

Dec. 2, 1941.

R. P. TOOKE

2,265,087

COLLAPSIBLE DRUM

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3 Sheets-Sheet 1

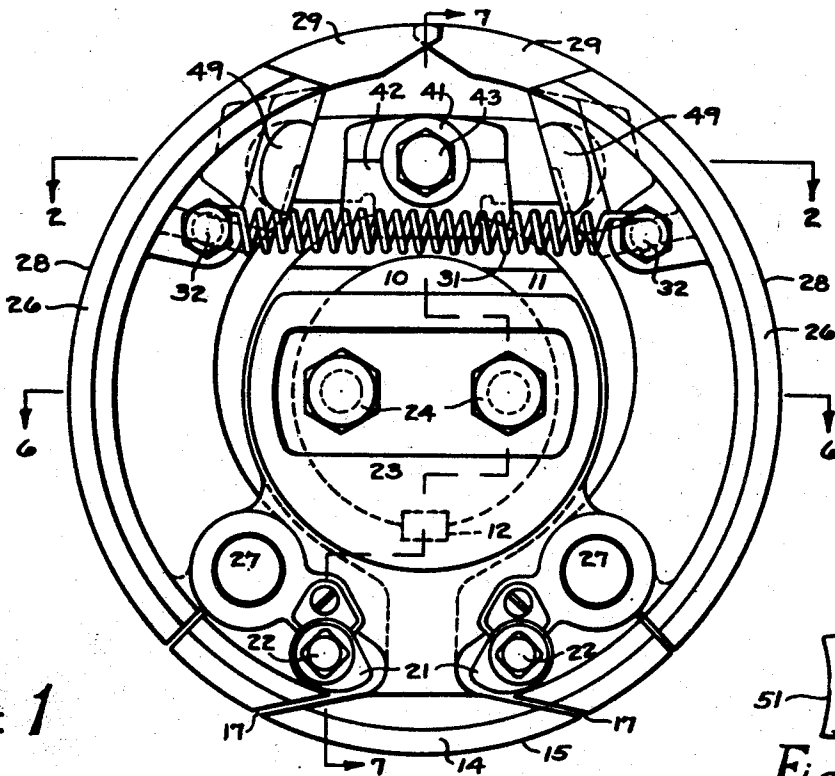


Fig. 1

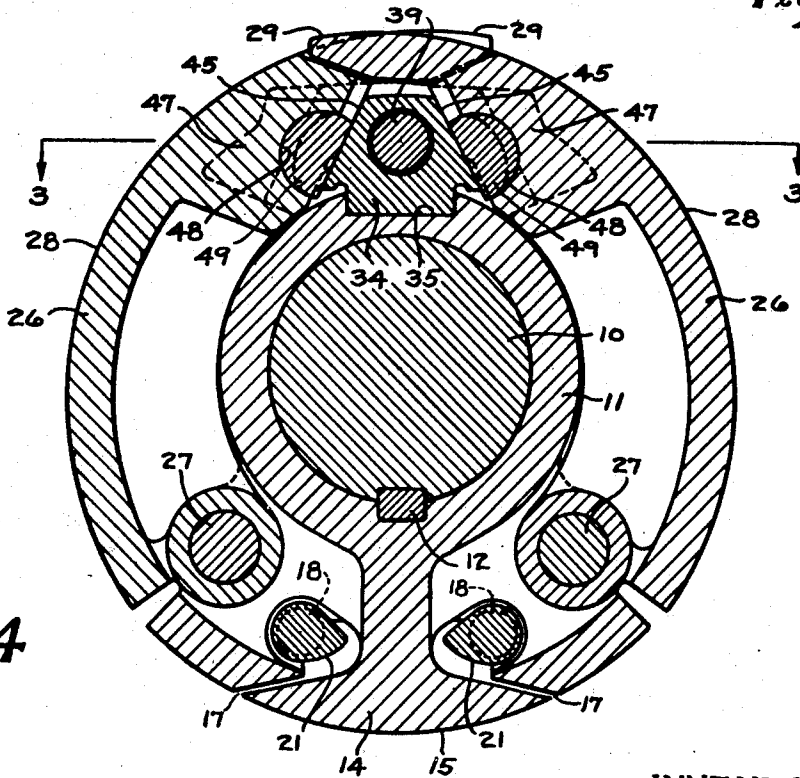


Fig. 4

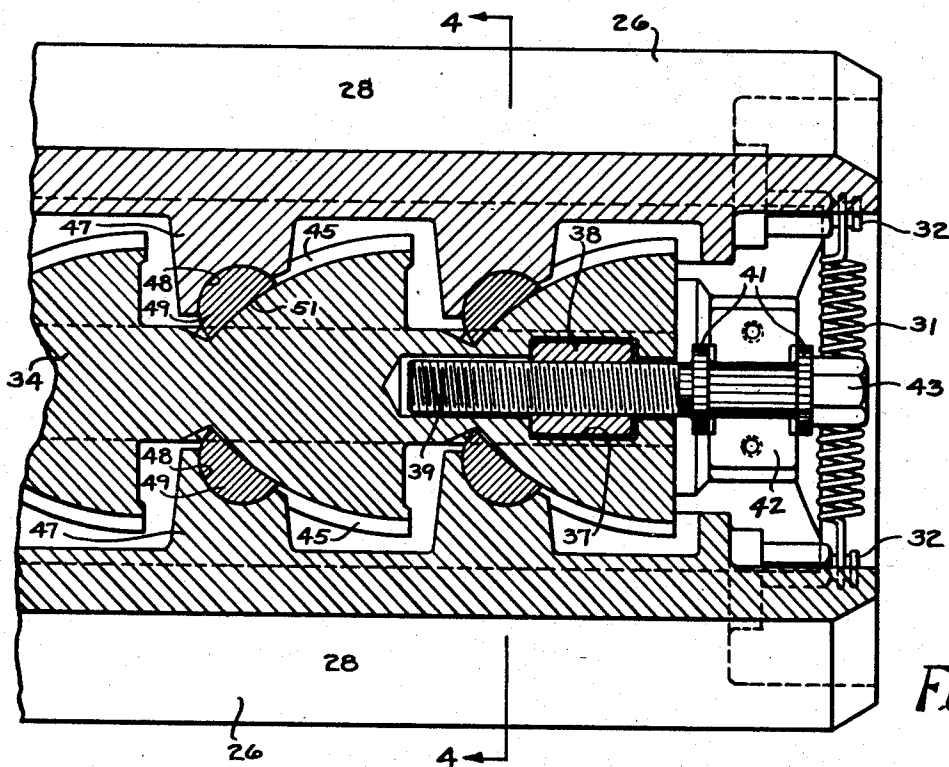
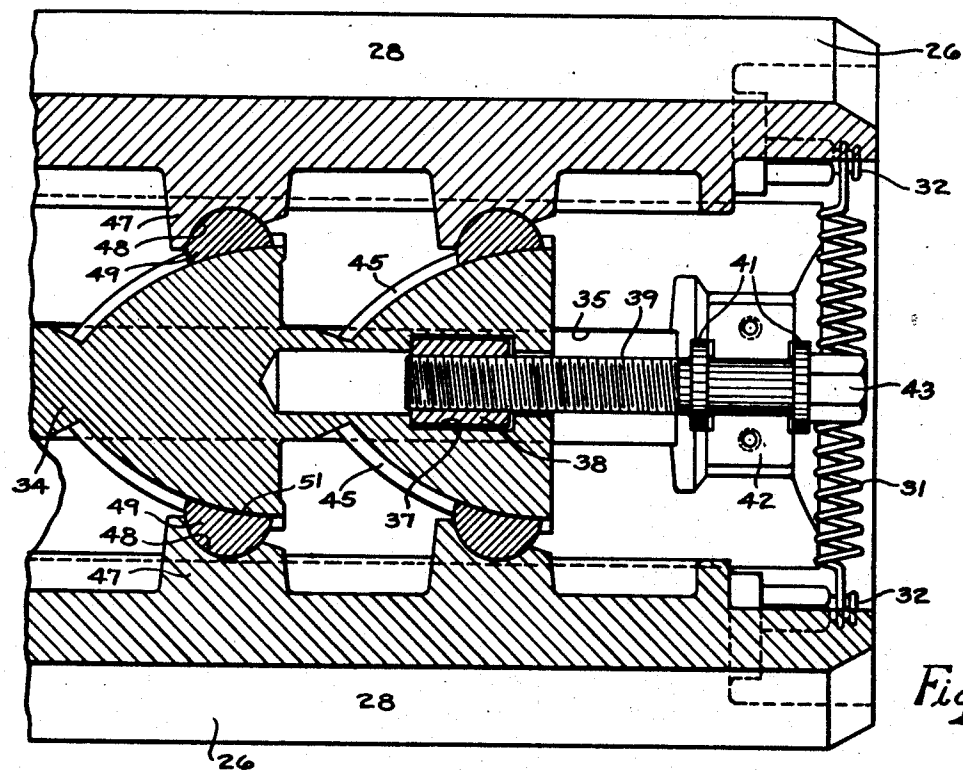
INVENTOR
ROY P. TOOKE
BY *Albert G. Blodgett*
ATTORNEY

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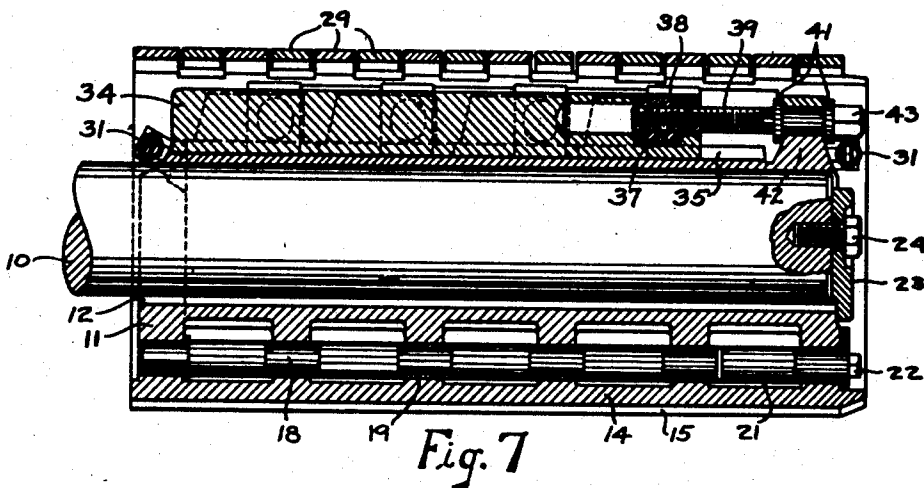
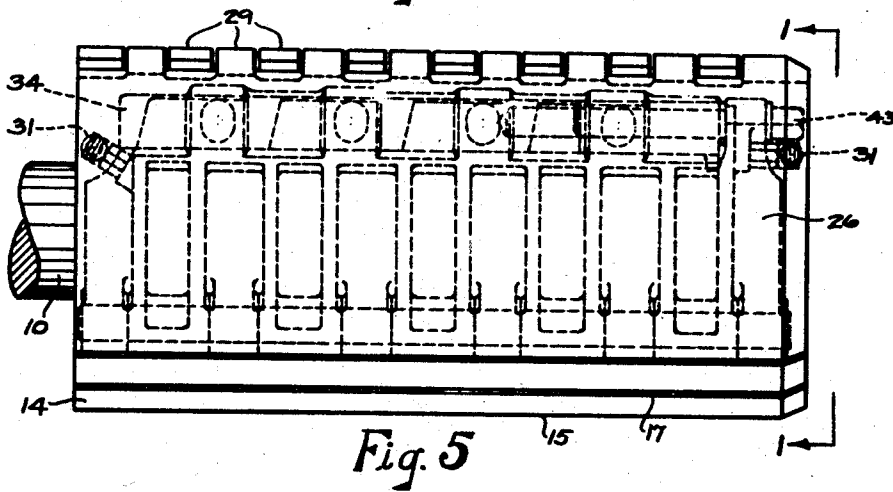
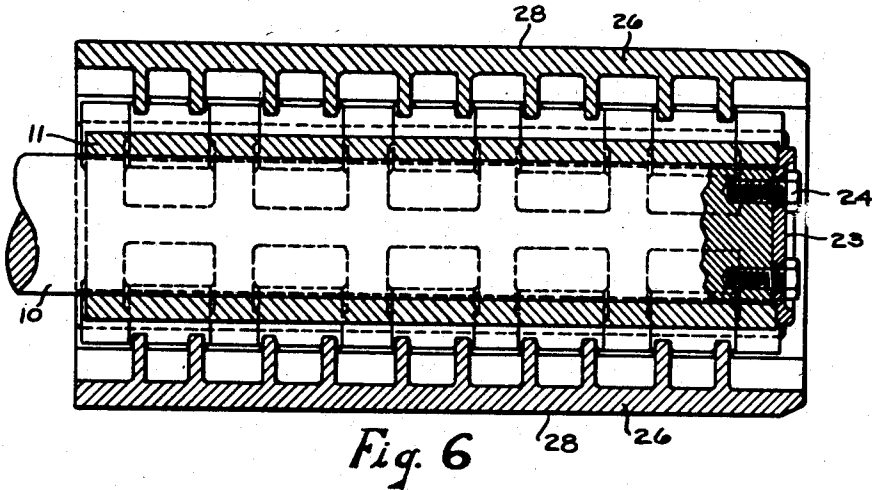
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3 Sheets-Sheet 3



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ATTORNEY

UNITED STATES PATENT OFFICE

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COLLAPSIBLE DRUM

Roy P. Tooke, Butler, Pa., assignor to Morgan Construction Company, Worcester, Mass., a corporation of Massachusetts

Application May 2, 1941, Serial No. 391,521

15 Claims. (Cl. 242—72)

This invention relates to collapsible drums, and more particularly to a revolvable drum arranged to present a substantially cylindrical outer surface for engagement with flat strip material. Such material may be wound into a coil on the drum, whereupon the drum may be collapsed to allow removal of the completed coil, or the same drum may be expanded within the interior of a completed coil to support the coil while the strip is paid-off therefrom for some further process or operation.

Many difficulties have been encountered with such drums, particularly in the metal working art. Coils of strip metal are often wound under tension, and the successively applied convolutions impose very heavy crushing forces on the drum. Furthermore, the completed coils may be of great weight. Since the outside diameter of the expanded drum is limited and determined by the inside diameter of the coil, it is usually not possible to construct the various parts as large as would otherwise be desirable in view of the forces involved. This problem is complicated by the necessity for providing a sufficient amount of collapse to allow easy removal of a completed coil, or easy mounting of a coil on the drum when the drum is to be used for unwinding purposes. In the case of a winding drum it is important to avoid the necessity for great exertion on the part of the operator in effecting the collapse of the block. Likewise, in the case of an unwinding drum it is important that the operator be able, without excessive muscular effort, to expand the drum firmly within the interior of a coil with sufficient pressure to prevent slippage of the coil relative to the drum during the unwinding operation. When the collapsing mechanism in prior drums is given sufficient mechanical advantage to eliminate the need for such muscular effort, it is found impractical to obtain the desired amount of collapse in a drum of limited outside dimensions and at the same time provide the necessary strength for the various parts of the drum, as well as its supporting shaft. Certain drums heretofore utilized depend upon the inertia of the completed coil to bring about the collapse of the drum when the driving shaft is decelerated; but this arrangement is not positive, and the drum may fail to collapse when it is supposed to, or it may collapse prematurely upon a relatively slight change in speed.

It is accordingly one object of the invention to provide a collapsible drum which can be made comparatively small in diameter while providing sufficient strength and rigidity to withstand

heavy crushing forces and at the same time afford a large amount of collapse in proportion to its diameter.

It is a further object of the invention to provide a collapsible drum which is so constructed that comparatively slight exertion will be required to expand and collapse the drum.

It is a further object of the invention to provide a collapsible drum of a relatively simple and inexpensive construction having manually operable means for expanding and collapsing the drum in a positive manner.

It is a further object of the invention to provide a collapsible drum which will have a large amount of collapse in proportion to its diameter and which is nevertheless so constructed that it can be adjusted very easily despite the application of heavy radial pressures thereto while it is fully expanded.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

Referring to the drawings illustrating one embodiment of the invention and in which like reference numerals indicate like parts,

Fig. 1 is an end elevation of a collapsible drum, shown in its expanded position;

Fig. 2 is a fragmentary section taken on the line 2—2 of Fig. 1;

Fig. 3 is a view similar to Fig. 2 but showing the drum in its collapsed position, the section being taken on the line 3—3 of Fig. 4;

Fig. 4 is a section on the line 4—4 of Fig. 3;

Fig. 5 is a side elevation of the drum;

Fig. 6 is a section on the line 6—6 of Fig. 1;

Fig. 7 is a section on the line 7—7 of Fig. 1; and

Fig. 8 is a detail of one of the swivel elements.

The embodiment illustrated comprises a horizontal rotatable shaft or arbor 10 which may be supported and driven by any suitable means (not shown). On the outer end of the shaft there is mounted a hub 11, relative rotation of these parts being prevented by a key 12. A segment 14 is connected with the hub 11 and extends radially therefrom, this segment having a cylindrical outer surface 15 coaxial with the shaft 10. The hub 11 and segment 14 constitute a single and preferably integral supporting member which in turn is supported and positively driven by the shaft 10. The segment 14 is provided with two angularly positioned and oppositely disposed narrow slots 17. The front end of the stock may be inserted in one or the other of these slots (de-

pending upon the direction of rotation). Adjacent to each slot is a shaft 18 revolvably mounted in bearings 19 (Fig. 7) in the hub 11, each shaft having a series of grip cams 21 thereon and an integral square projection 22 on its outer end. By applying a suitable wrench to the projection 22, the cams may be turned into proper gripping engagement with the stock. A plate 23 is secured to the outer end of the main shaft 10 by means of screws 24 and serves to hold the hub 11 in place.

Two segments 26 are pivotally connected to the hub 11 at opposite sides of the fixed segment 14 by means of hinge pins 27 (Fig. 1). The outer surfaces 28 of the hinged segments are cylindrical, and when these segments are moved outwardly, as shown in Fig. 1, the surfaces 28 are coaxial with the shaft 10. The hinged segments are formed with axially spaced interfitting fingers 29 which bridge the gap between the free edges of the segments. Two coiled tension springs 31 are provided at opposite ends of the drum, the ends of these springs being connected to studs 32 which project from the hinged segments, so that these segments are biased toward their inner or collapsed positions.

The movements of the hinged segments are controlled by an adjusting mechanism comprising an elongated member 34 arranged to slide in a longitudinally extending groove or guideway 35 formed in the hub 11 at the side opposite the fixed segment 14. This groove is preferably parallel with the axis of the drum. The member 34 is provided near its outer end with a recess 37 to receive a nut 38 (Fig. 2) through which there extends a screw 39. This screw is formed with spaced thrust flanges 41, and it is rotatably supported between these flanges by means of a bearing 42 on the adjacent portion of the hub 11. The outer end of the screw 39 is provided with a hexagonal head 43 to which a suitable wrench can be applied. By turning the screw 39 it will be apparent that the member 34 can be moved along the groove 35 in a desired manner.

This member 34 is shaped to provide cam or wedge surfaces 45 on opposite sides thereof, these surfaces converging in a direction longitudinal of the member, as shown particularly in Figs. 2 and 3. Preferably there are several pairs of these surfaces 45, the successive pairs being spaced along the member and all converging in the same direction. Each surface 45 is convex, and so arranged that as it approaches the longitudinal center line of the member 34 it makes a gradually increasing angle with this center line. Not only do the surfaces 45 of each pair converge longitudinally of the member 34, but they also converge in a radially outward direction, as shown particularly in Fig. 4. These surfaces are preferably conical or cylindrical, so that they can readily be machined in an accurate manner.

Each hinged segment 26 is provided with a series of inwardly projecting bosses 47, corresponding in number with the number of pairs of surfaces 45. Each of these bosses is formed with a socket 48 having a concave spherical surface arranged to receive a swivel member or device 49. As indicated particularly in Fig. 8, each member 49 is shaped substantially as a hemisphere having on one side a concave surface 51 of either conical or cylindrical form to correspond with the form of the surfaces 45. At assembly the swivel members 49 rest in the sockets 48, with the surfaces 51 of the swivel members in contact with the surfaces 45 of the adjustable member 34. The parts are so constructed and arranged that when the

drum is fully expanded, as shown in Fig. 2, the swivel members 49 will engage those portions of the surfaces 45 which make a comparatively small angle with the longitudinal center line of the member 34, this angle preferably being approximately equal to the friction angle between the surfaces 45 and 51. Hence there is little or no tendency for the member 34 to move axially by reason of the crushing forces applied to the drum during the formation of a coil, and yet only a slight force is required to collapse the drum by turning the screw 39.

The operation of the invention will now be apparent from the above disclosure. With the shaft 10 stationary, the operator will apply a wrench to the projection 22 and rotate the screw 39 to move the member 34 from the position shown in Fig. 3 to the position shown in Fig. 2. During this movement the cam surfaces 45 will slide along the surfaces 51 of the swivel members 49, and these members will turn in the sockets 48 as may be required to maintain contact between the sliding surfaces. This will swing the hinged segments 26 outwardly against the tension of the springs 31 and expand the drum. The front end of the stock will now be inserted in one of the slots 17, and the projection 22 of the corresponding cam shaft 18 will be turned by a suitable wrench to bring the cams 21 into gripping engagement with the stock. Power will thereupon be applied to the shaft 10 to rotate the entire drum and wind the stock into a coil thereon. Upon completion of the coil the shaft will be stopped, the grip cams 21 released, and the screw 39 rotated in the opposite direction to return the member 34 to the position shown in Fig. 3. This will allow the springs 31 to pull the hinged segments 26 inwardly and collapse the drum, so that the coil can then be readily withdrawn from the drum in an axial direction.

The swivel members 49 are in surface contact with the cams 45 and the sockets 48, and hence are capable of withstanding readily the large crushing forces which are applied to the drum when a coil is wound thereon under tension. When the drum is expanded, the swivel members engage the cams at portions which are inclined only slightly with respect to the drum axis, so that no great force need be applied axially to the member 34 either to hold the drum expanded or to collapse the same. Furthermore the curvature of the cams 45 greatly reduces the amount of motion required for the member 34 while providing a large amount of collapse and also makes it possible to provide a closer axial spacing between the swivel members, thus reducing the load which each must support. There is no tendency for the drum to expand or collapse by reason of the inertia of the coil, since the segment 14 is firmly keyed to the shaft. It will be noted from Fig. 4 that when the drum is collapsed it assumes a generally elliptical shape, which is similar to the shape assumed by a coil by reason of the sag or deflection caused by its own weight. Thus if the long axis of the ellipse is maintained upright, the removal of a coil or its mounting on the drum will be facilitated. When the drum is used as a pay-off drum, it can be easily tightened very firmly against the inner surface of a completed coil, for as it approaches its expanded position the swivel members 49 will engage the gradually inclined portions of the cam surfaces 45, which affords a high mechanical advantage to overcome the resistance caused by the radial pressure of the coil against the segments.

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

1. A collapsible drum comprising a rotatable supporting member, two segments hinged to the member at opposite sides thereof, a wedge member mounted on the driven supporting member, and means to move the wedge member in a direction substantially parallel with the axis of the supporting member, the wedge member being so shaped as to swing the segments outwardly during such movement.
2. A collapsible drum comprising a rotatable supporting member including a hub and a segment, two segments hinged to the member at opposite sides thereof, a wedge member mounted on the hub opposite the first segment, the wedge member having wedge surfaces on opposite sides thereof, means on the hinged segments engaging the wedge surfaces, and means to move the wedge member along the hub in a direction substantially parallel with the axis thereof, the wedge surfaces being so shaped as to swing the hinged segments outwardly during such movement.
3. A collapsible drum comprising a rotatable supporting member including a hub and a segment, the hub being shaped to provide a longitudinally extending guideway at the side opposite the segment, two segments hinged to the member at opposite sides thereof, a wedge member slidable along the guideway and provided with wedge surfaces on opposite sides, means on the hinged segments engaging the wedge surfaces, and means to slide the wedge member along the guideway, the wedge surfaces being so shaped as to swing the hinged segments outwardly during such movement.
4. A collapsible drum comprising a rotatable supporting member including a hub and a segment, the hub having a longitudinally extending groove therein at the side opposite the segment, two segments hinged to the member at opposite sides thereof, a wedge member slidable along the groove and provided with wedge surfaces on opposite sides, means on the hinged segments engaging the wedge surfaces, and means to slide the wedge member along the groove, the wedge surfaces being so shaped as to swing the hinged segments outwardly during such movement.
5. A collapsible drum comprising a rotatable supporting member, a segment hinged thereto, a wedge member mounted on the supporting member and having a curved wedge surface, a device rockably mounted on the segment and engaging the said wedge surface, and means to move the wedge member in such a manner as to swing the segment outwardly.
6. A collapsible drum comprising a rotatable supporting member, a segment hinged thereto and provided on its inner side with a socket having a concave spherical surface, a wedge member mounted on the supporting member and having a curved wedge surface, a device rockably mounted in the socket, the device having on one side a convex spherical surface which engages the said concave surface of the socket and on the opposite side a surface which engages the curved wedge surface and is curved to fit the same, and means to move the wedge member in such a manner as to swing the segment outwardly.
7. A collapsible drum comprising a rotatable supporting member, a segment hinged thereto and provided on its inner side with a socket having a concave spherical surface, a wedge member mounted on the supporting member and having a convex curved wedge surface, a device rockably mounted in the socket, the device having on one side a convex spherical surface which engages the said concave surface of the socket and on the opposite side a concave surface which engages the curved wedge surface and is curved to fit the same, and means to move the wedge member in such a manner as to swing the segment outwardly.
8. A collapsible drum comprising a rotatable supporting member shaped to provide a longitudinally extending guideway, a segment hinged to the member, a wedge member slidable along the guide way and having a curved wedge surface, a device rockably mounted on the segment and engaging the said wedge surface, and actuating means for the wedge member.
9. A collapsible drum comprising a rotatable supporting member shaped to provide a longitudinally extending guideway, a segment hinged to the member and provided on its inner side with a socket having a concave spherical surface, a wedge member slidable along the guideway and having a convex curved wedge surface, a device rockably mounted in the socket, the device having on one side a convex spherical surface which engages the said concave surface of the socket and on the opposite side a concave surface which engages the curved wedge surface and is curved to fit the same, and actuating means for the wedge member.
10. A collapsible drum comprising a rotatable supporting member shaped to provide a longitudinally extending guideway, two segments hinged to the member and located on opposite sides of the guideway, a wedge member slidable along the guideway and having curved wedge surfaces on opposite sides, a device rockably mounted on each segment and engaging the adjacent wedge surface, and actuating means for the wedge member.
11. A collapsible drum comprising a rotatable supporting member shaped to provide a longitudinally extending guideway, two segments hinged to the member and located on opposite sides of the guideway, a wedge member slidable along the guideway and provided with a plurality of pairs of wedge surfaces which converge in a longitudinal direction, means on the segments engaging the adjacent wedge surfaces, and actuating means for the wedge member.
12. A collapsible drum comprising a rotatable supporting member shaped to provide a longitudinally extending guideway, two segments hinged to the member and located on opposite sides of the guideway, a wedge member slidable along the guideway and provided with a plurality of pairs of curved wedge surfaces which converge in a longitudinal direction, devices rockably mounted on the segments and engaging the adjacent wedge surfaces, and actuating means for the wedge member.
13. A collapsible drum comprising a rotatable supporting member including a hub and a segment, the hub being shaped to provide a longitudinally extending guideway at the side opposite the segment, two segments hinged to the member at opposite sides thereof, a wedge member slidable along the guideway and provided with a plurality of pairs of convex curved wedge surfaces which converge in a longitudinal direction and also in a radially outward direction, devices rockably mounted on the hinged segments

and engaging the adjacent wedge surfaces, and actuating means for the wedge member.

14. A collapsible drum comprising a rotatable supporting member including a hub and a segment, the hub being shaped to provide a longitudinally extending guideway at the side opposite the segment, two segments hinged to the member at opposite sides thereof and each provided on its inner side with a plurality of longitudinally spaced sockets with concave spherical surfaces, a wedge member slidable along the guideway and provided with a plurality of pairs of convex curved wedge surfaces which converge in a longitudinal direction and also in a radially outward direction, a device rockably mounted in each socket, each device having on one side a convex spherical surface which engages the concave surface of the socket and on the other side a concave surface which engages the adja-

cent curved wedge surface and is curved to fit the same, and actuating means for the wedge member.

15. A collapsible drum comprising a rotatable supporting member shaped to provide a longitudinally extending guideway, a segment hinged to the member, a wedge member slidable along the guideway and having a convex curved wedge surface, a device rockably mounted on the segment and engaging the wedge surface, and actuating means for the wedge member, the parts being so constructed and arranged that when the drum is fully expanded the device will engage a portion of the wedge surface which is inclined relative to the guideway at an angle approximately equal to the angle of friction between the device and the wedge surface.

ROY P. TOOKE.