

June 18, 1940.

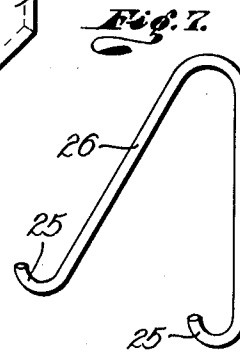
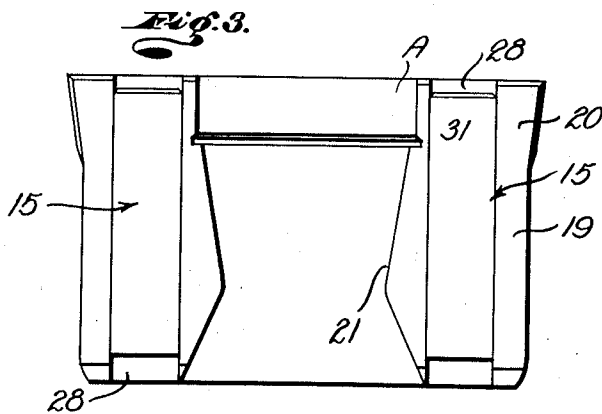
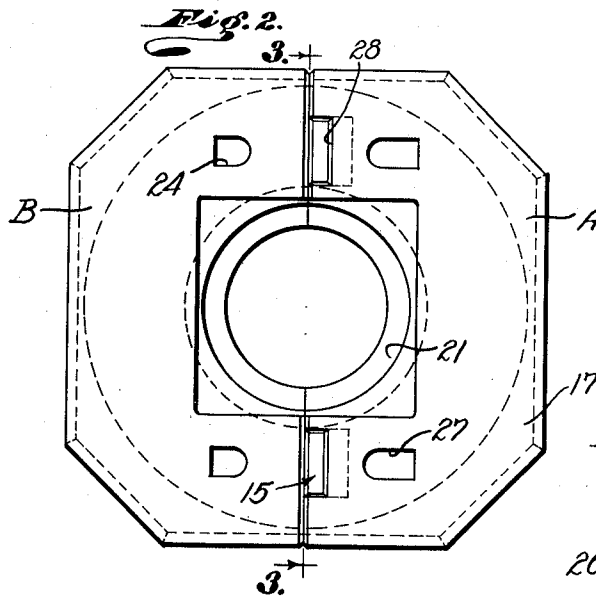
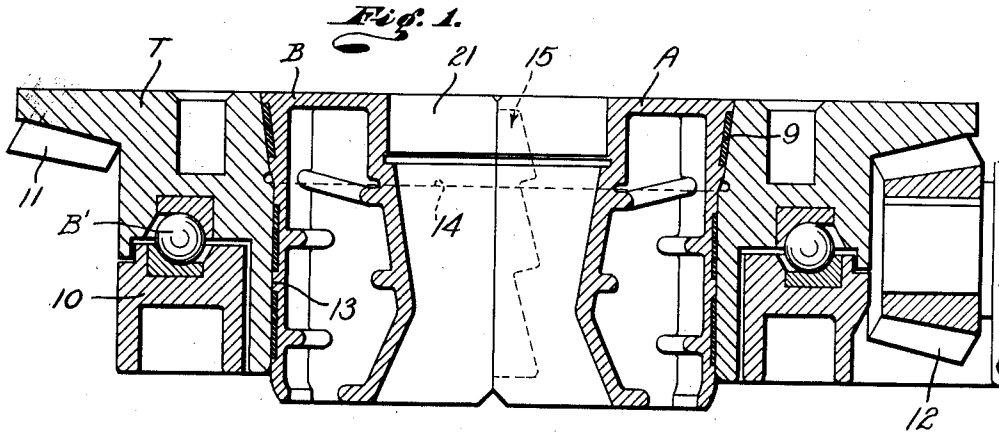
L. F. BAASH

2,204,645

ROTARY TABLE ASSEMBLY

Filed Dec. 17, 1938

2 Sheets-Sheet 1



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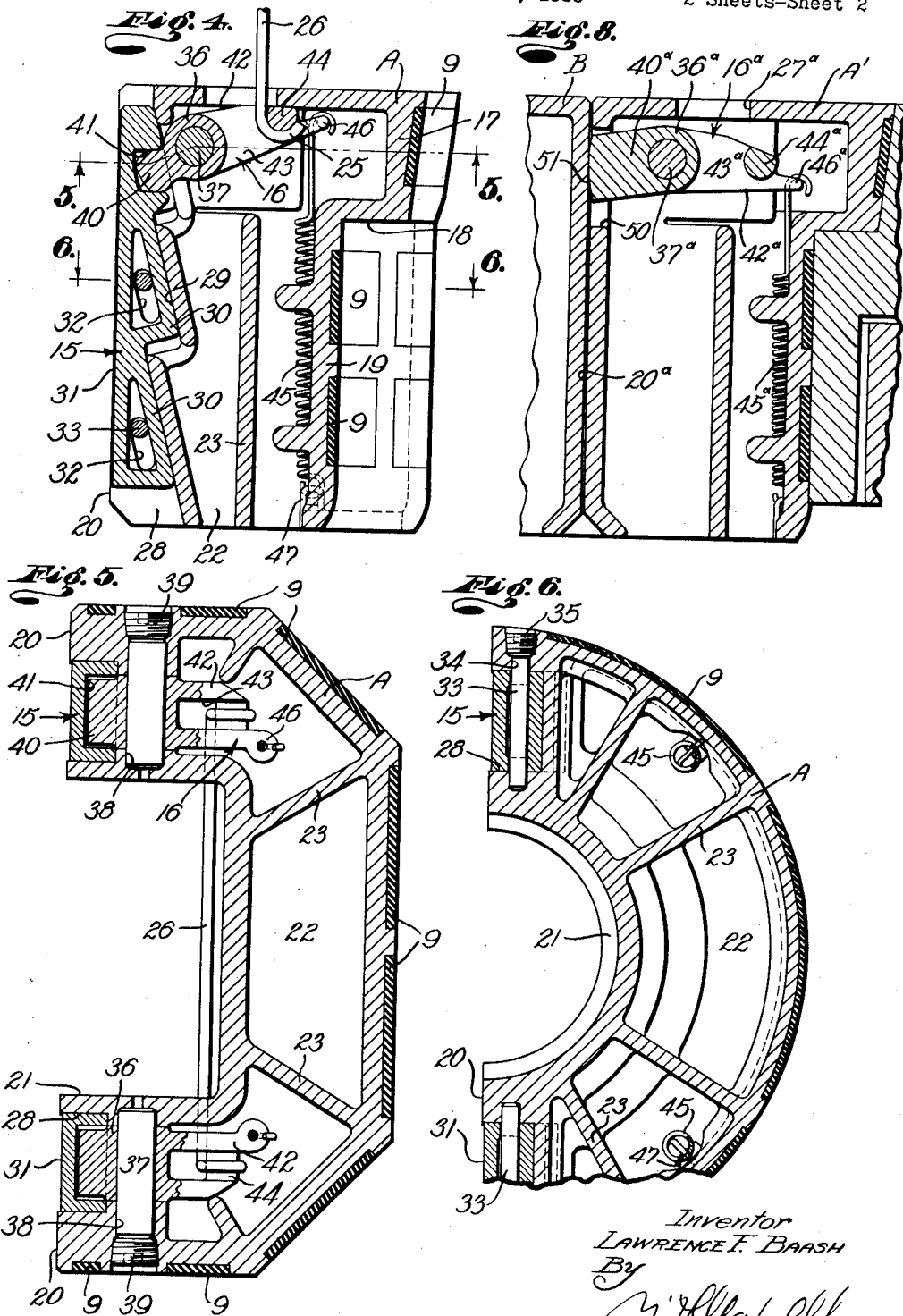
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ROTARY TABLE ASSEMBLY

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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ROTARY TABLE ASSEMBLY

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10 Claims. (Cl. 255—25)

This invention relates to well drilling equipment and relates more particularly to the rotaries or rotary table units of well drilling rigs. A general object of this invention is to provide a practical, effective and improved master bushing and rotary table.

In the rotary method of well drilling a rotary table is provided in the derrick and is driven by an engine or other power means to effect rotation of the drilling string. The rotary table is usually provided with a large central opening equipped with what is known as a master bushing. The master bushing in turn is adapted to receive a drive bushing or Kelly bushing for transmitting rotation to the drive stem of the drilling string. During the drilling operations the rotary table and the associated equipment are subjected to severe strains and very hard usage. This sometimes results in movement and slap between the contacting surfaces of the table and the master bushing and the bushing often works or wears loose in the table.

An object of this invention is to provide a master bushing that remains tight in the opening of the rotary table and does not work loose or move in the table, and therefore, does not cause wearing of the engaging table and bushing surfaces.

Another object of this invention is to provide a master bushing and table assembly in which the master bushing accurately fits the table to assure a proper fit of the slips and drive bushings in the master bushing.

Another object of this invention is to provide a sectional master bushing embodying novel means for holding the bushing sections tight in the opening of the rotary table and for holding the sections against relative movement and play.

Another object of this invention is to provide a master bushing of the character mentioned that automatically tightens itself in the rotary table even though the opening of the table may be worn or irregular.

Another object of this invention is to provide a master bushing of the character mentioned in which the means for holding the bushing tight in the rotary table automatically compensates for any wear that may occur and, therefore, maintains the firm engagement of the bushing in the table throughout the period of use of the bushing.

Another object of this invention is to provide a master bushing of the character mentioned in which the means for holding the bushing tight in the rotary table is automatically released or retracted when the bushing is inserted in and

removed from the table and does not in any way interfere with the easy insertion and removal of the bushing.

A further object of this invention is to provide a master bushing of the character mentioned that is simple and inexpensive to manufacture.

The various objects and features of my invention will be fully understood from the following detailed description of typical preferred forms and applications of the invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a central vertical detailed sectional view of a typical rotary table and a master bushing of the present invention arranged therein. Fig. 2 is a plan view of the bushing removed from the table. Fig. 3 is a side elevation of one of the bushing sections being a view taken as indicated by line 3—3 on Fig. 2. Fig. 4 is an enlarged vertical detailed sectional view of the bushing section illustrated in Fig. 3 showing one of the wedge elements and its actuating means in the released or retracted condition. Fig. 5 is a horizontal detailed sectional view taken substantially as indicated by line 5—5 on Fig. 4. Fig. 6 is a fragmentary horizontal detailed sectional view taken as indicated by line 6—6 on Fig. 4. Fig. 7 is a perspective view of a lifting tool that may be utilized to handle the bushing sections, and Fig. 8 is a view similar to Fig. 4 illustrating another form of the invention in the rotary table.

The present invention may be embodied in bushings for use in rotary tables of various makes and designs. In the following detailed description I will describe typical preferred forms of the invention as employed in a specific form of rotary table, it being understood that the invention is not to be limited or restricted to this particular form or application of the invention but is to be taken as including any features or modifications that may fall within the scope of the claims.

The rotary table T illustrated in Fig. 1 is supported for rotation about a vertical axis by bearings B' carried by a base 10. Teeth 11 are provided on the under side of the table T and a driven bevel gear 12 meshes with the teeth 11 to drive the table T. A central vertical opening 13 is provided in the table T to receive the master bushing. The upper portion of the opening 13 is square or polygonal in cross section and has downwardly and inwardly tapered walls while the lower portion of the opening 13 is cylindrical and has a vertical wall. An upwardly facing shoulder 14 occurs on the wall of the opening 13 where its polygonal and cylindrical portions join.

The improved master bushing of the present invention illustrated in Figs. 1 to 7, inclusive, may be said to comprise, generally, bushing sections A and B for arrangement in the table opening 13, wedge elements 15 for acting between the sections A and B and means 16 for controlling and actuating the wedge elements 15.

The bushing sections A and B form an assembly that constitutes the body of the master bushing. In the construction illustrated there are two like complementary sections A and B, that is, the bushing is divided on a vertical diametric plane. The sections A and B are shaped and proportioned to accurately fit the opening 13 in the table T with sufficient clearance to allow the bushing to be inserted in the table. The two sections A and B have polygonal upper parts or heads 17 for fitting in the polygonal upper portion of the opening 13 so that the master bushing rotates with the table T. The sides of the heads 17 are tapered to conform to the tapered walls of the upper portion of the opening 13. The lower sides of the heads 17 form downwardly facing shoulders 18 which rest on the shoulder 14 in the table T. The lower portions 19 of the sections A and B have cylindrically curved exteriors to fit or enter the cylindrical lower portion of the opening 13. The upper ends of the sections A and B are flat and are adapted to lie flush with the upper surface of the table T. The inner opposing faces 20 of the sections A and B occurring at the vertical plane of division of the bushing are flat and vertical.

In accordance with the invention the heads 17 and portions 19 of the sections A and B have blocks or inserts 9 of rubber, rubber composition, or the like, for cooperating with the walls of the opening 13 to absorb shock and slap and to take the wear. The inserts 9 may initially protrude from the external surfaces of the sections A and B and are compressed when the bushing is seated in the table opening 13. The inserts 9 are set or vulcanized in spaced recesses 8 in the external surfaces of the bushing sections A and B. When the bushing is seated in the table T the compressed resilient inserts 9 effectively absorb shock, take the wear and assist in holding the bushing tight in the table T.

The master bushing has a central vertical opening 21, that is, the sections A and B are shaped to define or provide a vertical opening 21. The opening 21 is provided to pass the drilling tools, to receive pipe engaging slips, to receive the drive bushing and to pass and receive other well drilling equipment. The upper portion of the opening 21 is polygonal or square and the walls of the opening taper downwardly and inwardly from this square portion. The sections A and B are hollow or cored out, each having a chamber 22 between its inner and outer walls. The chambers 22 are preferably open at the lower ends of the sections A and B. Reinforcing webs 23 may be provided in or may extend through the chambers 22. The elements and parts of the two sections A and B thus far described may be identical and I have applied corresponding reference numerals to the corresponding parts of the sections A and B described above. A pair of spaced sockets or openings 24 is provided in the upper end of the section B to receive the fingers 25 of a lifting tool 26 of the character illustrated in Fig. 7. Similar but somewhat larger openings 27 are provided in the upper end of the section A to receive the fingers 25 of a lifting tool 26.

The wedge elements 15 when active operate

to hold the bushing sections A and B tight against the walls of the opening 13 and thus prevent vibration of the master bushing in the table T. In the preferred construction there are two wedge elements 15 carried by the bushing section A to cooperate with the section B. The elements 15 are arranged at the inner faces 20 of the section A to cooperate with the opposing faces 20 of the section B and the section A is shaped to receive the wedge elements. A vertical recess 28 is provided in each face 20 of the section A. The side walls of the recesses 28 are flat and vertical while the inner walls of the recesses have pluralities of stepped downwardly and outwardly inclined faces 29. The wedge elements 15 are arranged in the recesses 28 and are shaped to cooperate with the faces 29. The wedge elements 15 are elongate members having flat vertical sides adapted to ride on the side walls of the recesses 28. The outer or rear sides of the wedge elements 15 are provided with series of stepped downwardly and outwardly inclined wedge faces 30. The wedge faces 30 shiftably or slidably cooperate with the faces 29. The active or inner surfaces 31 of the wedge elements 15 are flat and vertical and are preferably machined to better cooperate with the opposing faces 20 of the section B. When the wedge elements 15 are in their retracted or up positions illustrated in Figs. 4, 5 and 6, their surfaces 31 are flush with or inset from the faces 20 of the section A.

Means are provided for limiting the movement of the wedge elements 15 and for retaining the elements on the section A. Vertically spaced slots 32 are provided in the wedge elements 15 and are inclined in parallel relation with their wedge faces 30. Pins 33 are carried in horizontal openings 34 in the section A and pass through the slots 32 to limit the movement of the elements 15. Plugs 35 may be threaded in the outer ends of the openings 34 to hold the pins 33 against displacement. The pins 33 cooperating with the slots 32 guide the wedge elements 15 for movement in a direction parallel to the faces 29 and limit the movement of the wedge elements so that the elements are at all times within the confines of the upper and lower ends of the section A.

The means 16 are provided to actuate the wedge elements 15 and hold them active while the bushing is in the table T and are operable to retract the elements 15 to permit the easy insertion and removal of the bushing section A. There is a means 16 provided for each wedge element 15 and the two actuating means 16 may be identical. The actuating and controlling means 16 are contained within the hollow or cored out bushing section A.

Each means 16 includes a pivoted lever 36 supported by a pin 37. The lever supporting pins 37 are arranged in horizontal openings 38 in the head 17 of the section A. Plugs 39 may be threaded in the outer ends of the openings 38 to hold the pins 37 in place. Each lever 36 has an arm or finger 40 received in a socket 41 in the back or rear side of the adjacent wedge element 15. The forward ends of the fingers 40 are rounded to move or work in their sockets 41. Each lever 36 further includes an outwardly or rearwardly projecting arm 42. The levers 36 are located so that their arms 42 are adjacent and directly below the adjacent openings 27 in the upper end of the section A. The lever arms 42 have openings 43 in substantially vertical alignment with the adjacent openings 27 and the

openings 43 are adapted to receive the hooks or fingers 25 of the tool 26. The outer ends of the lever arms 42 have transverse bar-like parts 44 adapted to be engaged by the fingers 25 of the tool 26 as illustrated in Figs. 4 and 5 of the drawings. It will be observed that the two fingers 25 of the tool 26 may simultaneously cooperate with the lever arm parts 44 to simultaneously pivot the two levers 36. When the lever arms 42 are pulled or moved upwardly by the tool 26 the inner arms or fingers 40 move downwardly and cooperation of the fingers with the sockets 41 produces downward movement and retraction of the wedge elements 15.

The means 16 further include springs 45 acting on the levers 36 to actuate the wedge elements 15 and to hold the wedge elements in their active positions. The springs 45 are preferably in the nature of extensible helical springs and are arranged in the chamber 22 of the section A. The upper ends of the springs 45 are hooked or looped in eyes 46 on the outer ends of the lever arms 42. Suitable eyes 47 are provided on the lower wall portion of the chamber A and the lower ends of the springs 45 are engaged or hooked in these eyes 47. The springs 45 are normally under tension and normally exert downward forces on the lever arms 42. Thus the springs 45 exert an upward force on the wedge elements 15 through the medium of the pivoted levers 36 acting as cams. It is to be observed that the actuating forces exerted by the springs 45 transmitted by the cam-like levers 36 are continuous and constant so that the wedge elements are at all times urged outwardly through cooperation of the inclined faces 29 and 30. The spring urged wedge elements 15 forced outwardly against the opposing faces 20 of the section B act to force the sections A and B apart and maintain the outer surfaces of the sections in tight cooperation with the walls of the rotary table opening 13.

In the use or operation of the assembly shown in Figs. 1 to 7 inclusive, the sections A and B may be lowered into the rotary table T by means of lifting tools 26 of the character shown in Fig. 7. It is preferred to either lower the two sections A and B in the opening 13 simultaneously or to first arrange the section B in the table and then lower the section A into place. When the section A is held or suspended by means of a tool 26 the tool holds the levers 36 in a position where the wedge elements 15 are fully retracted. This is clearly illustrated in Figs. 4 and 5 of the drawings. Accordingly, when the section A is lowered into the rotary table opening 13 simultaneously with the section B or following the section B the wedge elements 15 are retracted and do not contact the section B or interfere with the insertion of the section A.

When the section A is in place in the opening 13 and the tool 26 is disengaged from the section the springs 45 pivot the lever arms 42 downwardly and thus move the wedge elements 15 upwardly. This upward movement of the wedge elements 15 is accompanied by sliding cooperation of the faces 29 and 30 which causes inward movement of the elements 15 against the opposing faces 20 of the section B. The springs 45 acting through the medium of the levers urge the wedge elements 15 against the faces 20 of the section B with sufficient force to hold the external surfaces of the two sections A and B in tight engagement with the walls of the rotary table opening 13. The engagement of the sur-

faces 31 of the spring-urged wedge elements 15 with the opposing faces 20 of the section B prevents relative movement and working of the two bushing sections A and B. In practice the spring urged wedge elements 15 carried by the section A and acting against the section B fully take up the necessary tolerance or clearance between the sections A and B and between the sections and the walls of the opening 13 and serve to prevent vibration of the master bushing in the rotary table T. The springs 45 exerting continuous and substantially constant forces on the wedge elements 15 assure the proper functioning of the wedge elements throughout the time that the master bushing remains in the rotary table T.

When it is desired to remove the master bushing from the table T it is preferable to remove the section A before removing the section B. A tool 26 is manipulated so that its fingers 25 engage the lever parts 44 and the tool is then raised to lift the section A from the rotary table T. The upward force exerted on the tool 26 causes upward pivoting of the lever arms 42 and downward swinging of the lever fingers 40. This, of course, results in downward shifting of the wedge elements 15 and retraction of the wedge elements. Thus the wedge elements 15 are automatically retracted when the section A is withdrawn from the rotary table T.

In the form of the invention illustrated in Fig. 8 the means 16^a for holding the bushing sections tight in the opening 13 of the table T are in the nature of simple cam means. The section B of the structure shown in Fig. 8 may be identical with the section B described above and the section A' may be similar to the section A except that it is devoid of the recesses 28 and the wedge faces 29. Openings 50 are provided in the faces 20^a of the section A' to communicate with the interior of the hollow section.

The means 16^a include cam levers 36^a pivotally supported within the section A'. The levers 36^a are supported on horizontal pins 37^a and have their rear arms 42^a below the openings 27^a in the top of the bushing section A'. The lever arms 42^a have openings 43^a to receive the fingers 25 of the tool 26 and have parts 44^a engageable by the said fingers for the purpose of releasing or retracting the means 16^a. Springs 45^a substantially identical with the above described springs 45 are connected with eyes 46^a on the ends of the lever arms 42^a. The springs 45^a actuate or urge the lever arms 42^a downwardly. The forward or active arms 40^a of the levers 36^a are in the nature of cams having curved cam faces 51 on their outer ends. The cam faces 51 are formed and shaped to cam or bear against the surfaces 20 of the section B to urge the sections A' and B apart and thus maintain the sections tight in the table opening 13.

The form of the invention illustrated in Fig. 8 operates in substantially the same manner as the previously described form of the invention. When the bushing is seated in the opening 13 of the table T the springs 45^a acting on the levers 36^a maintain the cam faces 51 in camming or pressure engagement with the faces 20 of the section B. This engagement in turn maintains the sections A' and B tight in the table opening 13 and resists or prevents slap and movement of the bushing in the table opening. The cam levers 36^a are adapted to be retracted by the tool 26 in the same manner as the levers 36. The structure illustrated in Fig. 8 is characterized by its simplicity.

Having described only typical preferred forms and applications of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. A bushing for arrangement in the opening of a rotary table comprising bushing sections to be inserted in the opening, and a spring urged element engaging between the sections to urge the sections apart and hold them against the walls of said opening.
2. A bushing for arrangement in the opening of a rotary table comprising bushing sections to be inserted in the opening, a cam on one section engaging the other section to prevent movement of the bushing sections in the opening, and spring means urging the cam against said other section.
3. A bushing for arrangement in the opening of a rotary table comprising bushing sections to be inserted in the opening, and means for preventing vibration of the bushing sections in the opening, said means including a vertically shiftable wedge element carried by one section and engaging the other section, and means for actuating the wedge element.
4. A bushing for arrangement in the opening of a rotary table comprising bushing sections to be inserted in the opening, and means for preventing movement of the bushing sections in the opening, said means including an element shiftable carried by one section to cooperate with another section, and spring means actuating the said element.
5. A bushing for use in the opening of a rotary table comprising at least two bushing sections for arrangement in said opening, and means for preventing play of the sections in the opening comprising a wedge face on one section, a wedge element shiftable on said face and adapted to bear against the other section, and spring means acting on the wedge element to urge it along said face.
6. A bushing for use in the opening of a rotary table comprising at least two bushing sections for arrangement in said opening, and means for preventing play of the sections in the opening comprising a wedge face on one section, a wedge element shiftable on said face and adapted to bear against the other section, a pivoted lever on

the first mentioned section operatively connected with the wedge element, and a spring acting on the lever to move the wedge element along said face.

7. A bushing for use in the opening of a rotary table comprising at least two bushing sections for arrangement in said opening, and means for preventing play of the sections in the opening comprising a wedge face on one section, a wedge element shiftable on said face and adapted to bear against the other section, a pivoted lever on the first mentioned section for operating the wedge element, and a spring normally acting on the lever to cause the wedge element to wedge against said other section, said first mentioned section having an opening rendering the lever accessible for the purpose of retracting the wedge element.

8. A bushing for the opening of a rotary table comprising two bushing sections arranged in the opening, there being a vertical opening through the sections, inclined faces on one section at opposite sides of the last named opening, wedge elements shiftable on said faces to be forced against the other section to hold the sections tight in the first mentioned opening, and means on the first named section for actuating the wedge elements.

9. A bushing for the opening of a rotary table comprising two bushing sections arranged in the opening, there being a vertical opening through the sections, inclined faces on one section at opposite sides of the last named opening, wedge elements shiftable on said faces to be forced against the other section to hold the sections tight in the first mentioned opening, means for actuating the wedge elements, and means for simultaneously retracting the elements.

10. A bushing for the opening of a rotary table comprising two bushing sections arranged in the opening, there being a vertical opening through the sections, inclined faces on one section at opposite sides of the last named opening, wedge elements shiftable on said faces to be forced against the other section to hold the sections tight in the first mentioned opening, levers pivoted on the first named section for shifting the wedge elements, springs acting on the levers to urge the wedge elements against said other section, and means for simultaneously retracting the wedge elements.

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