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CONTRACTILE DRUM

2 SHEETS--SHEET 1



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2 SHEETS--SHEET 2

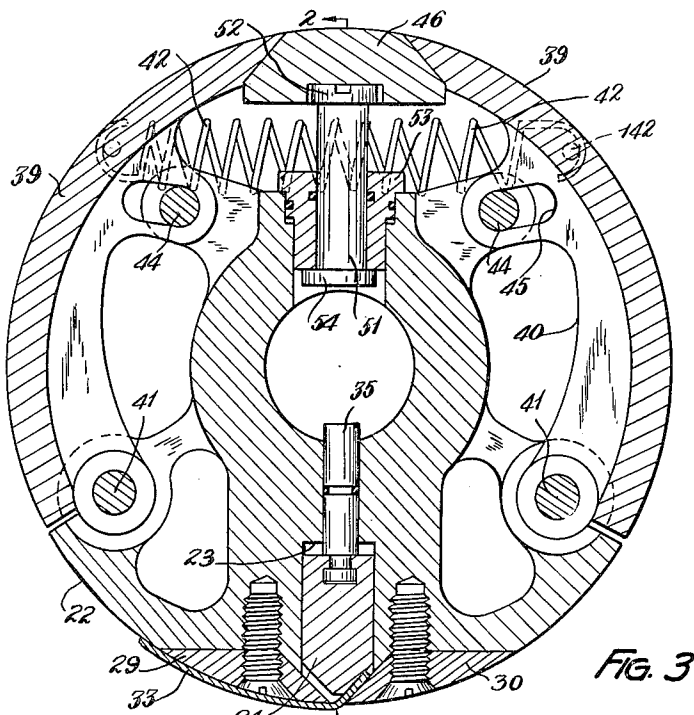


FIG. 3

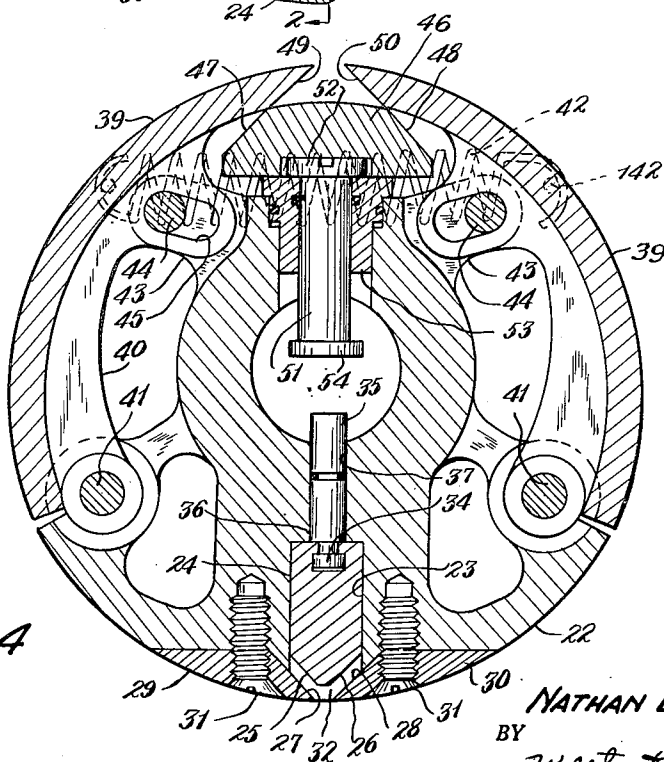


FIG. 4

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CONTRACTILE DRUM

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1

This invention relates to apparatus for forming coils from strip material, and especially relates to a coiling device for use with long strips of sheet material, such as metal sheet or the like.

The general object of the present invention is to provide new and improved apparatus of the character described wherein the apparatus is adapted to grip an end of a sheet of material and to have such material formed into a coil on the apparatus which thereafter can be disengaged from the formed coil of material.

A further object of the invention is to provide an improved, novel drum of the character described that is readily controllable and actuated so that the operations of attaching the sheet material to the drum, coiling the material on the drum, and releasing a coil are all facilitated.

Still another object of the invention is to provide an improved collapsible drum having relatively few sections and a simplified position and movement control mechanism provided therefor so that the drum can be readily collapsed, or expanded, as desired, by remote control means.

Another object of the invention is to provide one or more pivotally positioned drum sections in coil forming apparatus wherein the pivotal drum sections can be moved radially of the drum in order to be disengaged from a coil formed on the drum of the invention, or to provide a cylindrical coil forming surface on a support drum of the apparatus.

Another object of the invention is to provide a compact coil forming apparatus of the character described which is adapted to have high pressure supplied thereto by a stationarily positioned pressure member connected to a rotatable drum support of the invention.

Yet another object of the invention is to control the radial positions of a plurality of pivotally positioned drum sections by a common member.

A further object of the invention is to simplify and to use hydraulic fluid in the control means of a collapsible coil forming device.

Still another object of the invention is to utilize a stationarily positioned pressure producing member adapted for axial movement and to provide axial movement thereby of a pressure controlled plunger carried by and rotating with a rotatable member in the coil forming device.

The foregoing and other objects and advantages of the invention will be made more apparent as the specification proceeds.

For a better understanding of the present invention, attention is directed to the accompanying drawings, wherein:

2

Fig. 1 is a longitudinal vertical section taken through one portion of apparatus embodying the principles of the invention, and particularly showing a pressure producing device;

Fig. 2 is a longitudinal vertical section taken on line 2—2 of Fig. 3 of the remaining portion of the apparatus, which particularly comprises rotatable coil support drum;

Fig. 3 is a transverse vertical section taken on line 3—3 of Fig. 2 with the drum in its expanded position; and

Fig. 4 is a section, similar to Fig. 3, with the drum in its collapsed position.

In the present invention, a collapsible coil support drum is provided which includes a rotatable tubular support shaft which has one or more drum sections pivotally secured thereto. The movable portions of such drum sections have piston means associated therewith which extend into the bore of the tubular support shaft in which fluid pressure means are received. A gripper bar is slidably carried by the support shaft, or a drum section secured thereto, at the periphery of such drum portion and the piston means connect to such gripper bar and extend into the bore of the tubular shaft. Stationarily positioned pressure forming means are provided and connect through a suitable connector member to a plunger slidably received in the support shaft whereby pressure may be transmitted through the connector member to the plunger. Hence desired pressure can be set up in the bore of the support shaft for controlling the radial positions of the drum sections and the gripper bar by the piston means secured thereto.

It should be noted that the apparatus of the invention has certain conventional equipment normally associated therewith and which equipment has not been shown in the accompanying drawings. Such equipment would comprise a motor, usually having brake means associated therewith, which would drive the coiling drum, usually through a suitable speed reducer device. No claim for originality is made on the general arrangement of the drive mechanism for the coiler device since the present invention is concerned specifically with the construction of the coiling drum and with the connection provided between the pressure generating means and pressure actuated means carried by the coiling drum. Of course, the apparatus may be used to coil any desired kind of strip material and may coil a plurality of strips at one time, if desired.

Reference first will be made to the details of the apparatus of the invention shown in Fig. 1 of the drawings and in this instance there is pro-

3

vided a driven support shaft or spindle 1 which is the primary support medium for the coil forming drum of the invention. This support shaft 1 usually is tubular and has a bore 2 in which a piston or plunger 3 is slidably received. The plunger 3 is retained in fluid-tight engagement with the bore 2 by any conventional means and in this instance a bushing 4 is provided for the plunger 3 and it has an end flange 5 formed thereon which is adapted to be abutted against the end of the support shaft 1. Usually a plurality of O-rings 6 and 7 are associated with the surfaces of the bushings 4 to aid in sealing such bushing in engagement with the support shaft and the plunger 3 for permitting relative sliding movement therebetween. Usually the inner end of the bushing 4 is slotted or otherwise recessed for the reception of a key 8 that may be secured to the bushing 4 by conventional device, such as a cap screw 9. The key 8 is received in a slot in the plunger 3 to permit longitudinal movement of the same with relation to the key 8 and bushing 4. The bushing 4 may be secured to the shaft 1 for rotation therewith by conventional means (not shown) and the plunger 3 will of course also rotate therewith.

The support shaft 1 may be supported by means of a conventional bearing 10 which is secured in a housing 11 welded or otherwise secured to a frame member 12 whereby the support shaft 1 can be accurately and fixedly positioned for rotation by drive means.

In order to control the position of the plunger 3 and to control the pressure set up within the bore 2, as hereinafter explained, a conventional pressure producing or control means, such as a cylinder 13, is positioned adjacent the end of the support shaft 1 and it has a piston rod 14 extending therefrom. This piston rod 14 has a controllable pressure set up on the opposite end (not shown) thereof which is received within the cylinder 13. Of course other conventional devices may be provided for regulating the pressure set up on this rod 14 which may have a screw control or other pressure means connected thereto.

As a special feature of the present invention, a novel type of a coupling member is provided for engaging the reciprocable piston rod 14 to the plunger 3 which is received within the bore of the shaft 1 and which rotates therewith. Hence a thrust bearing 15 is engaged with a reduced diameter portion 16 of the rod 14 and is retained in engagement therewith by a conventional retainer ring 17 that is engaged with a recess 18 formed in the reduced diameter portion 16 of the piston rod. An outer race 19 of the bearing 15 is secured to a cup shaped housing 20 which in turn is fixedly secured at its base in any conventional manner to the outer end of the plunger 3. The open portion of the cup shaped member 20 may be closed and in this instance a cap 21 is suitably secured to the open end of the cup member 20 and engages an edge or side of the race 19 of the bearing 15. This cap 21 may be in intimate association with the rod 14 but will rotate with relation thereto. Hence axial pressure or force exerted by the rod 14 in either direction can effectively be transmitted to the plunger 3 for inserting same or withdrawing it from the bore 2 of the shaft 1. Suitable fluid pressure transmitting means are received in the bore 2 and the pressures set up therein will effectively be controlled by means of a stationarily positioned member, such as the cylinder 13.

In the present embodiment of this invention, it is desired to operate drum forming sections by

4

means of the pressure generated in and controlled by the cylinder 13. Hence the support shaft 1 is shown as being provided with a drum section or portion 22, Figs. 3 and 4, which may be formed integrally therewith. This drum portion 22 is of arcuate periphery and is spaced appreciably radially from the remaining portion of the support shaft 1 with the drum portion 22 being formed in the shape of a longitudinally extending lug or offset portion provided on the support shaft 1. The drum portion 22, as an additional feature of the present construction, has a longitudinally extending slot or recess 23 formed in the periphery thereof. A gripper bar 24 is positioned in the recess 23 for movement radially of the support shaft 1. This gripper bar in turn is provided with a pair of inclined sheet engaging surfaces 25 and 26 on the radially outer end thereof and these surfaces 25 and 26 are adapted to cooperate with complementary shaped surfaces 27 and 28, respectively, that are formed on inserts or jaw members 29 and 30, respectively, that extend longitudinally of the gripper bar 24 adjacent both edges of the recess 23. These jaw members 29 and 30 can be retained in engagement with the support shaft 1 by means of screws 31 or similar devices. It will be noted that Figs. 3 and 4 show that the surfaces 27 and 28 terminate in circumferentially spaced relation so that a longitudinally directed slot or opening is formed in the periphery of the drum portion 22. This opening 32 is formed to engage with the ends of one or more strips of material 33 which can be threaded therethrough and be engaged between the inclined surfaces 27 and 28 of the jaw members and the similar surfaces provided on the ends of the gripper bar. As will be hereinafter described, the gripper bar can be moved radially of the drum portion 22 to effect a gripping or release action. It should be noted that the radially inner end or edge of the gripper bar 24 is provided with an undercut channel 34 which may extend the length of the gripper bar 24. Fig. 2 also shows that a plurality of rods or pistons 35 are secured to the channel 34 by means of head portions 36 provided thereon which are placed in fixed engagement with the channel 34 by sliding the head 36 into engagement therewith from one end thereof. These pistons 35 extend through substantially radially extending holes 37 provided in longitudinally spaced portions of the shaft 1. Thus any pressure set up within the bore 2 of the shaft 1 will be effectively applied to the gripper bar 24 by means of the pistons 35 which extend between the gripper bar and the bore 2.

In order to prevent undesired endwise movement of the gripper bar and to aid in retaining it in the recess 23, a guide plate 38 is secured to the drum portion 22 of the shaft 1 at each end of the recess 23.

To complete the coil supporting and forming drum provided in the apparatus of the invention, a pair of drum sections 39 are provided and one edge of each of the sections 39 is pivotally secured to the drum portion 22 of the shaft 1 adjacent each edge thereof. These drum sections 39 may have ribs 40 provided thereon to strengthen same and conventional pins or pintles 41 extend through aligned hinge portions of the drum sections 39 and the drum portion 22 to secure one edge of each drum section pivotally to the drum portion 22. Of course, the outer peripheries of the drum sections 39 are arcuate and each of the drum sections is of slightly more

5

than about one quadrant in circumferential length. Figs. 3 and 4 indicate that one or more means, such as a coil spring 42, may be engaged with the free edges or portions of the drum sections 39 by pins 42 and extend tautly therebetween for urging such drum sections 39 to take positions swung radially inwardly with relation to the support shaft 1. A pair of radially extending, circumferentially spaced apertured lugs 43 may be provided on the support shaft 1 substantially diametrically opposed to the edges of the drum portion 22 thereof. These lugs 43 are provided to secure pins 44 in fixed position with relation to the movable edges of the drum section 39. Each of the drum sections 39 is provided with a slot 45 formed in one portion of the rib 40 formed thereon. This slot 45 in turn engages or receives the pin 44 whereby the pins 44 will serve to control or limit the pivotal or swinging movement of the drum sections 39 whereby no undesired expansion or contraction of same may be effected.

Suitable means are provided for positively controlling the positions of the free edge portions of the drum sections 39 and in this instance are shown as comprising a wedge bar or block 46 that extends longitudinally of the support shaft adjacent and below the free edge portions of the drum sections 39. This wedge bar 46 is provided with a pair of inclined surfaces 47 and 48 on opposed sides thereof. These inclined surfaces 47 and 48 individually engage with a complementary shaped end surface 49 and 50 that is formed on each of the free edge portions of the drum sections 39 so that radial movement of the wedge bar 46 will effect a sliding of the surfaces 47 and 48 with relation to the surfaces 49 and 50 and a consequent radial or arcuate movement of the drum sections.

In order to control the position of the wedge bar 46, a plurality of pistons 51 are secured thereto, if desired, or as shown, are received in a recess 52 provided on the radially inner surfaces of the wedge bar 46. These pistons are positioned by bushings 53 and are slidable axially with relation thereto. The bushings 53 are shown in threaded engagement with longitudinally spaced portions of the support shaft 1. The inner ends of the pistons 51 have piston heads 54 secured thereto or formed thereon, as desired. Thus pressure set up in the bore 2 will be transmitted through the pistons 51 to the wedge bar and from it to the drum section to effect pivotal movement thereof. Of course, any desired packing means are associated with the bushings 53 to retain them in sealing engagement with the shaft 1 and the pistons 51.

The wedge bar 46 is also normally urged inwardly of the support shaft 1 and in this instance a coil spring 55 is directly secured between one end portion of the wedge bar 46 and one end portion of the gripper bar 24. A second resilient member, in this instance also a coil spring 56 extends between the opposite end portions of the same members and is bowed out around the intervening portion of the support shaft 1.

In order to set up a fluid tight chamber within the shaft 1, the bore 2 thereof is provided with an end cap or plate 57 thereon which may be secured thereto in any conventional manner.

It will be realized that any desired type of a fluid receiving chamber may be provided in the support shaft or spindle 1, but usually it is formed in the bore of the shaft. Usually a hydraulic material is received within the fluid chamber in

6

this shaft since relatively high pressures are ordinarily used in the apparatus of the invention.

By the use of a relatively large cylinder or pressure member 13 which has a relatively large cross-sectional area, and by the use of a relatively small cross-sectional area plunger 3, one is able to obtain a very large pressure per square inch on the surface of this plunger 3. Of course, all of the pistons 35 and 51 are free to move, in this instance radially, of the support shaft 1 as any volume of the fluid contained in the bore 2 is displaced by movement of the plunger 3 into the bore 2, and these smaller pistons 35 and 51 will be practically instantaneously moved outwardly of the support shaft 1 whereby the desired positioning of the drum sections can be achieved, as can be the gripping action desired on the sheet 33 which is to be wound upon the drum apparatus of the invention. It will be noted that the cross sectional area of the pistons 35 is appreciably less than that of the pistons 51 whereby no excessive pressures will be set up on the gripper means used in the apparatus of the invention.

Fig. 3 indicates that a complete cylindrical surface is provided by the apparatus of the invention when the drum sections are in their expanded positions. When the plunger 3 is withdrawn from engagement with the bore 2, then atmospheric pressure and suction will usually cause the pistons 35 and 51 to move radially inwardly of the shaft so that the desired retracting action will be instantaneously and automatically effected. Should such atmospheric pressure fail to move the apparatus of the invention, then the resilient return means provided in the forms of the springs 42, 55 and 56 will effectively retract the wedge and gripper bars and the drum sections. Any coil formed on the apparatus of the invention when the drum is in its expanded position will be released from tight engagement with such drum when it is collapsed.

It will be noted that the torque which is transmitted to the cylinder 13 through the rod 14, is held to a minimum since the special type of coupling means provided with draws substantially all of such torque from the cylinder 13 and means associated therewith.

It also will be noted that the cylinder 13 can easily be controlled by automatic or remote control means whereby the coil engaging and release action of the drum means of the invention can be effectively and easily controlled. The novel connection member of the invention also permits a static seal to be provided for the support shaft 1 inasmuch as the plunger 3 and bushing 4 rotate therewith and the high pressure set up within the fluid chamber in the shaft 1 will be effectively sealed therein by these means which are stationary with relation to each other insofar as rotation of the shaft 1 is involved.

As a possible modification of the bearing construction 15 and the housing 20 which is associated therewith, the components of this member could be reversed from the position shown. That is, the housing member 20 could be fixedly secured to the piston rod 14 which extends from the cylinder 13 and which only is positioned for axial reciprocatory movement. Then the thrust bearing 15 will be positioned on a portion of the plunger or piston 3 with a cap, similar to the cap 21 usually being used to aid in securing the thrust bearing 15 between the housing 20 and plunger 3. Then the outer race 19 of the bearing member would be secured to the housing 20 and an auxiliary guide member (not shown) could be pro-

7

vided for limiting the housing 20 to reciprocating movement. In this instance, the outer periphery of the housing 20 probably would be irregularly contoured, and would merely be square or of other conventional shape whereby rotation of such housing could easily be prevented by the guide with which the housing 20 would be engaged.

While one complete embodiment of the invention has been disclosed herein, it will be appreciated that modification of this particular embodiment of the invention may be resorted to without departing from the scope of the invention as defined by the appended claims.

Having thus described my invention, what I claim is:

1. A collapsible drum for coiling strip material thereon comprising a tubular support shaft having a bore and having a drum portion of arcuate external contour formed integrally therewith, a pair of drum sections, means pivotally securing one lateral edge of said drum sections to said support shaft with one section being adjacent each lateral edge of said drum portion, the other edge portions of said drum sections being free for arcuate movement, an elongate wedge block positioned intermediate the free edges of said drum sections and normally engaged therewith to position same, pistons positioned by said support shaft and extending into the bore thereof for radial movement only with relation thereto, said pistons being engaged with the said wedge block to control the radial position thereof, means for setting up pressure in said bore on said pistons, and resilient means for urging said wedge block to its radially inner position.

2. A collapsible drum for coiling strip material thereon comprising a tubular support shaft having a bore and an integral drum portion, said drum portion having a longitudinally extending radial recess formed therein, a gripper bar snugly received in said recess for sliding movement radially of said portion, vise means secured in said recess and adapted to be engaged by said bar on outward movement of same for gripping an end of a sheet member positioned therebetween, piston means connected to said gripper bar and extending into the said bore, said piston means being positioned by said support shaft for radial movement only with relation thereto, means for setting up pressure in said bore on said piston means, and resilient means for urging said gripper bar to its radially inner position.

3. A collapsible drum for coiling strip material thereon comprising a tubular support shaft having a bore, a drum portion having a longitudinally extending recess formed in the surface thereof and being rigidly positioned on and carried by said shaft, a gripper bar snugly received in said recess for movement radially only of said portion, jaw means secured in said recess and adapted to be engaged by said bar on outward movement of same for gripping an end of a sheet member positioned therebetween, piston means connected to said gripper bar and extending into the said bore, said piston means being slidably positioned by said support shaft, a pair of drum sections, means pivotally securing one lateral edge of said drum sections to said support shaft with one edge of each section being secured adjacent each lateral edge of said drum portion, the other edge portions of said drum sections being adjacent each other and being free for arcuate movement, a wedge block positioned intermediate the free edges of said drum sections and

8

normally engaged therewith to position same, pistons positioned by said support shaft and extending into the bore thereof, said pistons being engaged with the said wedge block to control the radial position thereof, and means for setting up a controllable pressure in said bore on said piston means and said pistons.

4. An expansible drum comprising a support shaft having a bore, a drum section pivotally carried at one edge by said shaft, a piston extending between a pivotal portion of said drum section and said bore, means carried by said piston to form part of the drum surface, means drawing said drum section toward said support shaft to bear on said first means, hydraulic means in said bore, and means for controlling the pressure in said bore for controlling the pressure on said piston and the position of said piston and said drum section.

5. An expansible drum comprising a support shaft having a bore, a drum section being formed by one portion of said shaft, said drum section having a radially extending slot therein, a gripper bar snugly but slidably positioned in said slot, a piston connected to said gripper bar and extending into said bore, hydraulic means in said bore, and means for controlling the pressure in said bore for controlling the radial position of said piston and the position of said gripper bar.

6. An expansible drum comprising a support shaft having a bore and having an arcuate portion on a part of the periphery thereof to provide a fixed portion of a drum, a pair of drum sections having an arcuate outer periphery adapted to be combined with the arcuate portion of said support shaft to complete a drum therewith, means pivotally securing one longitudinal edge portion of each drum section to said shaft, piston means extending between and bearing on a free edge portion of each of said drum sections and engaged with said shaft and positioned thereby for radial movement with relation thereto, said piston means connecting to the bore of said shaft, fluid means in said bore, means for controlling the pressure in said bore for controlling said pistons and the relative pivotal position of said drum sections, said support shaft having a pair of apertured lugs provided thereon, and pin means extending through said apertured lugs and engaged with a free end portion of each of said drum sections, the apertures in said lugs being shaped to permit free pivotal action of said drum section but limiting radially outwardly directed movement of said drum section.

7. A collapsible drum for coiling strip material thereon comprising a tubular support shaft having a bore and a drum portion with a longitudinally extending recess formed in the surface thereof, a gripper bar received in said recess for movement radially of said drum portion, jaw means secured in said recess and adapted to be engaged by said bar on outward movement of same for gripping an end of a sheet member positioned in said recess, piston means connected to said gripper bar and extending into the said bore, said piston means being slidably positioned by said support shaft, a pair of longitudinally extending drum sections, means pivotally securing one lateral edge of each of said drum sections to said support shaft with one edge of each section being secured adjacent each lateral edge of said drum portion, the other edge portions of said drum sections being adjacent each other and being free for arcuate movement, a wedge block positioned intermediate the free edges of said

9

drum sections and normally engaged therewith to position same, pistons positioned by said support shaft and extending into the bore thereof, said pistons being engaged with the said wedge block to control the radial position thereof, and means for setting up a controllable pressure in said bore on said piston means and said pistons.

8. A collapsible drum for coiling strip material thereon comprising a tubular support shaft having a bore and a drum portion with a longitudinally extending recess formed in the surface thereof and being carried by said shaft, a gripper bar received in said recess for movement outwardly of said drum portion for gripping an end of a sheet member positioned in said recess for controlling the position of said gripper bar, a pair of longitudinally extending drum sections, means pivotally securing one lateral edge of each of said drum sections to said support shaft with one edge of each section being adjacent each lateral edge of said drum portion, the other edge portions of said drum sections being adjacent each other and being free for arcuate movement, a wedge block positioned intermediate the free edges of said drum sections and normally engaged therewith to position same, pistons positioned by said support shaft and extending into the bore thereof, said pistons being engaged with the said wedge block to control the radial position thereof, and means for setting up a controllable pressure in said bore on said pistons.

9. A drum as in claim 3 wherein said gripper

10

bar and wedge block are diametrically opposed, and spring means extend between said gripper bar and wedge block to urge both of same radially inwardly of the drum.

10. An expansible drum comprising a support shaft having a bore, a drum section pivotally carried at one edge by said shaft, a piston extending between a pivotal portion of said drum section and said bore, hydraulic means in said bore, means for controlling the pressure in said bore for controlling the pressure on said piston and the position of said drum section, a gripper bar slidably received in and positioned by said shaft for radial movement, and piston means engaging with said bar and extending into the bore of said shaft to be controlled by the pressure set up therein.

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