

[54] COLLAPSIBLE REEL

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242/68.2; 279/2; 269/48.1

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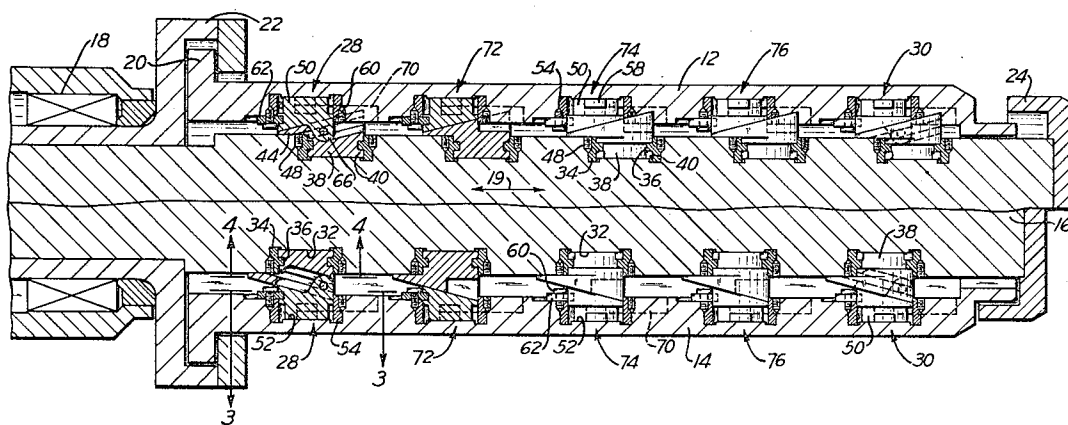
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[57] ABSTRACT

The disclosure of the present invention provides a central arbor for supporting three or more outer segments which are displaceable radially to effect an expansion and collapsing of the reeling surface during the process of winding up or paying off rolled steel strip. The radial displacement of the segments is accomplished by several readily replaceable and interchangeable wedge insert assemblies arranged between the arbor and segments. Each wedge assembly includes two cooperative wedge elements, one being arranged with one of the segments and the other with the arbor, the arbor being moved axially to effect a movement of the cooperative wedges.

7 Claims, 7 Drawing Figures



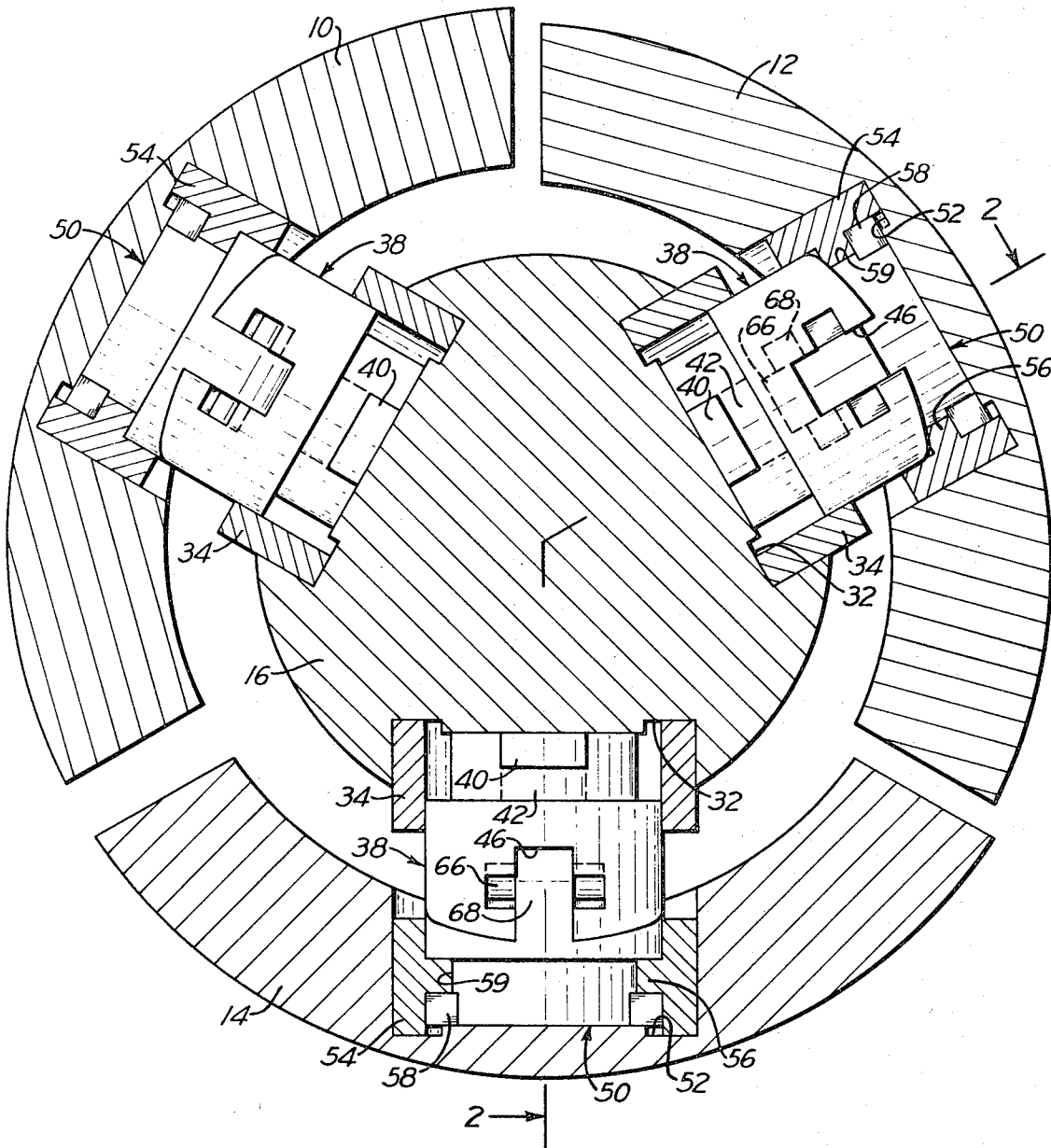


Fig. 1

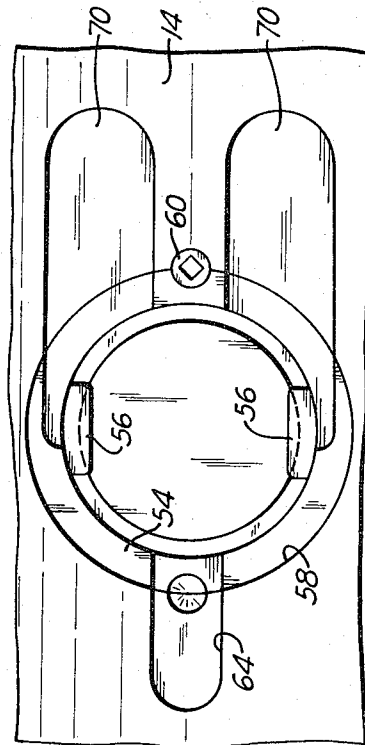
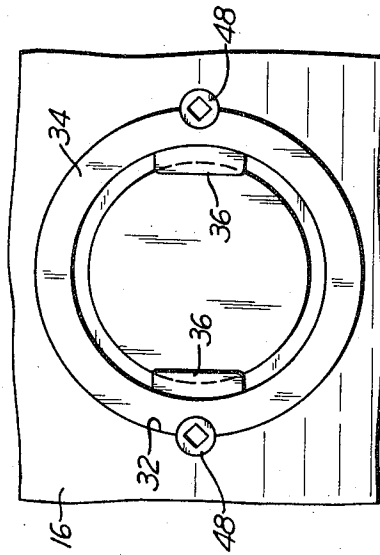
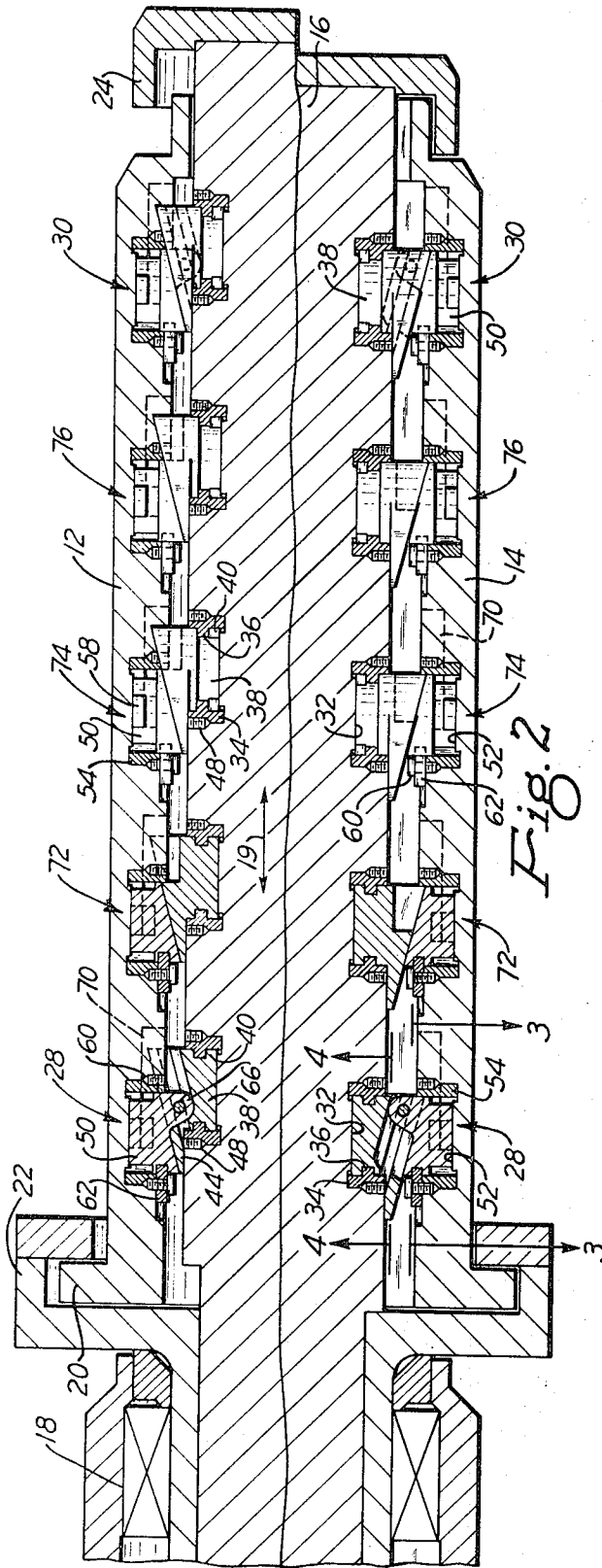
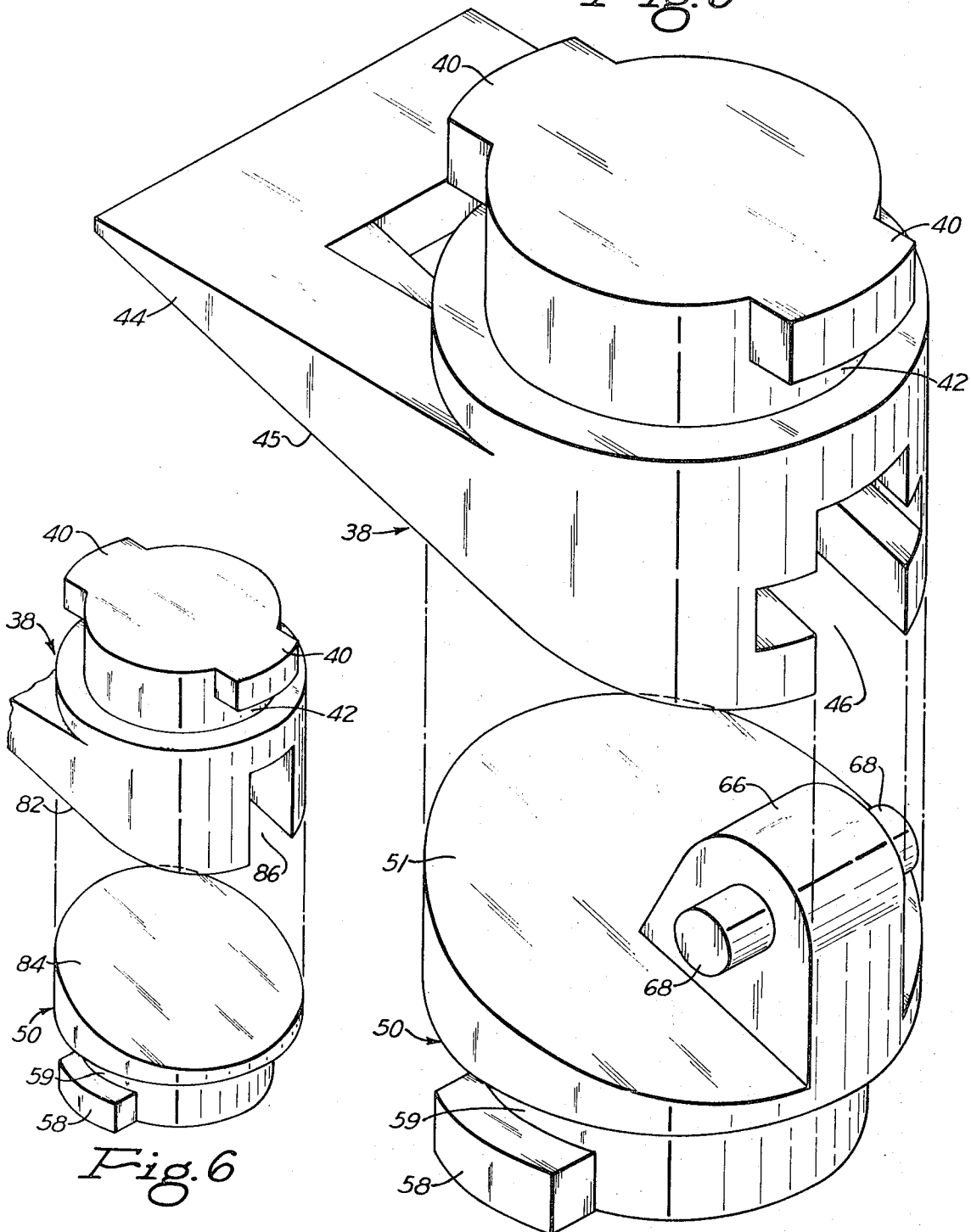
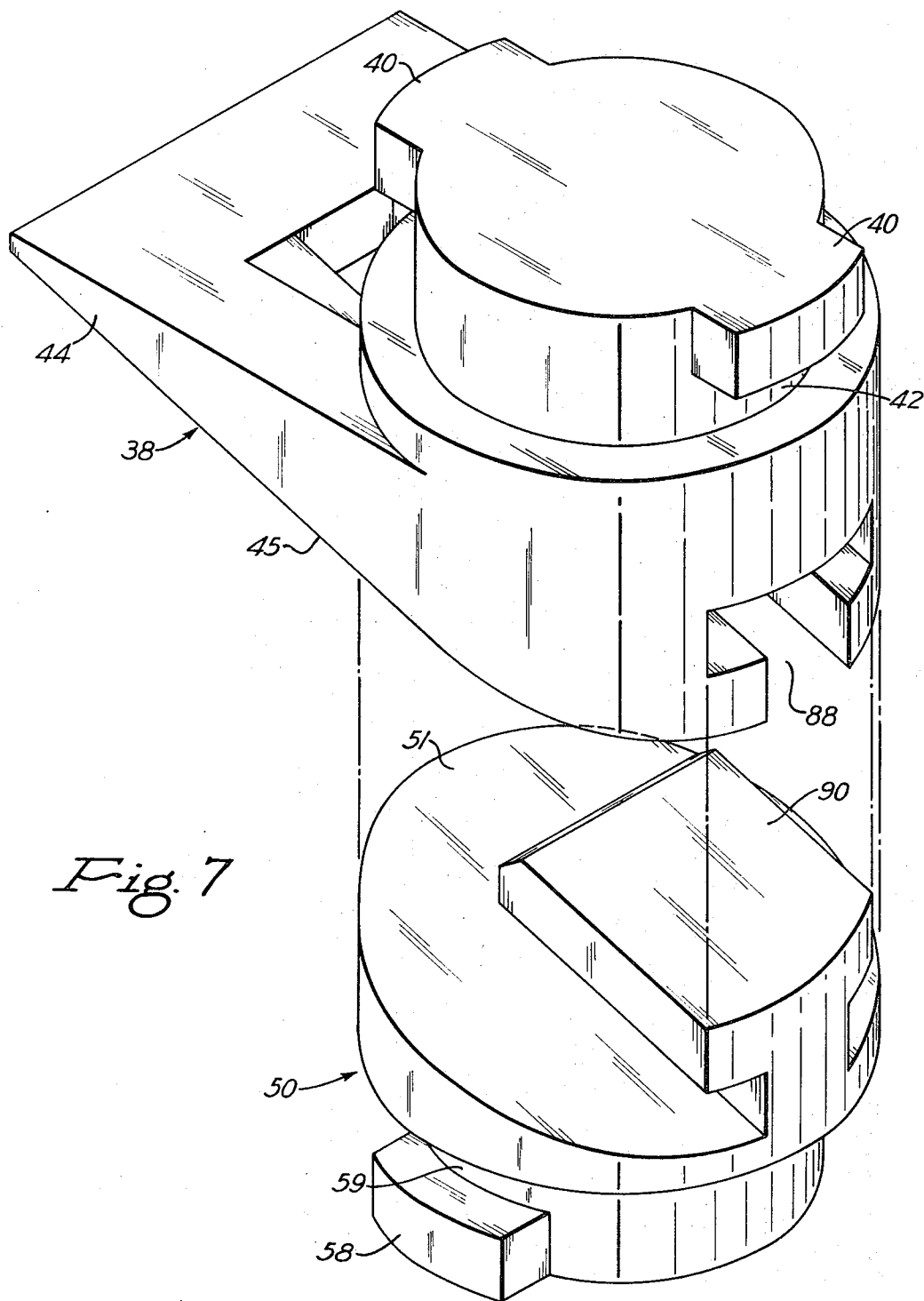


Fig. 5





COLLAPSIBLE REEL

In order to wind up or pay off strip-like material, for example, hot or cold rolled steel strip, there is usually provided a collapsible reel. These reels are subject to all sorts of adverse conditions such as high speeds, cantilever loading, heat, water, and centrifugal forces, all of which make for very poor performance and high up-keep costs. Moreover, because of the wide variations of applications, in which some cases the reel is employed as a pay-off reel or wind-up tension reel for coiling strip and in other cases as a mandrel of a hot strip coiler, past reels had to be designed more or less for each specific application which greatly adds to their costs. Even so, in many cases the strength of various parts of the reel and maintenance features had to be sacrificed.

It is therefore an object of the present invention to provide an expandable reel for handling strip-like material such as rolled steel strip or paper, etc., in which the cost of manufacture and up-keep will be very economical and the construction of the reel will be greatly improved so that it can be employed for a wide range of applications.

More particularly, the present invention provides a reel where the expanding and collapsing is accomplished by one or more rapidly replaceable wedge insert assemblies arranged between the arbor and segment.

Still further it is an object of the present invention to construct the wedge assemblies with two cooperative wedge elements, one element being associated with the outer segment of the reel and the other element with the central arbor thereof, in which bores are provided to receive the elements in a manner that the elements can be readily installed and removed and wherein the number of assemblies can be varied depending on the loads to which the reel is to be subject.

Another object of the invention is to provide for the wedge assemblies to include a wedge element made up with an inclined slot and a second wedge or piston element having a sliding pin or T-shaped member which is received in the slot.

These objects, as well as other novel features and advantages of the present invention, will be better understood when the following description of several embodiments is read along with the following drawings of which:

FIG. 1 is an end elevational view, with certain portions in section, of a three segment reel built in accordance with the teaching of the present invention, two segments being shown in their expanded positions and the third in its collapsed position;

FIG. 2 is a sectional view taken on lines 2—2 of FIG. 1 where according to FIG. 1 the upper segment is shown collapsed and the lower segment expanded;

FIG. 3 is an outside view taken on lines 3—3 of FIG. 2 with the piston insert element removed;

FIG. 4 is an outside view taken on lines 4—4 of FIG. 2 with the wedge insert element removed;

FIG. 5 is an exploded perspective view of the outer wedge and piston elements shown in FIG. 2; and

FIG. 6 is an exploded perspective view of a second embodiment of the wedge and piston elements shown in FIGS. 1—5;

FIG. 7 is an exploded perspective view of a third embodiment of the wedge and piston elements shown in FIGS. 1—5.

In referring first to FIGS. 1 and 2, there is shown an expandable reel for winding or unwinding flat rolled steel strip having three outer and radially displaceable segments 10, 12 and 14 arranged equi-distantly around a center supporting arbor 16, which as shown in FIG. 2 is cantileverly mounted and rotatably supported by a bearing assembly 18. As indicated by the arrow 19 in FIG. 2 the arbor is displaceable axially to effect the expansion and collapsing of the segments. The power means for accomplishing this axial displacement is not shown nor are other well-known components of the reel assembly such as the drive.

The inner or drive ends of the segments 10, 12 and 14 have circular projections 20 that are received in a rotating C-shaped head 22, the clearance relationship being such that the segments are permitted to move radially but restricted from moving axially and at the same time through a T-slot construction the segments are driven by the head 22. The other end of the segments 10, 12, and 14 are similarly restrained and driven by a circular end cup 24 which is secured to and rotates with the adjacent end of the arbor 16. A closer inspection of the upper and lower end portion of the reel shown in FIG. 2 will reveal the relationship between the members 22 and 24 and the segments in both the expanded position of the reel which is illustrated by the segment 14 and the collapsed position which is illustrated by the segment 12, the expanded and collapsed positions also, as noted before, being revealed in FIG. 1. For example, in reels having a great length or subject to high thermal conditions, it may be highly desirable to provide for a positive restrain at the longitudinal center of the segments which could be accomplished by employing one of the two disclosed forms of the interconnected types of wedge assemblies.

The expansion and collapsing of the segments is accomplished by three series of in-line wedge assemblies arranged between the arbor 16 and the segments 10, 12, and 14. It should be noted that in FIG. 2 two different types of wedge assemblies are employed, the inner ones being of a more simpler and less costly construction than the outer ones. The particular use of the two different types of wedge assemblies may change depending on the application of the reel, and as already noted the different type wedge assemblies are interchangeable so that if one or more particular features of one type are desired, the desired type can be substituted for the one presently being employed.

In referring first to the wedge assemblies 28 and 30 located at the opposite ends of the arbor and segments, these are provided because they have "safety" pins for preventing the segments from inadvertently separating themselves from the arbor due to centrifugal force should the reel, if used as a wind-up reel, be rotated at high speeds without any strip being wound around the reel. In certain reel applications it may be desirable to decrease or increase the number of these "pin" wedge assemblies depending on the speed of the reel and other factors.

Irrespective of the construction of the wedge assemblies, since they are interchangeable in the arbor and segments each of these elements is provided with a number of identical bores. Referring first to the arbor 16, it is provided with three axial rows of spaced-apart bores 32 which can be seen clearly from FIG. 4. The bores receive tubular liners 34 each having opposed pair of inward projections 36. These projections 36

form a type of a bayonet connection with an inward part of wedge elements 38 which, as best shown in FIG. 5, have circular projections 40 which when assembled in the liners are rotated under the projections 36 of the liners 34.

To assemble and disassemble the wedge elements 38 there is provided two diametrically opposite cut outs 42 which extend into the adjacent cylindrical portions of the wedge elements and which allow the wedge elements to be inserted into and removed from the liners 34 without interfering with the projections 36 of the liners when the wedge elements are rotated to line up the cut-outs 42 with the projections 36.

Continuing to describe the wedge assemblies 28 and 30, each outward portion is machined with a wedge portion 44 having an inclined surface 45 and an inclined +-shaped slot 46, again as best shown in FIG. 5, the length and degree of the inclined surfaces being designed to give the necessary expansion and collapsing of the segments 10, 12, and 14. The liners 34 are secured to the arbor 16 by two bolts 48.

Cooperating with each wedge element 38 is a piston element 50 having an inclined surface 51 that engages the inclined surface 45 of the element 38. The piston elements are received in bores 52 formed in the segments 10, 12, and 14 directly across from the bores 32 of the arbor 16. The bores 52 receive liners 54, best shown in FIG. 3, which are provided with projections 56. The piston elements 50 likewise have projections 58 to form a bayonet connection with the projections 56. As best shown in FIG. 5 the piston elements have cut-outs 59 that allow the elements to be inserted into the liners 54 then rotated to bring the projections 58 under the projections 56 of the liners 54. The liners 54 are secured to the segments by bolts 60 and further by slideable keys 62 received in cut-outs 64 best shown in FIG. 3.

To the inside of the piston elements 50 there is provided a lug 66 from which opposite sides project pins 68 that pass into the +-shaped slot 46 of the wedge elements 38 and which are guided by and slide on the inclined surfaces of the + slots wedge of the elements. As noted before, the expansion and collapsing of the segments 10, 12, and 14 are accomplished by the axial movement of the arbor 16 which carries with it the wedge elements 38. To provide for this movement of the wedge elements 38 the segments are cut-out at 70 which cut-outs are best shown in FIGS. 2 and 3.

In now describing the inner wedge assembling 72, 74 and 76 which are identical in construction and of a simplified form as compared with the end wedge assemblies 28 and 30, it will be observed that the reference numbers employed to describe the elements making up the assemblies 28 and 30 have been used for the assemblies 72, 74 and 76 where appropriate.

As can be best seen from FIG. 6 the three assemblies 72 - 76 each have wedge elements 38 and piston elements 50 that are received in the bores 32 and 52, respectively. Instead of providing the positive interlocking and driving +-shaped slot and pin arrangement of the assemblies 28 and 30, the assemblies 72 - 76 have cooperative inclined surfaces 82 and 84. A slot 86 provided in each of the wedge elements 44 allows the segment to extend into these slots when in the collapsed condition, as shown in FIG. 1.

FIG. 7 shows the third embodiment of the wedge assemblies of the present invention in which in place of

the +-shaped slot 46 and pins 68 of the assemblies 28 and 30, the positive interlocking and driving arrangement is accomplished by providing a simplified construction of a short T-slot 88 and mating T 90.

From the above it will not only be observed that the replaceability of the quickly insertable wedge and piston elements allow rapid servicing of the reel wherein a broken or worn element can be replaced and should a better construction be obtainable by substituting one of the other two types of the wedge assemblies herein described this can be done, but the strength has been greatly improved and the amount of machining greatly reduced on the more or less permanent and reusable elements of the reel, particularly the segments and arbor. It will also be appreciated that while the reel disclosed relies on the axial movement of the arbor 16, as is well known, a central actuated rod can be employed which would impart the axial movement directly to the segment to effect their radial displacement while the arbor is held against axial movement.

In accordance with the provisions of the patent statutes, I have explained the principle of my invention and have illustrated what I consider to be the best embodiment thereof.

I claim:

1. An expandable reel having a central arbor, radially movable segments arranged circumferentially around said arbor in a manner to form a continuous supporting surface for strip-like material, a series of spaced-apart cylindrical bores formed in said arbor for each segment, other series of cylindrical bores formed in each of said segments, one for each arbor bore and in radial alignment therewith to form associated pairs of bores, first elements having cylindrical portions received in one of said bores of each pair, each having similar inclined surfaces disposed in the same direction, second elements having cylindrical portions received in the other bores of each pair having means for engaging with and being displaced by said inclined surfaces, said inclined surfaces being such that on relative axial movement of said segments and arbor said segments are caused to move radially relative to said arbor, said first elements and said second elements each having projections, tubular shaped liners arranged in said both series of bores, each having at least one projection, cutouts provided on said first and second elements of sufficient size to pass over said projections of said liners when being assembled and disassembled, the thickness of said projections and said cutouts being such that said projections of said first and second elements are insertable behind and restrained by the projections of said liners, and means for securing said liners to said arbor and segments.
2. An expandable reel according to claim 1, wherein said first elements are received in said arbor and said second elements are received in said segments, wherein said arbor is moved axially to effect an expansion of said segments, and further wherein said segments have cut-outs for receiving said first elements when said reel is collapsed.

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3. An expandable reel according to claim 1, wherein said means for engaging said inclined surface includes a cooperative inclined surface.

4. A reel according to claim 1, wherein said inclined surface takes the form of an inclined slotted opening, and wherein said means for engaging said inclined surface includes a pin arranged to slide in said slotted opening.

5. An expandable reel according to claim 1, wherein said inclined surface takes the form of an inclined T-slot opening, and

wherein said means for engaging said inclined surface includes a cooperative T-shaped member arranged to be received in said T-slot opening.

6. An expandable reel having a central arbor, radially movable segments arranged circumferentially around said arbor in a manner to form a continuous supporting surface for strip-like material, a series of spaced-apart cylindrical bores formed in said arbor for each segment,

other series of cylindrical bores formed in each of said segments, one for each arbor bore and in radial alignment therewith to form associated pairs of bores,

first elements having cylindrical portions received in one of said bores of each pair, each having similar inclined surfaces disposed in the same direction, second elements having cylindrical portions received in the other bores of each pair having means for engaging with and being displaced by said inclined surfaces,

said inclined surfaces being such that on relative axial movement of said segments and arbor said segments are caused to move radially relative to said arbor,

said first element and said second element each having locking means,

holding means arranged in said both series of bores, and

said locking means of first and second elements including means adapted to be held by said holding

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means when said elements are rotated in a certain position relative to said holding means.

7. An expandable reel having a central arbor, radially movable segments arranged circumferentially around said arbor in a manner to form a continuous supporting surface for strip-like material,

a series of spaced-apart cylindrical bores formed in said arbor for each segment,

other series of cylindrical bores formed in said segments, one for each arbor bore and in radial alignment therewith to form associated pairs of bores, first wedge assemblies having cylindrical portions received in some of said associated pairs of bores,

second wedge assemblies having cylindrical portions received in the other of said associated pairs of bores,

said first wedge assemblies including first elements having similar inclined surfaces disposed in the same direction, said inclined surfaces having openings, and second elements having cooperative inclined surfaces for engaging with and being displaced by said inclined surfaces, of said first elements, said second elements also having interlocking means received in said openings of said second elements,

said second wedge assemblies including two cooperative wedge elements having cooperative inclined surfaces disposed in the same direction as said inclined surfaces of said first wedge assemblies,

said inclined surfaces being such that on relative axial movement of said segments and arbor said segments are caused to move radially relative to said arbor, and

said first assemblies and their associated bores and said second assemblies and their associated bores each having locking means so constructed and arranged that on rotation of said assemblies said assemblies may be quickly inserted into or removed from their associated bores.

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