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COLUMN ASSEMBLY, INCLUDING PRESSURE FLUID MOTORS FOR MOVING OBJECTS LONGITUDINALLY AND ANGULARLY

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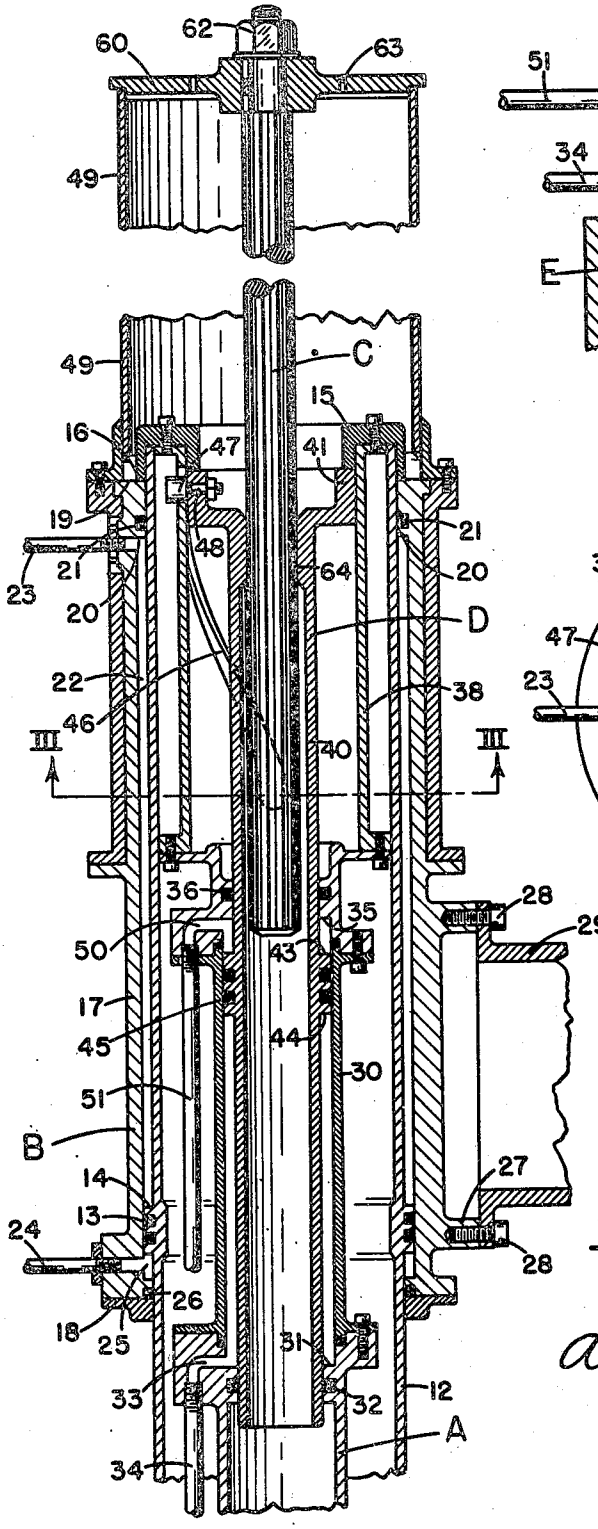


FIG. 1.

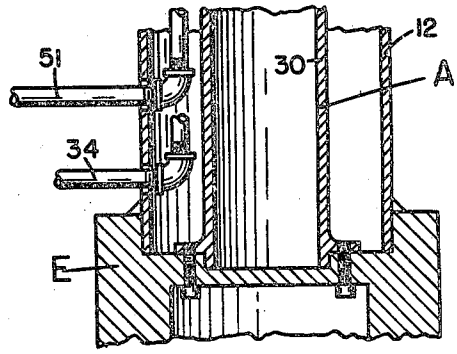


FIG. 2.

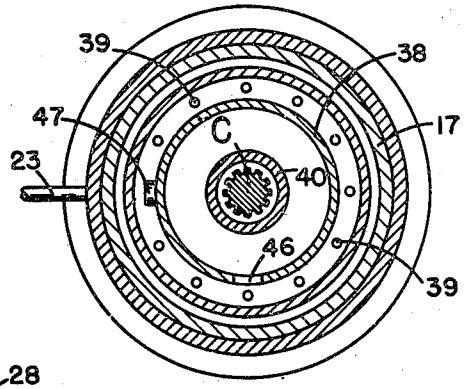


FIG. 3.

Albert L. Stone INVENTOR.

BY

J. S. McLean

ATTORNEY

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COLUMN ASSEMBLY, INCLUDING PRESSURE FLUID MOTORS FOR MOVING OBJECTS LONGITUDINALLY AND ANGULARLY

Albert L. Stone, Palos Verdes Estates, Calif., assignor, by mesne assignments, to Standard Oil Development Company, Elizabeth, N. J., a corporation of Delaware

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3 Claims. (Cl. 121—46)

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The present invention is directed to a column assembly adapted to produce longitudinal and angular motion.

It is sometimes desirable to provide a mounting means whereby an object may be supported by the mounting means and given longitudinal and rotative motion about a fixed axis. For example, in my copending application entitled "Apparatus for supporting, moving and rotating vertical drill pipe in a derrick," Serial No. 765,342, filed August 1, 1947, a combination is arranged whereby a tong is supported by a column for moving pipe in a derrick and means is arranged for moving the tong vertically and for allowing rotative motion of the tong about a fixed axis. Similarly, in my copending application entitled "Method for handling vertical sections of pipe in a derrick," Serial No. 753,591, filed June 9, 1947, a method for handling pipe is disclosed wherein a pipe is supported by a tong and when supported is moved vertically and also is given a rotative motion.

It is an object of the present application to provide a column assembly adapted to support a member and adapted to give the member vertical and angular motion about a fixed axis.

It is another object of the present invention to provide a column assembly adapted to be operated by liquid under pressure and capable of supporting a tool and giving the tool vertical and rotative motion about a fixed axis.

Other objects and advantages of the present invention will be seen from the following description taken in conjunction with the drawing in which

Fig. 1 is an elevation, partly in section, showing the upper end of an embodiment of the present invention;

Fig. 2 is an elevation, partly in section, showing the remainder of the device of Fig. 1; and

Fig. 3 is a view taken along line III—III of Fig. 1.

The device of the present invention may be described briefly as comprising a hollow post member adapted to have its end mounted on a suitable foundation and having a spiral groove defined by the inner surface thereof. Slidably mounted on the hollow post member is an assembly comprising an outer cylindrical member slidably mounted on the hollow post member and a rod of irregular section within the hollow post member and secured to the cylinder with its axis concentric with the cylinder and the post. Slidably mounted within the post member is a hollow piston member having an irregular section fitting over the irregular section of the rod

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whereby rotative motion between the rod and the hollow piston is prevented while longitudinal motion is permitted. A cam roller secured to the outer surface of the hollow piston rod member and fitting within the spiral groove defined by the hollow post causes the hollow piston to be moved angularly as well as longitudinally when a suitable force is supplied thereto.

The embodiment shown in the drawing of the present application will now be described in greater detail. In describing the assembly, the major portions or important subassemblies are designated by letters and the several parts of the assembly or parts of an important member are designated by numerals.

A hollow post A has slidably mounted thereon an outer cylinder B to which is secured a rod member C of irregular cross section. Means are arranged for securing cylinder B and rod C so that these two members move together. Slidably mounted within hollow post A is hollow piston D.

Post assembly A consists of an outer tubular member 12 which is secured to base plate E and an inner tubular assembly consisting of several sections having a uniform diameter and designated by numeral 30 and an upper section of greater diameter designated by numeral 38. The inner tubular assembly is secured to the outer tubular member 12 by a cap member 15.

Outer cylinder assembly B consists of a lower cylindrical member 17 to which is secured an upper cylindrical member 49 surmounted by a cap 60. The upper end of rod member C is secured to cap member 60 by suitable means hereafter described in detail.

Assemblies A, B, C, and D are arranged to cooperate with one another. That is to say, when piston D is moved longitudinally with respect to post assembly A, the cylinder B and rod C are forced to move angularly. Relative movement between hollow piston D and cylinder B is produced by hydraulic means.

In order to define a suitable hydraulic system the lower exterior portion of member 12 defines a uniform cylindrical surface above which are mounted sealing rings 13. Immediately above the sealing rings 13 is defined an externally projecting circular shoulder 14. In order to limit the upward movement of cylinder B, cap member 15 defines an externally projecting shoulder 16. Cylinder 17 of cylinder assembly B, defines a uniform cylindrical surface 18 which fits slidingly on the lower exterior surface of member 12. The upper end of cylinder 17 defines an upper shoulder

19, a lower shoulder 20 and is provided with a packing ring 21. The interior surface of cylinder 17 below shoulder 20 has a slightly greater diameter than the exterior surface of member 12 above shoulder 14 and the space between the upper end of member 12 and the interior of member 17 defines an expansible chamber designated as 22. Cylinder 17 can slide on member 12 with the movement limited in the upper direction by contact of shoulder 19 with cap 15 and the movement in the downward direction limited by contact of shoulder 20 with shoulder 14.

Mounted on the interior surface of cylinder 17 is a packing ring 26 which fits snugly but slidingly on the lower exterior surface of member 12. The space between packing rings 13 and 26 is an expansible chamber designated as 25. An inlet 23 extends through the wall of cylinder 17 immediately below shoulder 20 in communication with chamber 22. In the lower end of cylinder 17 inlet 24 extends through the wall thereof to connect with chamber 25.

The exterior surface of cylinder 17 defines a boss 27 which may serve as a base for a tong member which is not shown in detail but a part thereof is designated as 29 which is secured to the boss by suitable means such as cap screws 28.

The inner tubular structure 30 in post assembly A has an inwardly extending circular ledge which defines a shoulder 31 with a packing ring 32 adjacent the shoulder. Immediately above shoulder 31 is a port 33 which is connected through conduit 34 to a suitable source of fluid pressure, not shown in the drawing. At the upper end of inner tubular assembly 30 is another inwardly projecting circular ledge defining a shoulder 35 with a packing ring 36 adjacent thereto.

Hollow piston D consists of a hollow piston rod 40 having its upper end terminating in a head 41. Near the center portion of member 40 is an outwardly extending circular ledge defining shoulders 43 and 44 between which are mounted packing rings 45. Shoulders 43 and 44 cooperate with shoulders 31 and 35 of inner tubular structure 30 of assembly A to limit the vertical movement of hollow piston D. That is to say, when shoulders 44 and 31 come into contact further downward movement of hollow piston rod D is prevented and when shoulders 43 and 35 come into contact further upward movement of hollow piston rod D is prevented.

A spiral 46 is cut in the wall of member 38 of post assembly A. Fitting slidingly within the spiral cut is a cam roller 47 which is secured to head member 41 of hollow piston rod D by bolt 48. It will be seen that as hollow piston rod D moves upwardly the cam roller 47 moves in spiral cut 46 to give piston rod D angular motion as it moves vertically. Similarly, as hollow piston rod D moves downwardly the cam roller 47 forces it to move angularly as well as vertically. In the drawing the spiral cut 46 is shown as traversing an angle of 90° although it will be understood that a greater or lesser portion of a circumference of a circle may be traversed by the spiral cut which in turn will give the hollow piston rod D either a greater or lesser angular movement than indicated by the embodiment shown in the drawing.

A port 50 extends through the wall of inner tubular assembly 30 of the post assembly A immediately below shoulder 35. The port is fluidly connected through conduit 51 to a source of fluid pressure, not shown. It will be understood that if an operator wishes the hollow piston rod D to move upwardly, fluid pressure is exerted through conduit 34 which pressure is exerted against shoulder 44 and moves hollow piston rod D upwardly while at the same time pressure is released through conduit 51. If the operator wishes the hollow piston to be moved downwardly, fluid under pressure is forced through conduit 51 and acts against shoulder 43 to force the hollow piston D downwardly while at the same time pressure is released through conduit 34.

As stated heretofore, cylinder assembly B consists of member 17 to the upper end of which is secured a sleeve or extension 49 which is surmounted by cap 60. Cap 60 defines a central passage through which the end of rod C projects which rod is secured firmly to the cap nut 62. Cap 60 is provided with port 63 to allow the free flow of air into and out of the sleeve either upon movement of outer cylinder B with respect to post A or upon relative movement with respect to cylinder assembly B. The portion of rod C below cap 60 is splined in section and passes slidably through a splined central passage 64 defined by the inner wall of hollow piston D. In other words, rod C is free to move vertically and is secured to outer cylinder B so that the two assemblies have the exact vertical movement.

It has been previously explained that cylinder B and rod C may be forced upwardly by exerting fluid pressure through conduit 23 while releasing pressure through conduit 24 and similarly may be forced to move downwardly by exerting pressure through conduit 24 while releasing pressure through conduit 23. Cylinder B and rod C are forced to move angularly upon vertical movement of hollow piston D. It has been heretofore explained that piston rod D may be forced to move vertically by regulating the fluid pressure in conduits 34 and 51 as desired. As long as hollow piston rod D remains in a fixed position the unit consisting of outer cylinder B and rod C may be moved freely vertically either upwardly or downwardly or held in a fixed position. Whenever it is desired to give the assembly consisting of cylinder B and rod C angular movement, this may be brought about by forcing hollow piston rod D to move vertically. When viewing the assembly from the top, movement of the unit consisting of cylinder B and rod C in a clockwise direction is brought about by moving hollow piston rod D downwardly and similarly movement of the unit in a counterclockwise direction is brought about by moving hollow piston D upwardly. It will be apparent that angular movement of the unit consisting of cylinder B and rod C may be produced either when this unit is moving vertically or when it is held against vertical movement. That is to say, hollow piston rod D and the unit consisting of cylinder B and rod C may be moved simultaneously whereby the unit consisting of cylinder B and rod C moves simultaneously both in a vertical and angular direction. Or the unit consisting of cylinder B and rod C may be held against vertical movement while being moved angularly.

While I have described a specific embodiment of the present invention, it will be evident to a workman skilled in the art that various changes in the size, shapes and proportions of the parts may be made without departing from the scope of the invention.

Having fully described and illustrated preferred embodiments of the present invention, what I desire to claim as new and useful and to secure by Letters Patent is:

1. An assembly comprising, in combination, a post member, an outer cylinder slidably mounted on the post member for vertical and rotative movement thereon, a hollow piston rod and piston slidably mounted within the post member, means to cause said piston to move angularly with respect to the post member upon slidable movement and means mechanically connecting the hollow piston rod with the outside cylinder to cause angular movement of the outside cylinder upon angular movement of the hollow piston rod.

2. A column assembly comprising, in combination, a hollow post member having at least a portion of its surface defining a spiral cut groove, an outer cylindrical member slidably mounted on the post member for longitudinal and rotative motion with respect thereto, a hollow piston and piston rod slidably mounted within the post member and having a central passage of irregular cross section, a cam member secured to the exterior of the hollow piston and fitting slidably in the spiral cut in the post member, a rod member of irregular cross section fitting slidably within the central passage of the hollow piston rod and movable longitudinally but not angularly with respect thereto and means securing said rod member to said outer cylindrical member for unitary angularly motion of said two members.

3. A column assembly comprising, in combination, a hollow post member adapted to have an end firmly secured to a base member and having a portion of its wall spaced from the base member defining a spiral groove, an assembly comprising a cylinder slidably mounted on the post member and a rod of irregular cross section attached thereto and arranged concentrically within the post member, a hollow piston slidably mounted within the hollow post member and having a central passage of irregular cross section fitting slidably around said rod to allow relative longitudinal movement between the hollow piston and the rod while preventing relative rotative motion between the hollow piston and the rod and a cam roller mounted on the hollow piston and fitting in the spiral groove for movement therein.

ALBERT L. STONE.

REFERENCES CITED

The following references are of record in the file of this patent:

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