

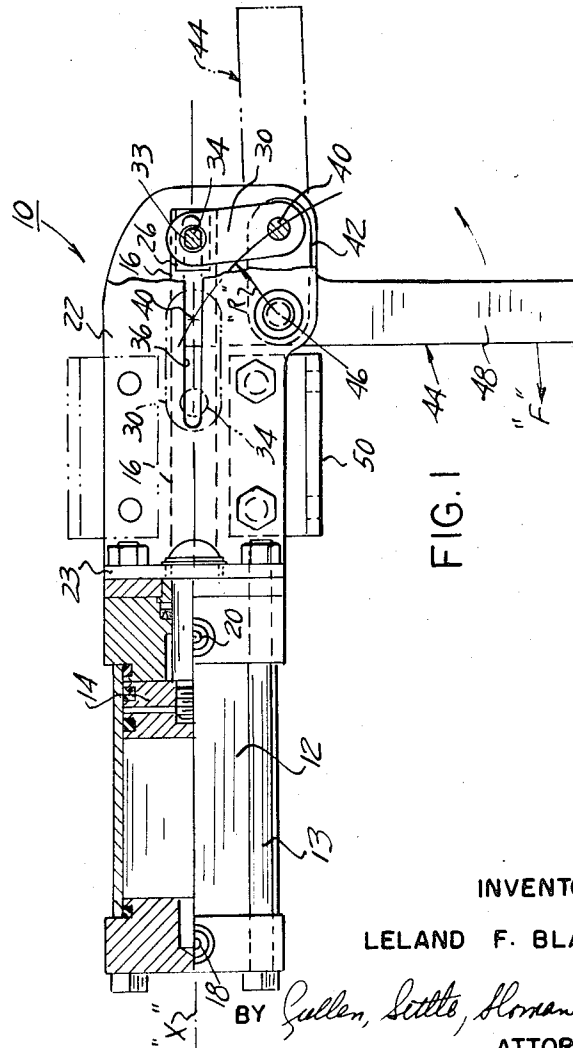
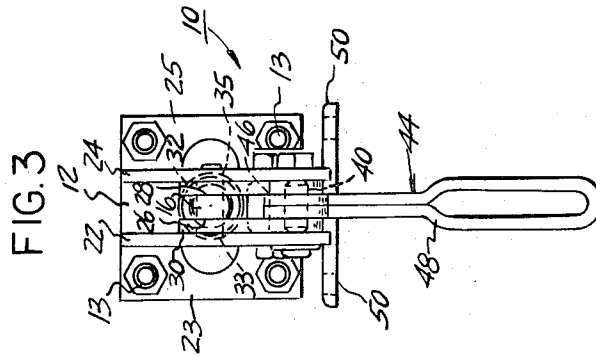
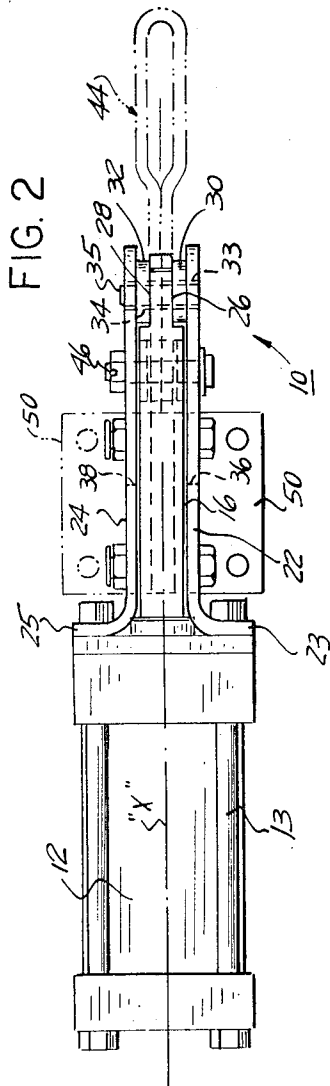
Nov. 7, 1972

L. F. BLATT

3,702,185

CYLINDER OPERATED POWER CLAMP

Filed Dec. 11, 1970



INVENTOR
LELAND F. BLATT

BY *Gullen, Little, Roman & Cantor*
ATTORNEYS

1

3,702,185

CYLINDER OPERATED POWER CLAMP

Leland F. Blatt, 790 Shoreham Road,

Grosse Pointe Woods, Mich. 48236

Filed Dec. 11, 1970, Ser. No. 97,165

Int. Cl. B23q 3/03; B25b 1/04

U.S. Cl. 269—32

1 Claim

ABSTRACT OF THE DISCLOSURE

A work clamp or hold down clamp used for holding workpieces against a corresponding surface which is power operated by a fluid motor having a piston and piston rod; the clamp comprises a pivot arm which is pivoted within an extension of the fluid motor and the outer end of the piston rod of the fluid motor is attached to one end of a link or swing lever and the other end of the swing lever is attached to the pivot arm; the pivotal connection to the swing lever or link is by means of a pin which extends into a longitudinal slot provided in the extension of the fluid motor and which is disposed along the center line of the fluid motor; upon reciprocation of the piston of the fluid motor the pin which connects the piston rod to the swing lever is moved longitudinally in the slot causing the swing lever to follow and thereby pivot the clamp arm around its fixed pivot from release into clamping position or vice-versa.

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to fluid motor operated power clamps, and more in particular to a hydraulic or pneumatically operated fluid motor type power clamp having a reciprocable piston and piston rod and a mechanical linkage for effecting operative pivotal movement of the clamping arm.

It is the primary object of the present invention to provide an efficient fast acting fluid motor operated power clamp wherein the rectilinear reciprocable motion of a piston and a linkage associated therewith is transmitted to a pivotally mounted clamp mechanism having an improved high mechanical advantage.

It is another object of the present invention to provide a novel linkage and guide arrangement between an axially movable piston and piston rod assembly and a pivotally mounted clamp arm whereby selective application of fluid pressure through a respective port at opposite ends of the cylinder effect opening and closing movement of the clamp arm around a fixed pivot.

A further object of the invention is to provide an improved power clamp having a considerably simplified but highly reliable operating linkage.

Power clamps are known of the type in which a fluid motor actuated reciprocating movement is adapted to be translated into a swinging movement of a clamp arm attached by an additional linkage or other force transmitting means to the end of the piston rod of the fluid motor. Normally, in retracted position of the fluid motor, the clamp is in released position, that is, the clamp arm is removed from the work supporting surface and by means of fluid pressure the clamp arm is pivotally moved into operating, i.e., clamping position to clamp a workpiece to a work supporting surface, and securely hold the work-

2

piece thereagainst by means of fluid pressure in the fluid motor.

Various guide and linkage means have been proposed heretofore to correctly translate reciprocating movement of a piston and piston rod to correct swinging movement of a clamp arm into or out of clamping position, seeking to obtain the highest mechanical advantage which can be utilized within the power stroke of the fluid cylinder. All of these known mechanisms, more or less, include complex designs of various mechanical components at high manufacturing and assembly cost.

The present invention provides a highly simplified yet very effective linkage and guide arrangement for the purpose of proper actuation of the clamp arm of a power clamp and which is fast acting, accurate and has a high mechanical advantage obtained by a simplified mechanism and maximum clamping power by reduction in the number of components liable to power losses due to friction.

The present improved, simplified power clamp mechanism provides a considerable reduction in manufacturing expense, assembly time and service.

Particular novel features as well as technical advantages of the present improved power clamp mechanism will be described and particularly pointed out by way of the following detailed description with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of the present improved power clamp, clamp arm and linkage mechanism with portions thereof shown in cross-section for clarity;

FIG. 2 is a top plan view of the device shown in FIG. 1; and

FIG. 3 is a right hand end view of the power clamp shown in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

With reference to the drawings, the present improved power clamp assembly 10 is actuated by means of a fluid cylinder 12 having a piston 14 therein which is attached to a piston rod 16. The cylinder 12 has respective opposite rear and front fluid inlets 18 and 20 which, as is known practice, are suitably connected by conduits (not shown) to a source of fluid under pressure (not shown), as is known in fluid motor arrangements of this kind. It should be mentioned at this time that the particular fluid motor construction for actuation of the power clamp 10 is unimportant and does not form a part of the present invention. The fluid motor 12 may be hydraulic or pneumatic or, conversely, a mechanical reciprocating device may be utilized to actuate the power clamp 10 by reciprocation of the rod 16, as will be understood.

Attached to the front end of the power cylinder 12 are a pair of opposite parallel, identical side plates 22 and 24, respectively, which extend forwardly from the power cylinder 12. Each of the side plates 22 and 24 is of L-shaped configuration each providing a 90° oriented flange 23 and 25, respectively, at their ends which extend away from each other and are in abutment against the front cover of the power cylinder 12 for securement thereto by means of cylinder bolts 13.

The opposite side plates 22 and 24 are spaced an equal distance to opposite sides of the longitudinal center line

3

"X" of the power cylinder 12 and clamp assembly 10. The piston rod 16 extends longitudinally between the side plates and terminates shortly adjacent the front end of the side plates.

As more particularly seen in FIGS. 2 and 3, the front end of the piston rod 16 is provided with opposite flats 26 and 28, respectively, in parallel aligned relation to the side plates 22 and 24.

The opposite flats 26-28 at the front end of the piston rod 16 are adapted to extend and be retained between opposite identical link members 30 and 32 respectively disposed in abutting relationship between the flats of the piston rod and the inner sides of the side plates 22 and 24 respectively. The upper end of the links 30-32 are pivotally connected to the front end of the piston rod 16 by means of a pivot pin 34. The opposite outer ends of the pivot pin 34 are axially flattened to comprise cam portions 33 and 35, respectively, for sliding retainment within opposite parallel longitudinal slots 36 and 38 provided in each of the side plates 22 and 24. Thus, the flat configuration of the cam portions 33 and 35 retained within the slots 36-38 prevent the pivot pin 34 from rotating.

The opposite slots 36 and 38 extend a substantial distance lengthwise towards the power cylinder 12 in coaxial aligned relationship with the center axis "X" of the power clamp assembly.

Each of the other ends of the links 30-32 is pivotally connected by means of a pivot pin 40 to the end of the crank portion 42 of a clamp arm 44 disposed between the opposite side plates 22-24 at the lower front end thereof. The clamp arm 44 is fixedly pivotally mounted by means of a fixed pivot pin assembly 46 between the opposite side plates 22 and 24. The clamp arm 44 has an extended clamping portion 48 of a length determined by the location of the power clamp assembly 10 from the work piece clamping area. It will be understood that any work holding device (not shown) of required shape may be attached to the clamping portion 48 for clamping a similarly shaped work piece to a work supporting surface (not shown), but as for instance disclosed in applicant's earlier Pat. No. 3,116,058.

The power clamp assembly 10 is adapted to be mounted to a support surface (not shown) by means of a mounting bracket 50 which, as is indicated in FIG. 1, can be mounted in alternate opposite positions as desired.

In the drawings, the clamping position of the clamp arm 44 is shown in solid lines and the release position of the clamp arm 44 is superimposed on the figures in dot-and-dash lines, for illustration.

It shall be further understood that, instead of the L-shaped clamp arm 44 having a short leg 42 and a longer clamping leg 48, a straight clamp arm can be used having one end attached to the fixed pivot pin 46 and the links 30-32 being attached at a point along the straight clamp arm corresponding to the distance between the pivot pins 40 and 46 in FIG. 1.

Similarly, the L-shaped clamp arm 44 could be reversed end-by-end if desired, that is, the outer end of the short leg portion 42 could be attached to the fixed pivot pin 46 and the junction of the short leg 42 with the clamping leg 48 could be pivotally connected to the pivot pin 40 of the links 30-32, for increased work clamping distance.

As is common practice, the bearing surfaces around the pivot pins 34, 40 and 46 are wear hardened or could be provided with suitable bushings and lubricated if desired. The same holds true for the bearing surfaces of the slots 36-38 and the flattened follower ends 33-35 of the pivot pin 34.

In operation of the present improved power clamp assembly 10, in the inoperative position of the device, the piston 14 of the power cylinder 12 will be in the retracted position against the outer end cap. In this position, the links 30-32 will be rearwardly and upwardly retracted into the position shown in dot-and-dash lines with the flat-

4

tened cam follower portions 33-35 of the pivot pin 34 being disposed in the rear end of the slots 36-38. In this position, the links 30-32 are located in substantially horizontal position along the slots 36-38 in alignment with the center line "X" of the power clamp. The clamp arm 44 is swung upwardly in a horizontal position as shown in dot-and-dash lines so that the short leg 42 is disposed vertically, as shown, having the axis of its pivot pin 40 being disposed in vertical planar alignment with the axis of the fixed pivot pin 46, and above thereof.

Upon work actuation of the power clamp assembly 10 fluid pressure is supplied to the rear inlet port 18 of the power cylinder 12, causing the piston 14 to be moved forwardly, whereby the piston rod 16 displaces the flattened cam portions 33-35 of the pivot pin 34 forwardly within the slots 36-38, to move the pivot pin 34 from the position shown in dot-and-dash lines in the rear of the slot 36-38 to the front of the slots 36-38, as shown in solid lines in FIG. 1. This causes the links 30-32 to be pivoted forwardly and downwardly, thereby swinging the pivot pin 40 around the fixed pivot 46 along the radius indicated by the arrow "R" in FIG. 1, into the position shown in solid lines, placing the axis of the pivot pin 40 into horizontal planar alignment with the axis of the fixed pivot 46. By this action of the links 30-32, the clamping portion 48 of the clamp arm 44 is swung from its horizontal inactive position into vertical clamping position relative to the axis "X" of the power clamp assembly, as shown in solid lines in FIG. 1 and FIG. 2. In this position, and as long as fluid pressure is maintained behind the piston 14, the clamping portion 48 of the clamp arm 44, exerts a force in the direction indicated by the arrow "F" against a work piece or other member which is to be clamped (not shown).

Thus, it will be obvious from the foregoing description and attached drawings, that the present invention provides a power clamp of uniquely simplified structure, yet maximum holding power at highest mechanical advantage can be obtained within the dimensional limits of the assembly.

As described and shown, the simplified structure is composed of a few inexpensively manufactured components (mostly stampings); some of which are identical to further facilitate and economize manufacture and assembly.

The flattened outer ends of the pivot pin 34 provide an increased cam area within their associated slot for maximum support and transmission of clamping force by simultaneously preventing pitting or roughening of the slot surfaces, which is likely to be caused by the use of round slot pins.

The present clamp mechanism provides accurate center line guidance for the piston rod during reciprocating movement without the use of auxiliary piston or block type guiding members retained within tubular guides or grooves, as in the known devices.

Although the present invention has been described in connection with a preferred embodiment, it will be obvious that various modifications in arrangement and details may be made by one skilled in the art to which the invention pertains. Accordingly, it is to be understood that the above description is illustrative only of a single embodiment of this invention and the invention is not to be interpreted as strictly limited to such embodiment.

I claim:

1. In a fluid power operated clamp assembly including a cylinder, a piston supported within said cylinder for reciprocation therein and a piston rod connected to said piston; a bifurcated housing attached to said cylinder, said housing being open at the top, bottom and front and comprised essentially of opposed spaced side walls with their ends out turned and secured to said cylinder; said rod extending into said bifurcated housing between said opposed side walls; a clamp arm pivotally secured within said bifurcated housing between said opposed side walls

5

on a fixed pivot; means pivotally connecting said clamp arm to said piston rod; said side walls having a pair of parallel opposed longitudinal slots; said means including a pair of links at their one ends pivotally connected to said clamp arm and at their other ends pivotally connected to said piston rod; said last named pivotal connection comprising a pin having opposed flat top and bottom follower portions slideably and nonrotatively disposed within said slots for longitudinal translating movement therein so that upon actuation of said cylinder said piston rod causes longitudinal movement of said links along said slots by means of said follower portions to thereby rotate the pivotal connection of said links to said clamp arm along a fixed radius and said clamp arm around said fixed pivot to move said clamp arm from a release position into a clamping position; said links moving from a

6

horizontal retracted position to a substantially upright position.

References Cited

UNITED STATES PATENTS

5	3,116,058	12/1963	Blatt	269—31
	3,381,954	5/1968	Blatt	269—32
	3,170,214	2/1965	Cochrane	269—94 X
	3,116,058	12/1963	Blatt	269—31

10 TRAVIS S. McGEHEE, Primary Examiner
N. ABRAMS, Assistant Examiner

U.S. Cl. X.R.

15 269—35, 94