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(54) **Dual camming action jaw assembly and power tong**

(57) A rotary tong for use in well drilling operations to make and break out drill strings or similar axially elongated objects is disclosed which has a secondary camming action provided by the jaw assemblies. Each jaw assembly comprises a jaw frame 2 in which a die assembly 17 is mounted for movement along a circular arc so contrived in relation to the mounting of the jaw assembly in a drag assembly 34, that displacement of the die assembly 17 relative to the jaw frame 2 consequent upon engagement of the die assembly 17 with the drill string upon rotation of a rotor 27 causes a secondary camming action which effectively reduces the cam angle of the primary camming action taking place between a cam surface 32 of the rotor and a cam follower 18 carried by the jaw frame. The reduced cam angle gives greater gripping force thereby reducing slippage. The secondary camming function also allows the jaw to be used for a greater variety of drill string sizes thereby reducing the need to change tongs or jaw elements when drill string sizes change.

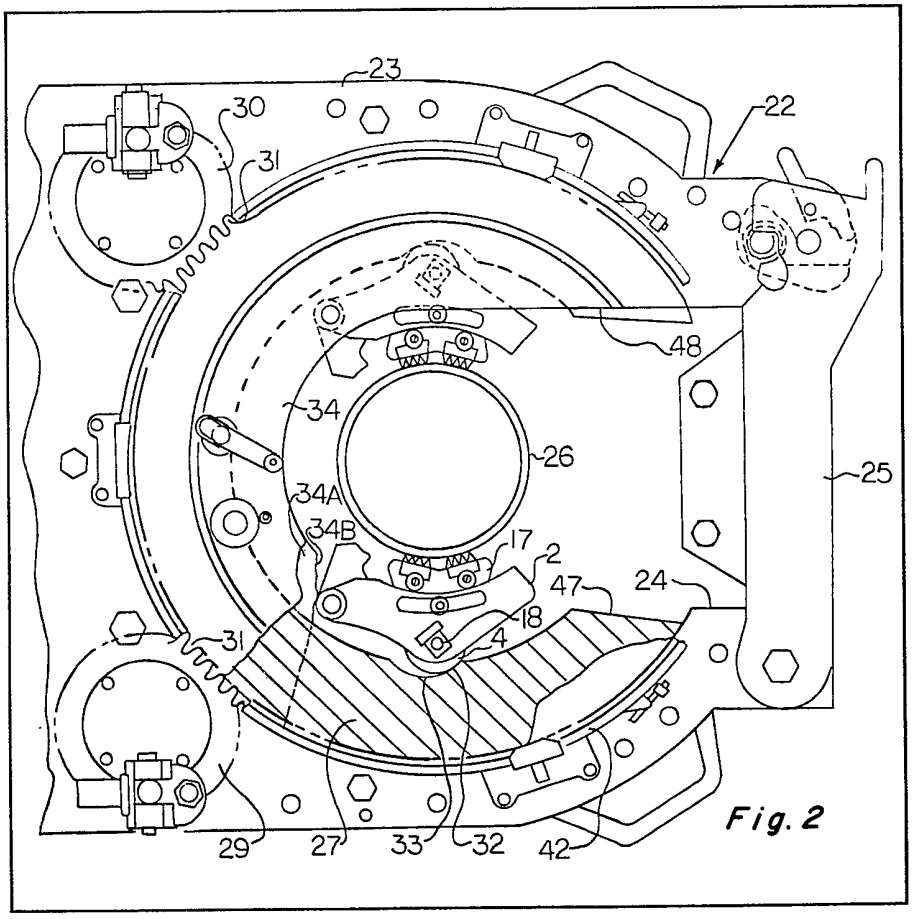

Fig. 2

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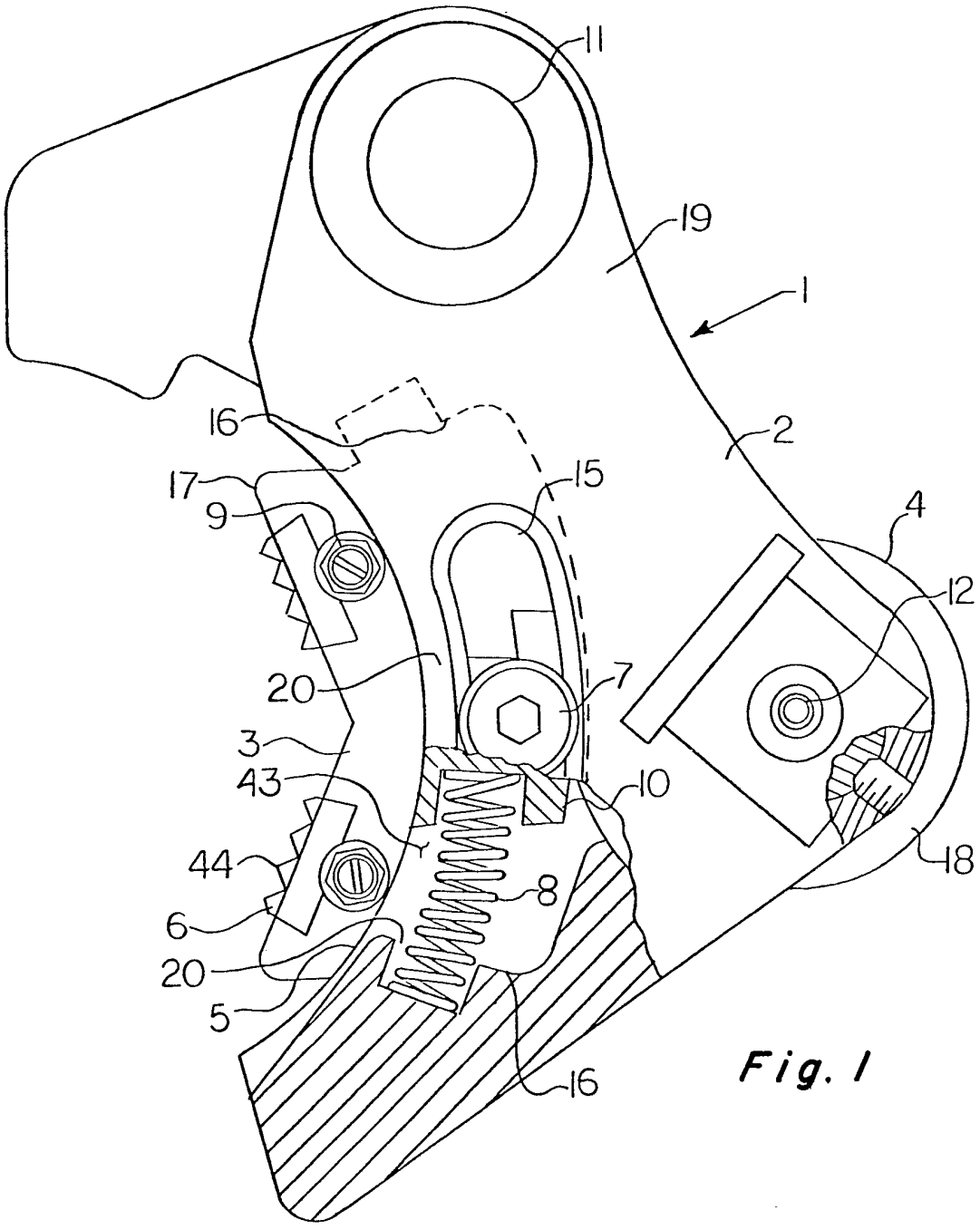

Fig. 1

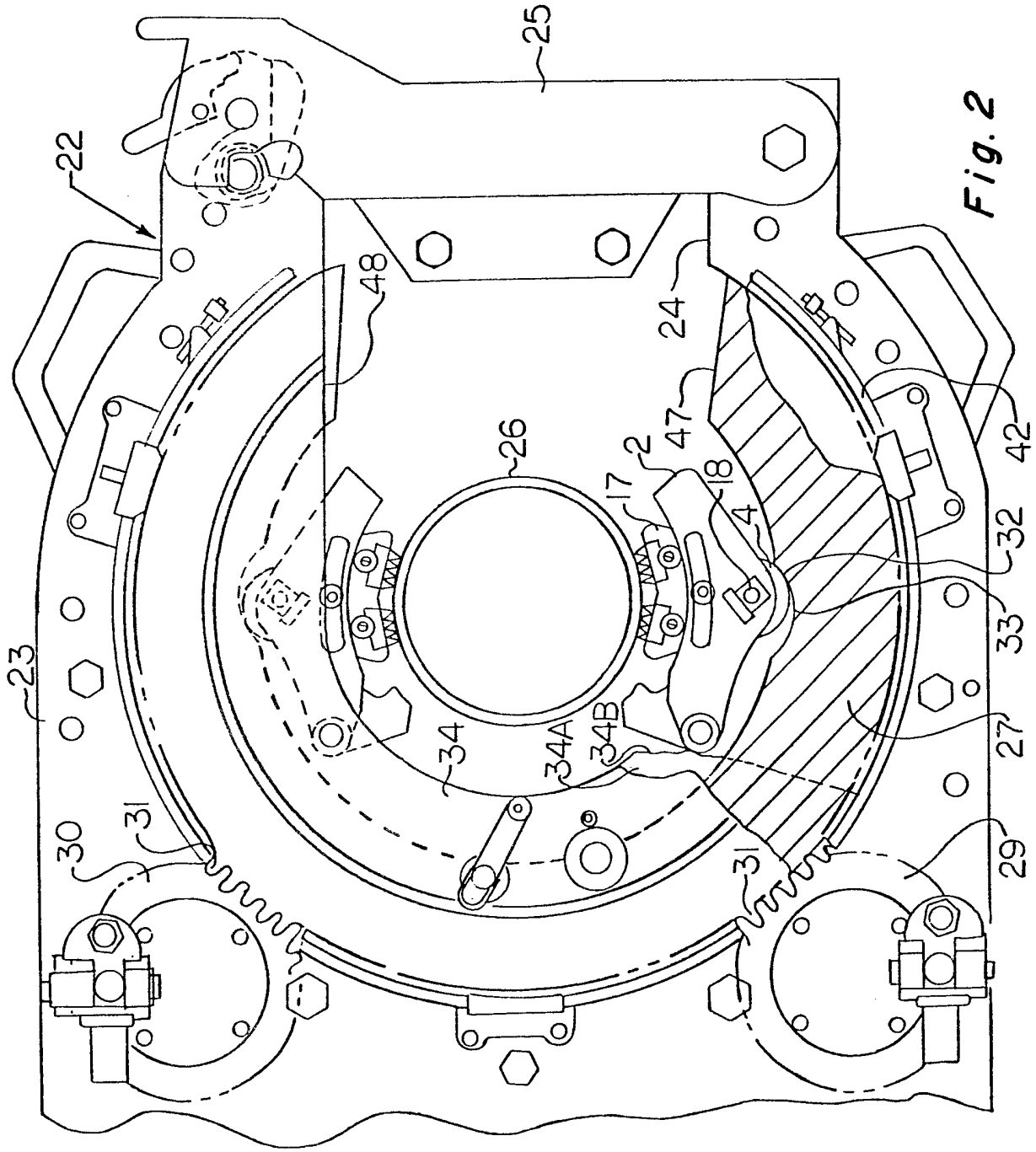

Fig. 2

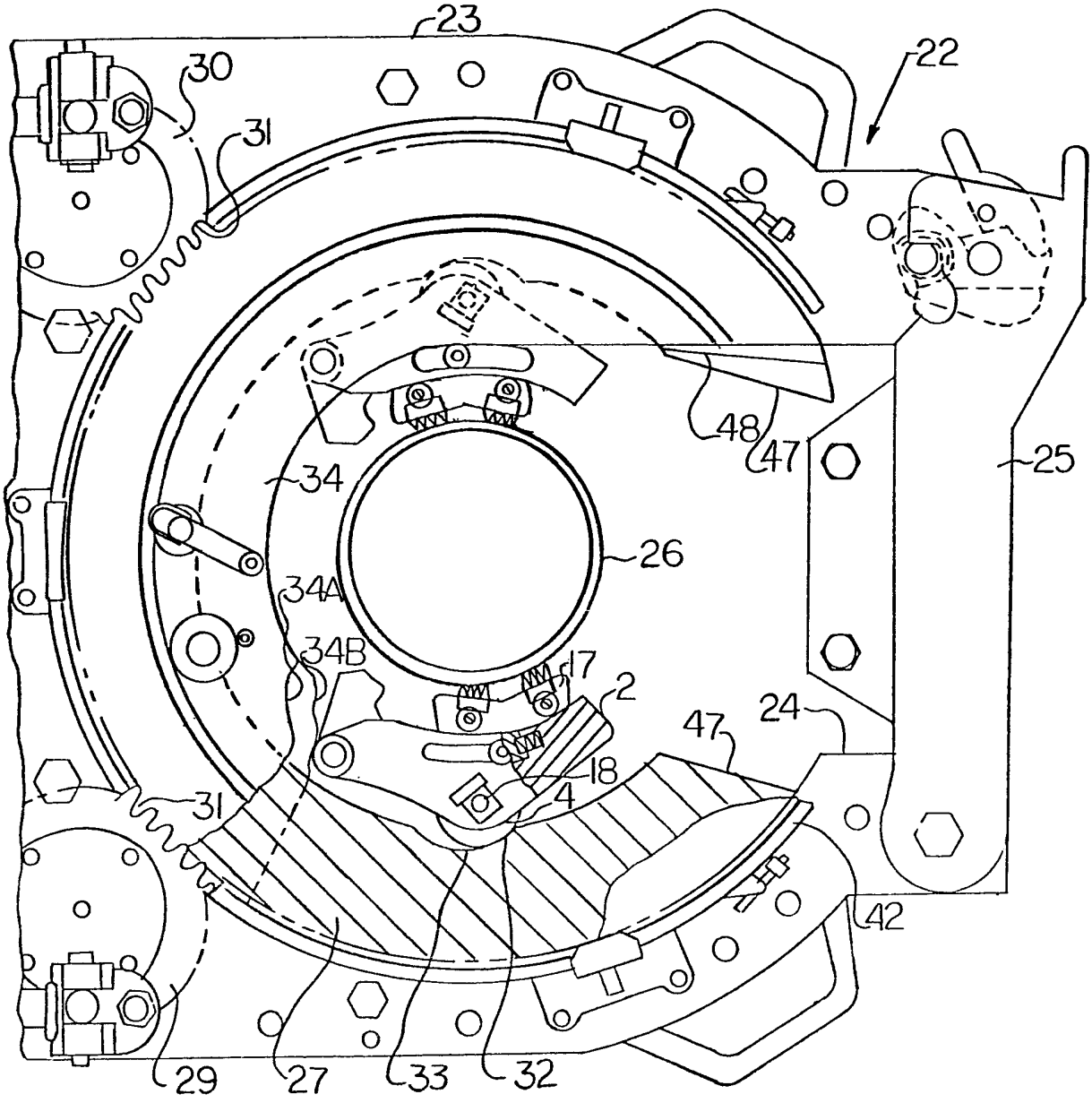
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Fig. 3

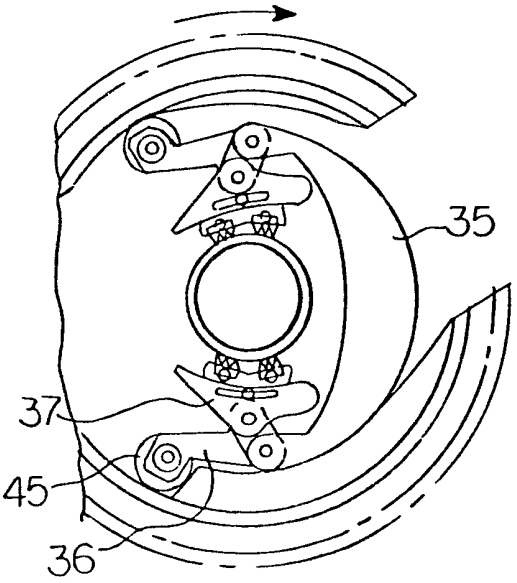
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Fig. 4

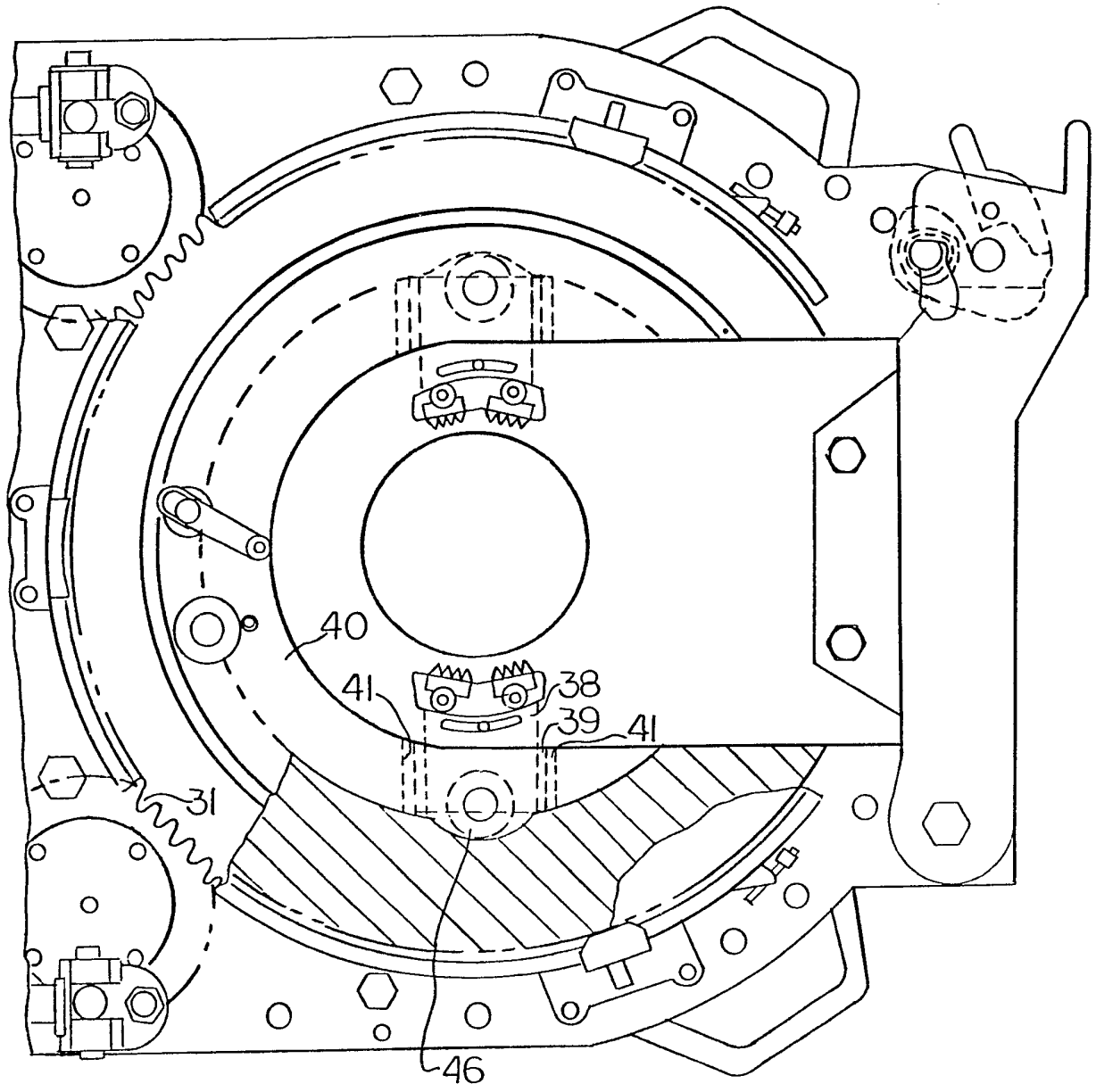

Fig. 5

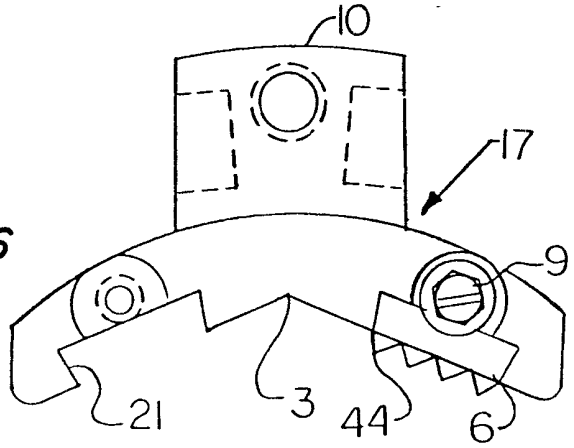

Fig. 6

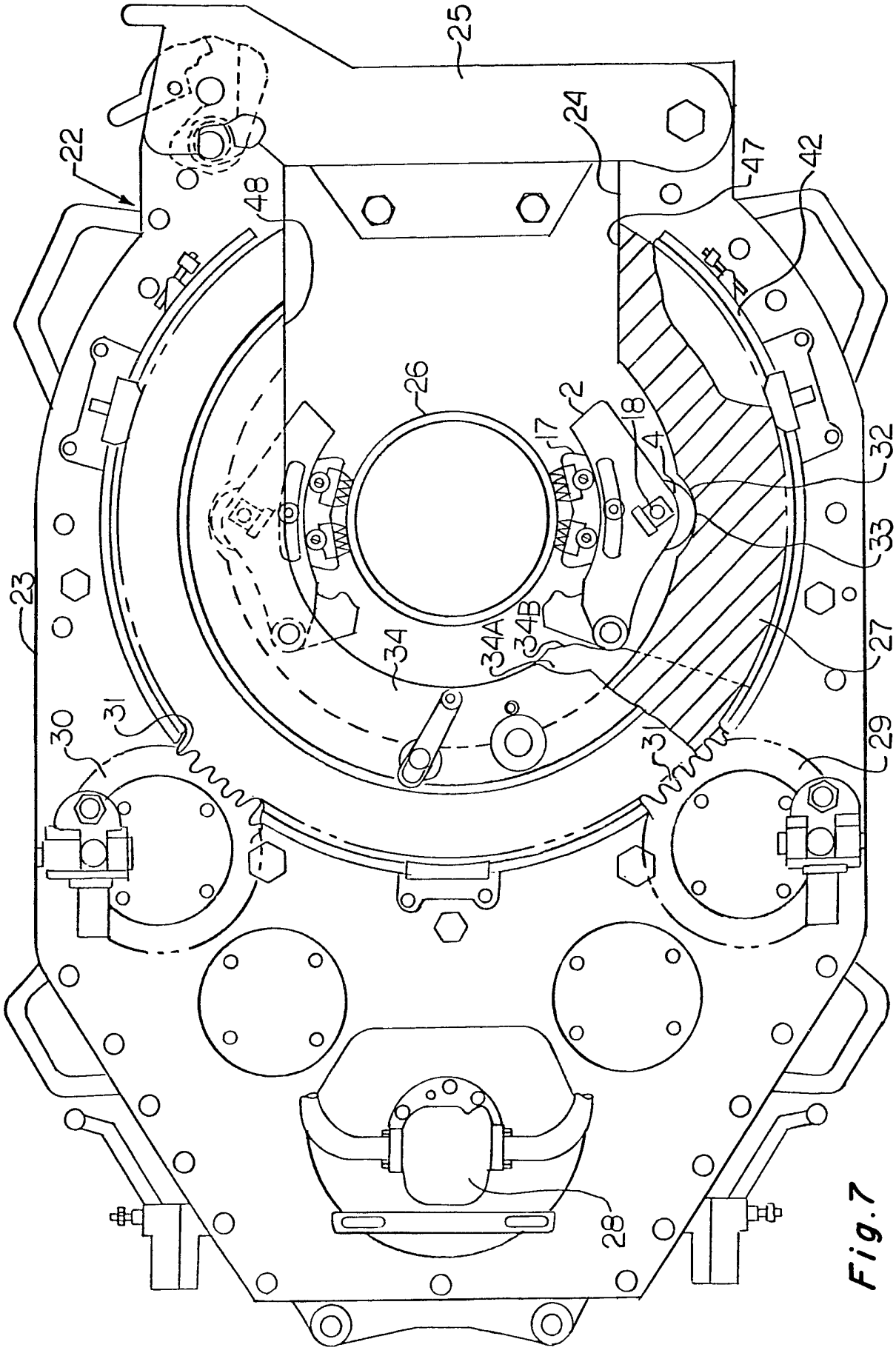

Fig.7

SPECIFICATION

Dual camming action jaw assembly and power tong

This invention relates to a power tong and to a jaw assembly for a power tong.

In well drilling operations, a power tong is used to grip and rotate lengths of pipes, rods, drill strings, or other axially elongated bodies for the purpose of connecting together or disconnecting threaded end sections of such bodies. In the usual case, the tong is of the open-headed type having a housing with a central opening and an outwardly-open passageway or throat which permits the tong to be positioned around a pipe joint without the necessity of lowering the tong over a length of pipe.

When the tong is operated, pipe-gripping means (often referred to as jaws) are caused to revolve around the aforesaid central opening, these jaws causing the pipe or axially elongated object being gripped thereby to rotate about its axis. Considering the gripping action of the jaws in more detail, most tongs accomplish this gripping action by means of a rotor which forces a cam which is attached to the jaw frame to lock into position against a cam surface along the inside surface of the rotor. The action of the cam against the cam surface forces the jaw radially or pivotally radially inwardly causing a die assembly to engage the pipe. The smaller the cam angle the greater the gripping force produced; however, reduced cam angles can often lead to forces which will deform the pipe. In prior tongs, many attempts to reduce the cam angle have failed because it was not possible to effectively limit the camming angle reduction. Since the range of variance of the cam angle which can be practically used is small, such jaw assemblies have very limited ranges of pipe radii that they can be used upon.

Accordingly, it is among the objects of the present invention to provide a jaw assembly and a power tong incorporating the same with a primary and a secondary camming function which permits a reduced angle for the primary camming function; thereby increasing grip and decreasing slippage.

In accordance with one aspect of the present invention there is provided a jaw assembly for use in a power tong for axially rotating an axially elongated body, the jaws assembly comprising; a jaw frame for mounting on a power tong for movement into and out of engagement with such an axially elongated body; a cam follower means connected to said jaw frame and adapted to cooperate with a cam surface portion of such a power tong to impart a primary camming action of the jaw frame into and out of engagement with such an axially elongated body, and; a die assembly slidably mounted in said jaw frame so as to allow relative motion between the die assembly and said jaw frame along a surface of contact of said die assembly with said jaw frame, the arrangement being such that a secondary camming action is provided between said die assembly and said jaw frame whereby, in operation, sliding movement of the die assembly relative to the jaw frame can force said die assembly radially against the axially elongated body independently of the primary camming action of the jaw frame.

According to another aspect of the invention, there is provided a power tong for axially rotating an axially elongated body which comprises; a housing; a generally annular rotor carried by said housing and rotatable relative to said housing about an axis extending generally perpendicular to the opposite sides of said housing; a cam surface formed on the inner periphery of said annular rotor; drive means carried by said housing for rotating said rotor; a generally annular disc drag assembly which is carried by said housing and is rotatable relative to said housing about an axis extending generally perpendicular to the opposite sides of said housing and is rotatable relative to the annular rotor; a plurality of jaw assemblies wherein at least one jaw assembly includes a jaw frame carried by said power tong for movement into and out of engagement with an axially elongated body, a cam follower means connected to said jaw frame and adapted to cooperate with said cam surface of said power tong to impart a primary camming action of the jaw frame into and out of engagement with such an axially elongated body, a die assembly slidably mounted on said jaw frame allowing relative motion between itself and said jaw frame along a surface of contact with said jaw frame and cooperating with said jaw frame to provide a secondary camming action which radially forces said die assembly against the axially elongated body independently of the primary camming action of the jaw frame, mounting means for connecting said jaw frame to said drag assembly, and friction means for restraining rotation of said drag assembly.

Embodiments of the invention are described below, by way of example with reference to the accompanying drawings in which:

Figure 1 is a plan view, partially in section, of a jaw assembly embodying the invention;

Figures 2 and *3* are fragmentary plan views showing operation of the tong illustrated in Figure 7;

Figure 4 shows another form of power tong embodying the invention wherein the cam follower means includes a lever arm pivotally connected to the rear portion of the jaw frame;

Figure 5 shows another form of power tong embodying the invention in which a jaw assembly is slidably mounted in radial interstices of the drag assembly;

Figure 6 is a plan view of a die assembly of the jaw assembly of Figure 1; and

Figure 7 is a plan view, partly in section, of a power tong incorporating the jaw assembly of Figure 1.

With reference now to the drawings, with particular attention to Figures 1, 6 and 7, Figure 7 shows a power tong 22, including a housing 23 which has an opening 24 therein referred to as a throat. Covering the throat 24 is a latch 25 which opens to allow the tong 22 to be placed around the axially elongated body 26 such as a pipe. The latch 25 is then closed to ensure safety during operation. Opposite the latch 25 the housing 23 contains drive means for turning a rotor 27 in the form of an annulus with a section removed to afford a throat or opening 47 which can

be aligned with throat 24 to allow passage of member 26. The drive means may be of any of several types. However, the drive means shown in Figure 7 comprises a hydraulic motor 28 which, through a gear train (not shown) rotates two pinion gears 29 and 30. The pinion gears 20 and 30 mesh with gear teeth 31 on the outer periphery of the annular rotor 27. The spacing between the pinion gears 29 and 30 ensures that the rotor 27 will continue to be rotated even when one of the pinion gears 29 and 30 is disposed at the opening or throat 47 of the rotor 27.

The rotor 27 is carried by the housing 23 and is rotatable relative to the housing 23 about an axis generally perpendicular to the opposite sides of the housing 23 (and corresponding to the axis of body 26 as shown). Also mounted on the housing 23, for rotational movement about the rotary axis of rotor 27 is a drag assembly 34, also in the form of an annulus with a section removed, to afford an opening or throat 48, which can be aligned with throat 47 and throat 24, and this drag assembly carries two diametrally opposed jaw assemblies 1, one on either side of the throat 48, the jaw assemblies having respective jaw frames 2. The jaw assemblies are movable towards and away from the rotary axis of rotor 27 for gripping and releasing any body 26 disposed in the region of said axis, the jaw assemblies being pivotally mounted for such movement in the drag assembly and being so movable by engagement of cam followers 18 thereon with respective cam surfaces 32 formed on the interior surface of the rotor 27, at diametrally opposed positions. Rotation of the drag assembly 34 relative to the housing is restrained by friction means 42 acting between the drag assembly and the housing. The cam surfaces 32 have respective neutral parts 33 (i.e. radially outermost parts), and when the cam followers of the jaw assemblies are in register with the respective said neutral parts, the jaw assemblies can open outwardly away from said axis, to allow the tong 22 to be fitted around an axially elongated body 26.

The drag assembly 34 (sometimes called a drag drum or carrier member) is comprised of two generally annular plate members 34a and 34b (hereinafter referred to as 34) bolted together in a sandwich or parallel fashion. Alternatively the drag assembly may comprise one substantial disc shaped member. In the preferred embodiment of Figure 7 the jaw assemblies 1 are sndwiched between the two plate members and each jaw assembly is pivotally connected to both plate members by means of a respective bolt which passes through an aperture 11 in the jaw frame (Figure 1). In the variant embodiment shown in Figure 4, each jaw assembly, indicated at 37, is pivotally connected to one arm of a respective lever 36 which is pivotally connected to the drag assembly, indicated at 35, each lever 36 having another arm which carries a cam follower 45 cooperating with the respective cam surface on the interior of the rotor. In the embodiment shown in Figure 5 each jaw assembly (38) is located, for radial sliding movement relative to the rotor axis, within a respective radial interstice 39 of the drag assembly, indicated at 40. As shown in Figure 5 each radial interstice is formed by two wall pieces 41 parallel to each other, attached perpendicular to the planes of the plate members of the drag assembly and sandwiched between said plate members to form therewith a box or radial interstice for the jaw assembly 38.

Figure 1 shows in detail the construction of a jaw assembly itself. The jaw assembly 1 comprises three basic parts, namely a jaw frame 2, a die assembly 17, and cam follower means 18. The front portion of the jaw frame 2 is that portion which, in use, is orientated towards the axially elongated body 26 to be rotated. The jaw frame 2 is made up of a main body portion 19 and spaced apart upper and lower side portions 20. The side portions 20 define between them, on the side of the jaw frame which, in the assembled tong, is nearer the rotary axis of the rotor, a groove 43 in which the die assembly 17 is mounted as described later. The side portions 20 also have respective aligned crescent-shaped slots 15 formed therethrough. In the assembled tong, the concave surfaces of the slots are directed towards the rotary axis of the rotor, ie towards the axially elongated body 26 to be rotated.

The upper and lower side portions 20 in the preferred embodiment are substantially in the form of respective plates arranged parallel with each other with a spacer, constituted by the main body portion 19, sandwiched therebetween, the groove 43 being formed at the location of a cut-away part of main body portion 19. However, the groove 43 could be formed by machining in a solid unitary frame member jaw. The upper and lower side portions 20 could be made to be converging while the die holder tongue 10 could be made with a taper to fit within the tapered groove 43 formed between the modified upper and lower side portions 20.

The die assembly 17 mainly comprises three basic parts. The main part of the die assembly 17 is the die holder 3. The die holder 3 is retained in the jaw frame by virtue of a pin 7 which is fixed in the die holder 3 and is retained within the crescent shaped slots 15. A portion of the die holder 3 which always rides within the groove 43 formed between the upper and lower side portions 20 is called the tongue 10. A further portion of the die holder projects from the frame 2 on the side of the latter which faces towards the axis of the rotor 27. The second part of the die assembly 17 is formed by the die inserts 6 which, in use, make direct contact with the cylindrical or axially elongated body 26. The die inserts 6 in the preferred embodiment fit into respective slots 21 made in the projecting part of the die holder 3. The third part of the die assembly 17 is formed by the washer head screws 9 which retain the die inserts 6 within the die holder 3. If desired the die inserts 6 can be eliminated and the die teeth 44 can be machined directly in the die holder 3. However, the provision of die inserts 6 allows the die teeth 44 to be replaced without changing the die holder 3. It is also possible to have detachable die inserts 6 without having the slots 21 formed on the die holder 3.

The die assembldy 17 is maintained in a neutral position in the jaw frame by a biasing means. For

example, Figure 1 shows, as biasing means, a coil spring 8 held captive between the jaw frame 2 and the die assembly 17. In a preferred embodiment two springs 8 are used, on at either end of the groove 43, in order to urge the die assembly 17 to a neutral position from either direction. However, only one of these springs is illustrated in Figure 1.

In the preferred embodiment the side of the jaw frame 2 which faces towards the axis of the tong is formed as a circularly arcuate bearing surface 5 (provided by the edges of portions 20), the axis of curvature of which is parallel with the axis of the tong but is closer to the jaw frame 2 than the axis of the tong. The die holder 3 is formed with correspondingly arcuate shoulders which engage and are slidable on said bearing surface. Although other forms of bearing surface may work a circularly arcuate surface of contact 5 will allow continuous line contact between the die assembly 17 and jaw frame 2. As the axis of curvature of surface 5 is closer to jaw frame 2 than the axis of the tong, and thus closer than the axis of any member effectively held in the tong, it follows that arcuate surface of contact 5 has a radius which is smaller than the radius of the axially elongated body 26 to be rotated. The focus of the circular surface of contact 5, ie the axis of curvature thereof is located at such a position that when the jaw assembly 17 is engaged upon the pipe 26 relative motion between the die assembly 17 and the jaw frame 2 generates a camming action which moves the die assembly 17 radially inwardly with respect to the axially elongated body 26 being gripped during rotation in either direction. When the jaw assembly 1 becomes engaged upon the axially elongated body 26 friction between the axially elongated body 26 and the die inserts 6 causes the die assembly 17 to resist continued rotation of the jaw frame 2 about the axis of the tong. As the jaw frame 2 continues to move in either rotary direction relative motion between the jaw frame 2 and die assembly 17 forces the die assembly 17 towards the axial center of the cylindrical body 26 to be rotated if the focus of the circular surface of contact 5 is located as described (see also Figures 2 and 3). The camming action caused by the relative motion between the die assembly 17 and jaw frame 2, referred to as the secondary camming action, decreases the effective cam angle, as compared with that of the cam surface 32 alone and increases the grip. Since grip is increased the jaw assembly 1 can be used for a greater range of axially elongated bodies 26.

To limit the relative motion between the die assembly 17 and the die holder 3 stopping means are utilised. Since the stopping means limits relative motion, it also limits the decrease in cam angle therefore preventing damage to the axially elongated body 26. In Figure 1 the stopping means comprises the tongue 10 making contact with the jaw frame landing 16.

The third major element of the jaw assembly 1 is the cam follower means 28. The cam follower means of the preferred embodiment is a circular cam surface contact member 4, such as a roller rotatably mounted on the portion of the jaw frame 2 remote from the tong axis.

Although the preferred embodiment has a cam surface contact member 4 which is rotatably mounted a cam surface contact member 4 rigidly fixed in the jaw frame may be used and also the cam surface contact member 4 can be non-circular. In Figure 1 roller pin 12 is used to mount the cam surface contact member 4 in the jaw frame 2. In the variants of Figures 4 and 5, likewise, the cam follower means may be either a roller or a cam follower member rigidly fixed to the lever 36 or the member 38 respectively.

Considering further the operation of the tong 22, of Figures 1 to 3,6 and 7 Figure 2 shows the position after rotor 27 has been rotated slightly in a clockwise direction by the pinion gears 29 and 30 acting on the gear teeth 31. Such rotation causes the cam surfaces 32 to push against the respective cam follower members 4. As the cam follower members 4 become engaged against the cam surface 32 the jaw frames 2 are pivotally pushed radially inwardly to engaging the die inserts 6 of the die assemblies with the member 26. As the rotor 27 continues to rotate in a clockwise direction relative motion between the jaw frames 2 and the die assemblies 17 occurs, as shown in Figure 3, and the die assemblies 17 move in a counterclockwise direction relative to the jaw frames 2 causing a secondary camming action. The secondary camming action is limited by the tongues 10 hitting the respective landings 16. As the rotor 27 continues to turn with the jaw frames 2 and die assemblies 17 engaged the friction means 42 is released or overcome allowing the drag assembly 34 to rotate with the jaw assembly 1, axially elongated body 26 and rotor 27.

The embodiment shown in Figure 4 works in the same manner except that each cam follower member 45 pushes a respective lever arm 36 which then pushes the respective jaw frame 37 pivotally inward. The embodiment shown in Figure 5 works in the same manner as the other embodiments described except that each cam follower member 46 pushes the respective jaw frame 38 radially inward instead of pivotally inward.

The power tong and jaw assembly described with reference to the drawings allow the cam angle of the primary camming function to be reduced, whilst, however, limiting the reduction and preventing damage to pipe or similar axially elongated object handled by the jaw assembly or tong.

Furthermore, this power tong, with the jaw assembly described, can be used for a greater range of pipes or similar cylindrical objects, therefore saving time and money from unneeded changes in equipment mandated by different pipe sizes.

CLAIMS

1. A jaw assembly for use in a power tong for axially rotating an axially elongated body, the jaw assembly comprising; a jaw frame for mounting on a power tong for movement into and out of engagement with such an axially elongated body; a cam follower means connected to said jaw frame and adapted to cooperate with a cam surface portion of

such a power tong to impart a primary camming action of the jaw frame into and out of engagement with such an axially elongated body, and; a die assembly slidably mounted in said jaw frame so as to allow relative motion between the die assembly and said jaw frame along a surface of contact of said die assembly with said jaw frame, the arrangement being such that a secondary camming action is provided between said die assembly and said jaw frame whereby, in operation, sliding movement of the die assembly relative to the jaw frame can force said die assembly radially against the axially elongated body independently of the primary camming action of the jaw frame.

2. A jaw assembly according to claim 1 wherein said cam follower means comprises a cam surface contact member which is rotatably connected to said jaw frame

3. A jaw assembly according to claim 1 wherein said surface of contact between said die assembly and said jaw frame has a curvature with a radius smaller than the radius of the axially elongated body to be axially rotated.

4. A jaw assembly according to claim 3 wherein said surface of contact is circularly arcuate, and has a focus located at such a point that when said jaw assembly is engaged upon an axially elongated body, relative motion in either direction between said jaw frame and said die assembly results in a second camming action.

5. A jaw assembly according to any preceding claim wherein said die assembly includes a die holder and a detachable die insert.

6. A jaw assembly according to any preceding claim wherein said die assembly has a tongue portion which fits within a groove of said jaw frame.

7. A jaw assembly according to claim 6 wherein said jaw frame includes upper and lower side portions to form said groove and said tongue is retained in said groove by means of a pin which connects with said tongue and is allowed to slide within crescent shaped slots formed within said jaw frame upper and lower side portions.

8. A jaw assembly according to any preceding claim including stopping means to limit the relative motion between said die assembly and said jaw frame.

9. A jaw assembly according to any preceding claim including biasing means to urge said die assembly into a neutral position in relation with said jaw frame when said jaw assembly is not engaged upon an axially elongated body.

10. A jaw assembly according to claim 9 wherein said biasing means is a coil spring captured between said die assembly and said jaw frame.

11. A jaw assembly according to any preceding wherein said cam follower means includes a lever arm pivotally connected to said jaw frame and a cam surface contact member rigidly attached to said lever arm opposite said jaw frame.

12. A jaw assembly according to any preceding claim wherein said cam follower means includes a lever arm pivotally connected to said jaw frame and a cam surface contact member which is rotatably connected to said lever arm opposite said jaw frame.

13. A jaw assembly according to claim 1 which further includes mounting means for mounting said jaw assembly on a drag assembly of the power tong.

14. A jaw assembly according to claim 13 wherein said mounting means includes means for pivotally connecting said jaw frame to said drag assembly.

15. A jaw assembly according to claim 13 wherein said mounting means includes a lever arm pivotally connected to said jaw frame, said lever arm being pivotally connected to said drag assembly.

16. A jaw assembly according to claim 15 wherein said lever arm is also connected to said cam surface contact member.

17. A jaw assembly according to claim 13 wherein said mounting means includes means for slidably mounting said jaw frame within a radial interstice of the drag assembly.

18. A jaw assembly for use in a power tong for axially rotating an axially elongated body which comprises: a jaw frame carried by the power tong for movement into and out of engagement with such an elongated body, said jaw frame including a main body portion and an upper and lower side portion, said upper and lower side portions being generally formed in the shape of a plate extending from the main body portion and forming a groove between them and said upper and lower side portions having respective crescent shaped slots, said crescent shaped slots being in alignment with each other in a direction generally perpendicular to said groove formed between said upper and lower side portions; a cam follower means connected to said jaw frame and adapted to cooperate with a cam surface portion of such a power tong to impart a primary camming movement of the jaw frame into and out of engagement with such an elongated body and said cam follower means including a circular cam surface contact member rotatably mounted; a die assembly slidably mounted on said jaw frame allowing relative motion between itself and said jaw frame along a circular-curvature surface of contact with said jaw frame and cooperating with said jaw frame providing a second camming action which radially forces said die assembly against the axially elongated body independently of the primary camming action of the jaw frame, said circular-curvature surface of contact having a radius smaller than the radius of the axially elongated body to be axially rotated and the focus of said circular curvature surface of contact being located at such a point that when said jaw assembly is engaged upon an axially elongated body, relative motion in either direction between said jaw frame and said die assembly results in a secondary camming action, and wherein said die assembly includes a tongue which slides within said groove which is formed between said upper and lower side portions of said jaw frame, and said tongue connecting with a pin retained within said crescent shaped slots of said upper and lower portions; stopping means being provided to limit relative motion between said jaw assembly and said die frame; biassing means being provided to urge said die assembly into a neutral position upon an axially elongated body, which biasing means includes a coil spring held captive

between said tongue and said jaw frame and another coil spring held captive between said tongue and said jaw frame opposite the first mentioned coil spring, and mounting means for connecting said jaw assembly to a drag assembly of a power tong.

19. A power tong for axially rotating an axially elongated body which comprises; a housing; a generally annular rotor carried by said housing and rotatable relative to said housing about an axis extending generally perpendicular to the opposite sides of said housing; a cam surface formed on the inner periphery of said annular rotor; drive means carried by said housing for rotating said rotor; a generally annular disc drag assembly which is carried by said housing and is rotatable relative to said housing about an axis extending generally perpendicular to the opposite sides of said housing and is also rotatable relative to the annular rotor; a plurality of jaw assemblies wherein at least one jaw assembly includes a jaw frame carried by said power tong for movement into and out of engagement with an axially elongated body, a cam follower means connected to said jaw frame and adapted to cooperate with said cam surface of said power tong to impart a primary camming action of the jaw frame into and out of engagement with such an axially elongated body, a die assembly slidably mounted on said jaw frame allowing relative motion between itself and said jaw frame along a surface of contact with said jaw frame and cooperating with said jaw frame to provide a secondary camming action which radially forces said die assembly against the axially elongated body independently of the primary camming action of the jaw frame, mounting means for connecting said jaw frame to said drag assembly, and friction means for restraining rotation of said drag assembly.

20. A power tong as claimed in claim 19 wherein there are at least two cam surfaces formed on diametrically - opposite sides of the inner periphery of said annular rotor and at least two said jaw assemblies each including a jaw frame carried by said power tong for movement into and out of engagement with an axially elongated body, a cam follower means connected to said jaw frame and adapted to cooperate with said diametrically opposite cam surfaces of such a power tong to impart a primary camming action of the jaw frame into and out of engagement with such an axially elongated body, a die assembly slidably mounted to said jaw frame so as to permit relative motion between the die assembly and said jaw frame along a surface of contact of said die assembly with said jaw frame and cooperation with said jaw frame and cooperating with said jaw frame to provide a secondary camming action which radially forces said die assembly against the axially elongated body independently of the primary camming action of the jaw frame, mounting means for connecting said jaw frame to said drag assembly, and friction means for restraining rotation of said drag assembly.

21. A power tong for axially rotating an axially elongated body which comprises: a housing with a throat for receiving an axially elongated body; a generally annular rotor carried by said housing and rotatable relative to said housing about an axis extending generally perpendicular to the opposite sides of said housing and having an opening therein which is adapted to be aligned with said throat so that an axially elongated body may be positioned within said annular rotor; cam surfaces formed on diametrically opposite sides of the inner periphery of said annular rotor; drive means carried by said housing for rotating said annular rotor; a generally annular drag assembly comprising two plate members connected in a parallel fashion by bolts, said drag assembly being pivotable relative to said housing about an axis extending generally perpendicular to the opposite sides of said housing and being rotatable relative to said annular rotor and having an opening therein which is adapted to be aligned with said throat so that an axially elongated body may be positioned within said drag assembly; a plurality of jaw assemblies each of which includes a jaw frame carried by said power tong for movement into and out of engagement with such an elongated body, said jaw frame including a main body portion, and upper and lower side portion, said upper and lower side portions generally being formed in the shape of a plate extending from the main body portion and forming a groove between them, said upper and lower side portions having respective crescent shaped slots, said crescent shaped slots being in alignment with each other in a direction generally perpendicular to said groove formed between said upper and lower side portions, cam follower means being connected to said jaw frame and being adapted to cooperate with a cam surface portion of the power tong to impart a primary camming movement of the jaw frame into and out of engagement with such an elongated body and sam cam follower means includes a circular cam surface contact member rotatably mounted, the die assembly being slidably mounted in said jaw frame so as to permit relative motion between itself and said jaw frame along a circular-curvature surface of contact with said jaw frame and the die assembly cooperating with said jaw frame to provide a secondary camming action which radially forces said die assembly against the axially elongated body independently of the primary camming action of the jaw frame, said circular-curvature surface of contact having a radius smaller than the radius of the axially elongated body to be rotated and the focus of said circular-curvature surface of contact being located at such a point that when said jaw assembly is engaged upon an axially elongated body, relative motion in either direction between said jaw frame and said die assembly results in a secondary camming action, said die assembly including a tongue which slides within said groove which is formed between said upper and lower side portions of said jaw frame and said tongue connecting with a pin retained within said crescent shaped slots of said upper and lower side portions, stopping means being provided to limit relative motion between said jaw frame and said die assembly, biasing means being provided to urge said die assembly into a neutral position in relation with said jaw frame when said jaw assembly is not engaged upon an axially elongated object,

said biasing means including a coil spring held captive between said tongue and said jaw frame and another coil spring being held captive between said tongue and said jaw frame opposite the first mentioned coil spring, mounting mens being provided connecting said jaw assembly to a drag assembly of the power tong; and friction means being provided for restraining rotation of said drag assembly.

22. A power tong as claimed in claim 19, 20 or 21 wherein said mounting means includes means for pivotally connecting said jaw frame to said drag assembly.

23. A power tong as claimed in claim 19, 20 or 21 wherein said mounting means mounts said jaw frame for radial sliding movement within a radial interstice of the drag assembly.

24. A power tong as claimed in claim 19, 20 or 21 wherein said mounting means includes a lever arm pivotally connected to said jaw frame, said lever arm being pivotally connected to said drag assembly.

25. A power tong as claimed in claim 24 wherein said lever arm is also included in said cam follower means.

26. A power tong as claimed in claim 19, 20 or 21 wherein the cam follower means includes a lever arm pivotally attached to said jaw frame and a cam surface contact member connected to said lever arm.

27. A jaw assembly for a power tong substantially as hereinbefore described with reference to, and as shown in, Figure 1 of the accompanying drawings.

28. A jaw assembly for a power tong substantially as hereinbefore described with reference to, and as shown in, Figure 4 of the accompanying drawings.

29. A jaw assembly for a power tong substantially as hereinbefore described with reference to, and as shown in, Figure 5 of the accompanying drawings.

30. A power tong substantially as hereinbefore described with reference to, and as shown in, Figures 1 to 3, 6 and 7 of the accompanying drawings.

31. A power tong substantially as hereinbefore described with reference to, and as shown in, Figure 4 of the accompanying drawings.

32. A power tong substantially as hereinbefore described with reference to, and as shown in, Figure 5 of the accompanying drawings.

33. A novel feature or combination of features disclosed herein.

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