the expander nuts 30 and 32 are preferably of equal outer diameter and have therein a predetermined number of equally spaced peripheral notches 39 and 40, respectively, extending axially therethrough. As will be more fully understood as the description progresses, the total number of notches is desirably even so as to provide two sets of equally spaced notches with the number of notches in each set preferably greater than two. The number of notches in the two expander nuts is equal and the spacing thereof in the two nuts is similar, so that the notches may be aligned axially of the spindle in a plurality of positions. Since the portions 28 and 29 of the spindle and their respective expander nuts are reversely threaded, relative rotation between the nuts and the spindle in one direction effects movement of the nuts axially toward one another, while such relative movement in the opposite direction effects axial movement of the nuts away from each other.

To effect an expanding action of the hub upon relative movement between the spindle and the nuts in one direction, a plurality of wedge elements, such as 42*a*, 42*b* and 42*c*, are disposed in equally spaced ones of the notches 39 and 40. By preference, the wedge elements 42*a*, 42*b* and 42*c* are similarly shaped and constructed. Each such wedge element has in the mid-portion of its inner surface a locating notch 43 adapted to straddle the centering ring 34 to locate the wedge element axially of the spindle while permitting its movement radially of the spindle. On opposite sides of the locating notch 43, the inner end surfaces of the wedge elements 42*a*, 42*b* and 42*c* are disposed in obtuse angular relationship to one another and symmetrically with respect to the locating notch to provide opposed wedge surfaces 44 and 45, which wedge surfaces seat against complementary bottom surfaces 46 and 47 of the notches 39 and 40, respectively, in the expander nuts. When thus disposed, the wedge elements extend axially of the spindle and are resiliently retained in place by means such as a coil spring 48 which encompasses the wedge elements and is disposed in notches, such as 49, in their outer surfaces. For the accommodation of cylindrical spools, such as 19, the outer surfaces 50 of the wedge elements are concentrically disposed with respect to the axis of the spindle and parallel to that axis.

For effecting the initial placement of the wedge elements in their respective equally spaced notches of the spindle nuts, the two nuts are adjusted approximate to similar positions along the threads which will provide approximate parallelism of the outer surfaces of the wedge elements with the axis of the spindle. To obtain accurate placement of the wedge elements, the wedge element may be removed from one nut while that nut is moved with respect to the other in one direction or the other, after which replacement of the wedge element may be effected and the alignment checked by means such as the placement of a square against the front face of the face plate 17 and along the outer edge of the wedge element. When the alignment of one wedge element is proprly determined, the placement of the others will follow without the necessity of being separately checked.

In the expanding hub disclosed, the wedge elements are so constructed and related that an expanding action of the hub is obtained by rotation of the expander nuts relative to the spindle in either direction. This adapts the hub for an automatic tendency to tighten due to tension of wound material in either direction, as indicated in Fig. 1. It also adapts the hub to the accommodation of material wound in opposite directions. To accomplish this expansion of the hub as a result of rotation of the expander nuts in either direction with respect to the spindle, I provide a second set of equally spaced wedge elements 52*a*, 52*b* and 52*c*, which latter wedge elements are alternately placed in the notches 39 of the expander nuts with respect to the previously described wedge elements 42*a*, 42*b* and 42*c*. The wedge elements 52*a*, 52*b* and 52*c* are preferably like in construction.

Each of the wedge elements 52*a*, 52*b* and 52*c* has a locating notch 53 like the notch 43 in the other wedge elements for straddling the ring 34 to locate the wedge element axially of the spindle. Each such wedge element also has inner surfaces on opposite sides of the notch 53 which are disposed in obtuse angular relationship to one another and symmetrically with respect to the notch 53, thus providing inner wedge surfaces 54 and 55. The angularity of the wedge surfaces 54 and 55, however, is opposed to that of the adjacent wedge surfaces of the other set of wedge elements and has opposite angularity with respect to the axis of the spindle. The wedge surfaces 54 and 55 seat against complementary bottom surfaces 56 and 57, respectively, in the notches 39 and 40.

With the opposed angularity of the wedge surfaces of the two sets of wedge elements, it may be readily understood that it is desirable to have all of the wedge elements so constructed that the position of parallelism of their outer surfaces with the axis of the spindle is attained with the same setting of the expander nuts; the outer surfaces 58 of the wedge elements 52*a*, 52*b* and 52*c* being concentric with respect to the spindle axis and parallel in the preferred setting. It is also desirable that the outer surfaces of the wedge elements of both sets shall have equal diameters when the expander nuts are placed at a position midway between the ends of their respective threads. With such a setting, one set of wedge elements will effect the expansion of the

hub upon movement in one direction from a predetermined minimum diameter; while the other set of wedge elements will expand from the predetermined minimum diameter when the expander nuts are turned in the other direction.

It is readily understandable that either of the two types of wedge elements may be used alone. When thus used, any member of the wedge elements greater than two may comprise a set. Also, the minimum diameter setting is reached with the expander nuts near the inner or outer ends of the threaded portions of the spindle, depending upon the type of wedge elements used; while the maximum diameter is reached with the wedge elements at the opposite ends of the threaded portions. The latter described positions of the parts of my expanding hub are depicted in Figs. 4 and 6; the expanding action in each instance being adapted to use with material wound in the directions depicted in Figs. 5 and 7, respectively.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

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

1. An expanding hub adapted to be rotatably supported relative to a spindle shaft and comprising, in combination, a hollow spindle journaled for rotation on the spindle shaft, said hollow spindle having on its outer surface a circumferential channel at the mid-portion thereof and reversely cut threads of equal lead and unequal diameters on opposite sides of said channel, expander nuts mounted on said threads and movable in opposite axial directions along the hollow spindle in response to rotation relative to the spindle in the same direction, said expander nuts each having in the periphery thereof a predetermined number of symmetrically disposed and equally spaced notches extending axially therethrough, a split centering ring mounted in and located by said circumferential channel and having parallel side walls projecting radially from the spindle, a resilient snap ring holding the split centering ring in place, wedge elements carried by said notches for movement therein relative to the expander nuts in a direction axial to the spindle, said wedge elements each having a centering notch in the mid-portion thereof straddling said centering ring to locate the wedges axially of the spindle, each of said wedge elements also having longitudinally extending inner wedge surfaces of like and opposed angularity symmetrically disposed on opposite sides of said centering notch, the angularity of the wedging surfaces of alternate ones of the wedge elements being equal and similar, and the angularity of the wedging surfaces of adjacent ones of the wedge elements being oppositely transverse to lines parallel to the axis of said spindle, said wedge elements having substantially parallel outer surfaces, and resilient means encompassing the wedge elements to hold them in place with their wedge surfaces seated in said notches, said expander nuts being so disposed that the outer surfaces of the wedge elements are substantially parallel to the axis of the spindle, and adjacent ones of the wedge elements moving radially in opposite directions as said expander nuts are turned in either direction.

2. An expanding hub adapted to be rotatably supported relative to a spindle shaft and comprising, in combination, a hollow spindle journaled for rotation on the spindle shaft, said hollow spindle having on its outer surface a circumferential channel at the mid-portion thereof and reversely cut threads of equal lead and unequal diameters on opposite sides of said channel, expander nuts mounted on said threads and movable in opposite axial directions along the hollow spindle in response to rotation relative to the spindle in the same direction, said expander nuts each having in the periphery thereof a predetermined number of equally spaced notches extending axially therethrough, a split centering ring mounted in and located by said circumferential channel and having parallel side walls projecting radially from the spindle, means for holding the split centering ring in place, wedge elements carried by said notches for movement therein relative to the expander nuts in a direction axial to the spindle, said wedge elements each having a centering notch in the mid-portion thereof straddling said centering ring to locate the wedges axially of the spindle, each of said wedge elements also having longitudinally extending inner wedge surfaces disposed symmetrically and in obtuse angular relationship to one another on opposite sides of said centering notch, the angularity of the wedge surfaces of each wedge element being equal with respect to the opposite sides of a central plane through said centering ring, said wedge elements having substantially parallel outer surfaces, and resilient means for holding the wedge elements in place with their wedge surfaces seated in said notches, whereby said wedge elements move radially in a direction dependent upon the direction of rotation of the expander nuts relative to the spindle.

3. An expanding hub adapted to be rotatably supported relative to a spindle shaft and comprising, in combination, a hollow spindle journaled for rotation on the spindle shaft, said hollow spindle having on its outer surface a circumferential locating means at the axial mid-portion thereof and reversely cut threads of equal lead on opposite sides of said locating means, expander nuts mounted on said threads and movable in opposite axial directions along the hollow spindle in response to rotation relative to the spindle in the same direction, said expander nuts each having in the periphery thereof two alternately disposed sets of equally spaced notches extending axially therethrough, wedge elements of similar shape and construction carried by each set of said notches for movement therein relative to the expander nuts in a direction axial to the spindle, said wedge elements each having a centering means in the mid-portion thereof interfitting radially with said locating means on the spindle to locate the wedges axially of the spindle, each of said wedge elements also having longitudinally extending inner wedge surfaces disposed symmetrically and in obtuse angular relationship to one another on opposite sides of said centering means, and the angularity of adjacent wedging surfaces of adjacent ones of the wedge elements being oppositely transverse to lines parallel to the axis of said spindle, said wedge elements having outer gripping surfaces, and a coil spring encompassing the wedge elements for holding the wedge elements in place with their wedge surfaces seated in said notches, said ex-

pander nuts being so disposed relative to their respective threads on the spindle that the outer gripping surfaces are disposed in predetermined relationship with respect to the axis of the spindle, and adjacent ones of the wedge elements being moved radially in opposite directions as said expander nuts are turned in either direction relative to the spindle.

4. An expanding hub adapted to be rotatably supported relative to a spindle shaft supported at only one end and comprising, in combination, a hollow spindle journaled for rotation and axial movement on the spindle shaft, an adjustable mechanism mounted on one end of the hollow spindle and coacting with the spindle shaft to determine the axial position of the hollow spindle relative to the spindle shaft, said hollow spindle having on its outer surface a circumferential locating means at the axial mid-portion thereof and reversely cut threads of equal lead on opposite sides of said locating means, expander nuts mounted on said threads and movable in opposite axial directions along the hollow spindle in response to rotation relative to the spindle in the same direction, said expander nuts each having in the periphery thereof a predetermined number of spaced notches extending axially therethrough, wedge elements of similar shape and construction carried by said notches for movement therein relative to the expander nuts as said expander nuts are moved axially of the spindle, said wedge elements each having a centering means in the mid-portion thereof interfitting radially with said locating means on the spindle to locate the wedges axially of the spindle, each of said wedge elements also having longitudinally extending inner wedge surfaces disposed symmetrically and in obtuse angular relationship to one another on opposite sides of said centering means, and the angularity of the wedging surfaces of each of the wedge elements being oppositely transverse to a line parallel to the axis of said spindle, said wedge elements having outer gripping surfaces, and a resilient band element encompassing the wedge elements for holding the wedge elements in place with their wedge surfaces seated in said notches, said expander nuts being so disposed relative to their respective threads on the spindle that the outer gripping surfaces are disposed in predetermined relationship with respect to the axis of the spindle, and said wedge elements being moved radially as said expander nuts are turned relative to the spindle.

5. An expanding hub comprising, in combination, a spindle, said spindle having on opposite end portions of its outer surface reversely cut threads of equal lead and unequal diameters, the diameters of said threads differing by an amount such that the minor diameter of the larger threads exceeds the major diameter of the smaller threads, expander nuts mounted on said threads and movable in opposite axial directions along the spindle in response to rotation of the nuts relative to the spindle in the same direction, said expander nuts each having in the periphery thereof a predetermined number of notches equally spaced peripherally of the nuts and extending axially therethrough, wedge elements carried by said notches for movement therein relative to the expander nuts as said nuts are moved in a direction axial to the spindle, a ring element removably mounted on the outer surface of the spindle between the reversely cut threads for locating and maintaining the position of the wedge elements axially of the spindle, each of said wedge elements having longitudinally extending inner wedge surfaces symmetrically disposed in obtuse angular relationship to one another on opposite end portions of the wedge elements, said wedge elements having surfaces facing outwardly away from the spindle axis, and resilient means for holding the wedge elements in place with their wedge surfaces seated in said notches, and said expander nuts being set at positions such that said outwardly facing surfaces of the wedge elements are disposed in predetermined relationship to the spindle axis.

6. In a rotatably supported expanding hub, the combination comprising, a spindle shaft adapted to be supported at one end only, a hollow spindle journaled for rotation on said shaft, said hollow spindle having reversely threaded portions on opposite ends of its outer surface, the threads on said portions having equal lead and the threads nearer the supported end of the spindle shaft being of larger diameter than the others, parts threaded to fit each of said threaded portions, and the difference in the diameters of the threaded portions being sufficient that the part fitting the threaded portion of larger diameter will pass freely over the threaded portion of smaller diameter so that both parts may be put in place and removed without removing the spindle from the spindle shaft.

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