

Sept. 20, 1971

D. W. SESSODY

3,605,569

FLUID FORCE APPLYING DEVICE

Filed Jan. 6, 1970

2 Sheets-Sheet 1

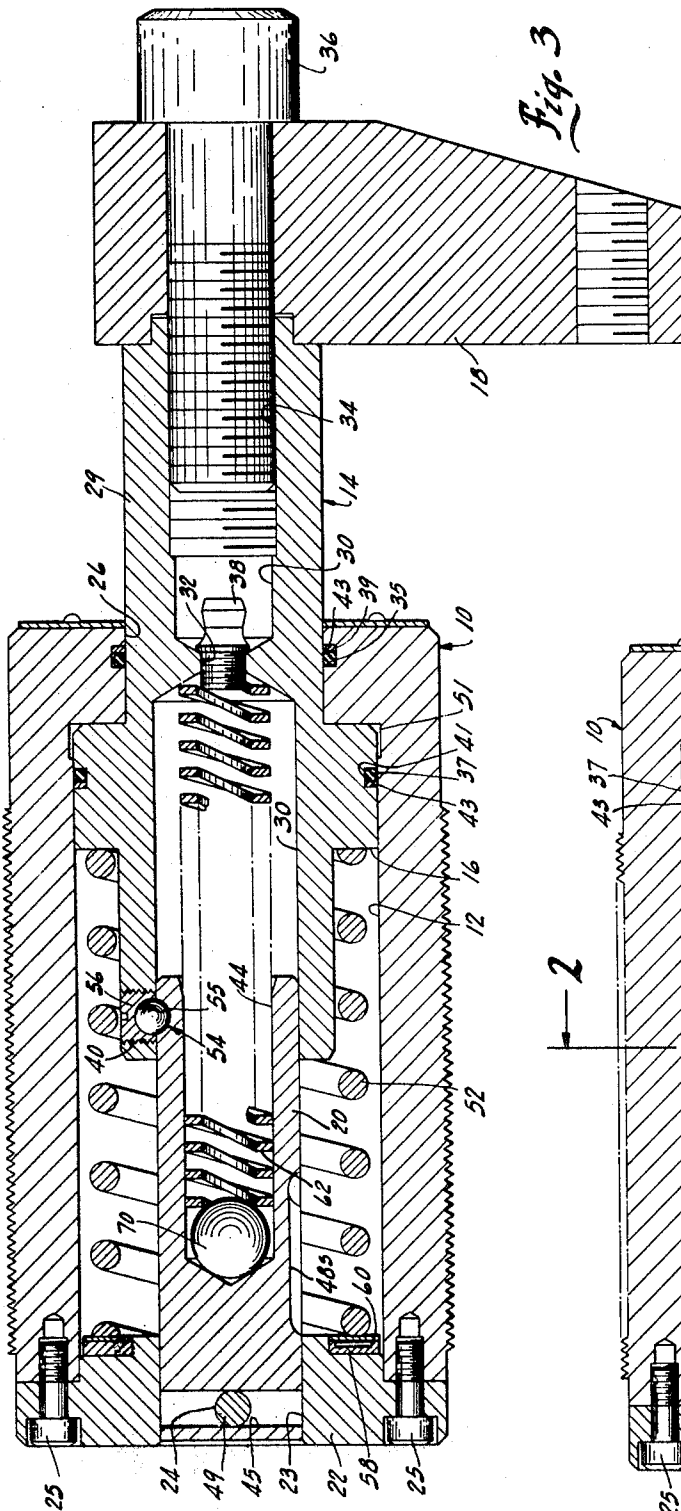


Fig. 3

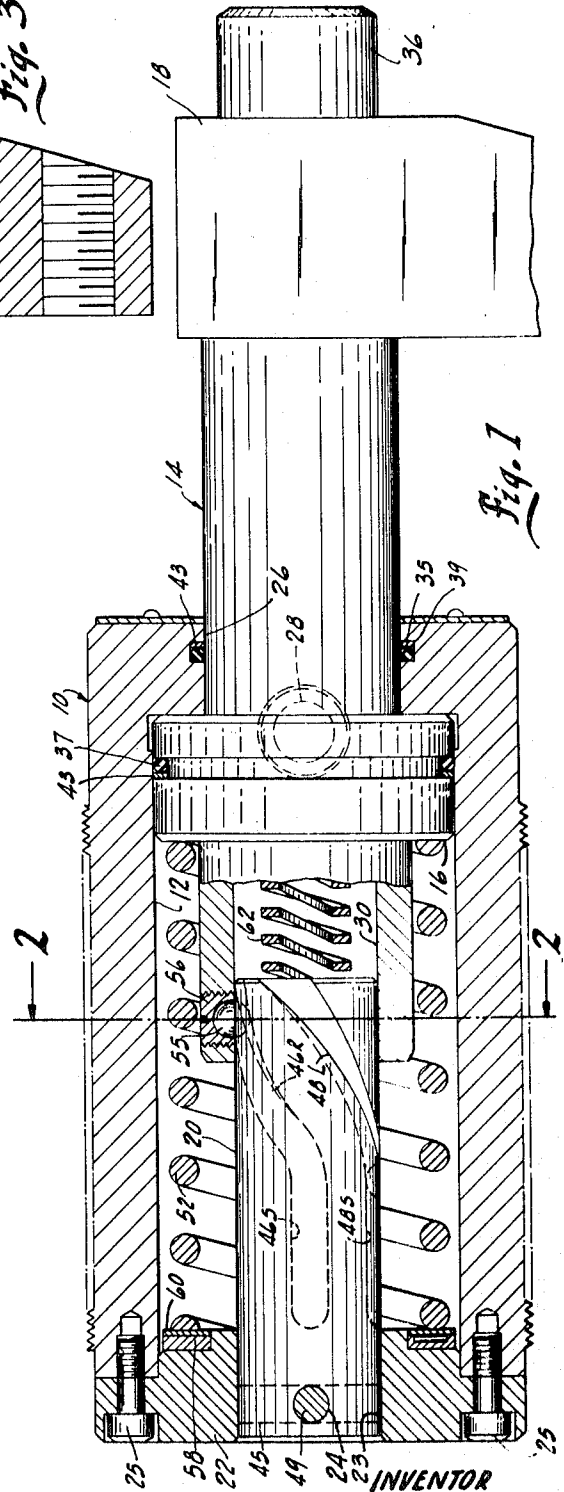


Fig. 1

BY: DONALD W. SESSODY:

James E. Nilles
ATTORNEY

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2 Sheets-Sheet 2

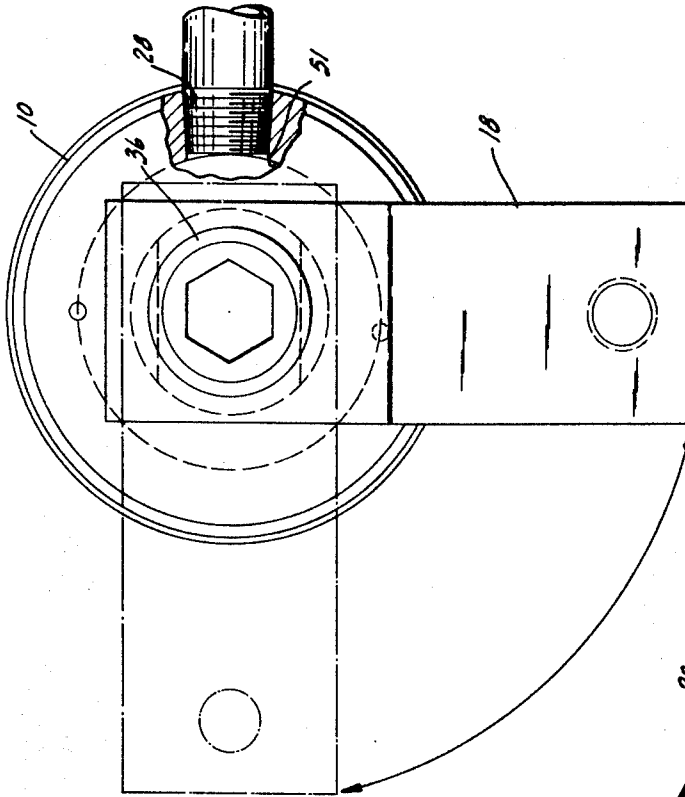


Fig. 4

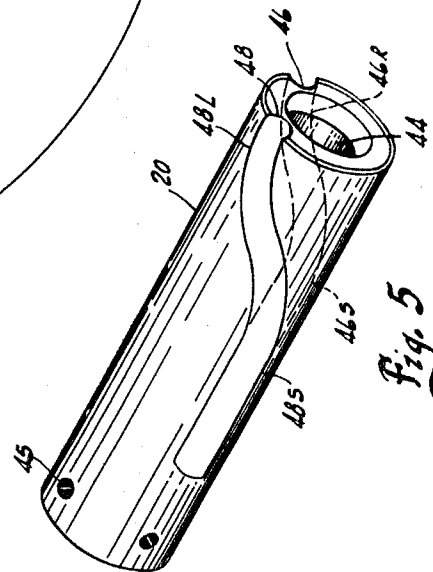


Fig. 5

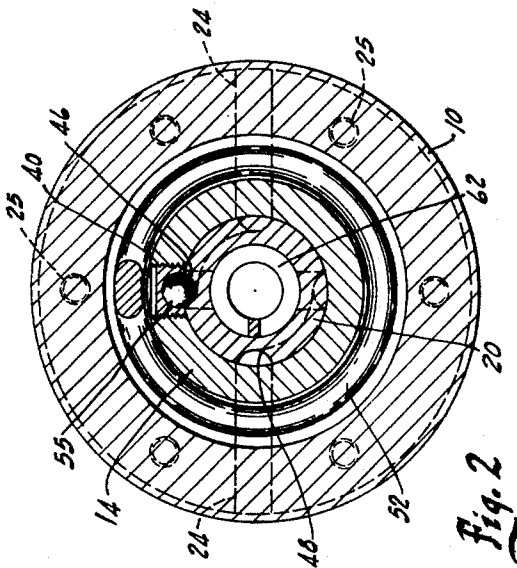


Fig. 2

INVENTOR :

BY : DONALD W. SESSODY
James E. Nilles

ATTORNEY

1

3,605,569

FLUID FORCE APPLYING DEVICE

Donald W. Sessody, Milwaukee, Wis., assignor to Allied Power Industries, Inc., Milwaukee, Wis.

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8 Claims

ABSTRACT OF THE DISCLOSURE

A force applying device having a piston and cylinder assembly, a guide member positioned in the cylinder and slidably engageable with a bore provided in the piston. A pair of non-intersecting cam slots provided in one of said guide member and piston assembly and a cam follower provided in the other of said guide member and piston assembly, the cam follower being selectively engageable with one of said cam slots to guide said piston assembly in its movement in said cylinder, and a first return spring provided between said cylinder and piston assembly and a second return spring provided between said guide member and said piston assembly. The first and second springs are seated on thrust bearings provided at one end of each spring.

BACKGROUND OF THE INVENTION

Force applying devices of the type contemplated herein are shown in copending application Ser. No. 818,692 filed Apr. 23, 1969, and now Pat. No. 3,572,216. These devices include a piston and cylinder assembly and a guide member positioned to engage and guide the piston assembly. The guide member is provided with a cam slot, a portion of which is in the form of an arcuate spiral around the outer periphery of the guide member and another portion extends linearly in parallel relation to the axis of the guide member. A cam follower is provided in the piston assembly to engage the cam slot and guide the piston assembly in its movement in the cylinder. Where a spring is used to provide the return motion of the piston assembly, it has been found that the spring tends to retard the pivotal motion of the piston due to the engagement of both ends of the spring with the fixed surfaces of the piston and cylinder. Generally, these types of devices are provided with a single cam slot producing a single direction of motion for the piston assembly. There is no provision for changing the initial position of the cam slot to achieve a different rotary movement.

SUMMARY OF THE INVENTION

The force applying device of this invention can be readily adapted to provide rotary motion in either a right hand or a left hand direction. This is accomplished by providing a pair of cam slots in one of the guide member and piston assembly and a cam follower in the other of the guide member and piston assembly which can be selectively set to engage one or the other of the cam slots depending on the direction of rotary motion required for the clamp arm. A spring return is provided in this device with a thrust bearing provided at one end of the spring to allow the spring either to rotate freely with the piston assembly or to allow the piston assembly to rotate freely with respect to the spring. A second spring is provided between the guide member and the piston assembly and is seated on a ball which allows for the free rotation of the spring with respect to the guide member and the piston assembly.

Other advantages of the present invention will become apparent from the following detailed description read in conjunction with the accompanying drawings.

2

THE DRAWINGS

FIG. 1 is a side view partly in section showing the force applying device of this invention;

FIG. 2 is a view taken on line 2—2 of FIG. 1 showing the relation of the piston assembly, cylinder and guide member to each other;

FIG. 3 is a view in section of the device showing the spring return system;

FIG. 4 is a top view of the force applying device; and
FIG. 5 is a perspective view of the guide member.

DESCRIPTION OF THE INVENTION

The force applying device of the present invention as seen in FIG. 1 of the drawing generally includes a housing or body 10 having a bore 12 and a piston assembly 14 mounted for reciprocal movement within the bore 12. A clamp arm 18 is secured to the piston assembly 14 and a guide member 20 is provided within the bore 12 of the housing 10 to produce rotary and linear movement of the piston assembly 14 on axial movement of the piston assembly 14 within the bore 12 of the housing 10. The housing 10 is generally fixedly mounted on a work surface and the clamp arm 18 is positioned to rotate over a work piece which is to be clamped to the work surface and then moved linearly into engagement with the work piece.

More particularly, the housing 10 includes at one end of the bore 12 a reduced diameter section 26 having an internal diameter substantially equal to the diameter of a portion of the piston assembly 14. The other end of the bore 12 is closed by means of an end plate 22 secured to the housing 10 by means of bolts 25 and having a central aperture 23 and a cross bore 24. Pressurized fluid is admitted into the housing 10 through a fluid inlet port 28 provided just below the reduced diameter section 26.

The piston assembly 14 includes a piston head 16 and a piston or ram 29 which extends outwardly through the reduced diameter section 26. An axially extending bore 30 is provided in the piston assembly 14 and includes a reduced diameter section 32 which is threaded to receive a grease fitting 38. A threaded section 34 is provided at one end of the bore 30 and a small threaded port 40 is provided in the wall of the piston at the other end of the bore 30. The piston assembly 14 is positioned in the bore 12 of the housing with the piston head 16 in sliding engagement with the bore 12 and the ram 29 in sliding engagement with the reduced diameter section 26.

Means are provided for sealing the piston head 16 and the ram 29 to the housing to form a pressure chamber in the bore 12. Such means is in the form of a pair of O-ring seals 35 and 37 positioned in grooves 39 and 41, respectively. Washers 43 are positioned in the grooves to hold the O-ring seals in position.

The guide member 20 includes a central bore 44, a pair of cross bores 45 and a pair of cam slots 46 and 48. Each cam slot has an upper arcuate portion 46r and 48r, respectively, and a linear terminal portion 46s and 48s, respectively. The guide member 20 is positioned in the central aperture 23 of the end plate 22 and projects into the bore 12 of the housing 10 and the bore 30 in the piston assembly 14. The guide member is retained therein by means of a roll pin 49 positioned in the cross bore 24 in the end plate and one of the cross bores 45 in the guide member 20.

The piston assembly 14 is reciprocated in the central bore 12 of the housing by means of pressurized fluid admitted through the port 28 and a return spring 52. The pressurized fluid is admitted into the pressure chamber formed by the seals 35 and 37. An enlarged diameter section 51 can be provided in the central bore 12 to aid in distributing the fluid around the piston head. The piston assembly 14 is returned by means of the spring 52 positioned between the end plate and the piston head 16.

3

The arm 18 is secured to the piston assembly 14 by means of a bolt 36 threadedly received in the threaded section 34 of the bore 30. The arm 18 extends outwardly transversely to the direction of motion of the piston assembly 14.

Means are provided for controlling or guiding the motion of the piston assembly 14 as the piston assembly 14 is reciprocally moved within the bore 12 of the housing 10. Such means includes a cam follower 54 which is positioned in one of the cam slots 46 or 48. The cam follower 54 includes a ball 55 positioned in a ball guide 56 threadedly received in the port 40. The ball is positioned in one or the other of the cam slots 46 and 48 to initially rotate the piston assembly 14 through a predetermined arc as the assembly moves axially through a portion of the bore 12 and to finally move the piston assembly in a straight line in the terminal portion of its movement in the housing 10.

The cam follower 54 can be selectively positioned to operatively engage one or the other of the cam slots 46 or 48 depending on the direction of rotation required for the arm 18. Referring to FIGS. 2 and 4, the ball 55 is shown positioned in the cam slot 46. When the piston assembly 14 is moved in the bore 12, the arm will rotate clockwise as seen in FIG. 4 as the ball 55 moves through the arcuate portion 46r of cam slot 46. If the ball 55 is positioned in cam slot 48, the cam 18 will rotate counter-clockwise as the bore initially moves through the arcuate cam slot 48r. It should be noted that this adjustment can be made by either rotating the guide member or the piston assembly 14 depending on the desired initial position for the arm 18.

Means are provided for preventing the spring 52 from retarding the rotary motion of the piston assembly 14. Such means is in the form of a thrust bearing 58 provided on the inner surface of the end plate 22. A thrust washer 60 is positioned between the thrust bearing 58 and the spring 52 to allow the spring 52 to rotate freely as the piston assembly 14 rotates in the bore 12 in the housing 10.

Additional return force can be provided for the piston assembly 14 by means of a second spring 62 positioned within the bore 44 of the guide member and the bore 30 in the piston assembly 14. The spring 62 is allowed to rotate freely within the piston assembly 14 by means of a ball 70 positioned at the inner end of the bore 44.

I claim:

1. A force applying device comprising
 - a housing having a cylindrical bore,
 - a piston assembly mounted for reciprocal motion in said bore and extending outwardly therefrom,
 - means including a return spring for moving said piston assembly in said bore,
 - a stationary guide member mounted within said housing and having a pair of non-intersecting cam slots, each of said cam slots including an arcuate portion to provide opposite rotary motion of said piston assembly, and said piston assembly including a cam follower positioned for selective engagement in one of said cam slots to produce rotary motion of said piston assembly through a portion of the axial movement of the piston assembly in the bore of said housing,

4

and means for allowing said spring to rotate freely on rotary motion of said piston assembly.

2. The device according to claim 1 wherein said means for allowing said spring to move freely includes a thrust bearing.

3. The device according to claim 1 including a second return spring provided between said piston assembly and said guide means.

4. A mechanical force applying device comprising

- a housing adapted to be mounted on a work surface and having a cylindrical bore,
- an end plate at one end of said bore and having a central aperture,

- a stationary cylindrical guide member positioned in said aperture and extending into said bore,
- a piston assembly having a first portion slidably confined within said bore in said body and a second portion operatively associated with said guide member,

- a pair of non-intersecting cam slots in one of said piston assembly and guide member,

- each of said cam slots includes an arcuate portion and a linear portion, each of said arcuate portions providing an opposite rotary motion of said piston assembly,

- a cam follower carried by the other of said piston assembly and guide member and being selectively engageable with one of said cam slots to guide said piston in its movement,

- and means for moving said piston assembly within said bore.

5. The device according to claim 4 wherein said moving means includes a spring positioned between said end plate and said piston.

6. The device according to claim 5 including means positioned between said end plate and said spring for allowing the spring to move freely with respect to said housing.

7. The device according to claim 6 wherein said free movement means comprises a thrust bearing.

8. The device according to claim 4 including a second spring positioned between said guide member and said piston assembly.

References Cited

UNITED STATES PATENTS

Re. 22,424	1/1944	Herzmark	92—33X
1,228,496	6/1917	Turner	92—31
1,932,915	10/1933	Taylor	92—31X
2,705,592	4/1955	Reiser	92—33X
2,889,816	6/1959	Loecy, Jr.	92—31X
2,942,580	6/1960	Siravo	92—31
3,046,802	7/1962	Cupedo	92—31X
3,357,182	12/1967	Jacoby	92—31X
3,375,760	4/1968	Taplin	92—100X
3,457,838	7/1969	Rowe	92—33
3,523,564	8/1970	Jonssen	92—31X

MARTIN P. SCHWADRON, Primary Examiner

I. C. COHEN, Assistant Examiner

U.S. Cl. X.R.

92—59; 74—89.14

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,605,569 Dated September 20, 1971
Inventor(s) D. W. Sessody

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In column 1 in the first line below the title the word
"Allied" should be ---Applied---.

Signed and sealed this 28th day of March 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents