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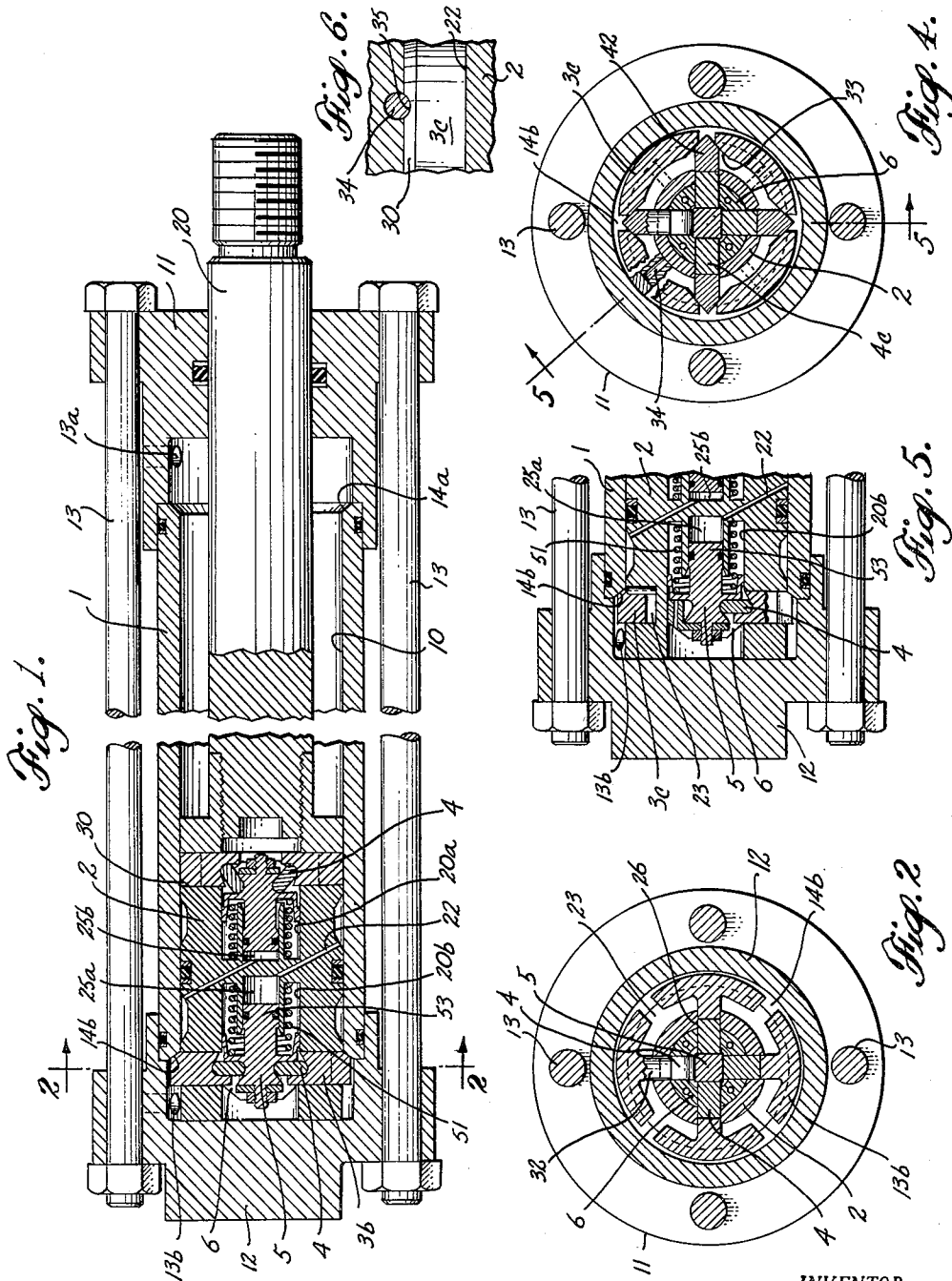
R. A. CHACE

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SEGMENTAL TYPE TOGGLE LOCK

Filed Feb. 8, 1960

2 Sheets-Sheet 1



INVENTOR.
RICHARD A. CHACE

BY
Reynolds, Basch & Christensen
ATTORNEYS

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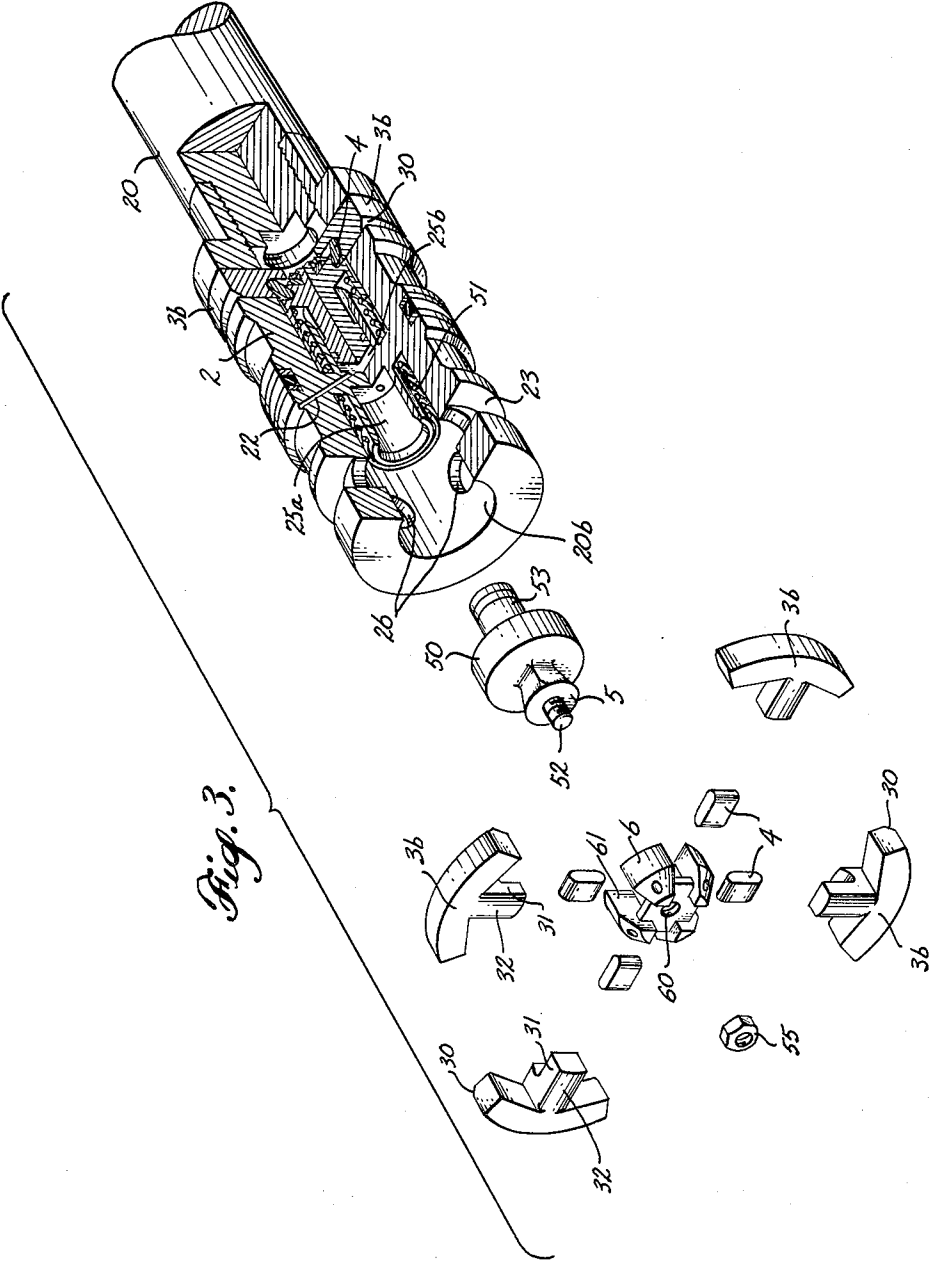
R. A. CHACE

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INVENTOR.
RICHARD A CHACE

BY
Reynolds, Beach & Christensen
ATTORNEYS

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SEGMENTAL TYPE TOGGLE LOCK

Richard A. Chace, Bellevue, Wash., assignor, by mesne assignments, to Clemco Aero Products, Inc., Gardena, Calif., a corporation of Delaware

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7 Claims. (Cl. 121—40)

The present device is of the same general nature as that disclosed in Patent No. 2,744,501, issued to myself and George C. Newell, Jr., and in the companion patent to E. H. Bakke, No. 2,764,132, and in that it pertains to a toggle lock employing dogs of the segmental type shown in the Bakke patent, it more nearly resembles the latter. However, it is not material whether the locking dogs and their actuating means be singular or plural, whereby to lock in one or in two positions, whether they be mounted in a piston which is reciprocable within a cylinder as in the Bakke patent, or in the cylinder for engagement with the piston, nor is it material whether the release of the lock and relative movement of the piston and cylinder or equivalent elements be accomplished hydraulically or otherwise. As to equivalent elements, the lock is applicable to any two relatively reciprocable elements, whether formed as a piston and cylinder, or otherwise.

The Bakke segmental form of the lock has advantages over a narrower form of lock in that the locking and releasing pressures are distributed over relatively wide areas and, therefore, are not concentrated to produce excessive and concentrated wear at any one particular point or limited area. The Bakke construction in use was found, however, to be subject to certain disadvantages. Projection of the segmental locking dogs into locking position was effected by the reaction of a double-beveled actuator upon complementary bevels at the opposite ends of the segments. These actuators would, in some instances, fail to project equally or simultaneously, which would result in cocking of the locking segments, or their displacement circumferentially, and possible failure to engage or to disengage properly. It was discovered after such troubles had developed, that it was especially necessary for locking dogs of this segmental type to be so guided in the member which supports them, that they may move only radially, and in no sense circumferentially, nor cock. The present invention relates to a construction wherein such segmental locking dogs are so guided, and in that manner are prevented from cocking or sticking, and will, in consequence, continue to work perfectly for an indefinite period of time.

The invention is shown in the accompanying drawings in two representative forms, the differences between which will appear shortly.

FIGURE 1 is a longitudinal sectional view through a hydraulic jack, strut, or the like, shown with parts in a locked position at one end of the relative travel of the two members, and incorporating the present invention.

FIGURE 2 is, in general, a transverse sectional view at the plane indicated by the line 2—2 in FIGURE 1.

FIGURE 3 is an exploded isometric and part-sectional view of the mechanism employed in the form of the device shown in FIGURES 1 and 2.

FIGURE 4 is a transverse sectional view, corresponding generally to FIGURE 2, and showing a modified form of guiding device for the segmental locking dogs, and FIGURE 5 is an axial sectional view of one end only of the same, taken substantially at the plane indicated by the line 5—5 in FIGURE 4.

FIGURE 6 is a transverse sectional view directly through the guiding element of this form of the device.

The present invention is, in fact, applicable to any pair of relatively reciprocable elements which must be locked

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together in at least one position, and will be shown and described in conjunction with a piston and cylinder constituting the respective elements, and which in the embodiment shown are locked together at each of two limits of their reciprocative movement. Relative movement between such positions is effected by the application of hydraulic pressure or the like behind the one end or the other of the piston.

The cylinder is indicated at 1, having a bore 10 and the ends being closed by end caps 11 and 12, the whole being held assembled by means such as the bolts 13 joining the end caps. One of the end caps is axially bored for sliding of a piston rod 20 in and out, this being connected interiorly of the cylinder 1 to a piston 2 which is fitted and reciprocable within the bore 10. The cylinder reacts from one of two members (not shown) which are to be moved apart or together, and the piston rod reacts from the other such member. Fluid passages for admission of pressure fluid to the respective ends of the cylinder, and for venting of the opposite end to a low pressure region, are indicated at 13a and 13b.

Locking dogs 3a and 3b are supported in and adjacent the respective ends or faces of the piston 2, in circumferential grooves 23, for radial projective and retractive movement. Each such locking dog at its radially outer or tip end is of segmental form, as best seen in FIGURE 2. In the form shown such dogs when retracted constitute a substantially 360° ring, but when projected as shown in FIGURE 2, are somewhat separated at their ends. It is this separation, which in the absence of the guidance provided according to this invention, would permit circumferential or endwise movement, or cocking with relation to a radius, and it is such irregular movement of the dogs, often induced by the projecting means employed, that has in past forms caused trouble.

Each dog 3a or 3b is beveled with relation to the direction of reciprocation of the piston 2, at its tip and along one face, as indicated at 30 in FIGURES 1 and 3. When the dogs are projected and locked in projected position these beveled surfaces will engage complementally beveled surfaces 14a and 14b outwardly of the respective ends of the cylinder bore 10, and so will lock the piston wherein the dogs are mounted, with relation to the cylinder wherein the piston slides. The bevels are of such slope with relation to the direction of reciprocation that pressure on the piston in opposition to the lock afforded by the shoulder and the beveled dog engaging it, will tend to urge the dog radially inwardly into its retracted position unless it is locked and held positively projected.

The dog projecting and locking means is similar to that disclosed in the Bakke patent. It includes toggle links 4 the outer end of each whereof is operatively engaged with its respective dog 3a or 3b, and each toggle link is fulcrumed at its inner end upon a fulcrum member 5 a skirt 50 whereof is guided within a bore 20a or 20b disposed axially within the piston 2. A servo piston 53 formed on the fulcrum member 5 slides axially within a servo cylinder 25a or 25b in the piston 2. Each servo cylinder is vented at 22 to the opposite face of the piston 2. Spring means 51 urge the fulcrum members 5 axially outwardly or away from the center of the piston 2. When the dogs are retracted, as are the dogs 3a in FIGURE 1, the toggle links 4 are not in alignment with the direction of the dogs' movements, and the spring pressure of the spring 51 cannot move the dogs outwardly, for their outer end or tip rides within the bore 10. However, when the dogs are disposed axially outwardly beyond the beveled shoulders 14a or 14b, as are the dogs 3b at the left in FIGURE 1, the spring pressure 51 acts through the fulcrum member 5 to move the toggle links 4 into alignment with the dogs and forces the dogs, 3b in this instance, outwardly beyond

the bore 10 and into engagement with the shoulder 14b. The toggle links 4, stopped by abutting the transverse face 54 of fulcrum member 5, remain in alignment and engaged with the dogs, thus to hold the dogs in locking position.

To effect movement of the piston 2 within the cylinder 1 from the locked position at the left in FIGURE 1 to the right and to a second locked position at the opposite end, it is only necessary to apply pressure at the port 13b, venting the opposite end of the cylinder through port 13a. Application of pressure at 13b applies pressure to the exposed end face 54 of the fulcrum member 5, which urges its servo piston 53 within the servo cylinder to the right, in opposition to spring 51, the right end of servo cylinder 25a being vented to the opposite end of the bore 10 by means of the vent 22. The same hydraulic pressure admitted at 13b is also applied to the left end of the piston 2, and immediately upon movement of the fulcrum member 5 to the right, the pressure upon the left end of the piston 2 urges the dogs 3b, is still projected, against the bevel of their shoulders 14b, and causes inward retractive movement of the dogs, so that now the piston, being free of any lock, is caused to traverse the bore 10 to the right. Eventually the piston will move to the extreme right end of the cylinder 1 and the compression on the right hand spring 51, assisted if need be by hydraulic pressure admitted behind the servo piston 5 through the vent passage 22, will now cause rightward movement of the right fulcrum member 5, and the links 4 at this end will move the dogs 3a outwardly, and the links will move into alignment with them. Thereby the piston 2 will be locked by engagement of the dogs 3a with the shoulder 14a, which lock will be maintained, despite cessation of hydraulic pressure, until application of pressure through the port 13a to the right hand end of the cylinder.

As has been indicated above, the dogs, if permitted to move other than directly radially, may not engage or disengage properly and evenly. Accordingly, a guidance element 6 (see FIGURE 3) is provided, fitted upon the fulcrum member 5 by means such as the stem 52 projecting from an end thereof and passing through an aperture 60 in the element 6, and secured in place by a nut 55. This guidance element 6 is formed with planar guide faces 61 which closely receive and guide the planar faces 31 of a radial stem 32 of each dog member 3a or 3b. The stems 32 also pass through radial bores 26 in the piston 2, leading to the groove 23. Due to the close fit of the faces 31 between the faces 61, the dogs are permitted only radial movement. They cannot move circumferentially, nor can they rotate to cock or stick. As a result, the dog segments at any given end move precisely radially into and from locked position.

Similar guidance can be afforded the locking dog members even though they more nearly resemble or are actuated as are the dogs of the Bakke patent. Such dogs are shown in FIGURES 4, 5 and 6, and are designated, to distinguish them, 3c. These dogs are not directly engaged by the toggle lever members indicated at 4c, but their ends are beveled as indicated at 33, and these beveled ends are urged outwardly by the projective movement of a complementally beveled element 42 which engages the opposite ends of two adjoining segments 3c, and which is itself urged outwardly by projective rotation of the toggle levers 4c. Similarly, upon collapse inwardly of the toggle levers 4c the elements 42 may move inwardly, and are urged inwardly by the inward pressure on the dogs communicated through the bevels 33 to the complemental bevels of the elements 42. Guidance of the dogs 3c in this instance is afforded by radially directed pins 34 supported in the piston 2 and engaging in a complemental groove 35 in the dog 3c (see FIGURE 6).

I claim as my invention:

1. In combination with a pair of members guided for

relative reciprocative movement, means to lock said members against relative reciprocation in a given position, said means including a circumferentially directed shoulder on one such member beveled relative to the direction of reciprocation, a segmental locking dog carried by the other such member for radial movement and beveled complementally to said shoulder for locking engagement therewith or disengagement therefrom, toggle link means separate from said locking dog, movable into radial alignment with said locking dog and from such alignment, and operatively engaged therewith to effect the locking dog's radial movement or into locking engagement to allow its opposite movement, and means engaging said locking dog to restrain the same against movement other than direct radial movement.

2. In combination with a cylinder, a piston slidably fitted therein for reciprocation to and from a given locked position, means to effect such relative reciprocative movement between the piston and its cylinder, a locking device including a shoulder on one of the relatively reciprocable members beveled relative to the direction of reciprocation, a plurality of part-segmental locking dogs supported in the other such member and beveled for interengagement with the beveled shoulder, means guiding each such dog for radial movement only in its mounting member, for engagement with or disengagement from said shoulder, toggle links separate from the dogs and rockably mounted in the dog-mounting member, and each bearing at one end upon the corresponding dog, a fulcrum member mounted in the same member for axial reciprocative movement, and operatively engaged with the other end of said links to shift them into alignment with said dogs and so to move the latter into position wherein they engage the shoulder, or to shift from such alignment for movement of the dogs from shoulder-engaging position; spring means urging the toggle links towards such aligned position, and means to shift said fulcrum member at will in opposition to said spring means into position for movement of the locking dogs from shoulder-engaging position by reaction between the beveled surfaces.

3. The combination of claim 2, wherein the dog-guiding means include a radially directed non-circular stem projecting from a midpoint of each segmental dog, and a complementally shaped radial guide for the stem formed in the dog-mounting member.

4. The combination of claim 2, wherein the operative engagement between the dogs and the toggle links include actuators oppositely beveled at their tips, the segmental dogs being complementally beveled at their ends for projective movement by movement of the actuators in one sense or retractive movement by movement of the actuators in the opposite sense, and wherein the dog-guiding means includes a radially directed key interengaged between each segment and its supporting member.

5. In combination with a cylinder, a piston slidably fitted therein for reciprocation to and from a given locked position, means to effect such relative reciprocative movement between the piston and its cylinder, a locking device including a shoulder within the cylinder beveled relative to the direction of reciprocation, a plurality of part-segmental locking dogs supported in the piston and beveled complementally to and for locking engagement with the beveled shoulder, means guiding each dog in its piston for radial projective and retractive movement only, toggle links rockably mounted in the piston, and separate from but bearing at their outer ends upon the respective dogs, a fulcrum member axially reciprocative in the piston and operatively engaged with the inner ends of said toggle links to shift them outwardly and into alignment with said dogs and so to project the dogs into locked shoulder-engaging position, or inwardly for retraction of the dogs, spring means urging the toggle links towards such projected position, and means to shift said fulcrum member at will in opposition to said spring means into

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position for retractive movement of the dogs by reaction between the beveled surfaces.

6. The combination of claim 5, including means for admission of pressure fluid to and its relief from the respective ends of the cylinder, thereby to effect reciprocal movement of the piston within the cylinder, and a servo cylinder in the piston proper and a servo piston mounting the fulcrum member and exposed to the pressure fluid admitted to the cylinder proper, and vented to the opposite end thereof, constituting the means to shift the fulcrum member.

7. The combination of claim 6, wherein the cylinder is bevel-shouldered at each limit of the piston's travel,

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and including two sets of dogs, toggle links, and fulcrum members at the respective faces of the piston proper, and a servo piston and servo cylinder arranged at each piston face for shifting the fulcrum member at the corresponding face.

References Cited in the file of this patent

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	2,744,501	Chace et al.	May 8, 1956
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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,997,985

August 29, 1961

Richard A. Chace

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, lines 12 and 13, for "or into locking engagement to allow" read -- into locking engagement or to allow --.

Signed and sealed this 13th day of March 1962.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

DAVID L. LADD

Commissioner of Patents