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FLUID PRESSURE OPERATED MULTIPLE PISTON WORK
DEVICES OF THE NONROTATING PISTON TYPE
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FLUID PRESSURE OPERATED MULTIPLE PISTON WORK DEVICES OF THE NONROTATING PISTON TYPE

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4 Claims

ABSTRACT OF THE DISCLOSURE

A fluid pressure operated multiple work device of the nonrotating piston type having means for assembling the dividing wall by holding the piston non-rotative relative to the dividing wall to ring in the retainer band to hold the dividing wall axially fast with respect to the cylinder.

My invention relates to improvements in fluid pressure-operated multiple piston work devices of the nonrotating piston type.

In the development of such work devices the dividing wall between adjacent pistons was and in some cases still is provided by boring or otherwise machining the cylinder from its opposite ends. Because of the large amount of machining required large bore cylinder means are not made this way. Moreover, this method requires fastening means at the rear of the cylinder to provide the rear cylinder wall. Such fastening means must be made removable for servicing of seals or for other repairs. There is a weakness and failures occur at the rear of such cylinders because of such removable fastening means. To make a cylinder which is stronger at the rear which can be made with an integral rear wall or one that is welded, a sleeve containing the dividing wall is inserted in the front end of the cylinder. See U.S. Patent 2,661,599. The cylinder bore containing such sleeve must be shouldered and its front portion enlarged in respect to the rear portion of such bore. This greatly weakens the cylinder means at its front because the wall thickness of such front portion is about half that of the rear portion. Failures in the field occur at the front end of such cylinders because of such decreased wall thickness. Because of this and because of the increased costs involved in providing such sleeve, manufacturers of such devices have reverted to removable fastening means for the rear cylinder wall in order to eliminate such sleeves and decreased front wall thickness. My invention provides such work devices which are both strong at the rear in that integral rear cylinder walls may be employed and strong at the front in that such dividing-wall providing front sleeves and concomitant decreased front cylinder wall thicknesses are eliminated.

The principal object of my invention is the provision of the new and improved assembly means and method for assembling the dividing wall between adjacent pistons of such work devices in respect to said cylinder means so that such work devices are both strong at the rear and front ends as mentioned.

The foregoing object of my invention and its advantages will become apparent during the course of the following description, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an elevational view partly in section of a fluid pressure operated multiple piston work device of the nonrotating piston type embodying my invention;

FIGS. 2 and 3 are front elevational and top plan views of said embodiment; and

FIGS. 4 through 6 are vertical sectional views of said embodiment taken on the lines 4—4 through 6—6 of FIG. 1.

Referring to the drawings in greater detail, 10 designates said embodiment, the structure and function of which are so well known as not to require description except as the same is necessary to understand my invention.

The dividing wall provided in accordance with my invention between adjacent pistons of the dual piston means shown is designated 11. Such piston means, as the term is used herein, is designated 12 and comprises, inter alia, the front and rear pistons mentioned and designated 14 and 16, respectively, and the piston rod 15. The cylinder means in which the piston means 12 operates is designated 18. The nonrotating means for the piston means, in the instance, comprises flats 20 formed on an otherwise cylindrical intermediate section 22 of the piston rod 15 and cooperating flats 24 formed in the front bushing 25. An anti-rotation fastener 26 in the front wall of the cylinder per se designated 27 holds the front bushing 25 from rotating in respect to such cylinder 27 during operation of the work device. In the prior art work devices having front sleeve-provided dividing walls an exterior strengthening pad had to be used to accommodate the head of the fastener 26 and to strengthen the front cylinder wall in the area thereof. Such strengthening pad has been eliminated in accordance with my invention by virtue of the strength at the front portion of the wall of the cylinder 27 by virtue of the thick wall thickness of such portion in relation to the rear portion imparted by the straight bore 28 therein. Such strength at the front of the cylinder 27 eliminates many failures in the field which occur with work devices having front sleeve-provided dividing walls and concomitant decreased wall thicknesses at their front ends. For a two inch diameter cylinder the cylinder wall thickness of the cylinder 27 is 0.12 inch thick whereas the cylinder wall thickness of the cylinder of a sleeve-provided dividing wall type work device is almost half this value, viz 0.062 inch thick. The front bushing 25 is held against movement axially of the cylinder 27 by a retainer band 29 which is rung-in in known manner via the aperture 32 in the cylinder wall for the fastener 26 into an annular groove 30 provided by cooperating annular open slots formed in the front bushing 25 and in the cylinder 27 as shown. The dividing wall 11 is provided with fluid seal means between itself and the bore 28 in the form of O-rings 34 and 36 disposed on opposite sides of the return port 38 therein. The latter is circumferentially aligned with the return port 39 in the cylinder 27. The dividing wall is also provided with fluid seal means in the form of an O-ring 37 between itself and an intermediate cylindrical section 40 of the piston rod 15. The dividing wall 11 is held against movement axially of the cylinder 27 by a retainer band 41 which is rung-in in the manner I have invented via rotary holding means to be described and the return port 39 in the cylinder wall into an annular groove 42 provided by cooperating annular open slots formed in the dividing wall 11 and the cylinder 27 as shown.

The rotary holding assembly means for the dividing wall 11 must be between said dividing wall and the piston means 12 and comprises in the instance a driving dog 44 in the form of a cylindrical rod fastened (as by press fitting and cementing or by the threadably engaging) in and projecting from the rear face of the front piston 14 and a cooperating detent 45 therefor in the form of a blind cylindrical aperture formed in and extending into the front face of the dividing wall. The rotary holding assembly means must be constructed so as not to interfere with the fluid seal means between the dividing wall 11 on the one hand and the piston means 12 and the cylinder means 18 on the other. The front piston 14 is press fitted on to the piston section 40 against a rearwardly facing radial shoulder 46 at the junction of the

piston sections 40, 22 and provides the holding power which holds itself fast in respect to the piston rod 15 when the piston means 12 is relatively rotated in respect to the cylinder means 18. The front piston 14 consequently provides the holding power which, when the means 44, 45 are engaged, holds the dividing wall 11 fast in respect to the piston rod 15 during such relative rotation of the piston means 12 and the cylinder means 18 to ring in the retainer band 41. (Added holding power during assembly between the front piston 14 and the piston rod 15 is provided by the circumferential alignment assembly means 54, 55 to be described.) The latter which is hooked at one end, as at 48, is inserted into the cylinder return port 39 when a holding aperture 49 in the dividing wall is circumferentially aligned with said return port 39 so that such hooked end 48 can be engaged in said aperture 49. Following such engagement the dividing wall 11 is relatively rotated in respect to the cylinder means 18 by engaging said rotary holding assembly means 44, 45 and relatively rotating (clockwise as viewed in FIG. 4 for the dividing wall 11 in respect to the cylinder 27) the piston means 12 in respect to said cylinder means 18 until the aperture 49 and the hooked end 48 engaged therein are along one side of the cylinder return port 39 and the tail end 50 of the retainer band is along the opposite side of said port 39 as shown in FIG. 4.

In the instance where the piston non-rotating means 20, 24 are separate and distinct from said rotary holding assembly means 44, 45 there must be circumferential alignment means between them and the cylinder means 18. In the instance every element that needs to be circumferentially aligned is circumferentially aligned with the alignment line on the cylinder means 18 defined by its longitudinal centerline (through which pass the aperture 32, the return port 39 and the force or pressure port 52). The flats 24 on the front bushing 25 and the flats 20 on the piston rod 15 are so aligned since such alignment line passes midway between and parallel to such flats as can be seen by reference to FIG. 3 and the flats 20 shown therein. The dividing wall 11 is so aligned since the return port 38 therein is circumferentially aligned with the return port 39. Consequently the driving dog 44 and the detent 45 therefor when engaged must be circumferentially aligned in respect to said piston non-rotating means 20, 24 so that in operation of the work device 10 the driving dog 44 will never fail to enter the detent 45 at the end of the return stroke of the piston means 12. Such alignment of the driving dog 44 and detent 45 with the piston non-rotating means 20, 24 is accomplished by the heretofore mentioned circumferential alignment assembly means 54, 55 which comprises, in the instance, an alignment dog 54 in the form of a cylindrical rod fastened (as in the case of the driving dog 44) to and projecting from the front face of the front piston 14 and a cooperating detent 55 therefor in the form of a slot formed in the piston section 22. Such slot opens to the radial shoulder 46 and is open along its length so that it can be milled in the piston section 22. It is blind at one end as shown in FIG. 1. The dog 54 must be circumferentially aligned with the detent 55 when the piston 14 is press fitted on the piston section 40 and when this is done alignment is insured of the rotary holding assembly means 44, 45 with the piston non-rotating means 20, 24 so that in operation of said work device 10 at the end of the piston return stroke the driving dog 44 will never fail to enter the detent 45.

The circumferential alignment assembly means 54, 55 described renders the rotary holding assembly 44, 45 non-interfering with the operation of said work device 10. During such operation the rotary holding assembly means 44, 45 is inoperative but operative during assembly of the work device 10. In such assembly the front piston 14 is press fitted on the piston section 40 so that the circumferential alignment assembly means 54, 55 is engaged as described. The dividing wall 11 is loosely placed over

such piston section 40 behind the front piston 14 and the rear piston 16 is bolted tightly via a washer 56 and nut 57 on the rear section 58 of the piston rod 15. The rear piston 16 abuts a rearwardly facing shoulder 59 at the junction of the piston sections 58, 40. The piston means 12 thus partially assembled is inserted rear end first into the bore 28 and the dividing wall 11 aligned axially and circumferentially with the cylinder 27 so that the holding aperture 49 in the former is aligned with the return port 39 on the latter. The retainer band 41 is then inserted hooked end 48 first into the return port 39 and such hooked end 48 is engaged in the holding aperture 49. The rotary holding assembly means 44, 45 is then engaged by moving the piston means 12 to its extreme rearward position (corresponding to its position in its return stroke). The piston means 12 is then held via the projecting front section 60 of the piston rod 15 and the cylinder means 18 held via the stud end section 62 of the cylinder 27 and the two means 12, 18 relatively rotated to rotate the dividing wall 11 relative to the cylinder 27 so as to ring in the retainer band 41 into the groove 42 as described. The dividing wall 11 is thus assembled fast against movement axially of the cylinder 27. The rotary holding assembly means 44, 45 is then disengaged by moving the piston means 12 forwardly out of its extreme rearward position and the front bushing 25 is then loosely placed over the piston section 22 with the flats 20 on the latter aligned with the flats 24 on the former. The front bushing 25 is then aligned axially and circumferentially with the cylinder 27 to engage the hooked end (not shown) of the retainer band 29 in a holding aperture (not shown) in the front bushing 25 like the holding aperture 49. The front bushing 25 is then rotated relative to the cylinder 27 by holding the cylinder means 18 and the piston means 12 as described and relatively rotating them to ring in the retainer band 29 into the groove 30. The front bushing 25 is thus made fast axially of the cylinder 27 in known manner and then made fast rotationally thereof, also in known manner, by inserting the fastening means 26 through the aperture 32 and threadably engaging the same in the threaded aperture 64 provided therefor in the front bushing 25.

It will thus be seen that there has been provided by my invention improvements in such work devices in which the objects hereinabove set forth together with many thoroughly practical advantages has been successfully achieved. While a preferred embodiment of the invention has been shown and described it is to be understood that variations and changes may be resorted to without departing from the spirit of my invention. For example, the new and improved means and method herein disclosed is equally applicable to triple piston means for providing two dividing walls between adjacent pistons (one dividing wall between the front and intermediate piston and the other between the intermediate and rear piston) in such triple piston work devices so that they are strong at both the rear and front ends as described.

What is claimed is:

1. A fluid pressure operated multiple piston work device of the nonrotating piston type, said work device comprising cylinder means and piston means having at least two axially spaced apart pistons slidable in said cylinder means, said cylinder means including a cylinder and a dividing wall separable from said cylinder, a retainer band operative to hold said dividing wall axially fast of said cylinder, assembly means operative during assembly of said work device to assemble said dividing wall axially fast of said cylinder between said two pistons, said assembly means comprising holding means operative between said piston means and said dividing wall to hold said piston means and said dividing wall together while said piston means is relatively circumferentially rotated in respect to said cylinder to ring in said retainer band circumferentially around said dividing wall.

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2. Assembly means as claimed in claim 1 in which said holding means comprises a rotational driving dog and a corresponding detent therefor between one of said pistons and said dividing wall.

3. Assembly means as claimed in claim 2 in which said work device includes piston nonrotating means and further comprising a second rotational driving dog and a corresponding detent therefor between said one piston and the piston rod of said piston means, said second rotational driving dog and corresponding detent serving to align said first mentioned rotational driving dog and corresponding detent with the piston non-rotating means of said work device.

4. Assembly means as claimed in claim 2 in which the driving dog projects from the rear face of said one piston and the detent is formed in the front face of said dividing wall.

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