This invention relates to hydraulic pressure accumulators and more particularly to an end cap construction which prevents removal of the end cap until the fluid under pressure has been exhausted from the accumulator.

A common form of hydraulic pressure accumulator includes a cylindrical tube with a freely movable piston therein dividing the bore of the tube into two chambers. Caps close the chambers at the ends of the tube. When the accumulator is in use one of the chambers contains air or other gas under pressure, the gas being introduced into the chamber through a check valve which may be the same as those used in tires. The other chamber is connected to a hydraulic system to be serviced by the accumulator, this connection usually being made by means of a port through this cap on that end of the accumulator. The gas pressure is such that at the normal working pressure of the hydraulic system hydraulic fluid from the system will enter the hydraulic chamber and move the piston to an intermediate position within the bore until the gas pressure is the same as the hydraulic pressure. At such time there is a predetermined volume of hydraulic fluid within the bore.

At times, as when replacing the piston packing, it is necessary to remove the accumulator from the hydraulic system and to remove at least one of the end caps. This is a dangerous operation if the air pressure has not been released because upon release of the end cap retaining means the end cap may be blown out in a dangerous manner. If the end cap on the hydraulic side is being removed, the piston as well as the end cap will be blown out.

It is an object of the present invention to provide an end cap retaining construction in which it is not possible to release the end cap for removal until the pressure within the accumulator has been released.

It is another object to provide an accumulator end cap construction in which a retainer for the end cap has a gripping means engageable by a tool for detaching the same and in which the gripping means is inaccessible until the end cap has been moved inwardly of the accumulator bore, such movement not being possible while there is air under pressure within the bore.

Other objects of the invention will be apparent from the description and from the drawing in which:

FIG. 1 is a view partly in longitudinal cross section.

The accumulator has a tubular body 10 with a bore 11, one end of which is closed by an end cap 12 welded to the tube. End cap 12 has a check valve 13 mounted therein through which air under pressure may be admitted.

The other end of the tube is closed by a removable end cap generally designated 14. A freely movable piston 15 divides bore 11 into an air chamber 16 and a hydraulic chamber 17, the piston being scaled with respect to which is adapted to be contacted by shoulder 23 for retaining plug 19 within bore 11. Retainer ring 27 has one or more radially extending drilled holes 28 which serve as a gripping means engageable by a spanner wrench or similar tool for threading ring 27 into and out of bore 11. Reduced diameter portion 24 of plug 19 closely fits within the inner diameter of ring 27 and overlaps openings 28 when shoulder 23 is in contact with ring 27 so as to render openings 28 inaccessible for engagement by a tool.

An annular plate 29 is secured to the end of tube 10 by a series of bolts 33. Plug 19 is attached to plate 29 by a series of bolts 34 to normally maintain shoulder 23 in contact with ring 27.

Plug 19 has a threaded opening 35 therethrough for connection to a hydraulic system.

When the accumulator is in operation, chamber 16 contains air or other gas under pressure and port 35 is connected to a hydraulic system with pressurized hydraulic fluid from the system being contained within chamber 17. At this time piston 15 will be in an intermediate position between end caps 12 and 14.

When the accumulator has been removed from the hydraulic system for servicing, the hydraulic fluid will have been drained from chamber 17 and the air under pressure in chamber 16 will have moved piston 15 against plug 19. If end cap 14 should now be released so as to be removable from tube 10, the pressure within chamber 16 will cause piston 15 and end cap 14 to blow out of the accumulator in a dangerous manner. However, end cap 14 is so constructed that it is not possible to release it for removal until the pressure in chamber 16 has been released, as by opening valve 13.

Thus, to remove end cap 14, bolts 33, 34 and plate 29 are first removed. If the pressure in chamber 16 has been released, plug 19 may then be moved inwardly along bore 11 until reduced diameter portion 24 clears openings 28 to permit insertion of a spanner wrench in the latter. With the aid of the spanner wrench, ring 27 may then be unthreaded and plug 19 removed.

If the pressure in chamber 16 has not been released it will not be possible to move plug 19 inwardly against such pressure and therefore the spanner wrench cannot be inserted into engagement with openings 28 for unthreading ring 27.

I claim:

1. In an accumulator, a body having a bore therein closed at one end, a freely movable piston within the bore dividing the same into first and second chambers, a chamber containing air, the other containing fluid under pressure, a removable plug closing the other end of the body, said plug being adapted to receive fluid under pressure, a removable plug closing the other end of the body, means for sealing the plug relative to the bore, said plug having an outwardly facing shoulder, a ring attached to the body and engageable with the shoulder for retaining the plug within said bore, said ring having gripping means spaced from either end thereof for engagement by a tool for unthreading the ring from the bore, and blocking means rendering said gripping means inaccessible to a tool unless said plug is moved inwardly of said bore away from said ring.

2. The accumulator of claim 1 in which said gripping means comprises a radial opening in said ring intersecting the inner diameter of the ring and said blocking means comprises a cylindrical portion of said plug having a close fit in said inner diameter and overlapping said opening when said shoulder is in contact with said ring.

3. In an accumulator, a body having a bore therein closed at one end, a freely movable piston within the bore dividing the same into first and second chambers adapted to receive fluid under pressure, a removable plug closing the other end of the body, means for sealing the plug relative to the bore, said plug having an outwardly facing shoulder, a ring threaded into the bore and engageable with the shoulder for retaining the plug within said bore, said ring having gripping means for engagement by a tool
3. Unthreading the ring from the bore, blocking means rendering said gripping means inaccessible to a tool unless said plug is moved inwardly of said bore away from said ring, removable means for holding said plug in a position with said shoulder in contact with said ring, said removable means comprising a plate releasably attached to both the body and plug.

4. In an accumulator, a body having a bore therein closed at one end, a freely movable piston within the bore dividing the same into first and second chambers adapted to receive fluid under pressure, a removable plug closing the other end of the body, means for sealing the plug relative to the bore, said plug having an outwardly facing shoulder, a ring threaded into the bore and engageable with the shoulder for retaining the plug within said bore, said ring having gripping means for engagement by a tool for unthreading the ring from the bore, blocking means rendering said gripping means inaccessible to a tool unless said plug is moved inwardly of said bore away from said ring, removable means for holding said plug in a position with said shoulder in contact with said ring, said removable means comprising a plate bolted to said other end of the body and bolted to said plug.

5. In an accumulator a body having a bore therein closed at one end, a freely movable piston within the bore dividing the same into first and second chambers each adapted to receive fluid under pressure, a removable plug closing the other end of the body, means for sealing the plug relative to the bore, said plug having an outwardly facing shoulder, a ring attached to the body and engageable with the shoulder for retaining the plug within said bore, said ring having gripping means for engagement by a tool for unthreading the ring from the bore, blocking means rendering said gripping means inaccessible to a tool unless said plug is moved inwardly of the bore away from said ring, removable means for holding said plug in a position with said shoulder in contact with said ring, said removable means comprising a plate abutting said other end of the body, and securing means separate of the plug and removable means for attaching the plug to said removable means.

6. The accumulator of claim 5 in which the securing means is a threaded member attachable to said plug and bearing upon said removable means.

7. In an accumulator, a body having a bore therein closed at one end, a freely movable piston within the bore dividing the same into first and second chambers adapted to receive fluid under pressure, a removable plug closing the other end of the body, means for sealing the plug relative to the bore, said plug having an outwardly facing shoulder, said bore having an internal thread at said other end of the body, a ring threadable into said internal thread with either of its ends entering said internal thread first, the inner end of said ring being engageable with the shoulder for retaining the plug within said bore, said ring having gripping means exposing to its inside diameter for engagement by a tool for unthreading the ring from the body, and blocking means rendering the gripping means inaccessible to a tool regardless of which end of the ring has entered the body first unless said plug is moved inwardly of said bore away from said ring.

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